# ANNUAL DANISH INFORMATIVE INVENTORY REPORT TO UNECE

## Emission inventories from the base year of the protocols to year 2008

NERI Technical Report no. 776 2010

NATIONAL ENVIRONMENTAL RESEARCH INSTITUTE
AARHUS UNIVERSITY

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# Data sheet

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Abstract: This report is a documentation report on the emission inventories for Denmark as reported to the UNECE Secretariat under the Convention on Long Range Transboundary Air Pollution due by 15 February 2010. The report contains information on Denmark's emission inventories regarding emissions of (1) $SO_X$ for the years 1980-2008, (2) $NO_X$, CO, NMVOC and $NH_3$ for the years 1985-2008, (3) Particulate matter: TSP, $PM_{10}$, $PM_{2.5}$ for the years 2000-2008, (4) Heavy Metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se and Zn for the years 1990-2008, (5) Polyaromatic hydrocarbons (PAH): Benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene for the years 1990-2008 and (6) Dioxin and HCB. Further, the report contains information on background data for emissions inventory.

Keywords: Emission Inventory; Emissions; Projections; UNECE; EMEP; $NO_X$; CO; NMVOC; $SO_X$; $NH_3$; TSP; $PM_{10}$; $PM_{2.5}$; Pb; Cd; Hg; As; Cr; Cu; Ni; Se; Zn; Polyaromatic hydrocarbons; Benzo(a)pyrene, Benzo(b)fluoranthene.

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# Contents

# Summary

## I Background information on emission inventories

### Annual report

This report is Denmark's Annual Informative Inventory Report (IIR) due March 15, 2010 to the UNECE-Convention on Long-Range Transboundary Air Pollution (LRTAP). The report contains information on Denmark's inventories for all years from the base years of the protocols to 2008.

The gases reported under the LRTAP Convention are $SO_2$, $NO_X$, NMVOC, CO, $NH_3$, As, Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn, dioxins/furans, HCB, PAHs, TSP, $PM_{10}$ and $PM_{2.5}$.

The annual emission inventory for Denmark is reported in the Nomenclature for Reporting (NFR) 2002 format. The new NFR format (revised in December 2008) in the current reporting guidelines and many of the new elements and demands in the reporting guidelines have not been implemented. The reason for this is that they require significantly more resources and furthermore, no extra funds have been available.

The issues addressed in this report are: trends in emissions, description of each NFR category, uncertainty estimates, recalculations, planned improvements and procedures for quality assurance and control. The structure of the report is, as far as possible, the same as the National Inventory Report to UNFCCC.

This report and NFR tables are available to the public on NERI's homepage:
http://www.dmu.dk/Luft/Emissioner/Home+of+Inventory/

and on the Eionet central data repository:
http://cdr.eionet.europa.eu/dk/Air_Emission_Inventories/Submission_EMEP_UNECE

### Responsible institute

The National Environmental Research Institute (NERI), Aarhus University, is on behalf of the Ministry of the Environment responsible for the annual preparation and submission to the UNECE-LRTAP Convention of the Annual Danish Emissions Report and the inventories in the NFR format. NERI participates in meetings under the UNECE Task Force on Emission Inventories and Projections and the related expert panels, where parties to the convention prepare the guidelines and methodologies on inventories.

## II Trends in emissions

### Acidifying gases

Figure S.1 shows the emission of Danish acidifying gases in terms of acid equivalents. In 1990, the relative contribution in acid equivalents was almost equal for the three gases. In 2008, the most important acidification factor in Denmark was ammonia nitrogen and the relative contributions for $SO_2$, $NO_x$ and $NH_3$ were 7 %, 40 % and 53 %, respectively. However, with regard to long-range transport of air pollution, $SO_2$ and $NO_X$ are still the most important pollutants.

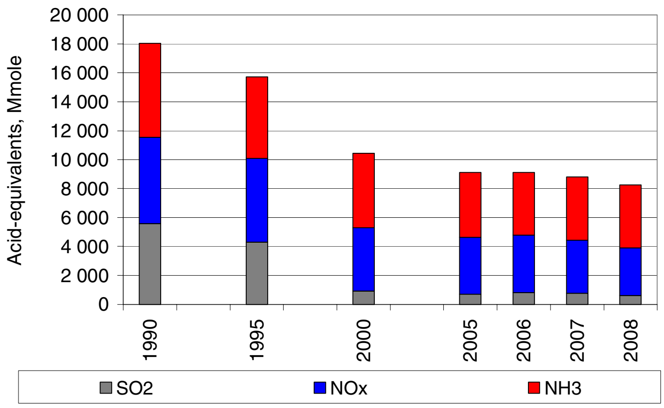



Figure S.1 Emissions of $NH_3$, $NO_X$ and $SO_2$ in acid equivalents.

***$SO_2$***

The main part of the $SO_2$ emission originates from combustion of fossil fuels, i.e. mainly coal and oil, in public power and district heating plants. From 1980 to 2008, the total emission decreased by 96 %. The large reduction is mainly due to installation of desulphurisation plant and use of fuels with lower content of sulphur in public power and district heating plants. Despite the large reduction of the $SO_2$ emissions, these plants make up 34 % of the total emission. Also emissions from industrial combustion plants, non-industrial combustion plants and other mobile sources are important. National sea traffic (navigation and fishing) contributes with about 5 % of the total $SO_2$ emission. This is due to the use of residual oil with high sulphur content.

***$NO_x$***

The largest sources of emissions of $NO_x$ are road transport followed by other mobile sources and combustion in energy industries (mainly public power and district heating plants). The transport sector is the sector contributing the most to the emission of $NO_x$ and, in 2008 47 % of the Danish emissions of $NO_x$ stems from road transport, national navigation, railways and civil aviation. Also emissions from national fishing and off-road vehicles contribute significantly to the $NO_x$ emission. For non-industrial combustion plants, the main sources are combustion of gas oil, natural gas and wood in residential plants. The emissions from energy industries have decreased by 73 % from 1985 to 2008. In the same period, the total emission decreased by 48 %. The reduction is due to the increasing use of catalyst cars and installation of low-$NO_x$ burners and denitrifying units in power plants and district heating plants.

#### *$NH_3$*
Almost all atmospheric emissions of $NH_3$ are related to agricultural activities. Only a minor fraction originates from road transport (2 %). This fraction is, however, increasing due to increasing use of catalyst cars. The major part of the emission from agriculture stems from livestock manure (80 %) and the largest losses of ammonia occur during the handling of the manure in stables and in field applications. Other contributions come from use of mineral fertilisers (7 %), N-excretion on pasture range and paddock (3 %), sewage sludge used as fertiliser, crops and ammonia used for straw treatment (7 %) and field burning (less than 1 %). The total ammonia emission decreased by 36 % from 1985 to 2008. This is due to the active national environmental policy efforts over the past twenty years.

### Other air pollutants

#### *NMVOC*
The emissions of NMVOC originate from many different sources and can be divided into two main groups: incomplete combustion and evaporation. Wood burning stoves, road vehicles and other mobile sources such as national navigation vessels and off-road machinery are the main sources of NMVOC emissions from incomplete combustion processes. Road transportation vehicles are still the main contributors, even though the emissions have declined since the introduction of catalyst cars in 1990. The evaporative emissions mainly originate from the use of solvents and the extraction, handling and storage of oil and natural gas. The emissions from the energy industries have increased during the 1990s due to the increasing use of stationary gas engines, which have much higher emissions of NMVOC than conventional boilers. The total anthropogenic emissions have decreased by 45 % from 1985 to 2008, largely due to the increased use of catalyst cars and reduced emissions from use of solvents.

#### *CO*
Other mobile sources and non-industrial combustion plants contribute significantly to the total emission of this pollutant. Transport is the second largest contributor to the total CO emission. A law banning the burning of agricultural crop residues on fields was implemented in 1990 and caused a significant reduction in CO emission. The emission decreased further by 40 % from 1990 to 2008, largely because of decreasing emissions from road transportation.

#### *PAHs*
The present emission inventory for PAH (polycyclic aromatic hydrocarbons) includes the four PAHs reported to UNECE: benzo(a)pyrene, benzo(b)-fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene. The most important sources of PAH emissions are combustion of wood in the residential sector and road transportation. The increasing emission trend is due to increasing combustion of fuel wood in the residential sector.

### Particulate Matter

The particulate matter (PM) emission inventory has been reported for the years 2000-2008. The inventory includes the total emission of particles

TSP (Total Suspended Particles), emission of particles smaller than 10 µm ($PM_{10}$) and emission of particles smaller than 2.5 µm ($PM_{2.5}$).

The largest $PM_{2.5}$ emission sources are residential plants (70 %), road traffic (12 %) and other mobile sources (8 %). For the latter, the most important sources are off-road vehicles and machinery in the industrial sector and in the agricultural/forestry sector (both 38 %). For the road transport sector, exhaust emissions account for the major part (72 %) of the emissions. The $PM_{2.5}$ emission increased by 26 % from 2000 to 2008 due to an increasing wood consumption in the residential sector.

The largest TSP emission sources are the residential sector and the agricultural sector. The TSP emissions from transport are also important and include both exhaust emissions and the non-exhaust emissions from brake and tyre wear and road abrasion. The non-exhaust emissions account for 53 % of the TSP emission from road transport.

#### Heavy metals

In general, the most important sources of heavy metal emissions are combustion of fossil fuels and municipal waste. The heavy metal emissions have decreased substantially in recent years, except for Zn. The reductions span from 7 % to 93 % for Cu and Pb, respectively. The reason for the reduced emissions is mainly increased use of gas cleaning devices at power and district heating plants (including waste incineration plants). The large reduction in the Pb emission is due to a gradual shift towards unleaded gasoline, the latter being essential for catalyst cars. The major source of Zn is accidental fires (53 %), and the increase in total Zn emission from 1990 to 2008 owe to an increasing number of car fires. Zn emissions from accidental fires are included for the first time in the inventory and due to the large share the emission factor will be further investigated before the next submission.

## *1.1 III Recalculations and Improvements*

In general, considerable work is being carried out to improve the inventories. Investigations and research carried out in Denmark and abroad produce new results and findings, which are given consideration and, to the extent of which is possible, are included as the basis for emission estimates and as data in the inventory databases. Furthermore, the updates of the EMEP/CORINAIR guidebook (now the EMEP/EEA Guidebook) and the work of the Task Force on Emission Inventories and its expert panels are followed closely in order to be able to incorporate the best scientific information as the basis for the inventories.

The implementation of new results in inventories is made in a way so that improvements, as far as possible, better reflect Danish conditions and circumstances. This is in accordance with good practice. Furthermore, efforts are made to involve as many experts as possible in the reasoning, justification and feasibility of implementation of improvements.

In improving the inventories, care is taken to consider implementation of improvements for the whole time-series of inventories to make it consistent. Such efforts lead to recalculation of previously submitted inventories. This submission includes recalculated inventories for the whole time-series. The reasoning for the recalculations performed is to be found in the sectoral chapters of this report. The text below focuses on improvements and recalculations, in general, and further serves as an overview and summary of the relevant text in the sectoral chapters.

### Energy

Improvements and updates of the Danish energy statistics are made regularly by the producer of the statistics, the Danish Energy Agency (DEA). In close cooperation with the DEA, these improvements and updates are reflected in the emission inventory for the energy sector. The Danish energy statistics have, for the most part, been aggregated to the SNAP categorisation. This, however, does not include energy statistics for fuel consumption data for specific industries.

The inventories are still being improved through work to increase the number of large point sources, e.g. power plants, included in the databases as individual point sources. Such an inclusion makes it possible to use plant-specific data for emissions etc. available, e.g. in annual environmental reports from the plants in question.

### Stationary Combustion

Improvements and recalculations since the 2009 emission inventory submission include:

- The national energy statistics has been updated for the years 1980-2008. This has only resulted in small differences.
- Improved emission factors for decentralised CHP plants referring to a Danish emission measurement program have been implemented.
- A time-series have been estimated for the HCB emission factor for MSW incineration.
- The NMVOC emission factors that are not country specific now all refer to the EMEP/EEA Guidebook. The emission factors for the key sources are country specific and are not affected by this recalculation.
- Improved emission factors for residential wood combustion have been estimated for NMVOC, TSP, $PM_{10}$, $PM_{2.5}$ and PCDD/F. The update in emission factors refer to a study funded by the Danish EPA.
- $NH_3$ emissions from residential plants have been estimated for the first time. The emission factors for coal, brown coal, coke and wood refer to the EMEP/EEA Guidebook.

### Mobile sources

#### *Road transport*

The total mileage pr vehicle category from 2005-2008 have been updated based on the traffic index development (derived from traffic counts on selected roads) from the Danish Road Directorate. In addition new data prepared by DTU Transport for the Danish Infrastructure Commission has given information of the total mileage driven by foreign trucks on Danish roads. This mileage contribution has been added to the total mileage for Danish trucks on Danish roads, for trucks > 16 tonnes of gross vehicle weight. The data from DTU Transport was estimated for 2005, and by using appropriate assumptions the mileage have been backcasted to 1985 and forecasted to 2008.

For passenger cars the new division of total mileage into gasoline and diesel made by the Danish Road Directorate is regarded as very broad. Hence in the subsequent model calculations, the fuel and emission results for diesel passenger cars are adjusted with the overall sales/calculated fuel ratio, being applied to the estimates for the other diesel vehicle categories as well. This is a change compared to previous year's inventory submissions for which the diesel passenger car results remain unadjusted.

For heavy duty vehicles an error for the NMVOC emission factors for Euro 0-III trucks and buses has been corrected giving somewhat smaller emission factors.

For mopeds and motorcycles, updated first registration year information for 2005+ and 2000+, respectively, has caused some changes in the fleet/technology mix and the resulting emissions.

The minimum and maximum percentage difference and year of numeric maximum differences (min %, max %, year of max %) for the different emission components are: Particulates (-2.5 %, -9.1 %, 2007), $NO_x$ (0.5 %, 5 %, 2007), $SO_2$ (0 %, - 0.1 %, 2007), NMVOC (0.1 %, -0.9 %, 2005), CO (-0.1 %, -1.8 %, 2007) and $NH_3$ (0 %, 0.8 %, 2003).

***Military***

Emission factors derived from the new road transport simulations have caused some emission changes from 1985-2007. The minimum and maximum emission differences (min %, max %) for the different emission components are: Particulates (-3 %, -9 %), $NO_x$ (0 %, 3 %), NMVOC (0 %, -5 %), CO (0 %, -2 %) and $NH_3$ (0 %, -1 %).

***Residential***

The number of riders has been updated for 2007. Thus, the emission increases are 1 % for NMVOC and particulates, 2 % for $SO_2$ and $NO_x$, and 3 % for CO and $NH_3$.

***Industrial non road machinery***

The number of wheel type excavators has been updated for 2007. The fuel consumption and emission increases are insignificant.

***Agricultural non road machinery***

The number of machine pool tractors, harvesters and self-propelled vehicles has been updated for 2007. The fuel consumption and emission increases are less than 1 %.

***Aviation***

En error for 2007 has been corrected. Erroneously, the flights between Denmark and Greenland/Faroe Islands were treated as international flights. As a result of this correction the fuel consumption and emissions change substantially. The fuel consumption increases by 51%, whereas particulates, $NO_x$, NMVOC and CO emissions increase by 34 %, 39 %, 7 % and 4 %, respectively.

Very small emission changes between 0 % and 2 % occur for the years 2001-2006, due to inclusion of new representative aircraft types.

## Fugitive emissions

***Coal import***

The amounts of imported coal used for calculation of fugitive emissions from storage of solid fuels (SNAP 050103) have been updated according to the Energy Statistics for 2008 for the years 1980-2002.

***Gasoline sales***

The amounts of gasoline sales used for calculation of fugitive emissions from service stations (SNAP 050503) have been updated according to the Energy Statistics for 2008 for the years 1983-2007.

***Service stations***

The emission factors for NMVOC from service stations have been updated for both reloading of tankers and refuelling of vehicles for the years 2000-2008.

***Town gas***

Emissions from distribution of town gas have been included in the emission inventory for the years 1985-2008. The input data are sparse as several of the distribution companies have been closed down. Only in the cities of Copenhagen and Aalborg town gas is still being distributed. Another two distribution companies are included in the inventory. Those were closed in 2004 and 2006, respectively. To complete the time-series interpolation and extrapolation has been used on basis of the available data.

***Flaring in storage and treatment plants***

The same emission factors are adopted for flaring in storage and treatment plants as for offshore flaring for the components $SO_2$, $NO_x$, CO, particulate matter, dioxin and PAHs. The emissions of NMVOC are given by the plants in the environmental reports.

***Flaring in refineries***

The emission factors for flaring in refineries have been updated. The emission factors for NMVOC are based on new information from one of the refineries on the fuel gas composition. The same emission factors are adopted for the second Danish refinery. Emission factors from the EMEP/EEA guidebook (2009) are used to calculate emissions of $NO_x$ and CO. For trace metals, dioxin and PAHs the emission factors given in the guidebook (EMEP/EEA, 2009) for stationary combustion Tier 1 are adopted for flaring in refineries.

## Industrial processes

For sector 2D2 Food and Drink, emissions of NMVOC from production of bread, sugar, ethanol, spirits, margarine, cooking fats, processing of meat and fish and coffee roasting have been included for the first time. The estimates cover the period 1990-2008.

## Solvents

Improvements and additions are continuously being implemented due to the comprehensiveness and complexity of the use and application of solvents in industries and households. The main improvements in the 2010 reporting include the following:

- An improved and more detailed source allocation method has been implemented, which enables emission calculation on SNAP sub-category level.
- Emission factors (EFs) have been improved for some chemicals.
- EFs have been attributed to all chemicals on SNAP sub-category level.

#### Agriculture

Compared with the previous $NH_3$ and PM emissions inventory (submission 2009), some changes and updates have been made. These changes cause a decrease in the $NH_3$ emission (1985 – 2007) and a decrease in the PM emission (2000 – 2007.

The main reason for the decrease in ammonia emission is calculations of ammonia have been adjusted to TAN for the whole period 1985-2008 and this have led to a decrease in the emission from animal manure of 4-8% in the period 1985-2007.

The PM emission mainly decreases because of changes in the emission factor for poultry in the EMEP/EEA Guidebook.

This year the emission from field burning of agricultural wastes has been reconsidered and burning of straw from grass seed production is taken into account. Emission of $NH_3$, $NO_x$, CO, NMVOC, $SO_2$, particulate matter (PM), heavy metals, dioxin and PAH from field burning of agricultural wastes are included in the inventory for the whole period 1985-2008 and recalculations for $NH_3$, $NO_x$, CO, NMVOC, $SO_2$ is made for the years 1985-1989.

#### Waste

The inventory submission for 2010 includes for the first time emissions from incineration of carcasses. Also emissions of other pollutants than PCDD/F from accidental fires have been estimated for the first time. This affects emission estimates of all relevant pollutants from the base years of the protocols to 2008.

# Sammenfatning

## I Baggrund for emissionsopgørelser

### Årlig rapport

Denne rapport er Danmarks årlige rapport om emissionsopgørelser sendt til UNECE-konventionen om langtransporteret grænseoverskridende luftforurening (LRTAP) 15. marts 2010. Rapporten indeholder oplysninger om Danmarks opgørelser for alle år fra basisårene for protokollerne til 2008.

Gasserne der rapporteres til LRTAP-konventionen er $SO_2$, $NO_x$, NMVOC, CO, $NH_3$, As, Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn, dioxiner/furaner, HCB, PAH, TSP, $PM_{10}$ og $PM_{2,5}$.

Den årlige emissionsopgørelse for Danmark rapporteres i NFR 2002-formatet. NFR-formatet blev væsentlig revideret i forbindelse med en ændring i retningslinjerne for rapportering vedtaget i december 2008, derudover blev der stillet en række nye krav til udarbejdelsen af emissionsopgørelserne. Opfyldelsen af disse nye krav er endnu ikke implementeret, da de er væsentligt mere ressourcekrævende og der ikke er afsat ressourcer hertil.

Emnerne behandlet i rapporten er: Udvikling i emissioner, beskrivelse af hver NFR-kategori, usikkerheder, rekalkulationer, planlagte forbedringer og procedure for kvalitetssikring og -kontrol. Strukturen i rapporten er, så vidt muligt, den samme som den nationale emissionsopgørelsesrapport sendt til FN's konvention om klimaændringer (UNFCCC).

Denne rapport og NFR-tabellerne er tilgængelige for offentligheden på DMU's hjemmeside:
http://www.dmu.dk/Luft/Emissioner/Home+of+Inventory/

samt på Eionets hjemmeside:

http://cdr.eionet.europa.eu/dk/Air_Emission_Inventories/Submission_EMEP_UNECE

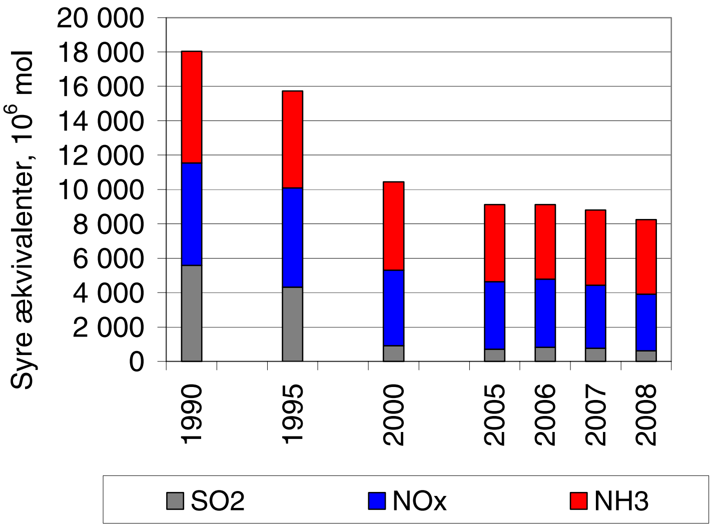
### Ansvarlig institution

Danmarks Miljøundersøgelser (DMU), Aarhus Universitet er på vegne af Miljøministeriet ansvarlig for udarbejdelse af den årlige danske emissionsrapport og opgørelserne i NFR. DMU deltager i møder under UNECEs arbejdsgruppe for emissionsopgørelser og –fremskrivninger samt ekspertpaneler, hvor parter i konventionen udarbejder retningslinjer og metoder for emissionsopgørelserne.

## *II Udviklingen i emissioner*

### Forsurende gasser

Figur S.1 viser emissionen af danske forsurende gasser opgjort i syreækvivalenter. I 1990 var det relative bidrag af syreækvivalenter næsten ens for de tre gasarter. I 2008 var ammoniak den vigtigste forsurende faktor i Danmark og de relative bidrag for $SO_2$, $NO_x$ og $NH_3$ var på henholdsvis 7 %, 40 % og 53 %. Med hensyn til langtransporteret luftforurening er det dog stadig $SO_2$ og $NO_x$ der er de største kilder.




Figur S.1 Emissioner af $NH_3$, $NO_x$ og $SO_2$ i syreækvivalenter.

### $SO_2$

Hovedparten af $SO_2$-emissionerne stammer fra forbrænding af fossile brændsler, dvs. primært kul og olie, på kraftværker, kraftvarmeværker og fjernvarmeværker. Fra 1980 til 2008 er den totale udledning reduceret med 96 %. Den store reduktion er primært opnået gennem installation af afsvovlingsanlæg og brug af brændsler med lavt svovlindhold på kraftværker og fjernvarmeværker. Trods den store reduktion er disse værker kilde til 34 % af den samlede udledning. Også emissioner fra industrielle forbrændingsanlæg, ikke-industrielle forbrændingsanlæg og andre mobile kilder er væsentlige bidragsydere til emissionen. National søfart (sejlads og fiskeri) bidrager med omkring 5 % af den totale $SO_2$-emission. Dette skyldes brug af fuelolie med et højt svovlindhold.

### *$NO_x$*

Den største kilder til emissioner af $NO_x$ er transportsektoren efterfulgt af andre mobile kilder og forbrænding i energisektoren (hovedsageligt kraftværker og fjernvarmeværker). Transportsektoren er den sektor der bidrager mest til udledningen af $NO_x$, og i 2008 stammede 47 % af de danske $NO_x$-emissioner fra vejtransport, national søfart, jernbaner og civil luftfart. Også emissioner fra nationalt fiskeri og off-road køretøjer (entreprenør-, landbrugsmaskiner, m.m.) bidrager betydeligt til $NO_x$-emissionen. For ikke-industrielle forbrændingsanlæg er de primære kilder forbrænding af gasolie, naturgas og træ i husholdninger. Emissionerne fra kraftværker og fjernvarmeværker er faldet med 73 % fra 1985 til 2008. I samme periode er den totale emission faldet med 48 %. Reduktionen skyldes øget brug af katalysatorer i biler og installation af lav-$NO_x$-brændere og de-$NO_x$-anlæg på kraftværker og fjernvarmeværker.

***$NH_3$***

Stort set alle atmosfæriske emissioner af $NH_3$ stammer fra aktiviteter i landbruget. Kun en mindre del skyldes vejtransport og stationære kilder. Andelen fra transporten er dog stigende pga. den øgede brug af biler med katalysator. Hovedparten af emissionen fra landbruget stammer fra husdyrgødning (80 %) og de største tab af ammoniak optræder under håndtering af gødningen i stalden og under spredning på marken. Andre bidrag kommer fra brug af kunstgødning (7 %), N-udskillelse af græssende dyr (3 %), slam fra rensningsanlæg brugt som gødning, afgrøder og ammoniakbehandlet halm (7 %) og markafbrænding (< 1 %). Den totale ammoniakemission er faldet 36 % fra 1985-2008. Dette er et resultat af den nationale miljøpolitik, der er ført gennem de seneste 20 år.

## Anden luftforurening

***NMVOC***

Emissionen af NMVOC stammer fra mange forskellige kilder og kan opdeles i to hovedgrupper: Ufuldstændig forbrænding og fordampning. Hovedkilderne til NMVOC-emissioner fra ufuldstændige forbrændingsprocesser er brændeovne, vejtrafik og andre mobile kilder, som national sejlads og ikke vejgående maskiner. Køretøjer til vejtransport er fortsat den største bidragsyder, selvom emissionerne er faldet siden introduktionen af biler med katalysator i 1990. Emissionerne fra fordampning stammer hovedsageligt fra brugen af opløsningsmidler. Emissionerne fra energisektoren er steget igennem 1990'erne pga. øget brug af stationære gasmotorer, som har meget højere emissioner af NMVOC end konventionelle kedler. De totale menneskeskabte emissioner er faldet med 45 % fra 1985 til 2008, primært som følge af øget brug af biler med katalysator og reducerede emissioner fra brug af opløsningsmidler.

***CO***

Selvom biler med katalysator blev introduceret i 1990, er vejtransport stadig årsag til den største del af den totale CO-emission. Også andre mobile kilder og ikke-industrielle forbrændingsanlæg bidrager betydeligt til den totale emission af denne gas. Faldet i emissioner i 1990 var en konsekvens af loven, der generelt forbyder markafbrænding af halm. Emissionen faldt med 40 % fra 1990 til 2008 hovedsageligt pga. faldende emissioner fra vejtransport.

***PAH'er***

Den nuværende emissionsopgørelse for PAH (polycycliske aromatiske hydrocarboner) inkluderer de fire PAH'er der rapporteres til LRTAP-konventionen: Benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene og indeno(1,2,3-cd)pyrene. De vigtigste kilder til emission af PAH er forbrænding af træ i husholdningerne samt vejtransport. De stigende emissioner skyldes øget forbrænding af træ i husholdningerne.

***Partikler***

Emissionsopgørelsen for partikler (Particulate Matter, forkortet PM) er blevet rapporteret for årene 2000-2008. Opgørelsen inkluderer den totale emission af partikler TSP (Total Suspended Particles), emissionen af partikler mindre end 10 µm ($PM_{10}$) og emissionen af partikler mindre end 2,5 µm ($PM_{2,5}$).

De største kilder til $PM_{2,5}$-emission er husholdninger (70 %), vejtrafik (12 %) og andre mobile kilder (8 %). For den sidstes vedkommende er off-road-køretøjer i industrien samt landbrugs- og skovbrugsmaskiner de vigtigste kilder (begge 38 %). I transportsektoren tegner udstødningsemissioner sig for størstedelen (72 %).

De største kilder til TSP-emission er landbrugssektoren og husholdningerne. TSP-emissionen fra transport er også vigtig og inkluderer både udstødningsemissioner og ikke-udstødningsrelaterede emissioner fra slid af bremser, dæk og vej. De ikke-udstødningsrelaterede emissioner udgør 53 % af TSP-emissionen fra transport.

#### *Tungmetaller*

Generelt er de vigtigste kilder til emissioner af tungmetaller forbrænding af fossile brændsler og affald. Emissionerne af tungmetaller er med undtagelse af zink faldet betydeligt de seneste år. Reduktionerne spænder fra 7 % til 93 % for henholdsvis Cu og Pb. Årsagen til de reducerede emissioner er hovedsageligt den øgede brug af røggasrensning på kraftværker og fjernvarmeværker (inklusive affaldsforbrændings-anlæg). Den store reduktion i emissionen af Pb skyldes et løbende skift til fordel for blyfri benzin, som er nødvendigt for biler med katalysator. Den største kilde til Zn er ildebrande, som står for 53 % af udledningen. Stigningen i Zn-udledningen fra 1990 til 2008 skyldes en stigning i antallet af bilbrande. Zn fra ildebrande er med for første gang i opgørelsen, og pga. det store bidrag til udledningen vil udledningsfaktoren blive gransket nærmere i det kommende år.

## *III Genberegninger og forbedringer*

Generelt pågår der et betydeligt arbejde med at forbedre emissionsopgørelserne. Nye undersøgelser og forskning fra Danmark og udlandet inkluderes så vidt muligt som basis for emissionsestimaterne. Desuden følges arbejdet med opdateringer af EMEP/CORINAIR-retningslinjerne for emissionsopgørelser nøje, med henblik på at indarbejde de bedste videnskabelige informationer som basis for opgørelserne.

Opgørelserne opdateres løbende med ny viden, således at opgørelserne bedst mulig afspejler danske forhold. Ved forbedringer lægges vægt på at opdateringer omfatter hele tidsserier, for at sikre konsistente data. Disse tiltag medfører genberegning af tidligere indberettede opgørelser. De vigtigste genberegninger for de forskellige sektorer er nævnt i nedenstående.

### Stationære forbrændingsanlæg

Den seneste officielle energistatistik er implementeret i opgørelsen. Der er for det meste tale om mindre ændringer.

Forbedrede emissionsfaktorer for decentraliserede kraftvarmeværker er blevet indarbejdet i opgørelsen.

Der er blevet udarbejdet en tidsserie for emissionsfaktoren for HCB fra affaldsforbrænding.

Emissionsfaktorerne for NMVOC der ikke er nationale, er opdateret i overensstemmelse med EMEP/EEA Guidebook. NMVOC emissionsfaktorerne for alle større sektorer er nationale og derfor ikke omfattet af denne genberegning.

Flere emissionsfaktorer for træfyring i husholdninger er blevet opdateret; det drejer sig om emissionsfak-torer for NMVOC, TSP, $PM_{10}$, $PM_{2.5}$ og PCDD/F. Opdateringen er sket med henvisning til en rapport udarbejdet for Miljøstyrelsen.

$NH_3$-emissioner fra husholdninger er estimeret for første gang. Der er indarbejdet emissionsfaktorer for kul, brunkul, koks og træ. Emissionsfaktorerne henviser til EMEP/EEA Guidebook.

## Transport

### *Vejtransport*

Data for årskørsler for de forskellige køretøjskategorier er blevet opdateret for 2005 til 2008 baseret på en indekseret udvikling på baggrund af trafiktællinger på udvalgte veje af Vejdirektoratet. Nye data estimeret af DTU Transport for Infrastrukturkommissionen har bidraget med viden om udenlandske lastbilers kørsel i Danmark. Dette bidrag er blevet adderet til bidraget fra danske lastbiler i kategorien lastbiler større end 16 ton. Data fra DTU Transport er for 2005, men er ud fra antagelser ekstrapoleret tilbage til 1985 og frem til 2008.

Den nye opdeling af årskørsler på benzin og diesel for personbiler udført af Vejdirektoratet er meget aggregeret. Derfor er dieselforbrug og emissioner i modelberegningerne blevet justeret med den overordnede ratio mellem solgt diesel og beregnet diesel, som anvendes for de øvrige køretøjskategorier. Dette er en ændring i forhold til tidligere år, hvor personbilerne ikke blev justeret.

For tunge køretøjer er en fejl i NMVOC-emissionsfaktorerne for EURO 0-III lastbiler og busser blevet rettet, hvilket har resulteret i mindre emissionsfaktorer.

For knallerter og motorcykler er data om første indregistreringsår blevet forbedret for 2005+ og 2000+. Dette har medført ændringer i bestand/teknologi-sammensætningen og dermed de resulterende emissioner.

Minimum og maksimum procentuelle forskelle og året for den maksimale forskel (min. %, maks. %, år hvor maks. %) for de forskellige forureningskomponenter er: Partikler (-2,5 %, -9,1 %, 2007), $NO_x$ (0,5 %, 5 %, 2007), $SO_2$ (0 %, - 0,1 %, 2007), NMVOC (0,1 %, -0,9 %, 2005), CO (-0,1 %, -1,8 %, 2007) and $NH_3$ (0 %, 0,8 %, 2003).

### *Militær*

Emissionsfaktorer udledt fra de nye modelberegninger for vejtransport har medført små emissionsændringer for 1985-2007. Minimum- og maksimumændringerne i emissionerne (min. %, maks. %) for de forskellige forureningskomponenter er: Partikler (-3 %, -9 %), $NO_x$ (0 %, 3 %), NMVOC (0 %, -5 %), CO (0 %, -2 %) and $NH_3$ (0 %, -1 %).

***Husholdninger***

Antallet af havetraktorer og lignende havekøretøjer (riders) er blevet opdateret for 2007. Dette har medført en stigning i emissionen på 1 % for NMVOC og partikler, 2 % for $SO_2$ og $NO_x$, og 3 % for CO og $NH_3$.

***Maskiner og redskaber i industrien***

Antallet af gravemaskiner er blevet opdateret for år 2007. Stigningen i brændselsforbrug og emissioner er ubetydelige.

***Landbrugsmaskiner***

Antallet af traktorer og mejetærskere er blevet opdateret for 2007. Stigningen i brændselsforbrug og emissioner er mindre end 1 %.

***Luftfart***

En fejl for år 2007 er blevet rettet. Ved en fejl er flyvninger mellem Danmark og Grønland/Færøerne for 2007 i den seneste aflevering blevet allokeret under international luftfart. Som følge af denne rettelse er der betydelige ændringer i brændselsforbrug og emissioner. Brændselsforbruget stiger med 51 % mens emissionerne af partikler, $NO_x$, NMVOC og CO-emissioner stiger med henholdsvis 34 %, 39 %, 7 % og 4 %.

Der er sket mindre ændringer i emissionerne på mellem 0 % og 2 % for årene 2001-2006, pga. indlemning af nye repræsentative flytyper.

## Flygtige emissioner

***Kulimport***

Mængden af importeret kul anvendt til beregning af flygtige emissioner fra lagring af faste brændsler (SNAP 050103) er blevet opdateret for årene 1980-2002 i henhold til energistatistikken for 2008.

***Benzinsalg***

Mængden af benzin anvendt til beregning af flygtige emissioner fra tankstationer (SNAP 050503) er blevet opdateret for årene 1983-2007 i henhold til energistatistikken 2008.

***Tankstationer***

Emissionsfaktorerne for NMVOC fra tankstationer er blevet opdateret både for lastning af tankbiler og tankning for årene 2000-2007.

***Bygas***

Emissioner fra distribution af bygas er blevet inkluderet i opgørelsen for årene 1985-2008. Datagrundlaget er spinkelt, da flere af distributionsselskaberne er lukket. Kun i København og Aalborg bliver der stadig anvendt bygas. To andre distributionsselskaber er inkluderet i opgørelsen, de to blev lukket i henholdsvis 2004 og 2006. For at etablere en fuldstændig tidsserie har det været nødvendigt at interpolere og ekstrapolere på baggrund af de tilgængelige data.

***Flaring I forbindelse med lagring og behandling af naturgas***

Der anvendes de samme emissionsfaktorer som for off-shore-flaring for forureningskomponenterne $SO_2$, $NO_x$, CO, partikler, dioxin and PAHs. Emissionerne af NMVOC stammer fra anlæggenes grønne regnskaber.

***Flaring i raffinaderier***

Emissionsfaktorerne for flaring i raffinaderier er blevet opdateret. Emissionsfaktoren for NMVOC er baseret på data fra et af raffinaderierne om sammensætningen af gassen til flaring. Denne emissionsfaktor er anvendt for begge raffinaderier. Emissionsfaktorer fra EMEP/EEA Guidebook er anvendt ved beregningen af emissioner af $NO_x$ og CO. For tungmetaller, dioxin og PAH anvendes emissionsfaktorer fra guidebogen (EMEP/EEA, 2009) for Tier 1 stationær forbrænding til beregning af emissioner fra flaring på raffinaderier.

### Industriprocesser

For sektor 2D2 produktion af mad og drikkevarer er NMVOC-emissioner fra produktion af brød, sukker, ethanol, spiritus, margarine og andre fedtstoffer, forarbejdning af kød og fisk samt ristning af kaffe blevet inkluderet i opgørelsen for første gang. Emissionerne er estimeret for perioden 1990 til 2008.

### Opløsningsmidler

Forbedringer og genberegninger finder løbende sted pga. den store udbredelse og kompleksitet af anvendelsen af opløsningsmidler i husholdninger og industrien. De største forbedringer i forbindelse med 2010 rapporteringen er:

- En forbedret og mere detaljeret allokering af aktivitetsdata på undersektorer er blevet implementeret, hvilket muliggør emissionsberegninger på et mere detaljeret SNAP-niveau.
- For nogle kemikalier er emissionsfaktorerne blevet opdateret.
- For alle kemikalier er der blevet tildelt emissionsfaktorer på det mest detaljerede SNAP-niveau.

### Landbrug

Sammenlignet med 2009-rapporteringen er der foretaget nogle opdateringer i opgørelserne af $NH_3$ og PM. Disse ændringer har medført et fald i både $NH_3$- og PM-emissionen.

Den største årsag til faldet i $NH_3$-emissionen skyldes, at beregningen er blevet fuldstændigt omlagt til TAN for hele perioden 1985-2008. Dette har medført et fald i emissionen fra husdyrgødning på mellem 4 % og 8 % i perioden 1985-2007.

Emissionen af partikler falder på grund af en ændring i emissionsfaktoren for fjerkræ i EMEP/EEA Guidebook.

I år er emissioner fra markafbrænding blevet genovervejet og afbrænding af frøgræsmarker er nu inkluderet. Emissioner af $NH_3$, $NO_x$, CO, NMVOC, $SO_2$, partikler, tungmetaller, dioxin og PAH fra markafbrændinger er inkluderet i opgørelsen for perioden 1985-2008. Der er samtidig foretaget genberegninger af emissionerne af $NH_3$, $NO_x$, CO, NMVOC, $SO_2$ fra markafbrænding for årene 1985-1989 inden det generelle forbud trådte i kraft.

### Affald

2010-rapporteringen inkluderer for første gang emissioner fra kremering af dyr. Emissioner af andre forureningskomponenter end dioxin fra ildebrande er estimeret for første gang. Denne genberegning omfatter alle relevante forureningskomponenter fra basisårene i protokollerne til 2008.

# 1 Introduction

## 1.1 Background information on emission inventories

### 1.1.1 Annual report

According to the guidelines for reporting emission data under the Convention on Long-Range Transboundary Air Pollution (ECE/EB.AIR/97) prepared by the Task Force on Emission Inventories and Projections and approved by the Executive Body, countries party to the UNECE-Convention on Long-Range Transboundary Air Pollution should annually submit an informative inventory report to the Secretariat. The new reporting Guidelines (ECE/EB.AIR/97) were accepted at the meeting of the Executive Body in December 2008. Due to lack of resources, it has not been possible to incorporate the new elements of the new reporting guidelines in this submission.

This report is Denmark's Annual Informative Inventory Report due March 15, 2010. The report contains information on Denmark's inventories for all years from the base years of the protocols to 2008.

The annual emission inventory for Denmark is reported in the Nomenclature for Reporting (NFR) 2002 format. Due to a lack of resources it has not been possible to use the reporting template as laid out in the reporting guidelines.

The issues addressed in this report are: trends in emissions, description of each NFR category, uncertainty estimates, recalculations, planned improvements and procedures for quality assurance and control. The structure of the report is, as far as possible, the same as the National Inventory Report to UNFCCC. The outline in annex V of the reporting guidelines is only partially followed.

This report and NFR tables are available to the public on NERI's homepage:

http://www.dmu.dk/Luft/Emissioner/Home+of+Inventory/

and on the Eionet central data repository:

http://cdr.eionet.europa.eu/dk/Air_Emission_Inventories/Submission_EMEP_UNECE

## 1.2 A description of the institutional arrangement for inventory preparation

The National Environmental Research Institute (NERI), Aarhus University, is responsible for the annual preparation and submission to the UNECE-LRTAP Convention of the Annual Danish Emissions Report, and the inventories in the NFR Format in accordance with the guidelines. NERI participates in meetings under the UNECE Task Force on Emission Inventories and Projections and the related expert panels where parties to the convention prepare the guidelines and methodologies on inventories. NERI is also responsible for estimating emissions for reporting to the NEC Directive, but the Danish EPA is responsible for the reporting.

The work concerning the annual emissions inventory is carried out in co-operation with other Danish ministries, research institutes, organisations and companies:

Danish Energy Authority, Ministry of Climate and Energy: Annual energy statistics in a format suitable for the emission inventory work and fuel-use data for the large combustion plants.

Danish Environmental Protection Agency, Ministry of the Environment. Database on waste.

Statistics Denmark, Ministry of Economic and Business Affairs. Statistical yearbook, production statistics for manufacturing industries, agricultural statistics and import/export/production figures for solvents.

The Faculty of Agricultural Sciences, Aarhus University. Data on use of mineral fertiliser, feeding stuff consumption and nitrogen turnover in animals.

The Road Directorate, Ministry of Transport. Number of vehicles grouped in categories corresponding to the EU classification, mileage (urban, rural, highway), trip speed (urban, rural, highway).

Civil Aviation Agency of Denmark, Ministry of Transport. City-pair flight data (aircraft type and origin and destination airports) for all flights leaving major Danish airports.

Danish Railways, Ministry of Transport. Fuel-related emission factors for diesel locomotives.

Danish companies. Audited environmental reports and direct information gathered from producers and agency enterprises.

Formerly, the provision of data was on a voluntary basis, but more formal agreements are now prepared.

## 1.3 Brief description of the process of inventory preparation. Data collection and processing, data storage and archiving

The background data (activity data and emission factors) for estimation of the Danish emission inventories is collected and stored in central databases located at NERI. The databases are in Access format and handled with software developed by the European Environmental Agency and NERI. As input to the databases, various sub-models are used to estimate and aggregate the background data in order to fit the format and level in the central databases. The methodologies and data sources used for the different sectors are described in Chapter 1.4 and Chapters 3 to 7. As part of the QA/QC plan (Chapter 1.5), the data structure for data processing support the pathway from collection of raw data to data compilation, modelling and final reporting.

For each submission, databases and additional tools and submodels are frozen together with the resulting NFR-reporting format. This material is placed on central institutional servers, which are subject to routine back-up services. Material which has been backed up is archived safely. A further documentation and archiving system is the official journal for NERI, for which obligations apply to NERI, as a governmental institute. In this journal system, correspondence, both in-going and out-going, is registered, which in this case involves the registration of submissions and communication on inventories with the UNECE-LRTAP Secretariat, the European Commission, review teams, etc.

Figure 1.1 shows a schematic overview of the process of inventory preparation. The figure illustrates the process of inventory preparation from the first step of collecting external data to the last step, where the reporting schemes are generated for the UNFCCC and EU (in the CRF format (Common Reporting Format)) and to the United Nations Economic Commission for Europe/Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (UNECE/EMEP) (in the NFR format (Nomenclature For Reporting)). For data handling, the software tool is CollectER (Pulles et al., 1999) and for reporting the software tool is developed by NERI. Data files and programme files used in the inventory preparation process are listed in Table 1.1.

| QA/QC Level | Name | Application type | Path | Type | Input sources |
|---|---|---|---|---|---|
| 4 store | CFR Submissions (UNFCCC and EU)<br>NFR Submissions (UNECE and EU) | External report | I:\ROSPROJ\LUFT_EMI\Inventory\AllYears\8_AllSectors\Level_4a_Storage\ | MS Excel, xml | CRF Reporter |
| 3 process | CRF Reporter | Management tool | Working path: local machine<br>Archive path: I:\ROSPROJ\LUFT_EMI\Inventory\AllYears\8_AllSectors\Level_3b_Processes | (exe + mdb) | manual input and Importer2CRF |
| 3 process | Importer2CRF | Help tool | I:\ROSPROJ\LUFT_EMI\Inventory\AllYears\8_AllSectors\Level_3b_Processes | MS Access | CRF Reporter, CollectEr2CRFand excel files |
| 3 process | CollectER2CRF | Help tool | I:\ROSPROJ\LUFT_EMI\Inventory\AllYears\8_AllSectors\Level_3b_Processes | MS Access | NERIRep |
| 2 process<br>3 store | NERIRep | Help tool | Working path: I:\ROSPROJ\LUFT_EMI\Inventory\AllYears\8_AllSectors\Level_3a_Storage | MS Access | CollectER databases; dk1972.mdb..dkxxxx.mdb |
| 2 process | CollectER | Management tool | Working path: local machine<br>Archive path: I:\ROSPROJ\LUFT_EMI\Inventory\AllYears\8_AllSectors\Level_2b_Processes | (exe +mdb) | manual input |
| 2 store | dk1972.mdb.dkxxxx. mdb | Datastore | I:\ROSPROJ\LUFT_EMI\Inventory\AllYears\8_AllSectors\Level_2a_Storage | MS Access | CollectER |

Table 1.1 List of current data structure; data files and programme files in use.

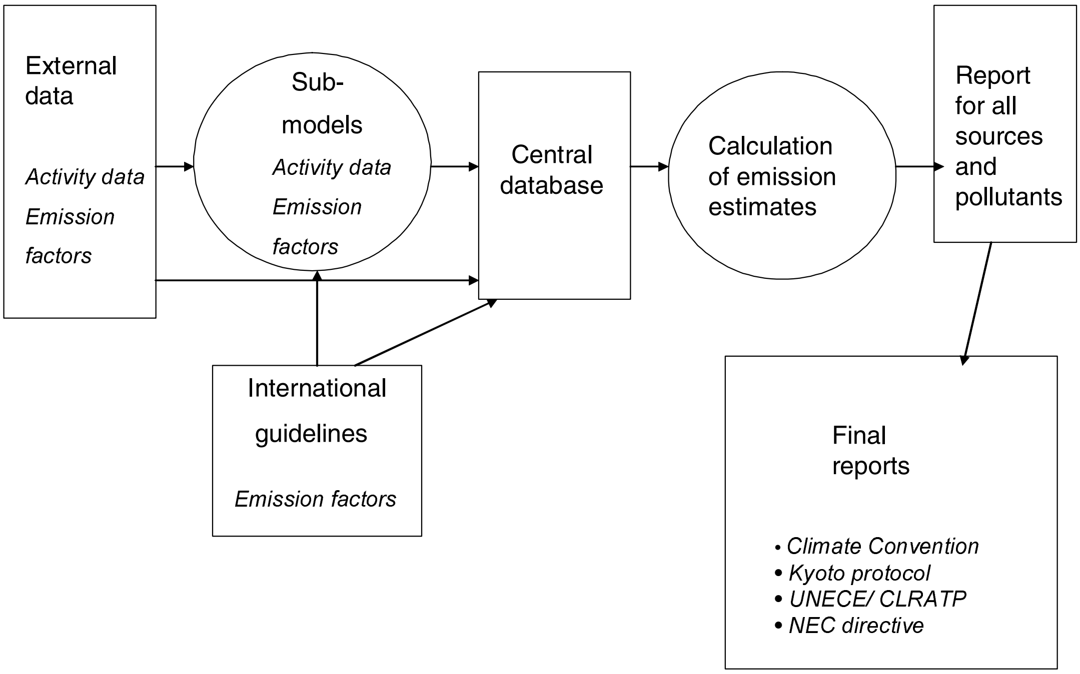



Figure 1.1 Schematic diagram of the process of inventory preparation.

## 1.4 Brief description of methodologies and data sources used

Denmark's air emission inventories are based on the Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories (IPCC, 1997), the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000) and the CORINAIR methodology. CORINAIR (COoRdination of INformation on AIR emissions) is a European air emission inventory programme for national sector-wise emission estimations, harmonised with the IPCC guidelines. In 2009 the EMEP/CORINAIR Guidebook changed name to the EMEP/EEA Guidebook. In this change the Guidebook switched nomenclature from SNAP to NFR. The Danish inventory is prepared at the more detailed SNAP level rather than at the NFR level that is only suitable for reporting. To ensure estimates are as timely, consistent, transparent, accurate and comparable as possible, the inventory programme has developed calculation methodologies for most subsectors and software for storage and further data processing.

A thorough description of the CORINAIR inventory programme used for Danish emission estimations is given in Illerup et al. (2000). The CORINAIR calculation principle is to calculate the emissions as activities multiplied by emission factors. Activities are numbers referring to a specific process generating emissions, while an emission factor is the mass of emissions pr unit activity. Information on activities to carry out the CORINAIR inventory is largely based on official statistics. The most consistent emission factors have been used, either as national values or default factors proposed by international guidelines.

A list of all subsectors at the most detailed level is given in Illerup et al. (2000) together with a translation between CORINAIR and IPCC codes for sector classifications.

### 1.4.1 The specific methodologies regarding stationary combustion

Stationary combustion plants are part of the CRF emission sources *1A1 Energy Industries*, *1A2 Manufacturing Industries* and *1A4 Other sectors*.

The Danish emission inventory for stationary combustion plants is based on the former CORINAIR system. In 2009 the Emission Inventory Guidebook was updated (EMEP/EEA, 2009). The inventory is based on activity rates from the Danish energy statistics and on emission factors for different fuels, plants and sectors.

The Danish Energy Authority aggregates fuel consumption rates in the official Danish energy statistics to SNAP categories.

For each of the fuel and SNAP categories (sector and e.g. type of plant), a set of general emission factors has been determined. Some emission factors refer to the EMEP/EEA guidebook and some are country specific and refer to Danish legislation, Danish research reports or calculations based on emission data from a considerable number of plants.

A number of large plants, e.g. power plants and municipal waste incineration plants are registered individually as large point sources and emission data from the actual plants are used. This enables use of plant-specific emission factors that refer to emission measurements stated in annual environmental reports. Emission factors of $SO_2$, $NO_X$, HM and PM are often plant specific.

Please refer to Chapter 3.2 and Annex 2A for further information on emission inventories for stationary combustion plants.

### 1.4.2 Specific methodologies regarding transport

The emissions from transport referring to SNAP category 07 (Road transport) and the sub-categories in 08 (Other mobile sources) are made up in the IPCC categories; 1A3b (Road transport), 1A2f (Industry-other), 1A3a (Civil aviation), 1A3c (Railways), 1A3d (Navigation), 1A4c (Agriculture/forestry/fisheries), 1A4b (Residential) and 1A5 (Other).

An internal NERI model with a structure similar to the European COPERT IV emission model (Ntziachristos, 2000) is used to calculate the Danish annual emissions for road traffic. The emissions are calculated for operationally hot engines, during cold start and fuel evaporation. The model also includes the emission effect of catalyst wear. Input data for vehicle stock and mileage is obtained from the Danish Road Directorate and Statistics Denmark, and is grouped according to average fuel consumption and emission behaviour. For each group, the emissions are estimated by combining vehicle type and annual mileage figures with hot emission factors, cold:hot ratios and evaporation factors (Tier 2 approach).

For air traffic, from 2001 onwards estimates are made on a city-pair level, using flight data from the Danish Civil Aviation Agency (CAA-DK), and LTO and distance-related emission factors from the CORINAIR guidelines (Tier 2 approach). For previous years, the background data consists of LTO/aircraft type statistics from Copenhagen Airport and total LTO numbers from CAA-DK. With appropriate assumptions, consistent time-series of emissions are produced back to 1990 and include the findings from a Danish city-pair emission inventory in 1998.

Off-road working machines and equipment are grouped in the following sectors: inland waterways (pleasure craft), agriculture, forestry, industry, and household and gardening. The sources for stock and operational data are various branch organisations and key experts. In general, the emissions are calculated by combining information on the number of different machine types and their respective load factors, engine sizes, annual working hours and emission factors (Tier 2 approach).

The inventory for navigation consists of regional ferries, local ferries and other national sea transport. For regional ferries, the fuel consumption and emissions are calculated as a product of number of round trips pr ferry route (Statistics Denmark), sailing time pr round trip, share of round trips pr ferry, engine size, engine load factor and fuel consumption/emission factor. The estimates take into account the changes in emission factors and ferry specific data during the inventory period.

For the remaining navigation categories, the emissions are calculated simply as a product of total fuel consumption and average emission factors. For each inventory year, this emission factor average comprises the emission factors for all present engine production years, according to engine life times.

Please refer to Chapter 3.3 and Annex 2B for further information on emissions from transport.

### 1.4.3 The specific methodologies regarding fugitive emissions

#### Fugitive emissions from oil (1.B.2.a)

Emissions from offshore activities are estimated according to the methodology described in the Emission Inventory Guidebook (EMEP/EEA, 2009). The sources include extraction of oil and gas, onshore oil tanks, and onshore and offshore loading of ships. Activity data is given in the Danish Energy Statistics by the Danish Energy Authority. The emission factors are based on the figures given in the guidebook except for in the case of onshore oil tanks where national values are used.

The VOC emissions from petroleum refinery processes cover non-combustion emissions from feed stock handling/storage, petroleum products processing, product storage/handling and flaring. $SO_2$ is also emitted from non-combustion processes and includes emissions from product processing and sulphur-recovery plants. The emission calculations are based on information from the Danish refineries and the energy statistics.

#### Fugitive emissions from natural gas (1.B.2.b)

Inventories of NMVOC emission from gas transmission and distribution are based on annual environmental reports from the Danish gas transmission company, DONG, and on a Danish inventory for the years 1999-2008 reported by the Danish gas sector (transmission and distribution companies).

#### Fugitive emissions from flaring (1.B.2.c)

Emissions from flaring offshore, in gas treatment and storage plants, and in refineries are included in the inventory. Emissions calculations are based on annual reports from the Danish Energy Agency and environmental reports from gas storage and treatment plants and the refineries. Calorific values are based on the reports for the EU ETS for offshore flaring, on annual gas quality data from Energinet.dk, and on additional data from the refineries. Emission factors are based on the Emission Inventory Guidebook (EMEP/EEA, 2009).

Please refer to Chapter 3.4 for further information on fugitive emissions from fuels.

### 1.4.4 Specific methodologies regarding industrial processes

Energy consumption associated with industrial processes and the emissions thereof is included in the inventory for stationary combustion plants. This is due to the overall use of energy balance statistics for the inventory.

#### Mineral products

The sub-sector includes production of cement, lime, container glass/glass wool, mineral wool, other production (consumption of lime), and roofing and road paving with asphalt. The activity data as well as emission data are primarily based on information from Environmental Reports (In Danish: "Grønne regnskaber") prepared by companies according to obligations under Danish law. The published information is supplemented with information obtained directly from companies or by use of standard emission factors. The distribution of TSP between $PM_{10}$ and $PM_{2.5}$ is based on European average data.

#### Chemical industry

The sub-sector includes production of nitric acid, catalysts, fertilisers and pesticides. The activity data as well as emission data are based on information from the companies as accounted for and published in the Environmental Reports combined with information obtained by contact to the companies. The distribution of TSP between $PM_{10}$ and $PM_{2.5}$ is based on European average data. Production of nitric acid ceased in the middle of 2004.

#### Metal production

The sub-sector includes production of steel sheets and bars, cast iron, aluminium, lead and lead products and various other metal products. The activity data as well as emission data for the steelworks are based on information from the companies as accounted for and published in the Environmental Reports, combined with information obtained by contact with the companies. The activity data or the other processes are based on information from Statistics Denmark combined with Danish average emission factors and standard emission factors. The distribution of TSP between PM10 and PM2.5 is based on European average data.

#### Other production

The sub-sector includes breweries and other activities within the food and drink sector. The activity data is obtained from Statistics Denmark and the emission factors are obtained from the EMEP/EEA Guidebook.

Please refer to Chapter 4 for further information on industrial processes.

### 1.4.5 Specific methodologies regarding solvents

The approach for calculating the emissions of Non-Methane Volatile Organic Carbon (NMVOC) from industrial and household use in Denmark focuses on single chemicals rather than activities. This leads to a clearer picture of the influence from each specific chemical, which enables a more detailed differentiation on products and the influence of product use on emissions. The procedure is to quantify the use of the chemicals and estimate the fraction of the chemicals that is emitted as a consequence of use.

The detailed approach in EMEP/EEA Guidebook (2009) is used. Here all relevant consumption data on all relevant solvents must be inventoried or at least those together representing more than 90 % of the total NMVOC emission. Simple mass balances for calculating the use and emissions of chemicals are set up 1) use = production + import – export, 2) emission = use emission factor. Production, import and export figures are extracted from Statistics Denmark, from which a list of 427 single chemicals, a few groups and products is generated. For each of these, a "use" amount in tonnes pr year (from 1995 to 2008) is calculated. For some chemicals and/or products, e.g. propellants used in aerosol cans, use amounts are obtained from the industry as the information from Statistics Denmark does not comply with required specificity. It is found that approx. 40 different NMVOCs comprise over 95 % of the total use and it is these 40 chemicals that are investigated further. The "use" amounts are distributed across industrial activities according to the Nordic SPIN (Substances in Preparations in Nordic Countries) database, where information on industrial use categories is available in a NACE coding system. The chemicals are also related to specific products according to the Use Category (UCN) system. Emission factors are obtained from regulators, literature or the industry.

Outputs from the inventory are: a list where the 40 most predominant NMVOCs are ranked according to emissions to air, specification of emissions from industrial sectors and from households, contribution from each chemical to emissions from industrial sectors and households. Furthermore tidal (annual) trend in NMVOC emissions expressed as total NMVOC and single chemical and specified in industrial sectors and households are shown.

Please refer to Chapter 5 for further information on the emission inventory for solvents.

### 1.4.6 Specific methodologies regarding agriculture

The emissions from the agricultural sector include emissions of ammonia, $NO_x$, CO, NMVOC, $SO_2$, particulate matter, heavy metals, dioxin and PAH. The emissions are registered in NFR tables under 4B Manure Management, 4D Agricultural Soils and 4F Field Burning of Agricultural Wastes.

The calculations of all sources are based on the Emission Inventory Guidebook (EMEP/EEA, 2009). In Denmark, a model-based system is applied for calculation of ammonia emissions, particulate matter and greenhouse gases. This model is called IAD (Inventory Agriculture Data), and data on activity and emissions are collected, evaluated and discussed in close corporation with the Faculty of Agricultural Sciences, Aarhus University and the Danish Agricultural Advisory Centre.

Livestock numbers and data concerning the land use and crop yield are based on the Agricultural Statistics published by Statistics Denmark. The emission factors used to calculate the emissions are primarily based on information from the Faculty of Agricultural Sciences, Aarhus University and the Danish Agricultural Advisory Centre. Furthermore, activity data from the Danish Environmental Protection Agency and the Danish Plant Directorate are used.

Uncertainties have been estimated. The estimated emissions for particulate matter are associated with very high uncertainties, which are estimated to be of several hundred percent. To ensure data quality, activity data and data for estimation of emission factors are collected and discussed in corporation with specialists and researchers at different institutes and research departments. This means that the emission inventories are continuously evaluated according to the latest knowledge and information. Furthermore, time-series of both emission factors and activity data are prepared, and considerable variations are checked and revised.

Please refer to Chapter 6 and Appendix 2C for further information on emission inventories for agriculture.

## 1.5 Information on the QA/QC plan including verification and treatment of confidential issues where relevant

In the Danish National Inventory Report to UNFCCC (Nielsen et al., 2009), the plan for Quality Control (QC) and Quality Assurance (QA) for greenhouse gas emission inventories prepared by the Danish National Environmental Research Institute is outlined. The plan is in accordance with the guidelines provided by the UNFCCC (IPCC, 1997) and the "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories" (IPCC, 2000). The ISO 9000 standards are also used as important input for the plan. The plan also, to a limited extent, includes the gases reported to the UNECE-LRTAP Convention.

## 1.6 General uncertainty evaluation, including data on the overall uncertainty for the inventory totals

The uncertainty estimates are based on the simple Tier 1 approach in the EMEP/CorinAir *Good Practice Guidance for LRTAP Emission Inventories* (Pulles & Aardenne, 2001).

The uncertainty estimates are based on emission data for the base year and year 2008, and on uncertainties for activity rates and emission factors for each of the main SNAP sectors. For particulate matter, the year 2000 is considered as the base year, but for all other pollutants the base year is 1990.

Uncertainty estimates include uncertainty of the total emission as well as uncertainty of the trend. The estimated uncertainties are shown in Table 1.2. The uncertainty estimates include the sectors: stationary combustion, transport, industry and agriculture.

Table 1.2 Danish uncertainty estimates, 2008.

| Pollutant | Uncertainty Total emission [%] | Trend[1] 1990[2]-2008 [%] | Uncertainty Trend [%-age points] |
|---|---|---|---|
| $SO_2$ | 23 | -89 | ±2.4 |
| $NO_x$ | 34 | -45 | ±5 |
| NMVOC | 89 | -45 | ±15 |
| CO | 37 | -40 | ±14 |
| $NH_3$ | 28 | -33 | ±15 |
| TSP [1] | 281 | +6.1 | ±104 |
| $PM_{10}$ [1] | 308 | +7.8 | ±120 |
| $PM_{2.5}$ [1] | 359 | +11.1 | ±140 |
| As | 170 | -72 | ±19 |
| Cd | 195 | -62 | ±42 |
| Cr | 230 | -82 | ±32 |
| Cu | 742 | -7 | ±224 |
| Hg | 142 | -74 | ±26 |
| Ni | 152 | -71 | ±21 |
| Pb | 332 | -93 | ±54 |
| Se | 352 | -53 | ±88 |
| Zn | 340 | +7 | ±260 |
| PCDD/F | 627 | -45 | ±255 |
| Benzo(b)fluoranthene | 918 | +138 | ±158 |
| Benzo(k)fluoranthene | 933 | +153 | ±212 |
| Benzo(a)pyrene | 939 | +149 | ±129 |
| Indeno(1,2,3-c,d) | 925 | +115 | ±104 |

1. Only including the emission sources for which uncertainty estimates have been estimated.

2. The base year for PM is 2000.

## 1.7 General assessment of the completeness

The Danish emissions inventory due 15 February 2010 includes all sources identified by the EMEP/EEA guidebook except the following:

### 1.7.1 Industrial processes

- Mineral products (NFR 2A): The inventory will be improved regarding completion of pollutants included. The methodology used for some of the pollutants from glass production is inconsistent and will be improved.
- Metal production (NFR 2C): For secondary aluminium and zinc production, potential emissions of heavy metals will be investigated.

### 1.7.2 General comment

For the 2010 submission Denmark did not use the new reporting template. The new template and Guidebook contains several new subsectors that will have to be estimated. Unfortunately resources are not available to improve the emission inventory by estimating the new source categories. At this time there is no timeline for implementing the new reporting guidelines and the EMEP/EEA Guidebook.

## 1.8 References

EMEP/EEA, 2009: EMEP/EEA air pollutant emission inventory guidebook — 2009 prepared by the UNECE/EMEP Task Force on Emissions Inventories and Projections, 2009 update. Available at: http://www.eea.europa.eu/publications/emep-eea-emission-inventory-guidebook-2009 (21-01-2010).

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Ntziachristos, L., Samaras, Z. 2000: COPERT III Computer Programme to Calculate Emissions from Road Transport - Methodology and Emission Factors (Version 2.1). Technical report No 49. European Environment Agency, November 2000, Copenhagen. Available at: http://reports.eea.eu.int/Technical_report_No_49/en

# 2 Trends in Emissions

## 2.1 Acidifying gases

Acid deposition of sulphur and nitrogen compounds mainly derives from emissions of $SO_2$, $NO_X$ and $NH_3$. The effects of acidification may appear in a number of ways, including defoliation and reduced vitality of trees, and declining fish stocks in acid-sensitive lakes and rivers.

$SO_2$ and $NO_X$ can be oxidised into sulphate ($SO_4^{--}$) and nitrate ($NO_3^-$) - either in the atmosphere or after deposition - resulting in the formation of two and one $H^+$, respectively. $NH_3$ may react with $H^+$ to form ammonium ($NH_4^+$) and, by nitrification in soil, $NH_4^+$ is oxidised to $NO_3^-$ and $H^+$ ions are formed.

Weighting the individual substances according to their acidification effect, total emissions in terms of acid equivalents can be calculated as:

$$A = \frac{m_{SO_2}}{M_{SO_2}} \cdot 2 + \frac{m_{NO_x}}{M_{NO_x}} + \frac{m_{NH_3}}{M_{NH_3}} = \frac{m_{SO_2}}{64} \cdot 2 + \frac{m_{NO_x}}{46} + \frac{m_{NH_3}}{17}$$

where $A$ is the acidification index in Mmole

$m_i$ is the emission of pollutant *i* in tonnes

$M_i$ is the mole weight [tonne/Mmole] of pollutant *i*

The actual effect of the acidifying substances depends on a combination of two factors: the amount of acid deposition and the natural capacity of the terrestrial or aquatic ecosystem to counteract the acidification. In areas where the soil minerals easily weather or have a high lime content, acid deposition will be relatively easily neutralised.

Figure 2.1 shows the emission of Danish acidifying gases in terms of acid equivalents. In 1990, the relative contribution in acid equivalents was almost equal for the three gases. In 2008, the most important acidification factor in Denmark was ammonia nitrogen and the relative contributions for $SO_2$, $NO_X$ and $NH_3$ were 7 %, 40 % and 53 %, respectively. However, with regard to long-range transport of air pollution, $SO_2$ and $NO_X$ are still the most important pollutants.

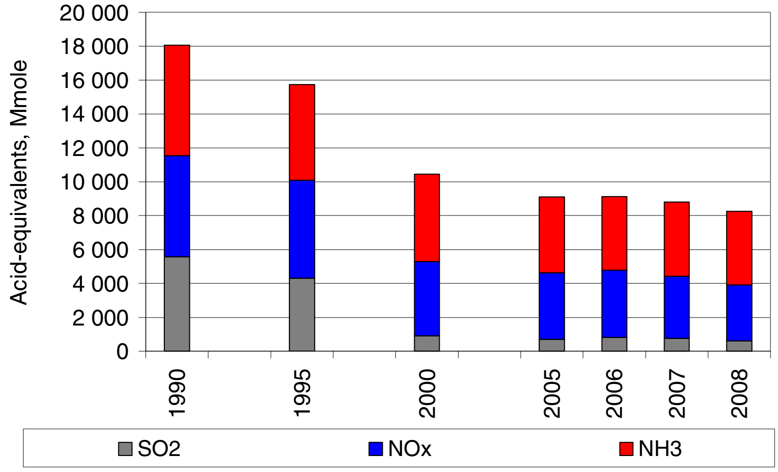



Figure 2.1 Emissions of $NH_3$, $NO_X$ and $SO_2$ over time in acid equivalents.

## 2.2 Description and interpretation of emission trends by gas

### 2.2.1 $SO_2$

The main part of the $SO_2$ emission originates from combustion of fossil fuels, i.e. mainly coal and oil, in public power and district heating plants. From 1980 to 2008, the total emission decreased by 96 %. The large reduction is mainly due to installation of desulphurisation plant and use of fuels with lower content of sulphur in public power and district heating plants. Despite the large reduction of the $SO_2$ emissions, these plants make up 34 % of the total emission. Also emissions from industrial combustion plants, non-industrial combustion plants and other mobile sources are important. National sea traffic (navigation and fishing) contributes with about 5 % of the total $SO_2$ emission. This is due to the use of residual oil with high sulphur content.

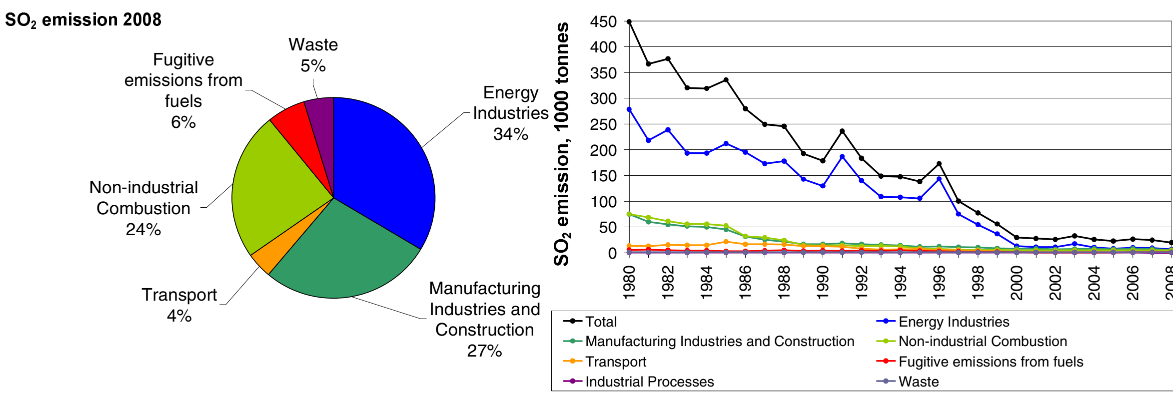



Figure 2.9 $SO_2$ emissions. Distribution according to the main sectors (2008) and time-series for 1990 to 2008.

### 2.2.2 $NO_X$

The largest sources of emissions of $NO_X$ are road transport followed by other mobile sources and combustion in energy industries (mainly public power and district heating plants). The transport sector is the sector contributing the most to the emission of $NO_X$ and, in 2008, 47 % of the Danish emissions of $NO_X$ stems from road transport, national navigation, railways and civil aviation. Also emissions from national fishing and off-road vehicles contribute significantly to the $NO_X$ emission. For non-industrial combustion plants, the main sources are combustion of gas oil, natural gas and wood in residential plants. The emissions from energy industries have decreased by 73 % from 1985 to 2008. In the same period, the total emission decreased by 48 %. The reduction is due to the increasing use of catalyst cars and installation of low-$NO_X$ burners and denitrifying units in power plants and district heating plants.

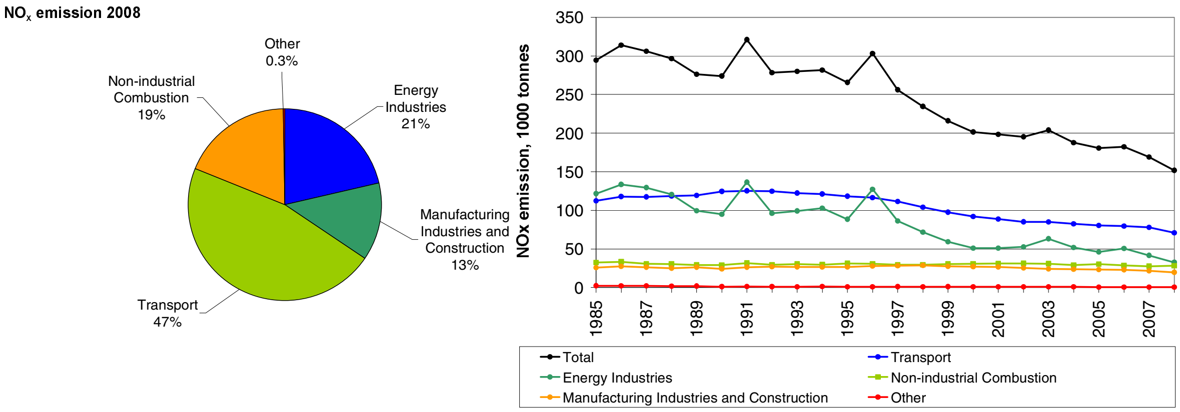



Figure 2.6 $NO_X$ emissions. Distribution according to the main sectors (2008) and time-series for 1985 to 2008.

### 2.2.3 $NH_3$

Almost all atmospheric emissions of $NH_3$ result from agricultural activities. Only a minor fraction originates from road transport (2 %). This fraction is, however, increasing due to increasing use of catalyst cars. The major part of the emission from agriculture stems from livestock manure (80 %) and the largest losses of ammonia occur during the handling of the manure in stables and in field application. Other contributions come from use of mineral fertilisers (7 %), N-excretion on pasture range and paddock (3 %), sewage sludge used as fertiliser, crops and ammonia used for straw treatment (7 %) and field burning (less than 1 %). The total ammonia emission decreased by 36 % from 1985 to 2008. This is due to the active national environmental policy efforts over the past twenty years. Due to the action plans for the aquatic environment and the Ammonia Action Plan, a series of measures to prevent loss of nitrogen in agricultural production has been initiated. The measures have included demands for improved utilisation of nitrogen in livestock manure, a ban against application of livestock manure in winter, prohibition of broadspreading of manure, requirements for establish-ment of catch crops, regulation of the number of livestock pr hectare and a ceiling for the supply of nitrogen to crops. As a result, despite an increase in the production of pigs and poultry, the ammonia emission has been reduced considerably.

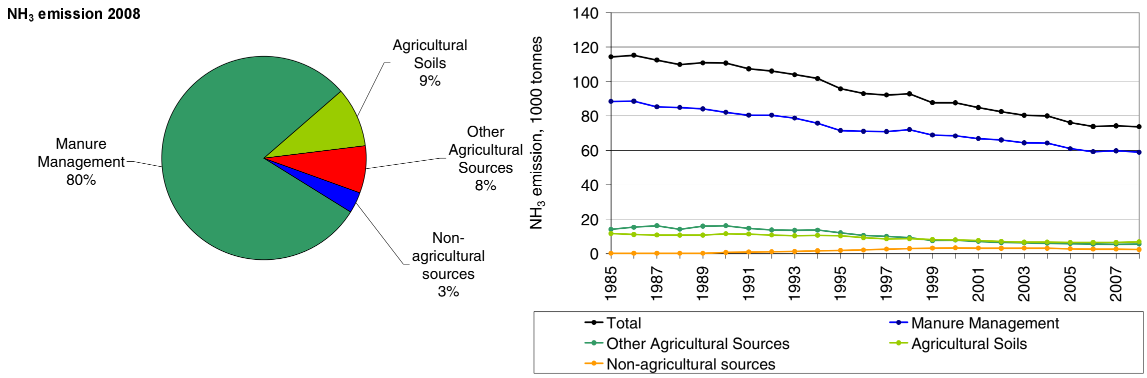



Figure 2.4 NH$_3$ emissions. Distribution on the main sectors (2008) and time-series for 1985 to 2008.

## 2.3 Other air pollutants

### 2.3.1 NMVOC

The emissions of NMVOC originate from many different sources and can be divided into two main groups: incomplete combustion and evaporation. Road vehicles and other mobile sources such as national navigation vessels and off-road machinery are the main sources of NMVOC emissions from incomplete combustion processes. Road transportation vehicles are still the main contributors, even though the emissions have declined since the introduction of catalyst cars in 1990. The evaporative emissions mainly originate from the use of solvents and the extraction, handling and storage of oil and natural gas. The emissions from the energy industries have increased during the nineties due to the increasing use of stationary gas engines, which have much higher emissions of NMVOC than conventional boilers. The total anthropogenic emissions have decreased by 45 % from 1985 to 2008, largely due to the increased use of catalyst cars and reduced emissions from use of solvents.

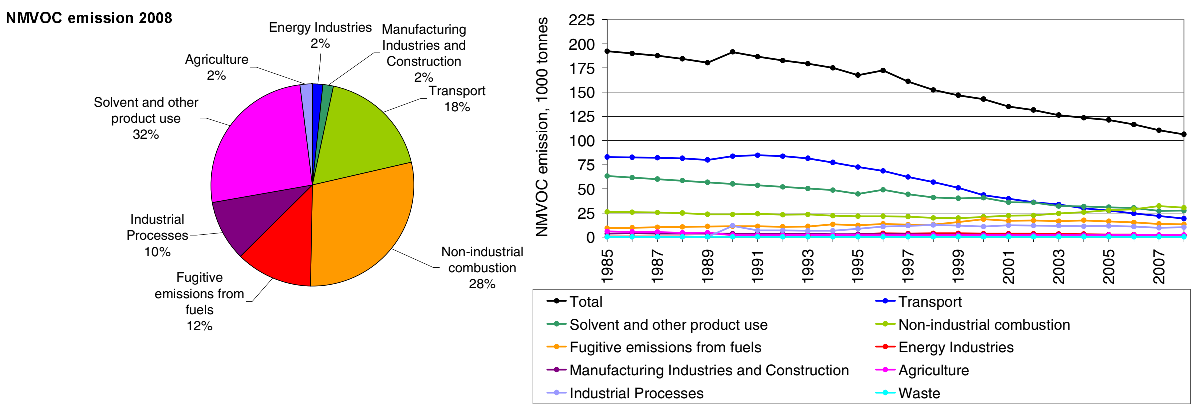



Figure 2.8 NMVOC emissions. Distribution according to the main sectors (2008) and time-series for 1985 to 2008.

### 2.3.2 CO

Other mobile sources and non-industrial combustion plants contribute significantly to the total emission of this pollutant. Transport is the second largest contributor to the total CO emission. In 1990 a law forbidding the burning of agricultural crop residues on fields was implemented this caused significant reduction in CO emission. The emission decreased further by 40 % from 1990 to 2008, largely because of decreasing emissions from road transportation.

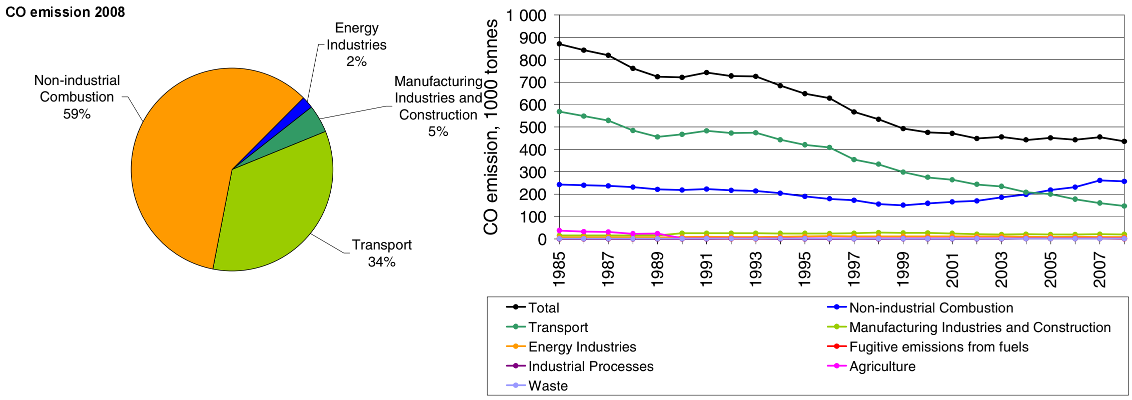



Figure 2.7 CO emissions. Distribution according to the main sectors (2008) and time-series for 1985 to 2008.

### 2.3.3 PAHs

The present emission inventory for PAH (polycyclic aromatic hydrocarbons) includes the four PAHs reported to UNECE: benzo(a)-pyrene, benzo(b)-fluoranthene, benzo(k)fluoranthene and indeno-(1,2,3-cd)pyrene. The most important sources of PAH emissions are combustion of wood in the residential sector and road transportation. The increasing emission trend is due to increasing combustion of wood in the residential sector.

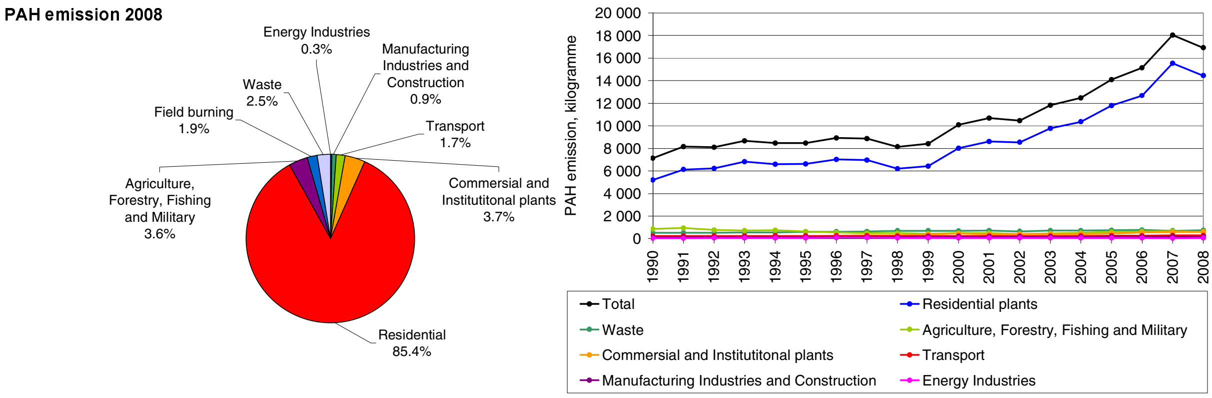



Figure 2.7 PAH emissions. Distribution according to the main sectors (2008) and time-series for 1985 to 2008.

### 2.3.4 Particulate Matter

The particulate matter (PM) emission inventory has been reported for the years 2000-2008. The inventory includes the total emission of particles TSP (Total Suspended Particles), emission of particles smaller than 10 µm ($PM_{10}$) and emission of particles smaller than 2.5 µm ($PM_{2.5}$).

The largest $PM_{2.5}$ emission sources are residential plants (70 %), road traffic (12 %) and other mobile sources (8 %). For the latter, the most important sources are off-road vehicles and machinery in the industrial sector and in the agricultural/forestry sector (both 38 %). For the road transport sector, exhaust emissions account for the major part (72 %) of the emissions. The $PM_{2.5}$ emission increased by 26 % from 2000 to 2008 due to an increasing wood consumption in the residential sector.

The largest TSP emission sources are the residential sector and the agricultural sector. The TSP emissions from transport are also important and include both exhaust emissions and the non-exhaust emissions from brake and tyre wear and road abrasion. The non-exhaust emissions account for 53 % of the TSP emission from road transport.

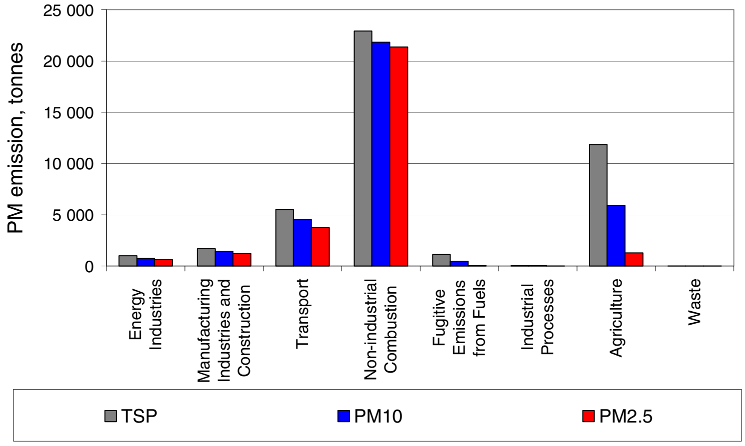



Figure 2.8 PM emissions pr sector for 2008.

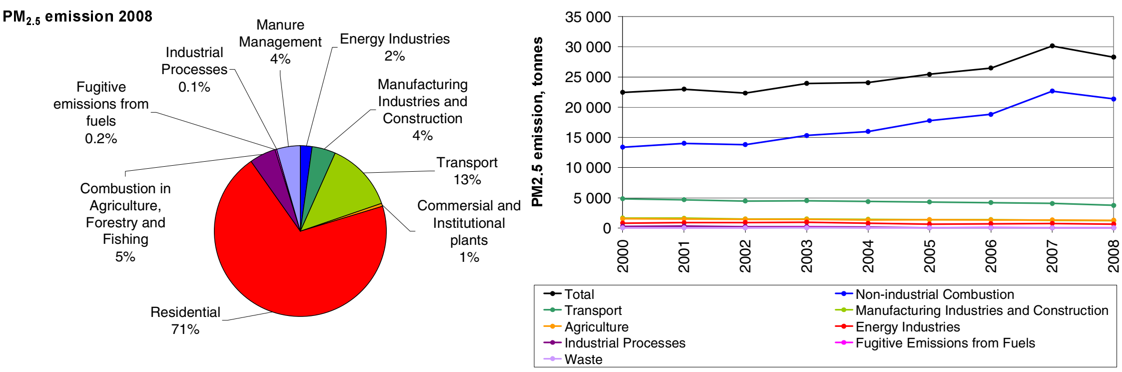



Figure 2.9 $PM_{2.5}$ emissions. Distribution according to the main sectors (2008) and time-series for 1985 to 2008.

### 2.3.5 Heavy metals

In general, the most important sources of heavy metal emissions are combustion of fossil fuels and waste. The heavy metal emissions have decreased substantially in recent years, except for Zn. The reductions span from 7 % to 93 % for Cu and Pb, respectively. The reason for the reduced emissions is mainly increased use of gas cleaning devices at power and district heating plants (including waste incineration plants). The large reduction in the Pb emission is due to a gradual shift towards unleaded gasoline, the latter being essential for catalyst cars.The major source of Zn is accidental fires (53 %), and the increase in total Zn emission from 1990 to 2008 owe to an increasing number of car fires.

Table 2.1 Emissions of heavy metals.

| Heavy metals, kilogramme | As | Cd | Cr | Cu | Hg | Ni | Pb | Se | Zn |
|---|---|---|---|---|---|---|---|---|---|
| 1990 | 1 522 | 1 095 | 6 371 | 10 327 | 3 218 | 24 794 | 122 296 | 4 870 | 25 814 |
| 2008 | 433 | 421 | 1 124 | 9 652 | 815 | 7 453 | 8 211 | 1 768 | 27 556 |
| Reduction [%] | 72 | 62 | 82 | 7 | 75 | 70 | 93 | 64 | -7 |

According to the UNECE Heavy Metal Protocol, the priority metals are Pb, Cd and Hg and the objective is to reduce emissions of these heavy metals.

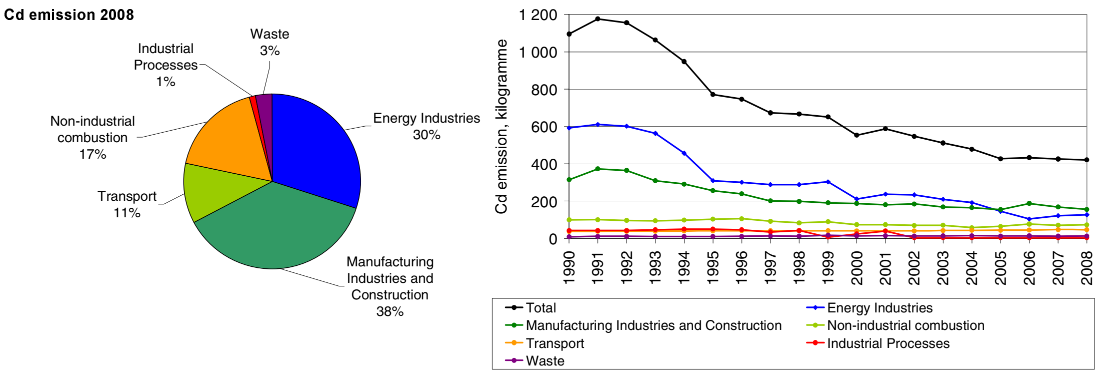



Figure 2.10 Cd emissions. Time-series for 1990 to 2008 and distribution by main sector for 2008.

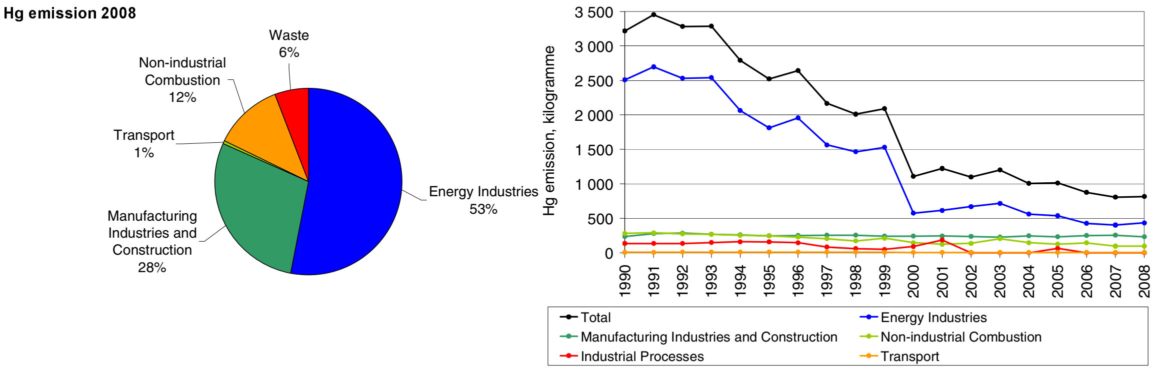



Figure 2.11 Hg emissions. Time-series for 1990 to 2008 and distribution by main sector for 2008.

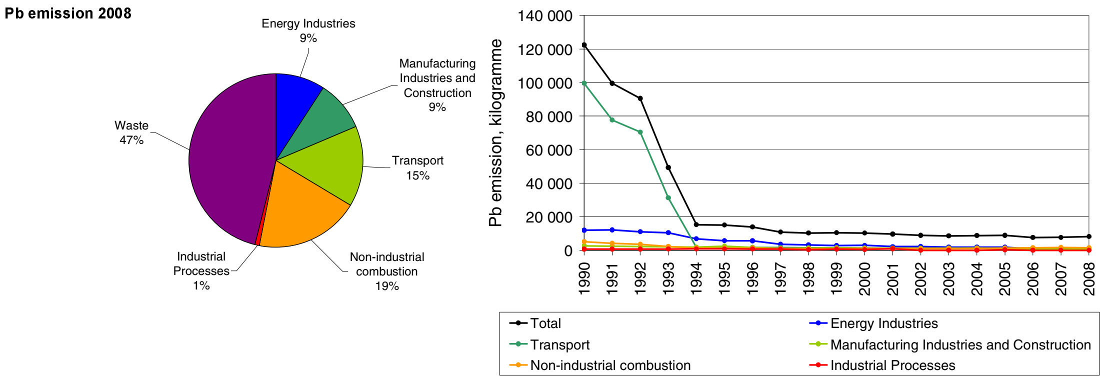



Figure 2.12 Pb emissions. Time-series for 1990 to 2008 and distribution by main sector for 2008.

# 3 Energy (NFR sector 1)

## 3.1 Overview of the sector

The energy sector is reported in three main chapters:

3.2 Stationary combustion plants (NFR sector 1A1, 1A2 and 1A4)

3.3 Transport (NFR sector 1A2, 1A3, 1A4 and 1A5)

3.4 Fugitive emissions (NFR sector 1B)

Although industrial combustion forms part of stationary combustion, detailed documentation for some of the specific industries is discussed in the industry chapters. The emissions are reported in NFR sector 1A2. Emissions from facilities with only fuel consumption in the industrial sector are included in the data presented in Chapter *3.2 Stationary Combustion*.

Table 3.1 shows detailed source categories for the energy sector and plant category in which the sector is discussed in this report.

Table 3.1 NFR source categories for the energy sector.

| NFR id | NFR sector name | NERI documentation |
|---|---|---|
| 1 | Energy | Stationary combustion, Transport, Fugitive, Industry |
| 1A | Fuel Combustion Activities | Stationary combustion, Transport, Industry |
| 1A1 | Energy Industries | Stationary combustion |
| 1A1a | Electricity and Heat Production | Stationary combustion |
| 1A1b | Petroleum Refining | Stationary combustion |
| 1A1c | Solid Fuel Transf./Other Energy Industries | Stationary combustion |
| 1A2 | Fuel Combustion Activities/Industry (ISIC) | Stationary combustion, Transport, Industry |
| 1A2a | Iron and Steel | Stationary combustion, Industry |
| 1A2b | Non-Ferrous Metals | Stationary combustion, Industry |
| 1A2c | Chemicals | Stationary combustion, Industry |
| 1A2d | Pulp, Paper and Print | Stationary combustion, Industry |
| 1A2e | Food Processing, Beverages and Tobacco | Stationary combustion, Industry |
| 1A2f | Other (please specify) | Stationary combustion, Transport, Industry |
| 1A3 | Transport | Transport |
| 1A3a | Civil Aviation | Transport |
| 1A3b | Road Transportation | Transport |
| 1A3c | Railways | Transport |
| 1A3d | Navigation | Transport |
| 1A3e | Other (please specify) | Transport |
| 1A4 | Other Sectors | Stationary combustion, Transport |
| 1A4a | Commercial/Institutional | Stationary combustion |
| 1A4b | Residential | Stationary combustion, Transport |
| 1A4c | Agriculture/Forestry/Fishing | Stationary combustion, Transport |
| 1A5 | Other (please specify) | Stationary combustion, Transport |
| 1A5a | Stationary | Stationary combustion |
| 1A5b | Mobile | Transport |
| 1B | Fugitive Emissions from Fuels | Fugitive |
| 1B1 | Solid Fuels | Fugitive |
| 1B1a | Coal Mining | Fugitive |
| 1B1a1 | Underground Mines | Fugitive |
| 1B1a2 | Surface Mines | Fugitive |
| 1B1b | Solid Fuel Transformation | Fugitive |
| 1B1c | Other (please specify) | Fugitive |
| 1B2 | Oil and Natural Gas | Fugitive |
| 1B2a | Oil | Fugitive |
| 1B2a2 | Production | Fugitive |
| 1B2a3 | Transport | Fugitive |
| 1B2a4 | Refining/Storage | Fugitive |
| 1B2a5 | Distribution of oil products | Fugitive |
| 1B2a6 | Other | Fugitive |
| 1B2b | Natural Gas | Fugitive |
| 1B2b1 | Production/processing | Fugitive |
| 1B2b2 | Transmission/distribution | Fugitive |
| 1B2c | Venting and Flaring | Fugitive |
| 1B2c1 | Venting and Flaring Oil | Fugitive |
| 1B2c2 | Venting and Flaring Gas | Fugitive |
| 1B2d | Other | Fugitive |

Summary tables for the emissions from the energy sector are shown below.

Table 3.2 $SO_2$, $NO_x$, NMVOC, CO and PM emission from the energy sector, 2008.

| | $NO_x$ | CO | NMVOC | $SO_x$ | $NH_3$ | TSP | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|---|---|---|---|
| | Gg $NO_2$ | Gg | Gg | Gg $SO_2$ | Gg | Mg | Mg | Mg |
| 1A1 Energy Industries | 32.6 | 8.2 | 1.9 | 6.6 | 0.0 | 990 | 761 | 640 |
| 1A2 Manufacturing industries and Construction | 19.7 | 19.9 | 1.7 | 5.4 | 0.4 | 1724 | 1485 | 1231 |
| 1A3 Transport | 70.9 | 146.8 | 19.1 | 0.8 | 1.6 | 5514 | 4539 | 3732 |
| 1A4 Other Sectors | 27.7 | 256.2 | 30.4 | 4.6 | 0.2 | 22 904 | 21 815 | 21 343 |
| 1A5 Other | 0.5 | 0.3 | 0.04 | 0.02 | 0.00 | 15 | 15 | 15 |
| 1B1 Fugitive Emissions from fuels, Solid Fuels | NA | NA | NA | NA | NA | 1135 | 454 | 45 |
| 1B2 Fugitive Emissions from fuels, Oil and Natural gas | 0.2 | 0.2 | 13.1 | 1.2 | 0 | 6 | 6 | 6 |
| Energy, Total | 151.5 | 431.7 | 66.3 | 18.6 | 2.2 | 32 288 | 29 075 | 27 012 |

Table 3.3 HM emissions from the energy sector, 2008.

| | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn |
|---|---|---|---|---|---|---|---|---|---|
| | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg |
| 1A1 Energy Industries | 0.75 | 0.13 | 0.43 | 0.17 | 0.36 | 0.32 | 1.59 | 1.01 | 1.55 |
| 1A2 Manufacturing industries and Construction | 0.78 | 0.16 | 0.23 | 0.17 | 0.34 | 0.73 | 4.19 | 0.52 | 1.78 |
| 1A3 Transport | 1.24 | 0.04 | 0.01 | 0.01 | 0.22 | 7.22 | 0.76 | 0.07 | 4.30 |
| 1A4 Other Sectors | 1.55 | 0.07 | 0.10 | 0.07 | 0.17 | 1.15 | 0.88 | 0.16 | 4.56 |
| 1A5 Other | 0.04 | 0.0003 | NA | NA | 0.002 | 0.06 | 0.002 | 0.0003 | 0.03 |
| 1B1 Fugitive Emissions from fuels, Solid Fuels | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1B2 Fugitive Emissions from fuels, Oil and Natural gas | 0.001 | 0.003 | 0.001 | 0.001 | 0.005 | 0.003 | 0.01 | 0.0001 | 0.09 |
| Energy, Total | 4.37 | 0.41 | 0.77 | 0.43 | 1.10 | 9.48 | 7.43 | 1.76 | 12.32 |

Table 3.4 PAH, dioxin and HCB emission from the energy sector, 2008.

| | benzo(a)-pyrene | benzo(b)-fluoranthene | benzo(k)-fluoranthene | Indeno-(1,2,3-c,d)-pyrene | Dioxin | HCB |
|---|---|---|---|---|---|---|
| | Mg | Mg | Mg | Mg | g I-Teq | kg |
| 1A1 Energy Industries | 0.01 | 0.03 | 0.02 | 0.01 | 1.19 | 0.35 |
| 1A2 Manufacturing industries and Construction | 0.03 | 0.09 | 0.02 | 0.01 | 0.18 | 0.04 |
| 1A3 Transport | 0.06 | 0.08 | 0.09 | 0.07 | 0.23 | NE |
| 1A4 Other Sectors | 4.71 | 4.92 | 2.71 | 3.33 | 19.87 | 0.15 |
| 1A5 Other | 0.0002 | 0.0003 | 0.0003 | 0.0002 | 0.001 | NE |
| 1B1 Fugitive Emissions from fuels, Solid Fuels | NA | NA | NA | NA | NA | NA |
| 1B2 Fugitive Emissions from fuels, Oil and Natural gas | 0.000004 | 0.000005 | 0.000005 | 0.000005 | 0.0001 | NA |
| Energy, Total | 4.80 | 5.11 | 2.83 | 3.42 | 21.46 | 0.54 |

## 3.2 Stationary combustion (NFR sector 1A1, 1A2 and 1A4)

This chapter includes stationary combustion plants in the NFR sectors 1A1, 1A2 and 1A4.

### 3.2.1 Source category description

Emission source categories and fuel consumption data are presented in this chapter.

#### Emission source categories

In the Danish emission database, all activity rates and emissions are defined in SNAP sector categories (Selected Nomenclature for Air Pollution) according to the CORINAIR system. The emission inventories are prepared from a complete emission database based on the SNAP sectors. Aggregation to the NFR sector codes is based on a correspondence list between SNAP and NFR enclosed in Annex 2A-1. Stationary combustion is defined as combustion activities in the SNAP sectors 01-03.

Stationary combustion plants are included in the emission source subcategories:

- 1A1 Energy, Fuel consumption, Energy Industries
- 1A2 Energy, Fuel consumption, Manufacturing Industries and Construction
- 1A4 Energy, Fuel consumption, Other Sectors

The emission and fuel consumption data included in tables and figures in Chapter 3.2 only include emissions originating from stationary combustion plants of a given NFR sector. The NFR sector codes have been applied unchanged, but some sector names have been changed to reflect the stationary combustion element of the source.

#### Fuel consumption data

In 2008 the total fuel consumption for stationary combustion plants was 531 PJ of which 423 PJ was fossil fuels and 108 PJ was biomass.

Fuel consumption distributed according to the stationary combustion subcategories is shown in Figure 3.1 and Figure 3.2. The majority - 58 % - of all fuels is combusted in the source category, *Electricity and heat production*. Other source categories with high fuel consumption are *Residential* and *Industry*.

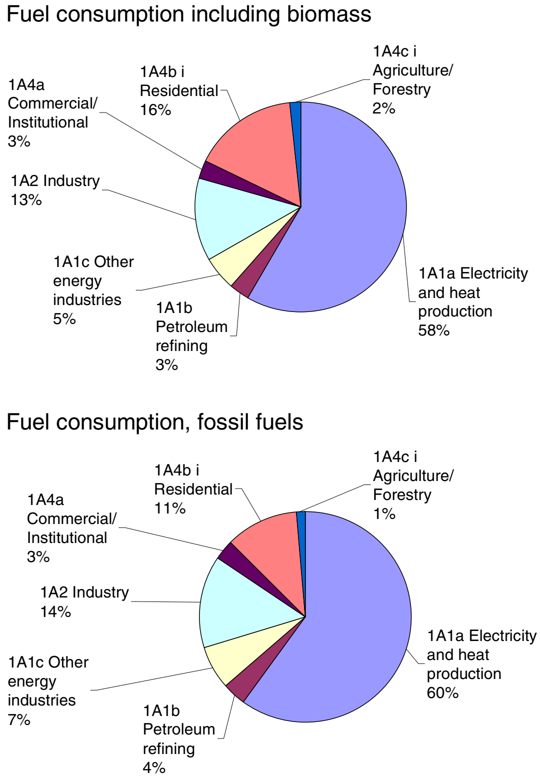



Figure 3.1 Fuel consumption of stationary combustion source categories, 2008 (based on DEA (2009a)).

Coal and natural gas are the most utilised fuels for stationary combustion plants. Coal is mainly used in power plants and natural gas is used in power plants and decentralised combined heating and power (CHP) plants, as well as in industry, district heating, residential plants and off-shore gas turbines (see Figure 3.2).

Detailed fuel consumption rates are shown in Annex 2A-4.

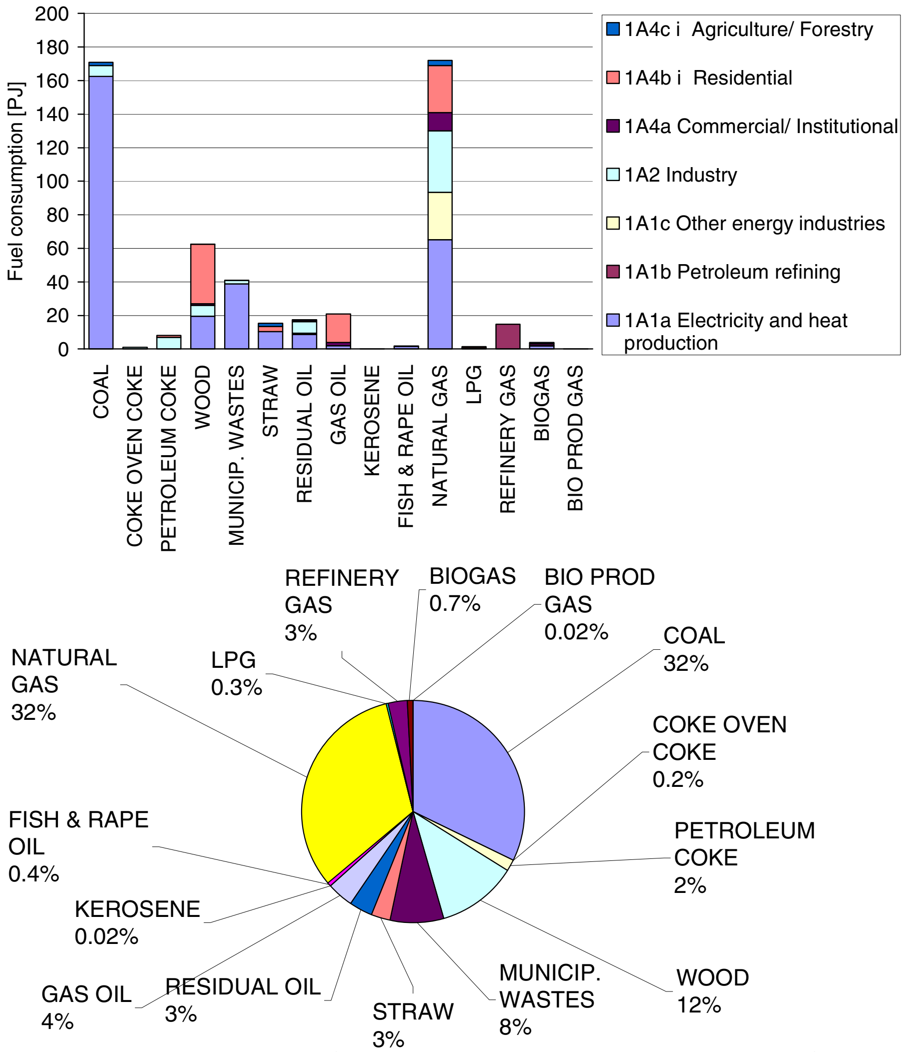
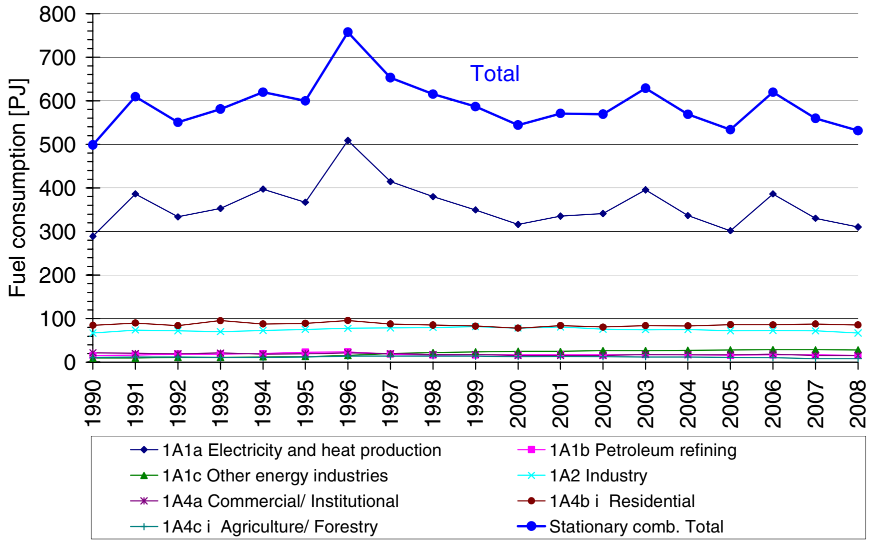


Figure 3.2 Fuel consumption of stationary combustion 2008, disaggregated to fuel type (based on DEA, 2009a).

Fuel consumption time-series for stationary combustion plants are presented in Figure 3.3[1]. The fuel consumption for stationary combustion was 7 % higher in 2008 than in 1990, while the fossil fuel consumption was 7 % lower and the biomass fuel consumption 153 % higher than in 1990.

The consumption of natural gas and biomass has increased since 1990 whereas coal consumption has decreased.

[1] Time-series 1980 onwards are included in Annex 2A-xx.



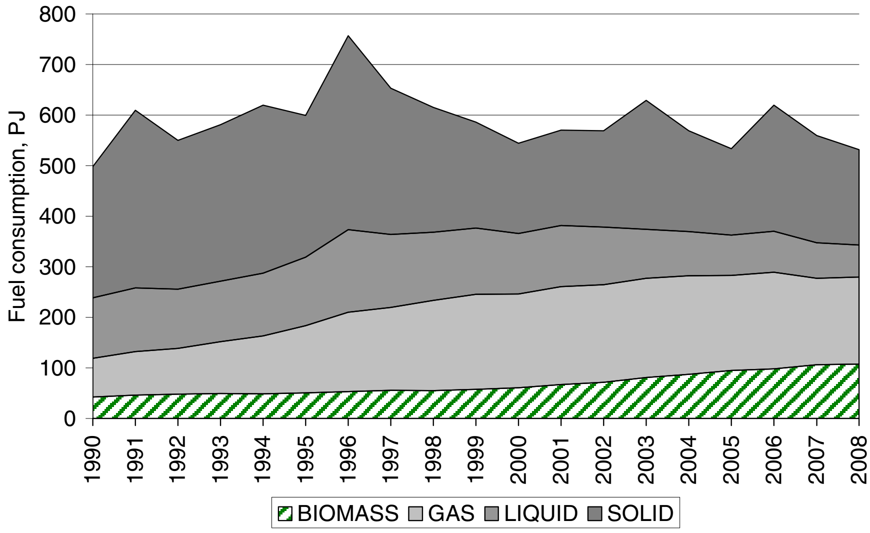




Figure 3.3 Fuel consumption time-series, stationary combustion (based on DEA, 2009a).

The fluctuations in the time-series for fuel consumption are mainly a result of electricity import/export, but also of outdoor temperature variations from year to year. This, in turn, leads to fluctuations in emission levels. The fluctuations in electricity trade, fuel consumption and $NO_x$ emission are illustrated and compared in Figure 3.4. In 1990 the Danish electricity import was large causing relatively low fuel consumption, whereas the fuel consumption was high in 1996 due to a large electricity export. In 2008 the net electricity import was 5234 TJ, whereas there was a 3420 TJ electricity import in 2007. The large electricity export that occurs some years is a result of low rainfall in Norway and Sweden causing insufficient hydropower production in both countries.

To be able to follow the national energy consumption as well as for statistical and reporting purposes, the Danish Energy Agency produces a correction of the actual fuel consumption without random variations in electricity imports/exports and in ambient temperature. This fuel consumption trend is also illustrated in Figure 3.4. The corrections are included here to explain the fluctuations in the time-series for fuel rate and emission.

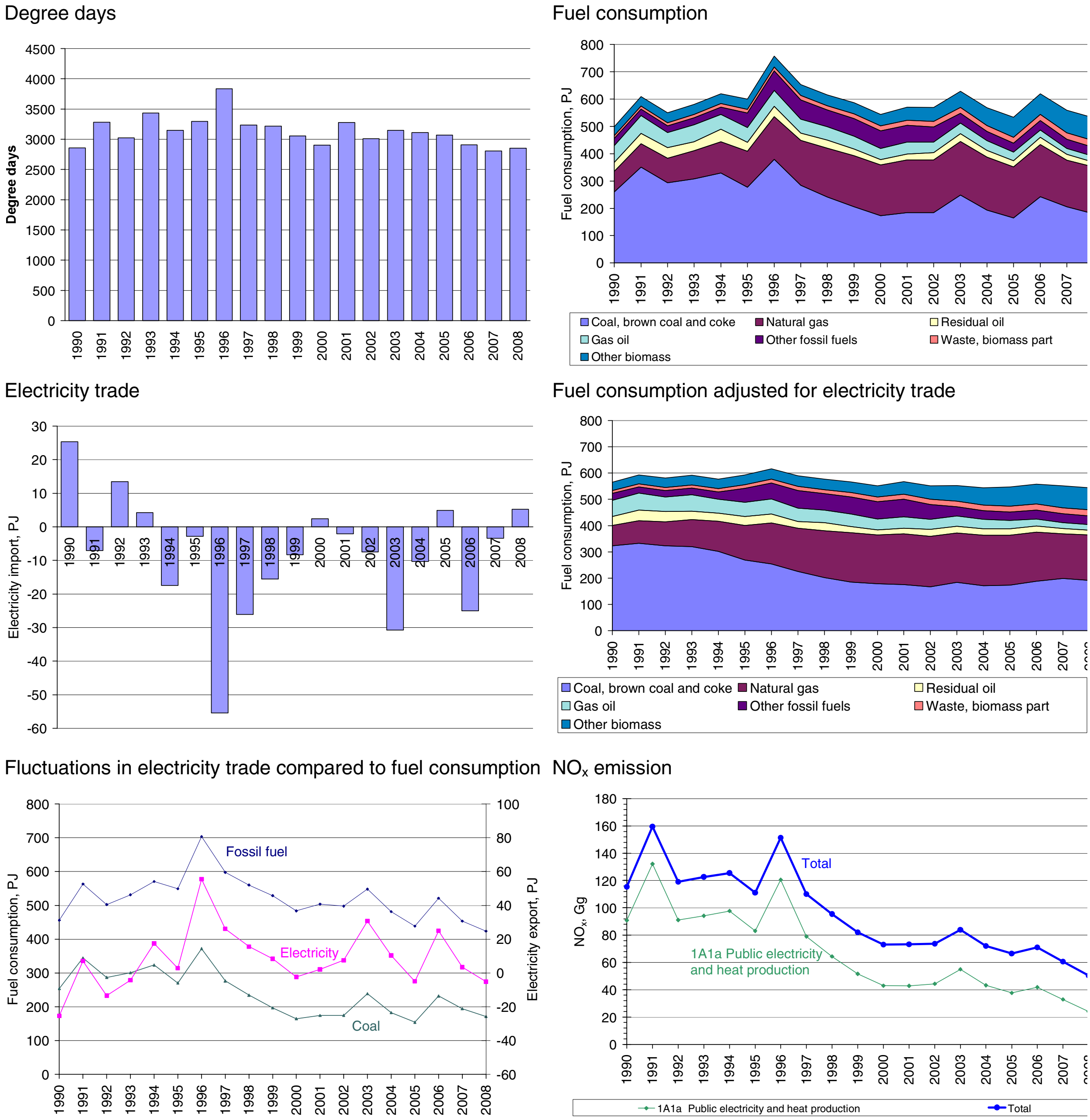



Figure 3.4 Comparison of time-series fluctuations for electricity trade, fuel consumption and $NO_x$ emission (based on DEA 2009b).

Fuel consumption time-series for the subcategories to stationary combustion are shown in Figure 3.5 – 3.7.

Fuel consumption for *Energy Industries* fluctuates due to electricity trade as discussed above. The fuel consumption in 2008 was 13 % higher than in 1990. The fluctuation in electricity production is based on fossil fuel consumption in the subcategory *Electricity and Heat Production*. The energy consumption in *Other energy industries* is mainly natural gas used in gas turbines in the off-shore industry. The biomass fuel consumption in *Energy Industries* 2008 added up to 56 PJ, which is 3.1 times the level in 1990.

The fuel consumption in *Industry* was the same in 2008 as it was in 1990 (Figure 3.6). However, in recent years the fuel consumption has been decreasing and the consumption in 2008 was 15 % lower than in

2000. The biomass fuel consumption in *Industry* in 2008 added up to 8 PJ which is a 36 % increase since 1990.

The fuel consumption in *Other Sectors* decreased 6 % since 1990 (Figure 3.7). The biomass part of the fuel consumption has increased from 16 % in 1990 to 40 % in 2008. Wood consumption in residential plants in 2008 was 2.4 times the consumption in year 2000.

Time-series for subcategories are shown in Chapter 3.2.3.

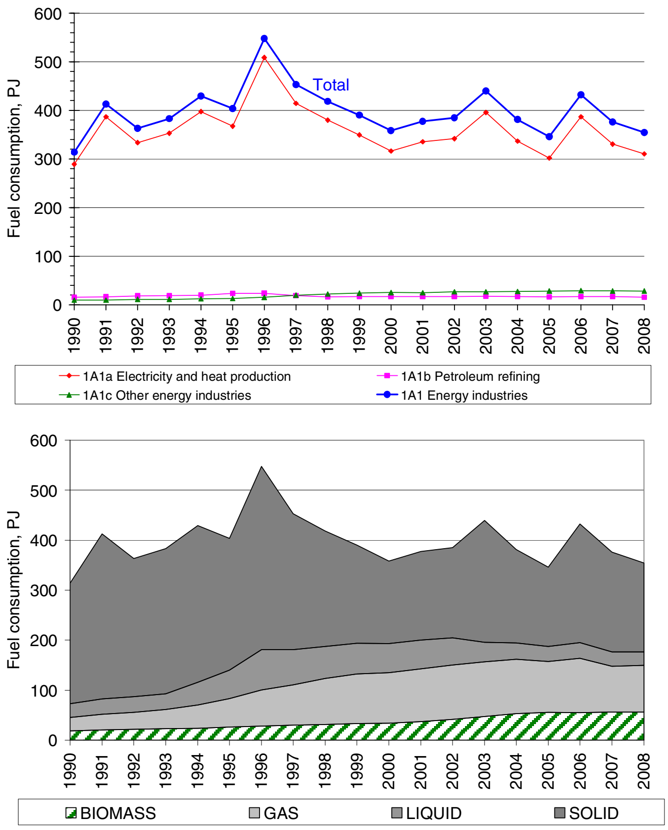



Figure 3.5 Fuel consumption time-series for subcategories - 1A1 Energy Industries.

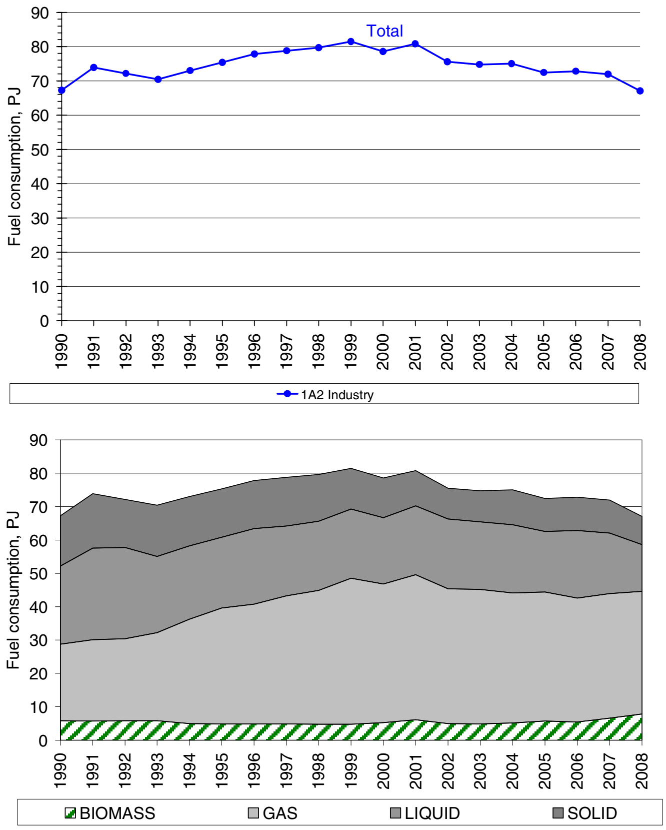



Figure 3.6 Fuel consumption time-series for subcategories - 1A2 Industry.

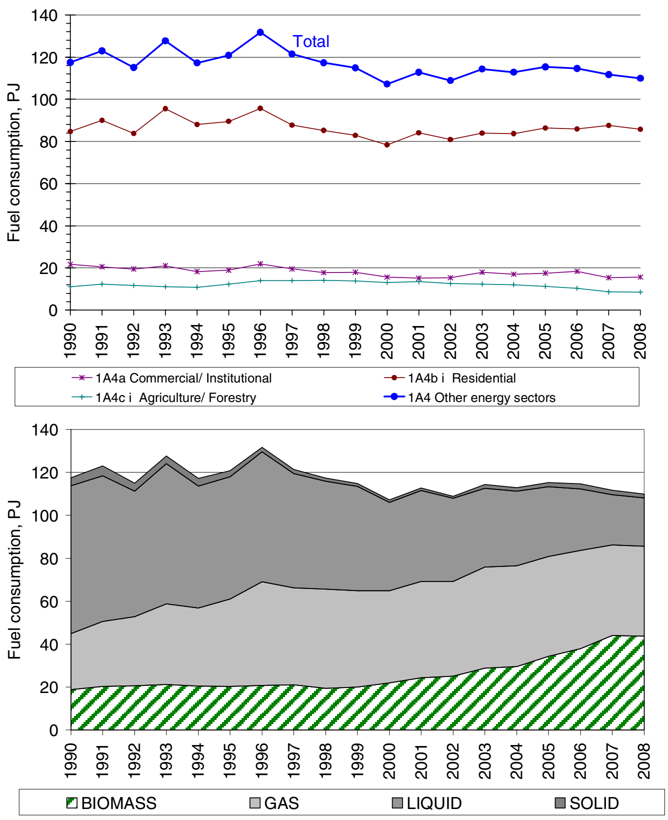



Figure 3.7 Fuel consumption time-series for subcategories - 1A4 Other Sectors.

### 3.2.2 Emissions

**$SO_2$**

Stationary combustion is the most important emission source for $SO_2$ accounting for 83 % of the national emission. Table 3.5 presents the $SO_2$ emission inventory for the stationary combustion subcategories.

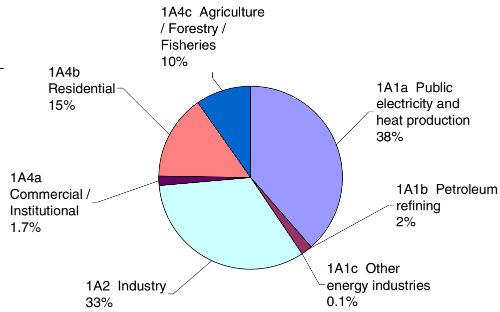
*Electricity and heat production* is the largest emission source accounting for 39 % of the emission. However, the $SO_2$ emission share is lower than the fuel consumption share for this source category, which is 58 %. This is a result of effective flue gas desulphurisation equipment installed in power plants combusting coal. In the Danish inventory the source category *Electricity and heat production* is further disaggregated. Figure 3.8 shows the $SO_2$ emission from *Electricity and heat production* on a disaggregated level. Power plants >300$MW_{th}$ are the main emission source, accounting for 70 % of the emission.

The $SO_2$ emission from industrial plants is 33 %, a remarkably high emission share compared with fuel consumption. The main emission sources in the industrial category are combustion of coal and residual oil, but emissions from the cement industry is also a considerable emission source. Ten years ago $SO_2$ emission from the industrial category only accounted for a small part of the emission from stationary combustion, but as a result of reduced emissions from power plants the share has now increased.

Time-series for $SO_2$ emission from stationary combustion are shown in Figure 3.9[2]. The $SO_2$ emission from stationary combustion plants has decreased by 96 % since 1980 and 90 % since 1990. The large emission decrease is mainly a result of the reduced emission from *Electricity and heat production*, made possible due to installation of desulphurisation plants and due to the use of fuels with lower sulphur content. Despite the considerable reduction in emission from electricity and heat production plants, these still account for 39 % of the emission from stationary combustion, as mentioned above. The emission from other source categories also decreased considerably since 1980. Time-series for subcategories are shown in Annex 2A-10.

Table 3.5 $SO_2$ emission from stationary combustion plants, 2008[1)].

| $SO_2$ | 2008 Mg |
|---|---|
| 1A1a Public electricity and heat production | 6281 |
| 1A1b Petroleum refining | 316 |
| 1A1c Other energy industries | 8 |
| 1A2 Industry | 5383 |
| 1A4a Commercial/Institutional | 273 |
| 1A4b Residential | 2466 |
| 1A4c Agriculture/Forestry/Fisheries | 1572 |
| Total | 16299 |




1) Only emission from stationary combustion plants in the source categories is included.

2 Time-series 1980 – 2008 for $SO_2$ emission are shown in Annex 2A-x.

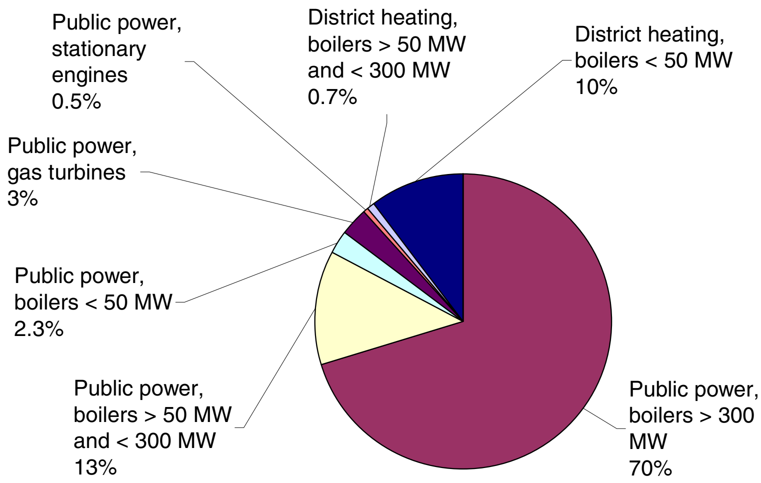



Figure 3.8 Disaggregated $SO_2$ emissions from 1A1a Energy and heat production.

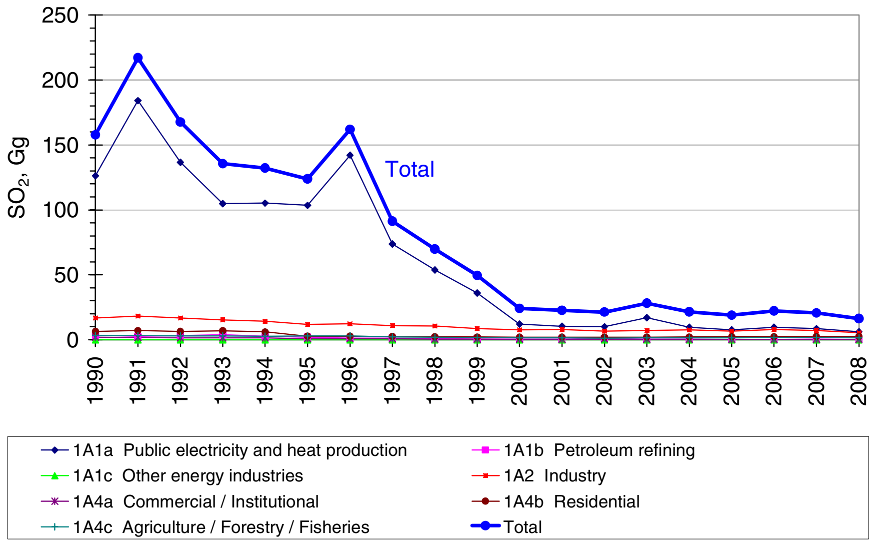



Figure 3.9 $SO_2$ emission time-series for stationary combustion.

**$NO_x$**

Stationary combustion accounts for 33 % of the national $NO_x$ emission. Table 3.6 shows the $NO_x$ emission inventory for stationary combustion subcategories.

*Electricity and heat production* is the largest emission source accounting for 48 % of the emission from stationary combustion plants. The emission from public power boilers > 300 $MW_{th}$ accounts for 45 % of the emission in this subcategory.

Industrial combustion plants are also an important emission source accounting for 19 % of the emission. The main industrial emission source is cement production, which accounts for 61 % of the emission.

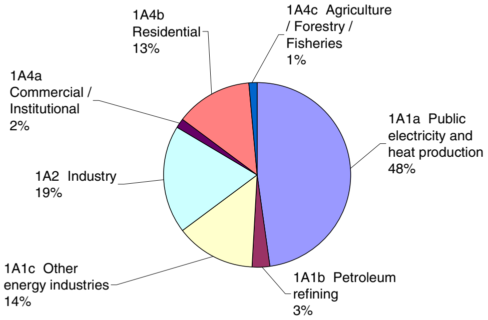
Residential plants account for 13 % of the $NO_x$ emission. The fuel origin of this emission is mainly wood, gas oil and natural gas accounting for 64 %, 13 % and 14 % of the residential plant emission, respectively.

*Other energy industries* which is mainly off-shore gas turbines accounts for 14 % of the $NO_x$ emission.

Time-series for $NO_x$ emission from stationary combustion are shown in Figure 3.10[3]. $NO_x$ emission from stationary combustion plants has decreased by 66 % since 1985 and 56 % since 1990. The reduced emission is largely a result of the reduced emission from electricity and heat production due to installation of low $NO_x$ burners, selective catalytic reduction (SCR) units and selective non-catalytic reduction (SNCR) units. The fluctuations in the time-series follow the fluctuations in electricity and heat production, which, in turn, result from electricity trade fluctuations.

Table 3.6 $NO_x$ emission from stationary combustion plants, 2008[1)].

| | 2008 Mg |
|---|---|
| 1A1a Public electricity and heat production | 24056 |
| 1A1b Petroleum refining | 1490 |
| 1A1c Other energy industries | 7031 |
| 1A2 Industry | 9557 |
| 1A4a Commercial/Institutional | 811 |
| 1A4b Residential | 6702 |
| 1A4c Agriculture/Forestry/Fisheries | 715 |
| Total | 50361 |




1) Only emission from stationary combustion plants in the source categories is included.

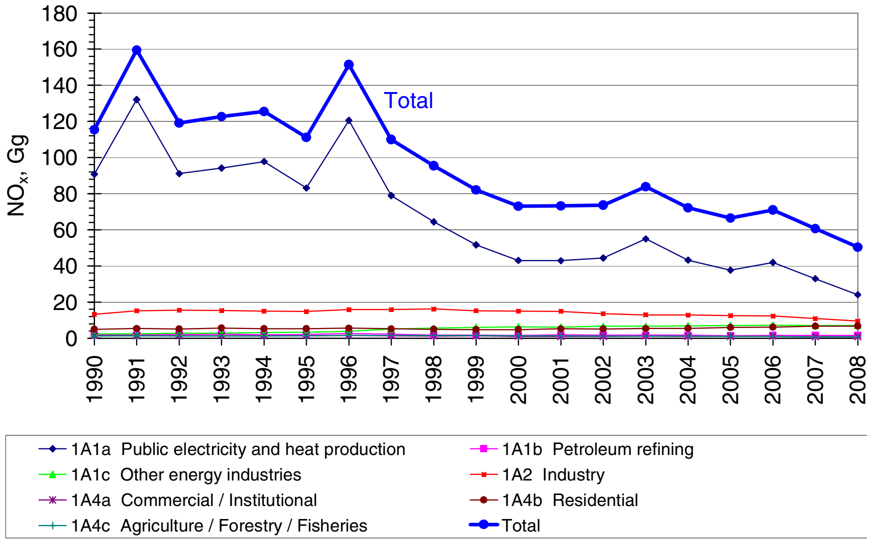



Figure 3.10 $NO_x$ emission time-series for stationary combustion.

**NMVOC**

Stationary combustion plants account for 21 % of the national NMVOC emission. Table 3.7 presents the NMVOC emission inventory for the stationary combustion subcategories.

Residential plants are the largest emission source accounting for 86 % of the emission from stationary combustion plants. For residential

[3] Time-series 1985 – 2008 for $NO_x$ emission are shown in Annex 2A-x.

plants NMVOC is mainly emitted from wood and straw combustion, see Figure 3.11.

Electricity and heat production is also a considerable emission source, accounting for 8 % of the emission. Lean-burn gas engines have a relatively high NMVOC emission factor and are the most important emission source in this subcategory (see Figure 3.11). The gas engines are either natural gas or biogas fuelled.

Time-series for NMVOC emission from stationary combustion are shown in Figure 3.12[4]. The emission has increased by 33 % from 1985 and 50 % from 1990. The increased emission is mainly a result of the increasing wood consumption in residential plants and of the increased use of lean-burn gas engines in CHP plants.

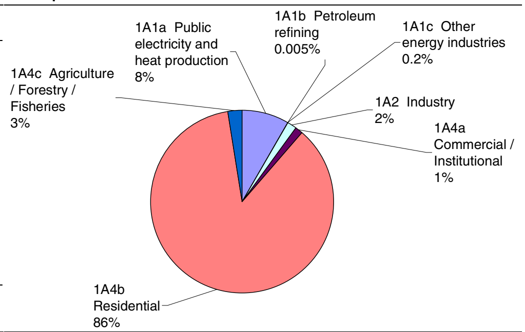
The emission from residential plants increased 59 % since 1990. The NMVOC emission from wood combustion in 2008 was 2.9 times the 1990 level due to increased wood consumption. However, the emission factor has decreased since 1990 due to installation of modern stoves and boilers with improved combustion technology. Further the emission from straw combustion in farmhouse boilers has decreased (75 %) over this period due to both a decreasing emission factor and decrease in straw consumption in this source category.

The use of wood in residential boilers and stoves was relatively low in 1998-99 resulting in a lower emission level.

The small decrease of the NMVOC emission in 2008 is a result of both a small decline of the consumption of wood pellets in residential plants and a decreasing emission factor for firewood combustion in residential plants. The DEA has assumed that the consumption of firewood in residential plants in 2008 was the same as in 2007; however, the 2008 consumption will be recalculated by the DEA again in 2010.

Table 3.7 NMVOC emission from stationary combustion plants, 2008[1)].

| | 2008 Mg |
|---|---|
| 1A1a Public electricity and heat production | 1838 |
| 1A1b Petroleum refining | 1 |
| 1A1c Other energy industries | 40 |
| 1A2 Industry | 371 |
| 1A4a Commercial/Institutional | 271 |
| 1A4b Residential | 19222 |
| 1A4c Agriculture/Forestry/Fisheries | 570 |
| Total | 22313 |




1) Only emission from stationary combustion plants in the categories is included.

[4] Time-series 1985 – 2008 for NMVOC emission are shown in Annex 2A-x.

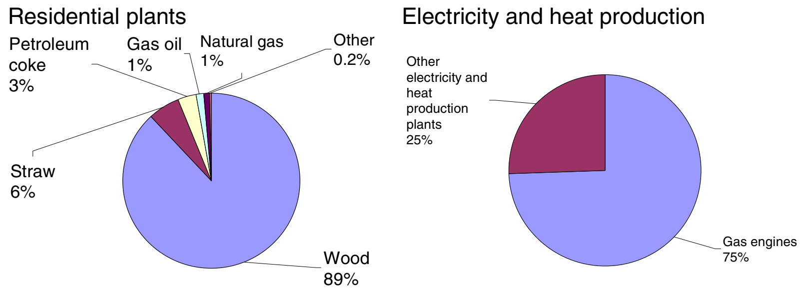



Figure 3.11 NMVOC emission from Residential plants and from Electricity and heat production, 2008.

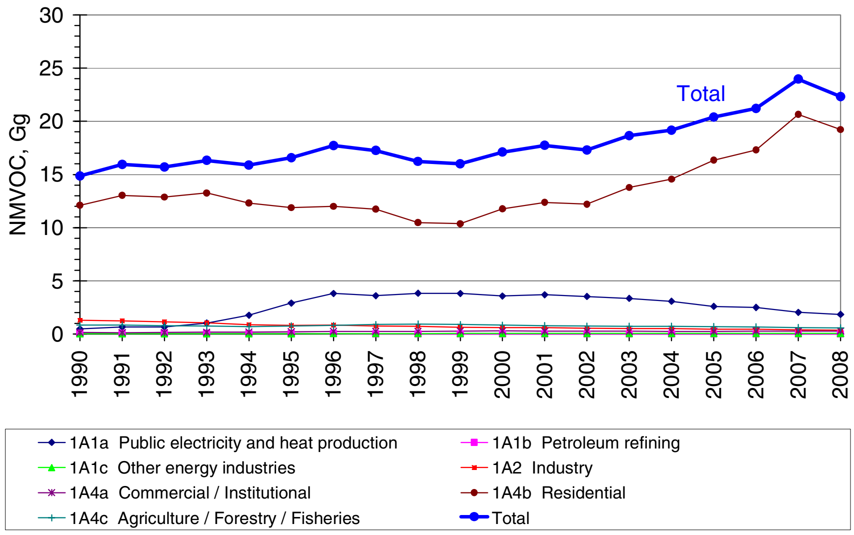



Figure 3.12 NMVOC emission time-series for stationary combustion.

### CO

Stationary combustion accounts for 38 % of the national CO emission. Table 3.8 presents the CO emission inventory for stationary combustion subcategories.

Residential plants are the largest emission source, accounting for 81 % of the emission. Wood combustion accounts for 89 % of the emission from residential plants, see Figure 3.13. This is in spite of the fact that the fuel consumption share is only 41 %. Combustion of straw is also a considerable emission source whereas the emission from other fuels used in residential plants is almost negligible.

Time-series for CO emission from stationary combustion are shown in Figure 3.14[5]. The emission has increased by 19 % from 1985 and 16 % from 1990. The time-series for CO from stationary combustion plants follows the time-series for CO emission from residential plants.

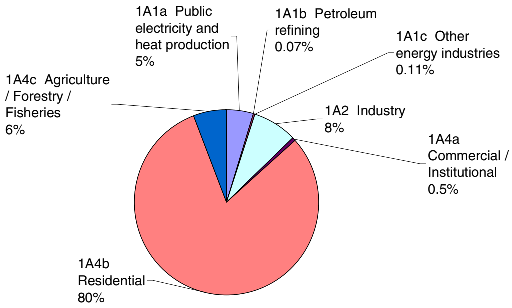
The consumption of wood in residential plants in 2008 was 4.0 times the 1990 level. However, the CO emission factor for wood has decreased since 1990 causing the CO emission from wood combustion in residential plants in 2008 to be only 3.2 times the 1990 level. Both straw consumption and CO emission factor for residential plants have decreased since 1990.

[5] Time-series 1985 – 2008 for CO emission are shown in Annex 2A-x.

The small decrease of the CO emission in 2008 is a result of both a small decline of the consumption of wood pellets in residential plants and a decreasing emission factor for firewood combustion in residential plants. The DEA has assumed that the consumption of firewood in residential plants in 2008 was the same as in 2007; however the 2008 consumption will be recalculated by the DEA again in 2010.

Table 3.8 CO emission from stationary combustion plants, 2008[1)].

| | 2008 Mg |
|---|---|
| 1A1a Public electricity and heat production | 7909 |
| 1A1b Petroleum refining | 119 |
| 1A1c Other energy industries | 183 |
| 1A2 Industry | 12879 |
| 1A4a Commercial/Institutional | 839 |
| 1A4b Residential | 133437 |
| 1A4c Agriculture/Forestry/Fisheries | 9709 |
| Total | 165077 |




[1)] Only emission from stationary combustion plants in the source categories is included.

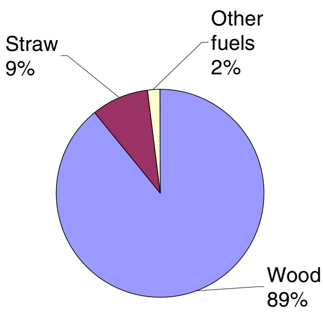
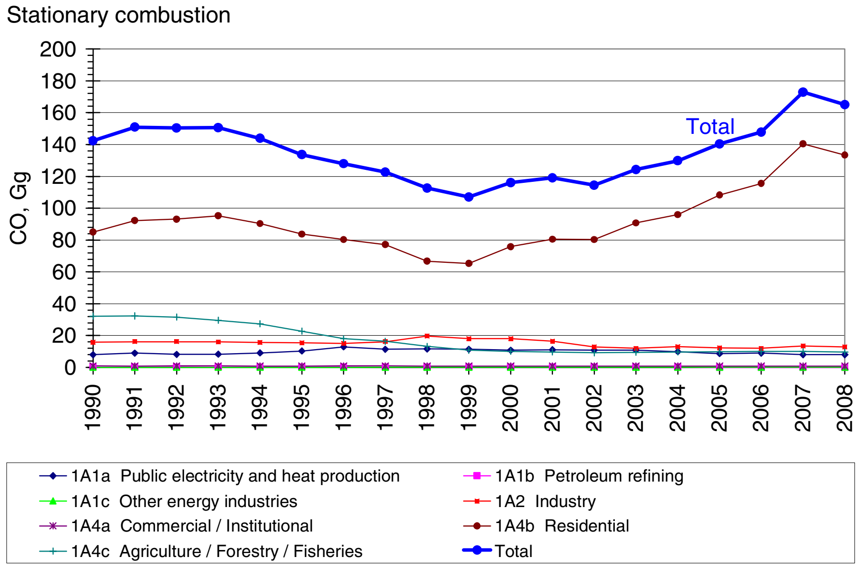



Figure 3.13 CO emission sources, residential plants, 2008.



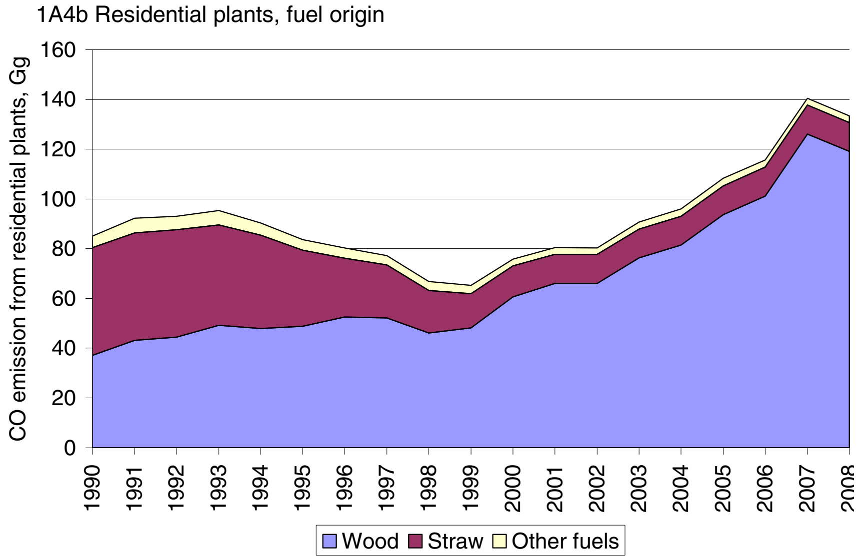




Figure 3.14 CO emission time-series for stationary combustion.

**Particulate matter (PM)**
TSP from stationary combustion accounts for 54 % of the national emission. The emission shares for $PM_{10}$ and $PM_{2.5}$ are 63 % and 75 %, respectively.

Table 3.9 and Figure 3.15 show the PM emission inventory for the stationary combustion subcategories. Residential plants are the largest emission source accounting for 92 % of the $PM_{2.5}$ emission from stationary combustion plants.

The primary sources of PM emissions are:

- Residential boilers, stoves and fireplaces combusting wood
- Farmhouse boilers combusting straw
- Power plants primarily combusting coal
- Coal and residual oil combusted in industrial boilers and processes

The PM emission from wood combusted in residential plants is the predominant source. Thus 89 % of the $PM_{2.5}$ emission from stationary combustion is emitted from residential wood combustion. This corresponds to 67 % of the national emission. A literature review (Nielsen et al., 2003) and a Nordic Project (Sternhufvud et al., 2004) has demonstrated that the emission factor uncertainty for residential combustion of wood in stoves and boilers is notably high.

Figure 3.16 shows the fuel consumption and the $PM_{2.5}$ emission of residential plants. Wood combustion accounts for 96 % of the $PM_{2.5}$ emission from residential plants in spite of a wood consumption share of 41 %.

Emission inventories for PM have only been reported for the years 2000-2008. Time-series for PM emission from stationary combustion are shown in Figure 3.17. The emission of TSP, $PM_{10}$ and $PM_{2.5}$ has increased 57 %, 59 % and 62 %, respectively, since year 2000. The increase is caused by the increased wood combustion in residential plants. However, the PM emission factors have decreased for this emission source category due to installation of modern stoves and boilers. The small decrease of the PM emissions in 2008 is a result of a constant consumption rate for firewood in residential plants assumed in the energy statistics and a decreasing emission factor. Further the consumption of wood pellets in residential plants has decreased. The consumption of firewood in residential plants 2008 will be recalculated by the DEA again in 2010.

The time-series for PM emission from stationary combustion plants follows the time-series for PM emission from residential plants.

Table 3.9 PM emission from stationary combustion plants, 2008[1).]

| | | TSP, Mg | $PM_{10}$, Mg | $PM_{2.5}$, Mg |
|---|---|---|---|---|
| 1A1a | Public electricity and heat production | 868 | 649 | 533 |
| 1A1b | Petroleum refining | 119 | 110 | 106 |
| 1A1c | Other energy industries | 3 | 2 | 1 |
| 1A2 | Industry | 863 | 625 | 370 |
| 1A4a | Commercial/Institutional | 176 | 172 | 161 |
| 1A4b | Residential | 21150 | 20102 | 19676 |
| 1A4c | Agriculture/Forestry/Fisheries | 508 | 472 | 438 |
| Total | | 23687 | 22131 | 21285 |

[1)] Only emission from stationary combustion plants in the source categories is included.

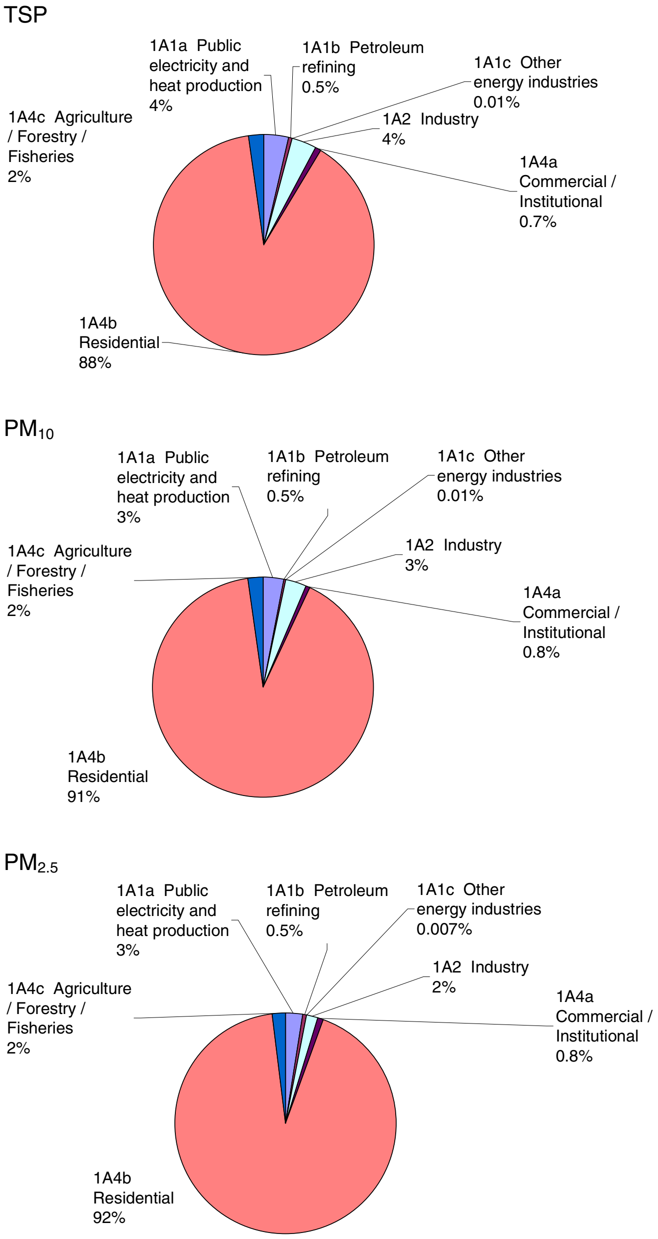



Figure 3.15 PM emission sources, stationary combustion plants, 2008.

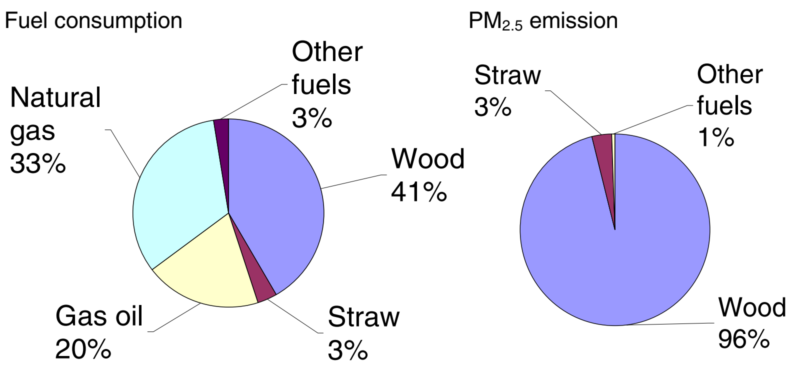



Figure 3.16 Fuel consumption and $PM_{2.5}$ emission from residential plants.

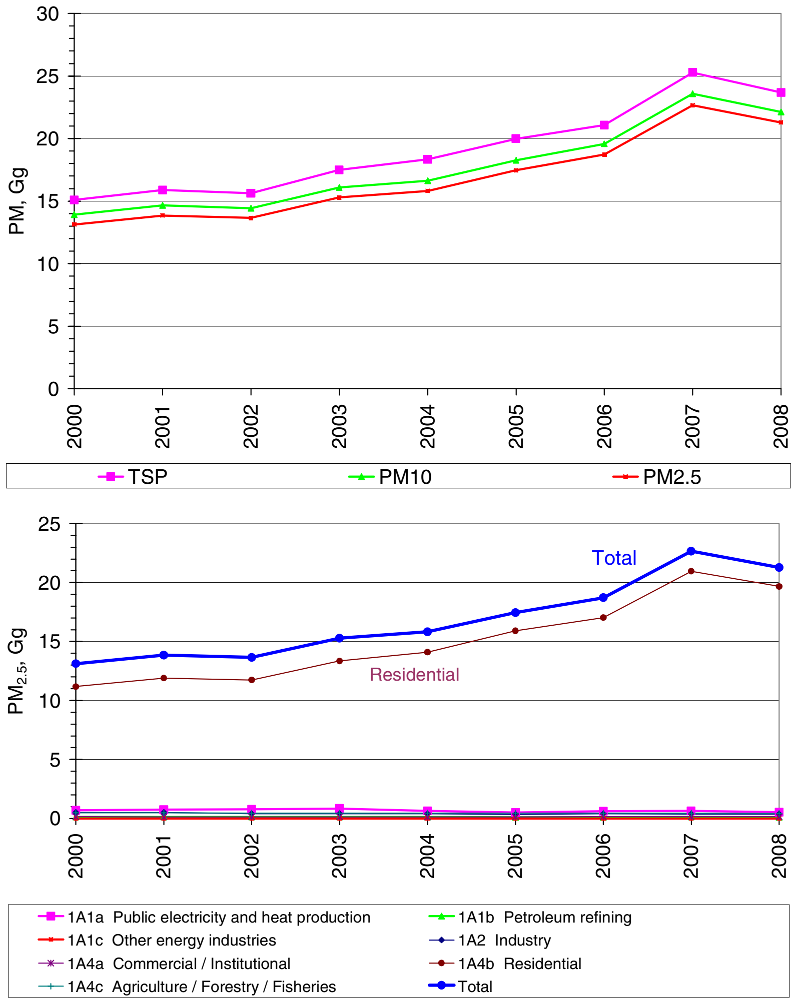



Figure 3.17 PM emission time-series for stationary combustion.

**Heavy metals**

Stationary combustion plants are among the most important emission sources for heavy metals. For Cu, Zn and Pb the emission share from stationary combustion plants is below 50 %, but for all other heavy metals the emission share is more than 50 %.

Table 3.10 and Figure 3.18 present the heavy metal emission inventory for the stationary combustion subcategories. The source categories *Public electricity and heat production, Residential* and *Industry* have the highest emission shares.

Table 3.10 Heavy metal emission from stationary combustion plants, 2008[1].

| | As | Cd | Cr | Cu | Hg | Ni | Pb | Se | Zn |
|---|---|---|---|---|---|---|---|---|---|
| | kg | kg | kg | kg | kg | kg | kg | kg | kg |
| 1A1a Public electricity and heat production | 155 | 115 | 332 | 309 | 430 | 1006 | 727 | 998 | 1550 |
| 1A1b Petroleum refining | 13 | 12 | 30 | 12 | 4 | 582 | 21 | 11 | 3 |
| 1A1c Other energy industries | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1A2 Industry | 174 | 156 | 326 | 164 | 232 | 4169 | 784 | 521 | 1443 |
| 1A4a Commercial/Institutional | 9 | 14 | 18 | 16 | 13 | 300 | 20 | 16 | 174 |
| 1A4b Residential | 42 | 42 | 93 | 312 | 56 | 98 | 1479 | 102 | 3796 |
| 1A4c Agriculture/Forestry/Fisheries | 15 | 11 | 28 | 17 | 20 | 438 | 33 | 12 | 52 |
| Total | 409 | 350 | 826 | 829 | 755 | 6593 | 3064 | 1661 | 7017 |

[1] Only emission from stationary combustion plants in the source categories is included.

Table 3.11 presents the emission share for municipal waste incineration plants. The emission share has decreased considerably since year 2000.

Table 3.11 Heavy metal emission share for municipal waste incineration plants, 2008.

| Pollutant | Emission share, % |
|---|---|
| As | 7 |
| Cd | 13 |
| Cr | 16 |
| Cu | 16 |
| Hg | 18 |
| Ni | 4 |
| Pb | 16 |
| Se | 2 |
| Zn | 1 |

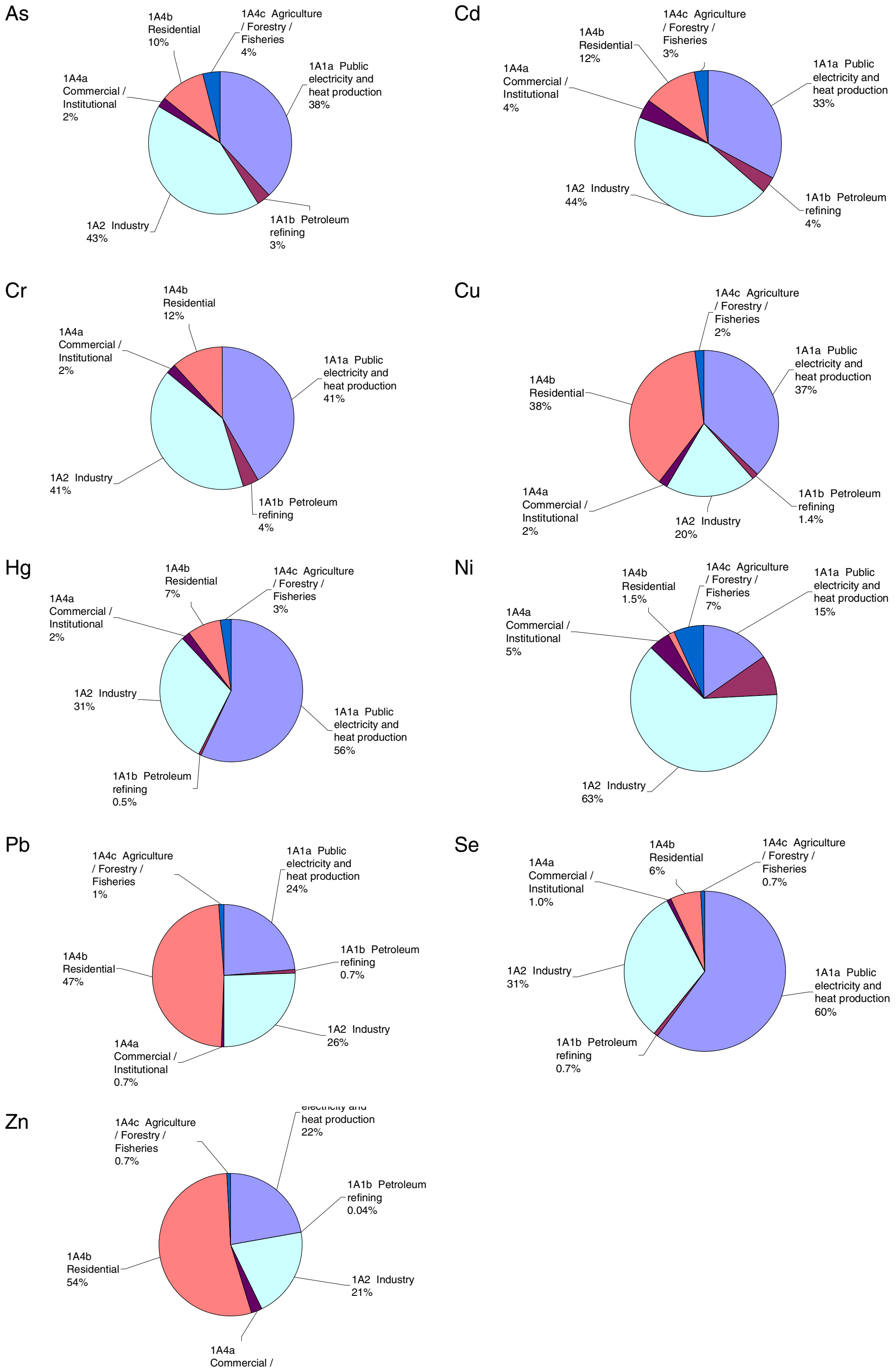



Figure 3.18 Heavy metal emission sources, stationary combustion plants, 2008.

Time-series for heavy metal emissions are provided in Figure 3.19. Emissions of all heavy metals, except Zn, have decreased considerably since 1990, see Table 3.12. Emissions have decreased despite increased incineration of municipal waste. This has been made possible due to installation and improved performance of gas cleaning devices in waste incineration plants and also in large power plants, the latter being a further important emission source.

The emission of Zn has decreased 5% since 1990. The emission of Zn from *Public electricity and heat production* has decreased 60 % since 1990 whereas the emission from residential plants has increased 153 %. The emission from residential plants adds up to 54 % of the emission in 2008.

The estimated As emission level decreased remarkably from 1994 to 1995. Plant-specific emission data for power plants are available for all power plants from 1995 onwards and the general point source emission factor for power plants has potentially been overestimated.

Table 3.12 Decrease in heavy metal emission 1990-2008.

| Pollutant | Decrease since 1990, % |
|---|---|
| As | 72 |
| Cd | 65 |
| Cr | 87 |
| Cu | 77 |
| Hg | 75 |
| Ni | 69 |
| Pb | 80 |
| Se | 65 |
| Zn | 5 |

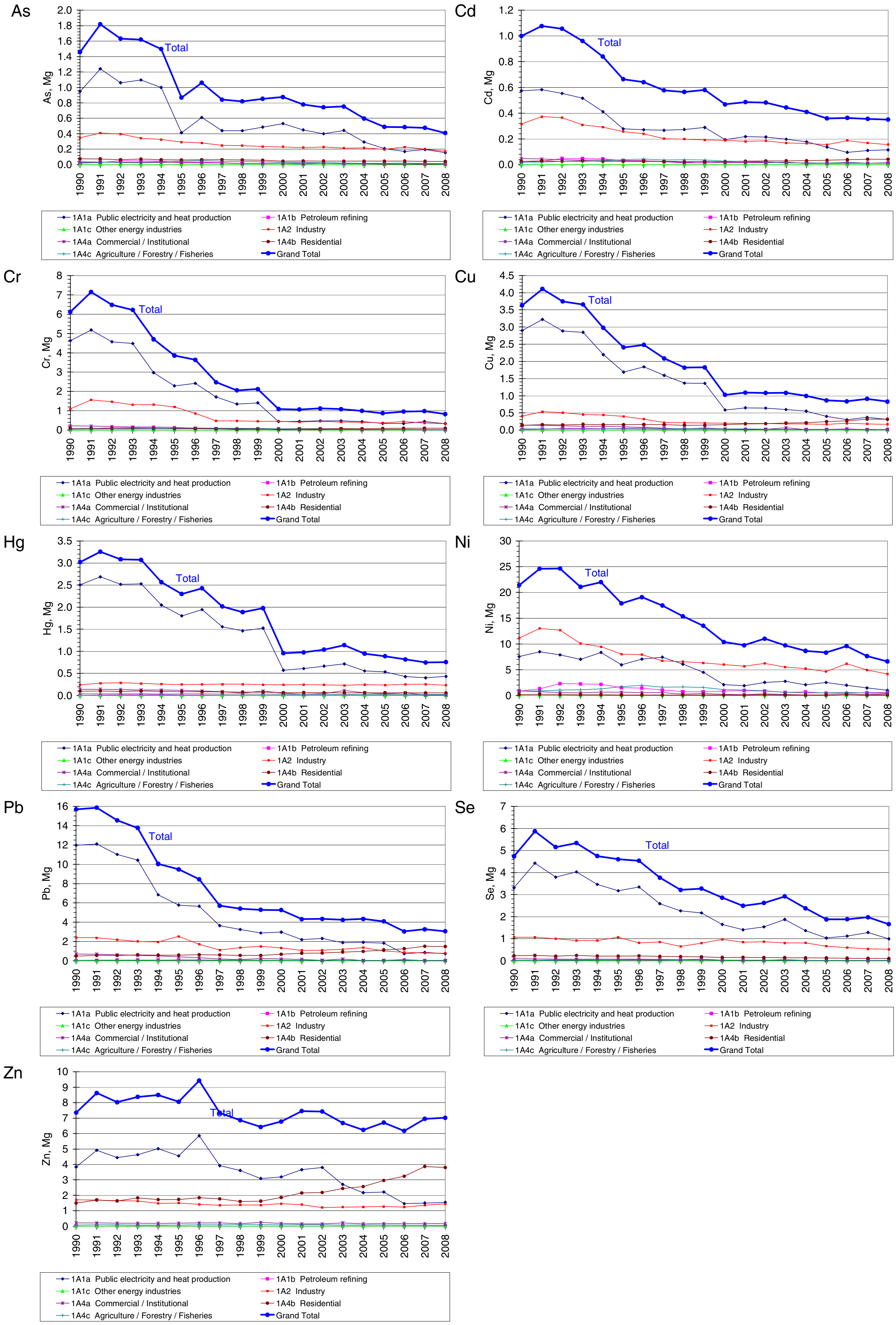



Figure 3.19 Heavy metal emission time-series, stationary combustion plants.

**PAH**

Stationary combustion plants accounted for more than 93 % of the PAH emission in 2008.

Table 3.13 and Figure 3.20 present the PAH emission inventories for the stationary combustion subcategories. Residential combustion is the largest emission source accounting for more than 89 % of the emission. Combustion of wood is the predominant source, accounting for more than 98 % of the PAH emission from residential plants, see Figure 3.21.

Time-series for PAH emissions are presented in Figure 3.22. The increasing (120 %-170 %) emission trend for PAH is a result of the increased combustion of wood in residential plants. The time-series for wood combustion in residential plants is also provided in Figure 3.22.

Table 3.13 PAH emission from stationary combustion plants, 2008[1)].

| | | Benzo(a)-Pyrene, kg | Benzo(b)-fluoranthene, kg | Benzo(k)-fluoranthene, kg | Indeno(1,2,3-c,d)pyrene, kg |
|---|---|---|---|---|---|
| 1A1a | Public electricity and heat production | 7 | 27 | 15 | 6 |
| 1A1b | Petroleum refining | 0 | 0 | 0 | 0 |
| 1A1c | Other energy industries | 0 | 0 | 0 | 0 |
| 1A2 | Industry | 23 | 82 | 16 | 6 |
| 1A4a | Commercial/Institutional | 180 | 237 | 79 | 128 |
| 1A4b | Residential | 4380 | 4507 | 2595 | 2954 |
| 1A4c | Agriculture/Forestry/Fisheries | 149 | 160 | 23 | 239 |
| Total | | 4739 | 5013 | 2727 | 3334 |

[1)] Only emission from stationary combustion plants in the source categories is included.

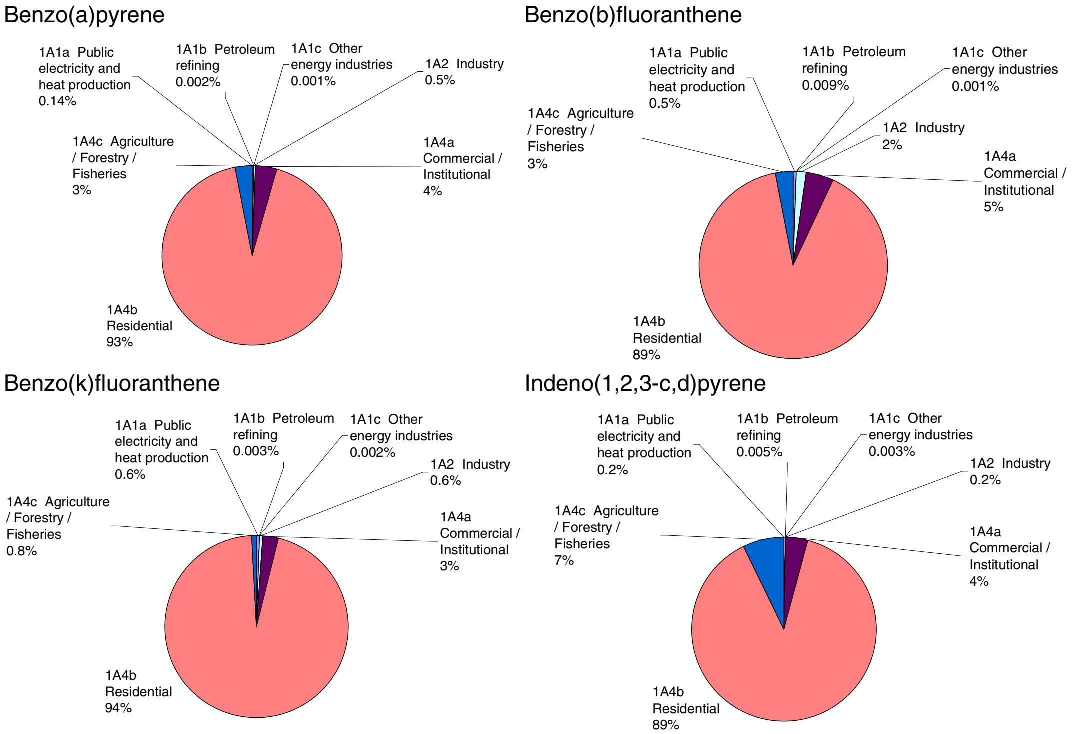



Figure 3.20 PAH emission sources, stationary combustion plants, 2008.

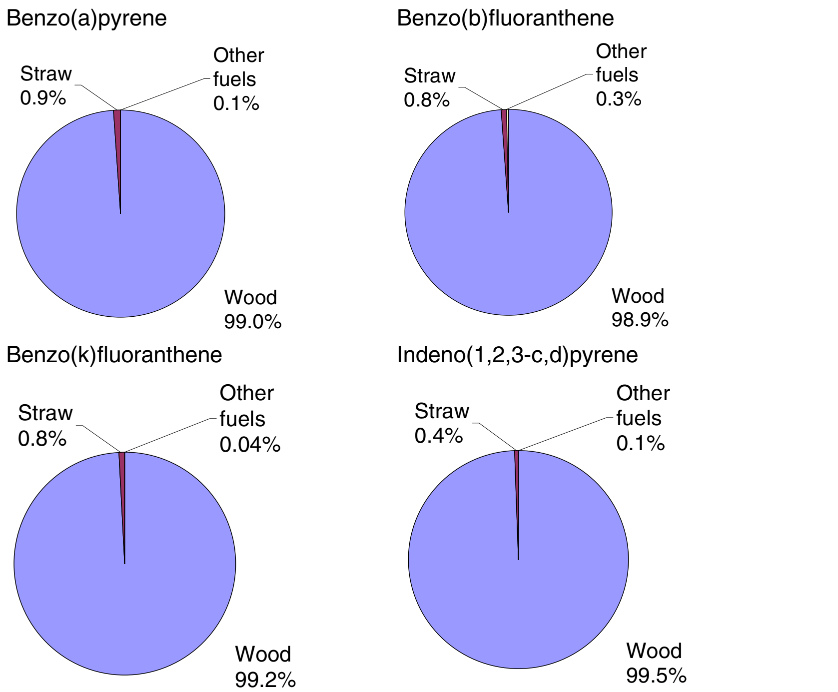



Figure 3.21 PAH emission from residential combustion plants (stationary), fuel origin.

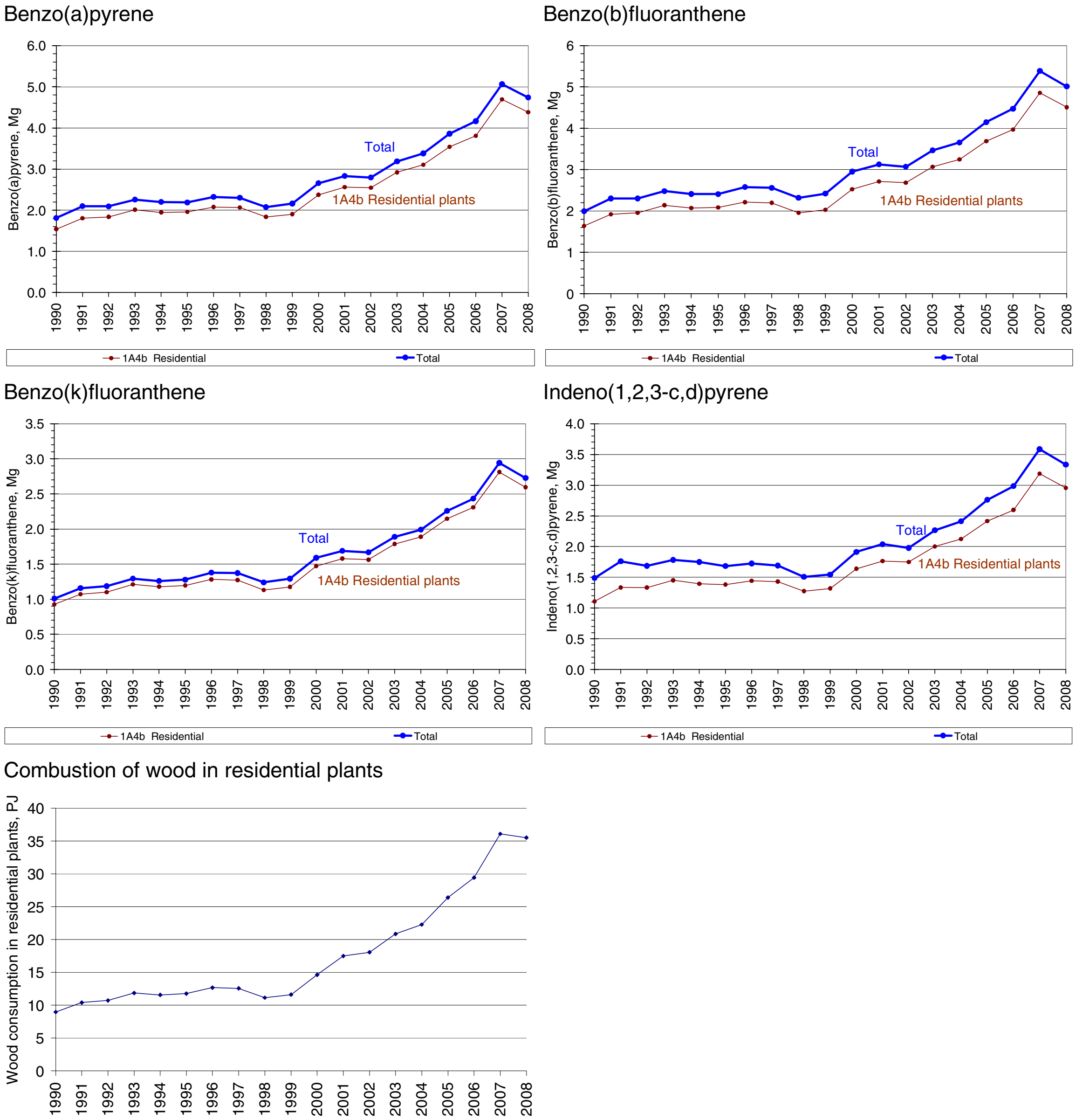



Figure 3.22 PAH emission time-series, stationary combustion plants. Comparison with wood consumption in residential plants.

**Dioxin**

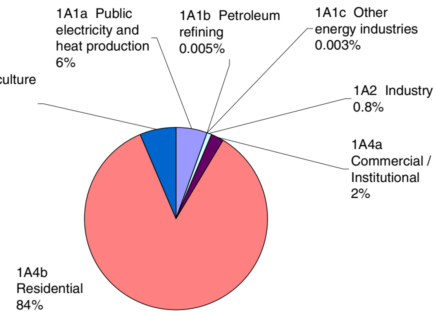
Stationary combustion plants accounted for 67 % of the national dioxin emission in 2008.

Table 3.14 presents the dioxin emission inventories for the stationary combustion subcategories. In 2008 the emission from residential plants accounts for 85 % of the emission. Combustion of wood is the predominant source accounting for 85 % of the emission from residential plants (Figure 3.23).

Time-series for dioxin emission are presented in Figure 3.24. The dioxin emission has decreased 55 % since 1990 mainly due to installation of dioxin filters in MSW incineration plants. The emission from residential plants has increased due to increased wood consumption in this source category.

Table 3.14 Dioxin emission from stationary combustion plants, 2008[1].

| | Dioxin g I-teq |
|---|---|
| 1A1a Public electricity and heat production | 1.19 |
| 1A1b Petroleum refining | 0.00 |
| 1A1c Other energy industries | 0.00 |
| 1A2 Industry | 0.17 |
| 1A4a Commercial/Institutional | 0.48 |
| 1A4b Residential | 17.91 |
| 1A4c Agriculture/Forestry/Fisheries | 1.38 |
| Total | 21.12 |




[1] Only emission from stationary combustion plants in the source categories is included.

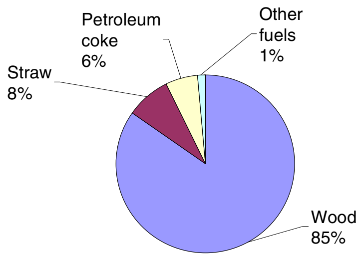



Figure 3.23 Dioxin emission from residential plants, fuel origin.

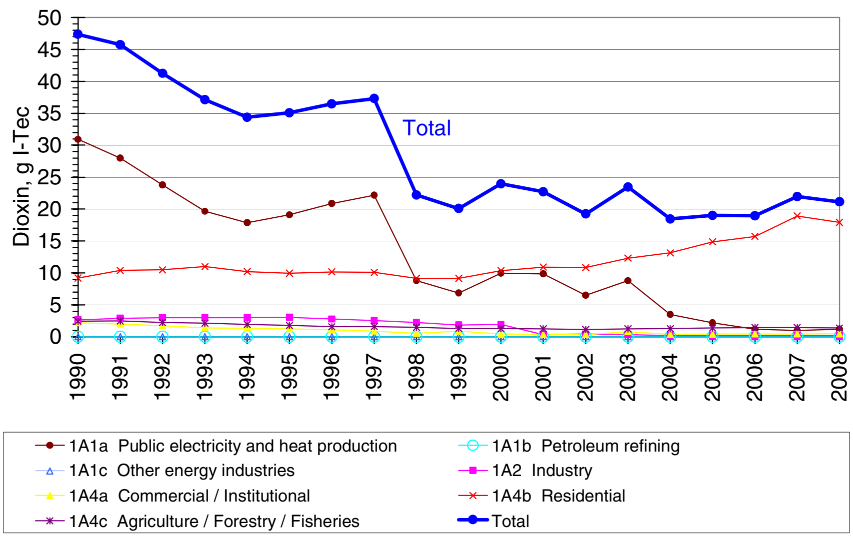



Figure 3.24 Dioxin emission time-series, stationary combustion plants.

**HCB**

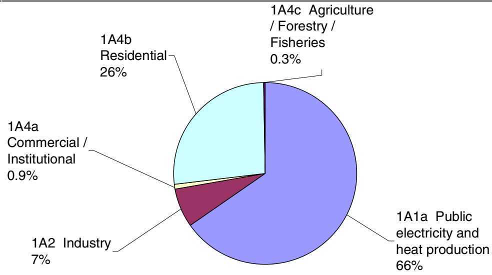
The HCB emission has been estimated only for stationary combustion plants and for cremation. Stationary plants accounted for more than 98 % of the estimated national HCB emission in 2008.

Table 3.15 shows the HCB emission inventory for the stationary combustion subcategories. *Public electricity and heat production* account for 65 % of the emission. Residential plants account for 26 % of the emission.

Time-series for HCB emission are presented in Figure 3.25. The dioxin emission has decreased 83 % since 1990 mainly due to improved flue gas cleaning in MSW incineration plants. The emission from residential plants has increased due to increased wood consumption in this source category.

Table 3.15 HCB emission from stationary combustion plants, 2008[1].

| | HCB, kg |
|---|---|
| 1A1a Public electricity and heat production | 0.35 |
| 1A1b Petroleum refining | - |
| 1A1c Other energy industries | - |
| 1A2 Industry | 0.04 |
| 1A4a Commercial/Institutional | 0.005 |
| 1A4b Residential | 0.14 |
| 1A4c Agriculture/Forestry/Fisheries | 0.002 |
| Total | 0.54 |




[1] Only the emission from stationary combustion plants in the source categories is included.

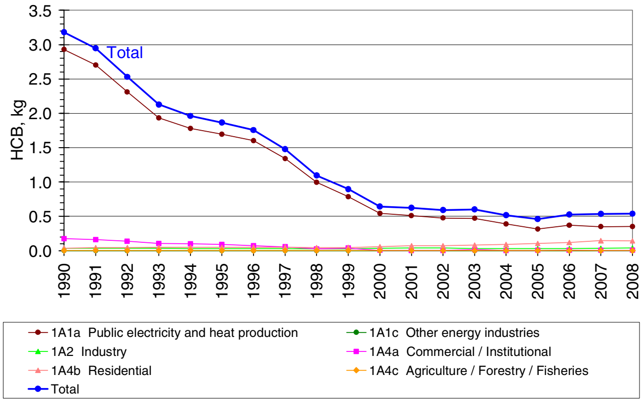



Figure 3.25 HCB emission time-series, stationary combustion plants.

**$NH_3$**

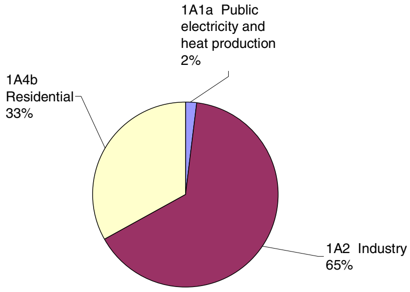
Stationary combustion plants accounted for only 0.8 % of the national $NH_3$ emission in 2008.

Table 3.16 shows the $NH_3$ emission inventory for the stationary combustion subcategories. *Industry* account for 65 % of the emission and the main industrial sources are industrial plants producing glass wool or mineral wool. Residential plants account for 33 % of the emission.

Time-series for the $NH_3$ emission are presented in Figure 3.26. The $NH_3$ emission was 3 % higher in 2008 than in 1990.

Table 3.16 $NH_3$ emission from stationary combustion plants, 2008[1)].

| | $NH_3$, Mg |
|---|---|
| 1A1a Public electricity and heat production | 10 |
| 1A1b Petroleum refining | - |
| 1A1c Other energy industries | - |
| 1A2 Industry | 374 |
| 1A4a Commercial/Institutional | - |
| 1A4b Residential | 189 |
| 1A4c Agriculture/Forestry/Fisheries | - |
| Total | 573 |




[1)] Only the emission from stationary combustion plants in the source categories is included.

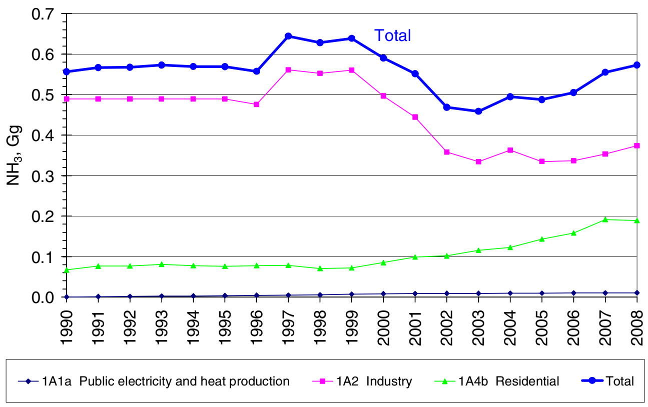



Figure 3.26 $NH_3$ emission time-series, stationary combustion plants.

### 3.2.3 Sectoral trend

In addition to the data for stationary combustion this chapter presents and discusses data for each of the subcategories in which stationary combustion is included. Time-series are presented for fuel consumption and emissions.

**1A1 Energy industries**

The emission source category *1A1 Energy Industries* consists of the subcategories:

1. 1A1a Electricity and heat production.
2. 1A1b Petroleum refining.
3. 1A1c Other energy industries.

Figure 3.27 – 3.31 present time-series for the *Energy Industries*. *Electricity and heat production* is the largest subcategory accounting for the main part of all emissions. Time-series are discussed below for each subcategory.

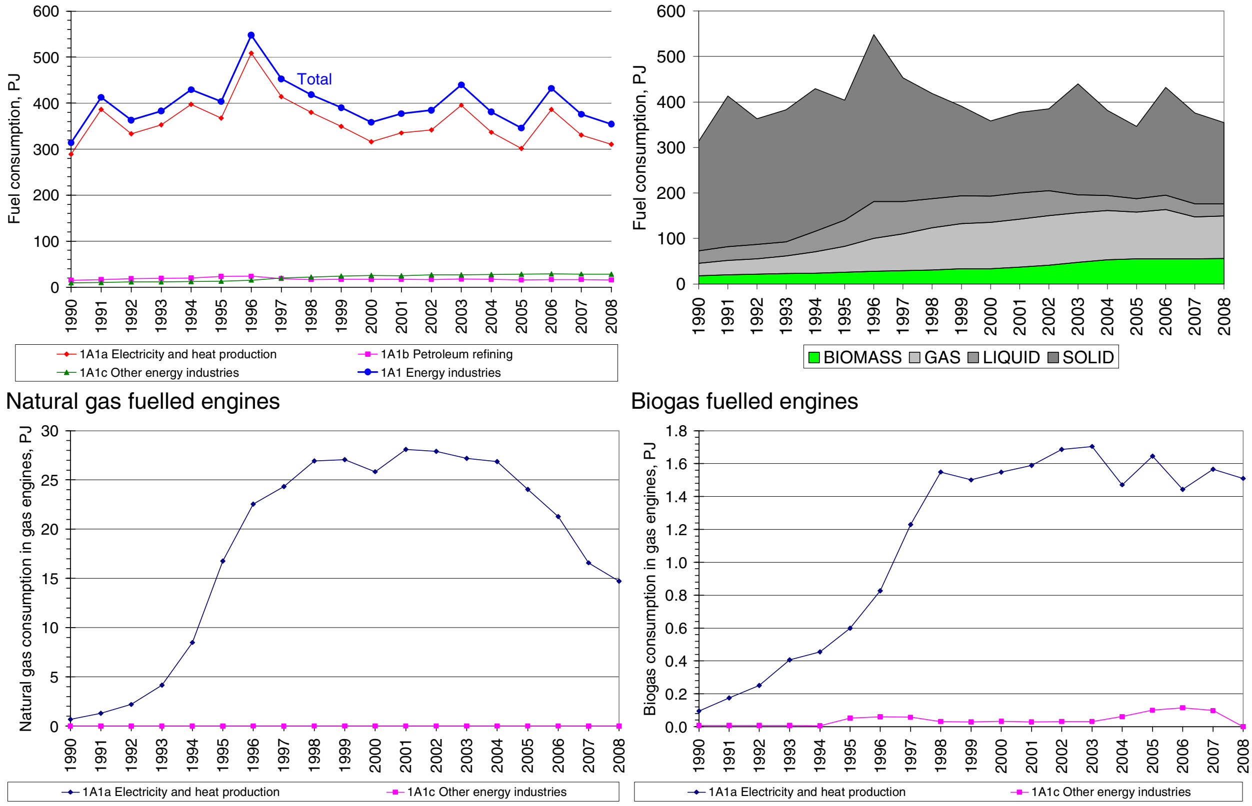



Figure 3.27 Time-series for fuel consumption, 1A1 Energy industries.

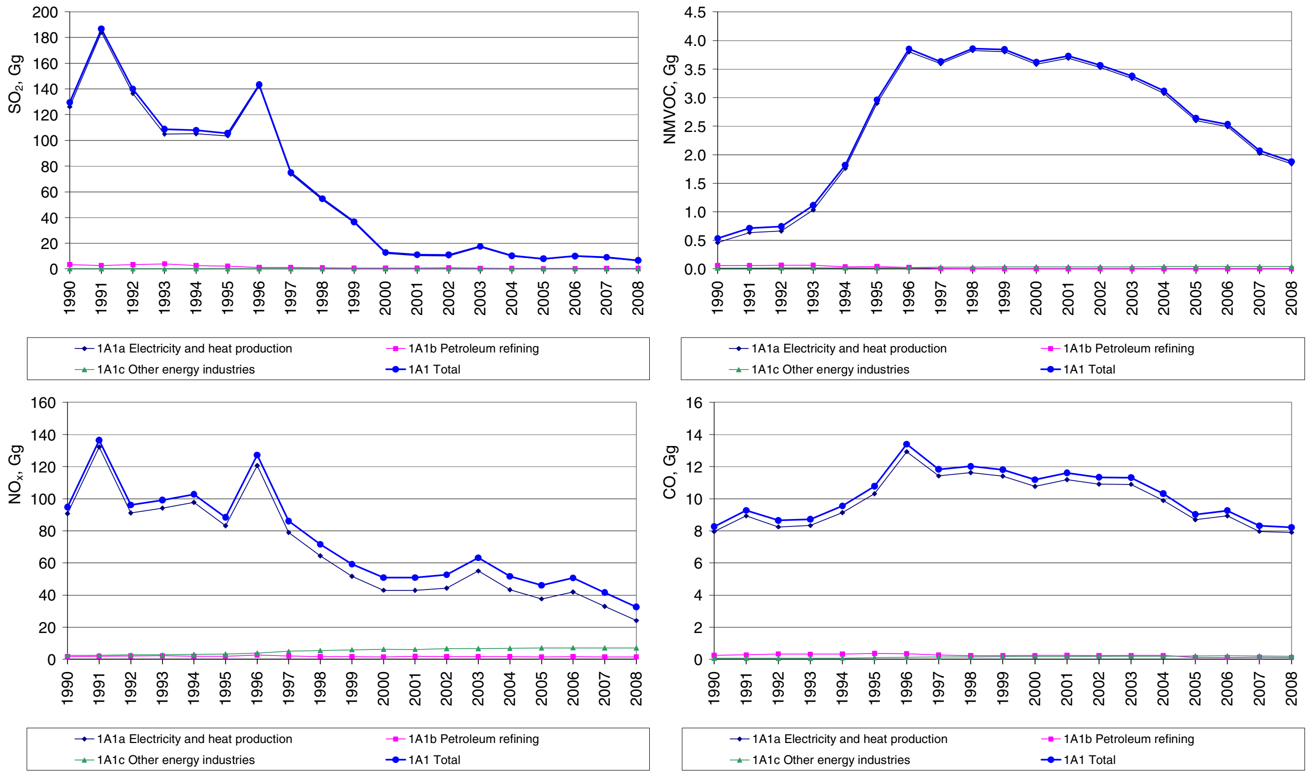



Figure 3.28 Time-series for $SO_2$, $NO_x$, NMVOC and CO emission, 1A1 Energy industries.

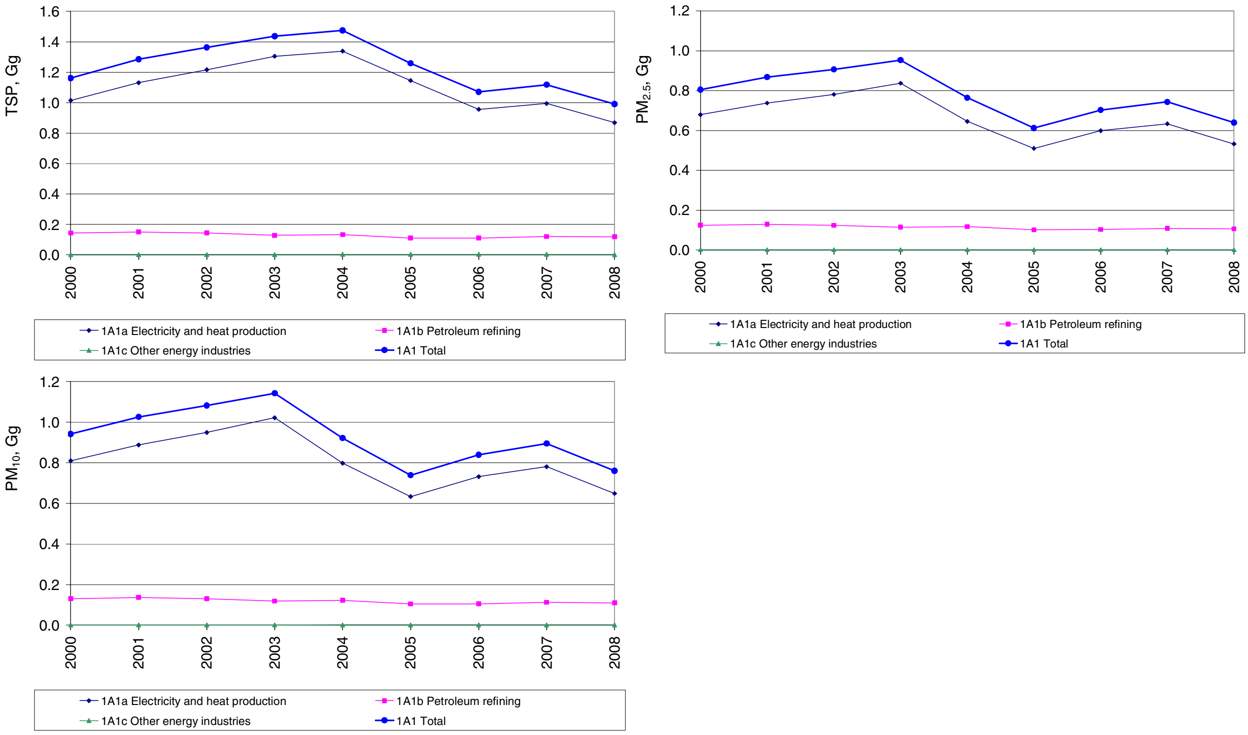



Figure 3.29   Time-series for PM emission, 1A1 Energy industries.

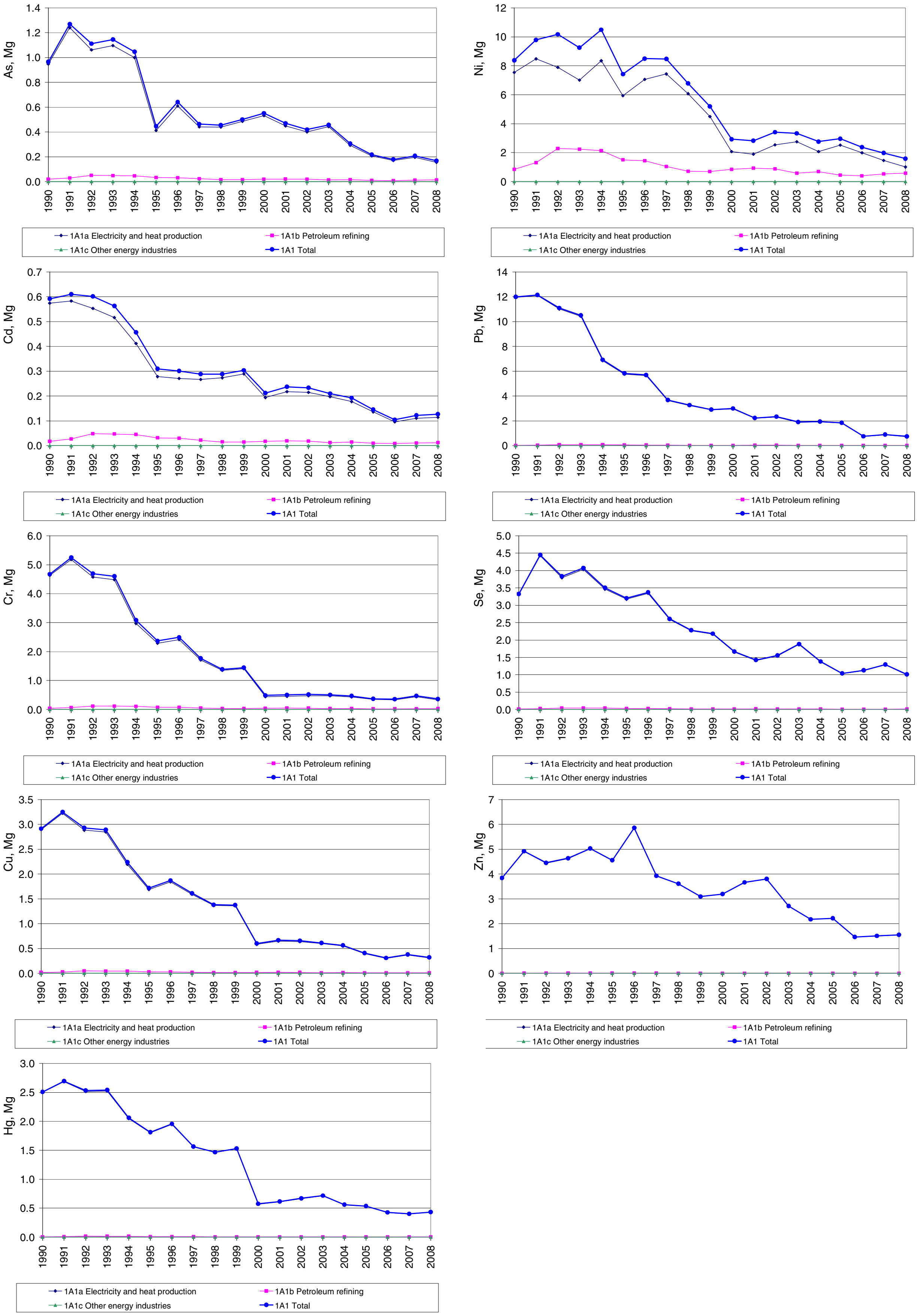



Figure 3.30 Time-series for HM emission, 1A1 Energy industries.

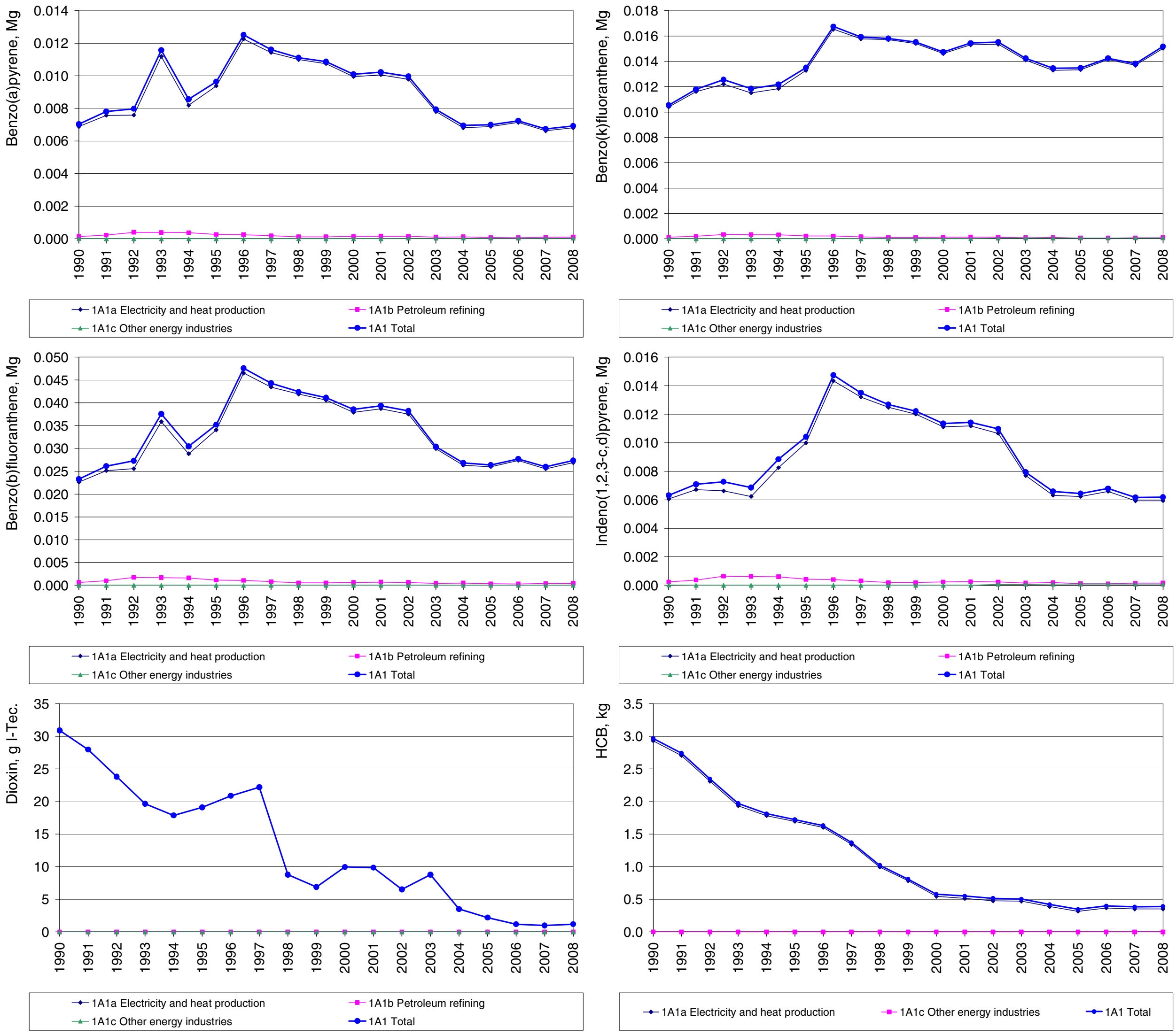



Figure 3.31 Time-series for PAH, dioxin and HCB emission, 1A1 Energy industries.

*1A1a Electricity and heat production*

Public electricity and heat production is the largest source category regarding fuel consumption for stationary combustion. Figure 3.32 shows the time-series for fuel consumption and emissions of $SO_2$, $NO_x$, NMVOC and CO.

The fuel consumption in electricity and heat production was 7 % higher in 2008 than in 1990. As discussed in Chapter 3.2.1 the fuel consumption fluctuates mainly as a consequence of electricity trade. Coal is the fuel that is affected the most by the fluctuating electricity trade. Coal is the main fuel in the source category even in years with electricity import. The coal consumption in 2008 was 31 % lower than in 1990. Natural gas is also an important fuel and the consumption of natural gas has increased since 1990, but decreased since 2003. A considerable part of the natural gas is combusted in gas engines (Figure 3.27). The consumption of municipal waste and biomass has increased.

The $SO_2$ emission has decreased 95 % since 1990. This decrease is a result of both lower sulphur content in fuels and installation and improved performance of desulphurisation plants.

The $NO_x$ emission has decreased 73 % due to installation of low $NO_x$ burners, selective catalytic reduction (SCR) units and selective non-catalytic reduction (SNCR) units. The fluctuations in time-series follow the fluctuations in fuel consumption and electricity trade.

The emission of NMVOC in 2008 was 4 times the 1990 emission level. This is a result of the large number of gas engines that has been installed in Danish CHP plants.

The CO emission was 1 % lower in 2008 than in 1990. The fluctuations follow the fluctuations of the fuel consumption. In addition the emission from gas engines is considerable.

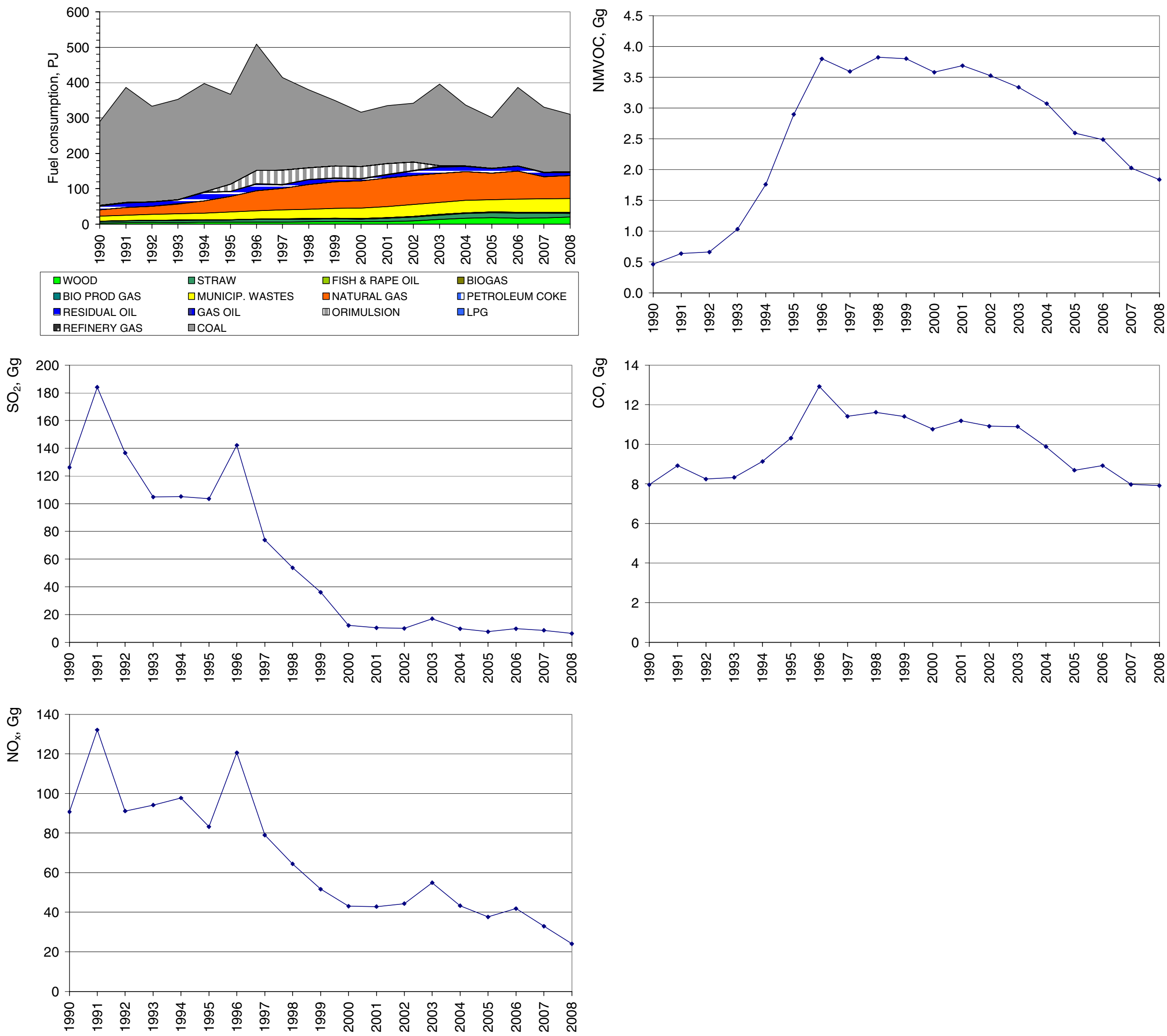



Figure 3.32 Time-series for 1A1a Electricity and heat production.

*1A1b Petroleum refining*

Petroleum refining is a small source category regarding both fuel consumption and greenhouse gas emissions for stationary combustion. There are presently only two refineries operating in Denmark.

Figure 3.33 shows the time-series for fuel consumption and emissions.

The significant decrease in both fuel consumption and emissions in 1996 is a result of the closure of a third refinery.

The fuel consumption has increased 3 % since 1990.

The emission of $SO_2$ has shown a pronounced decrease (91 %) since 1990, mainly because of technical improvements at the refineries. The $NO_x$ emission decreased 8 %. In recent years data for both $SO_2$ and $NO_x$ are plant specific data stated by the refineries.

A description of the Danish emission inventory for fugitive emissions from fuels is given in Plejdrup et al. (2009) and in IIR Chapter 3.4.

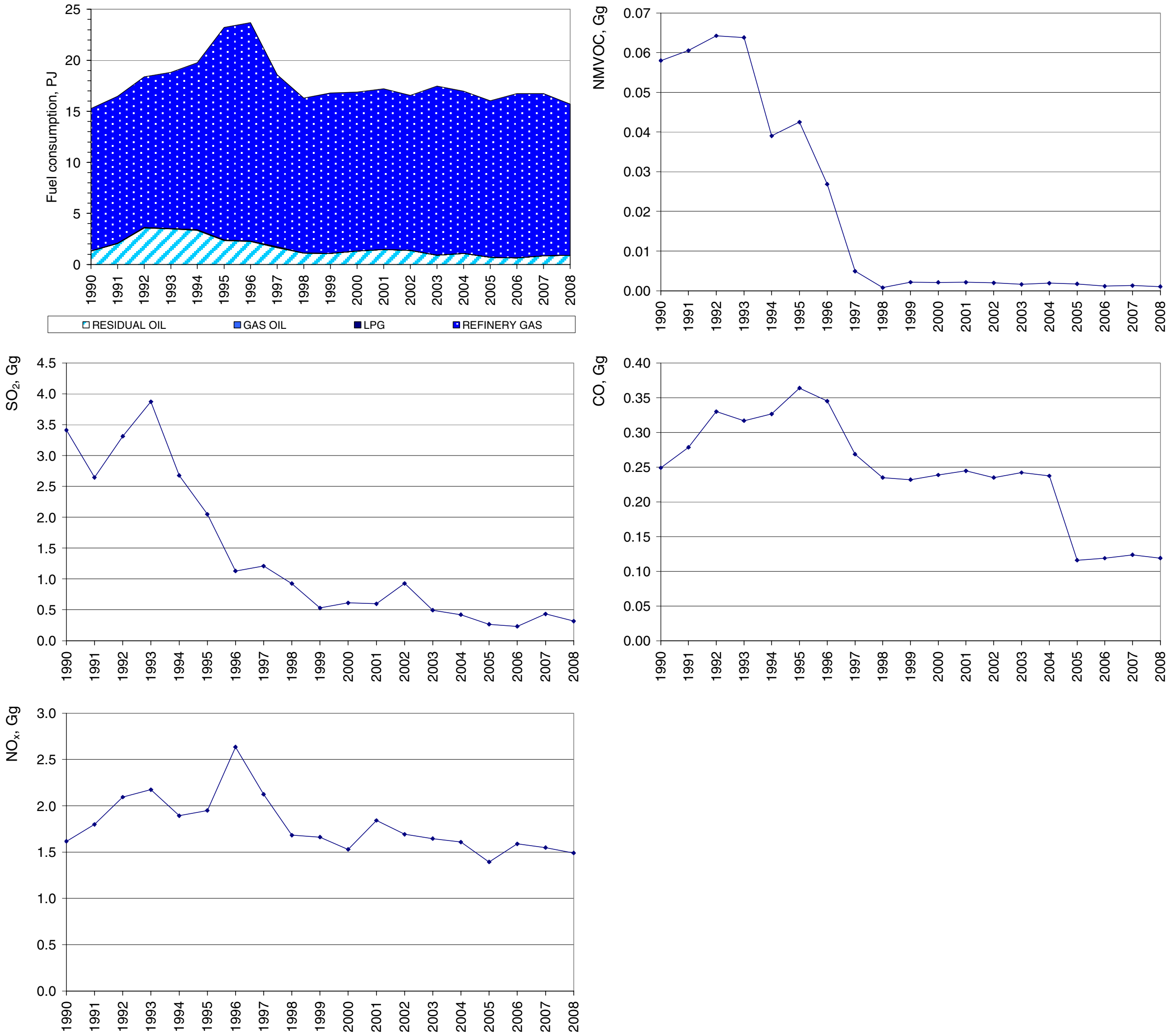



Figure 3.33 Time-series for 1A1b Petroleum refining.

*1A1c Other energy industries*

The source category *Other energy industries* comprises natural gas consumption in the off-shore industry. Gas turbines are the main plant type. Figure 3.34 shows the time-series for fuel consumption and emissions.

The fuel consumption in 2008 was three times the consumption in 1990.

The emissions follow the increase of fuel consumption.

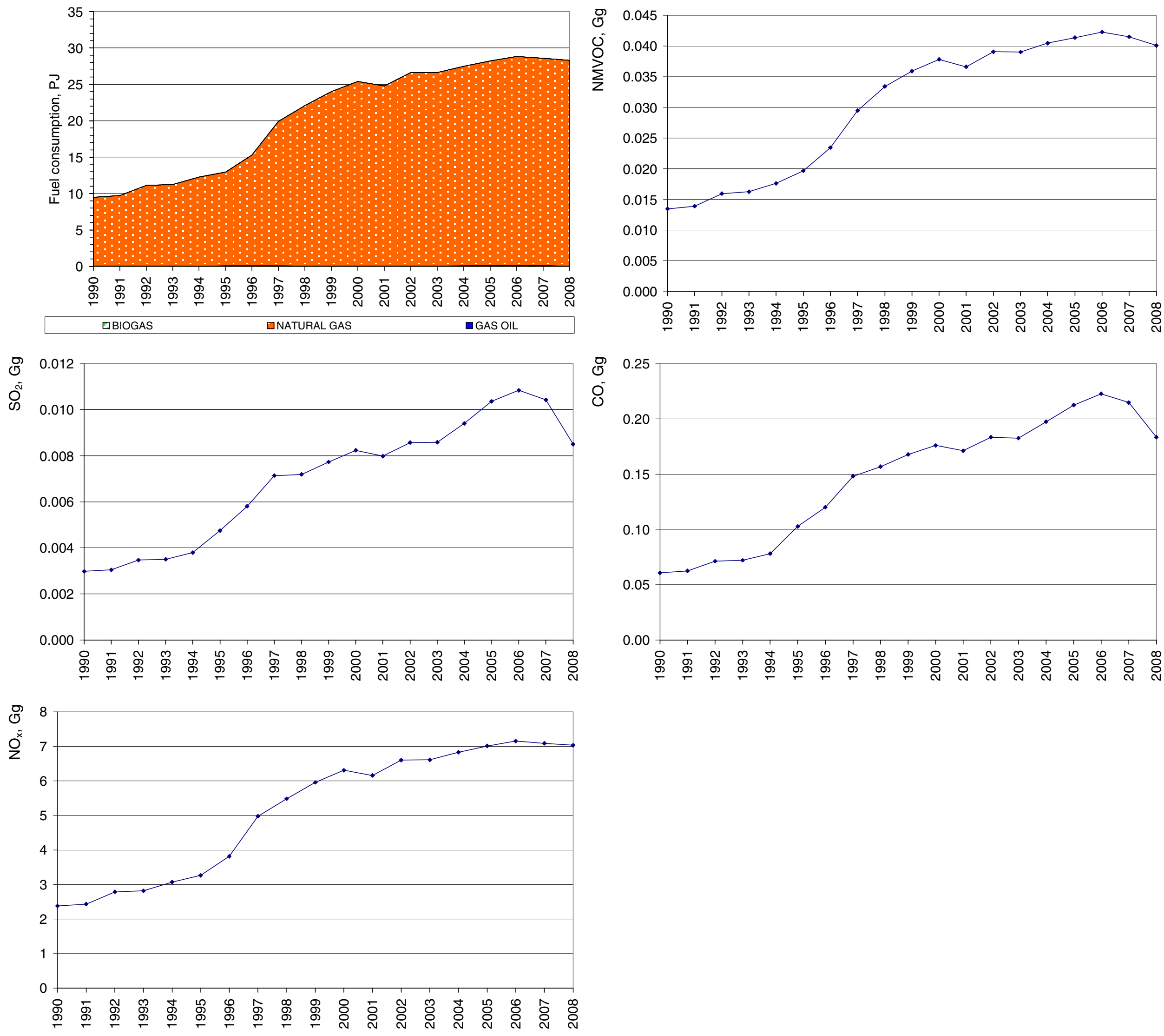



Figure 3.34 Time-series for 1A1c Other energy industries.

*1A2 Industry*

*Manufacturing industries and construction* (Industry) consists of both stationary and mobile sources. In this chapter only stationary sources are included.

Figure 3.35 - 3.39 show the time-series for fuel consumption and emissions. The data have not been disaggregated to industrial sub-categories due to the fact that the Danish inventory is based on data for the industrial plants as a whole.

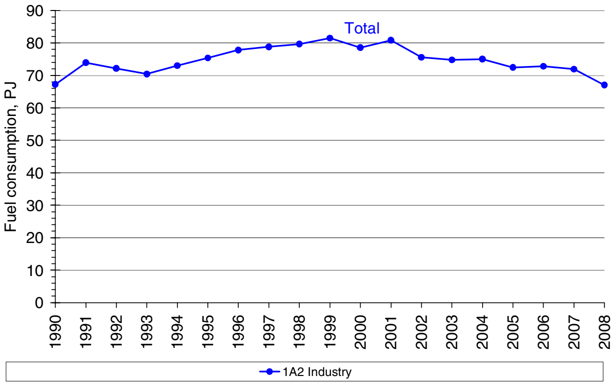
The total fuel consumption in industrial combustion has been rather stable since 1990 and was almost the same in 2008 as in 1990. However, the consumption of gas has increased whereas the consumption of coal has decreased. The consumption of residual oil has decreased, but the consumption of petroleum coke increased. The biomass part of fuel has not changed considerably since 1990.

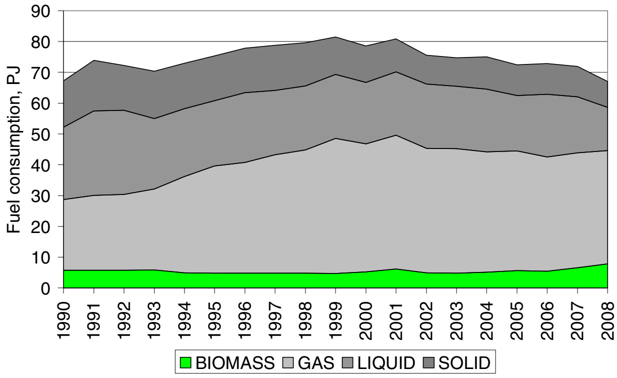
The $SO_2$ emission has decreased 68 % since 1990. This is mainly a result of lower consumption of residual oil in the industrial sector. Further the sulphur content of residual oil and several other fuels has decreased since 1990 due to legislation and tax laws.

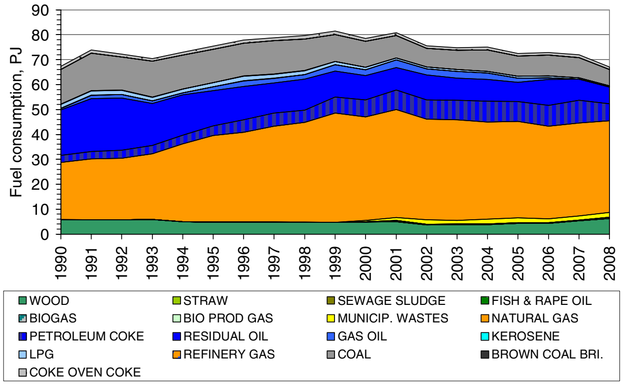
The $NO_x$ emission fluctuations follow the fuel consumption in the cement production. However, the $NO_x$ emission has decreased 27 % since 1990 due to the reduced emission from industrial boilers in general.

The NMVOC emission has decreased 71 % since 1990. The decrease is a mainly result of decreased emission factor for combustion of wood in industrial boilers. The emission from gas engines has however increased considerably after 1995 due to the increased fuel consumption that is a result of the installation of a large number of industrial CHP plants. The NMVOC emission factor for gas engines is much higher than for boilers regardless of the fuel.

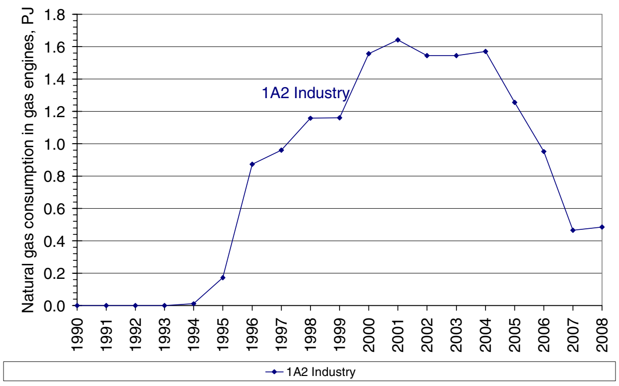
The CO emission in 2008 was 19 % lower than in 1990. The main source of emission is combustion in mineral wool production. This emission follows the fuel consumption in the mineral wool production plants.




Fuel consumption in natural gas fuelled engines




Fuel consumption, residual oil

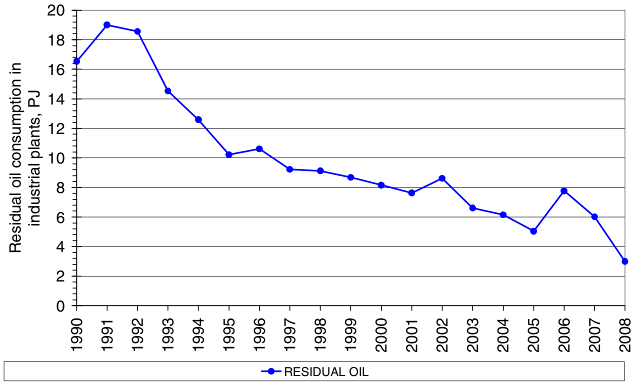



Figure 3.35 Time-series for fuel consumption, 1A2 Industry.

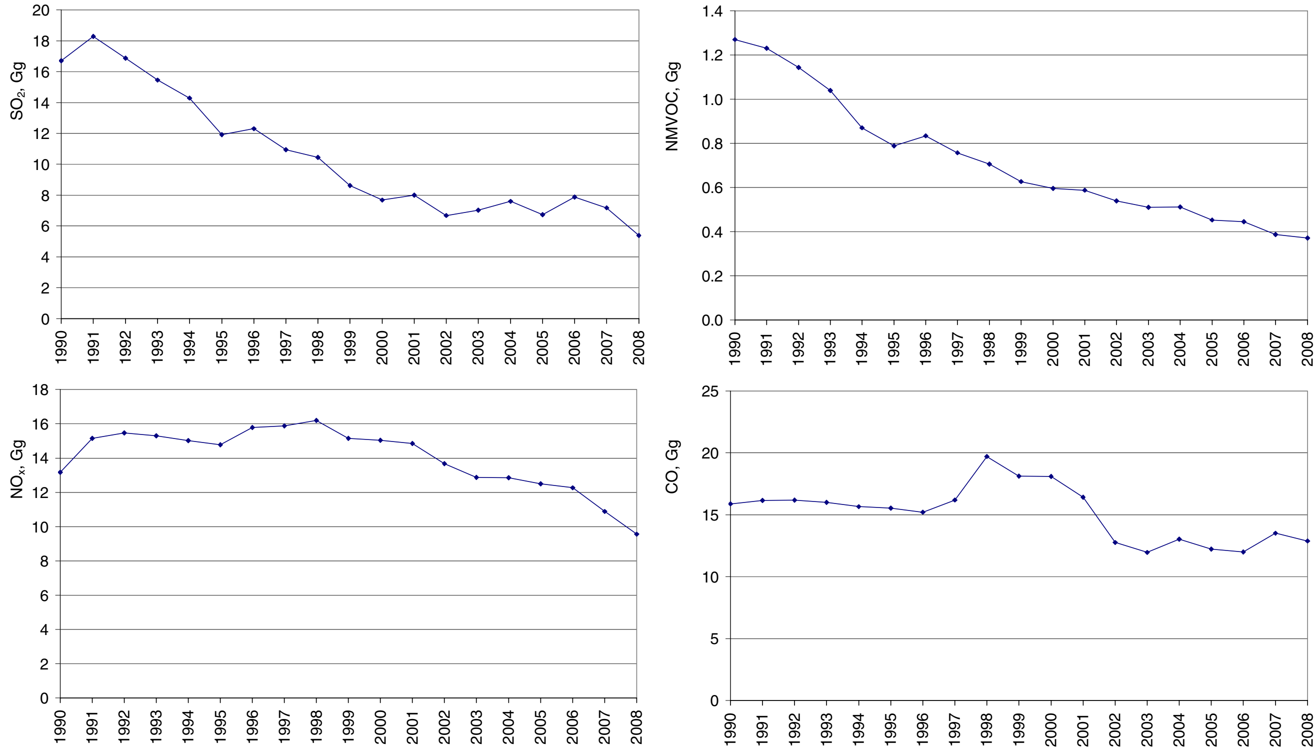



Figure 3.36 Time-series for $SO_2$, $NO_x$, NMVOC and CO emission, 1A2 Industry.

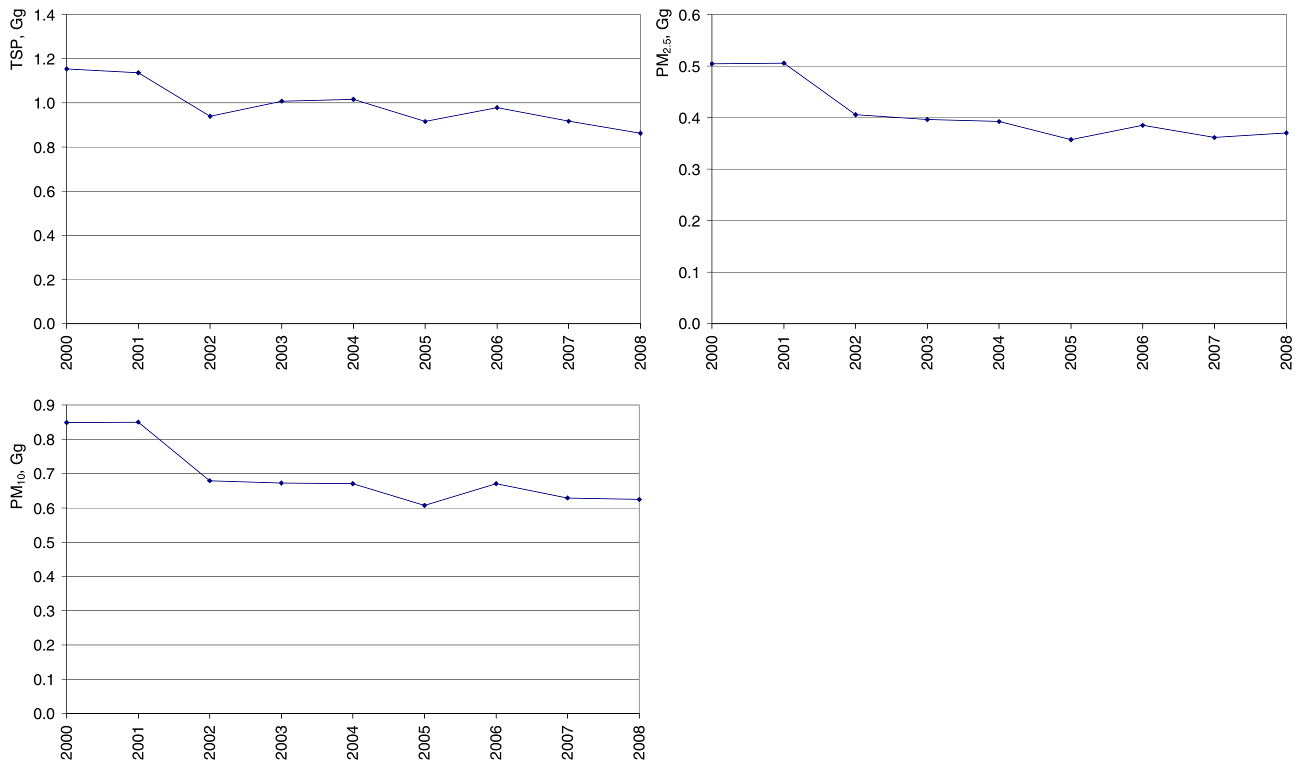



Figure 3.37 Time-series for PM emission, 1A2 Industry.

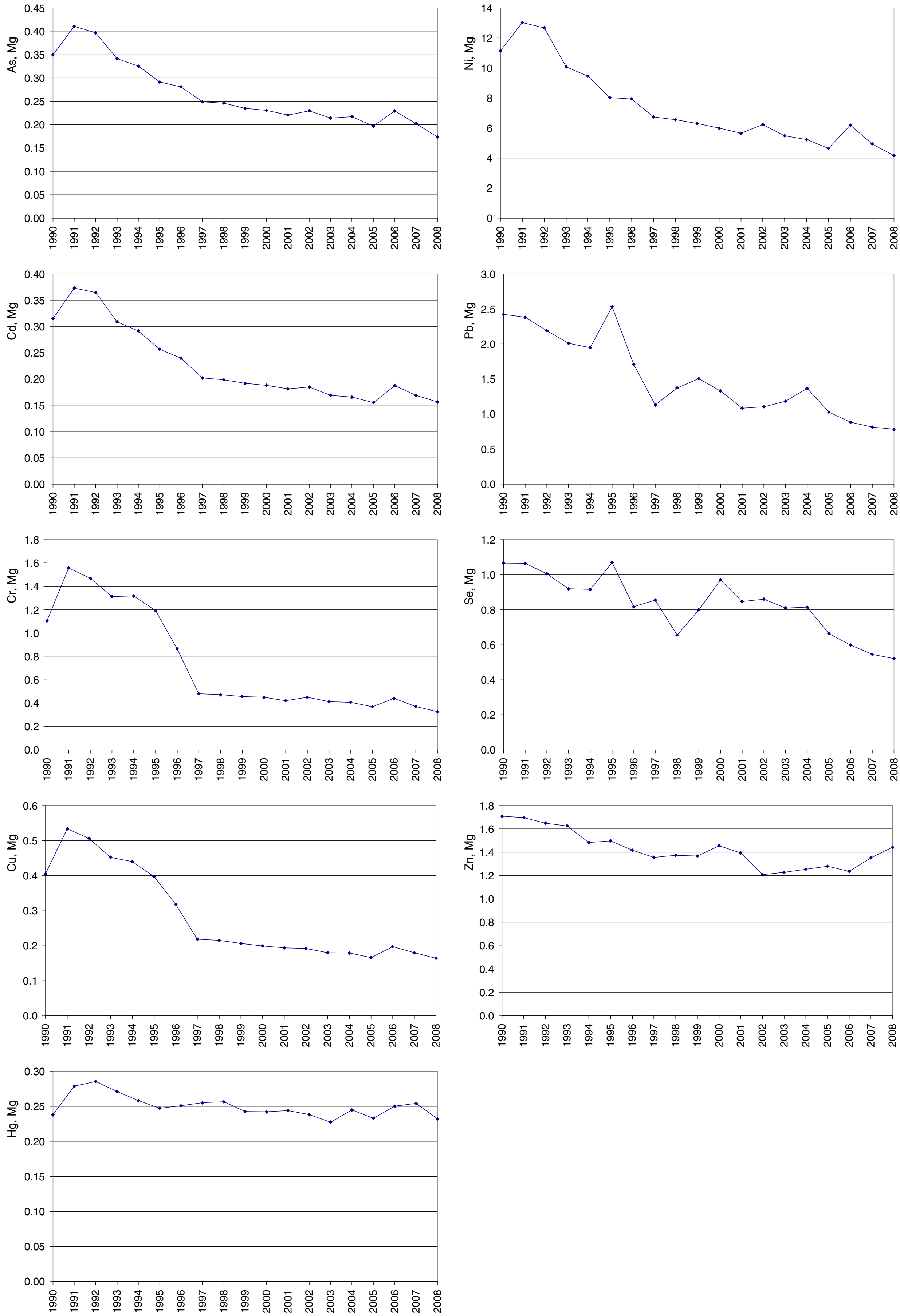



Figure 3.38 Time-series for HM emission, 1A2 Industry.

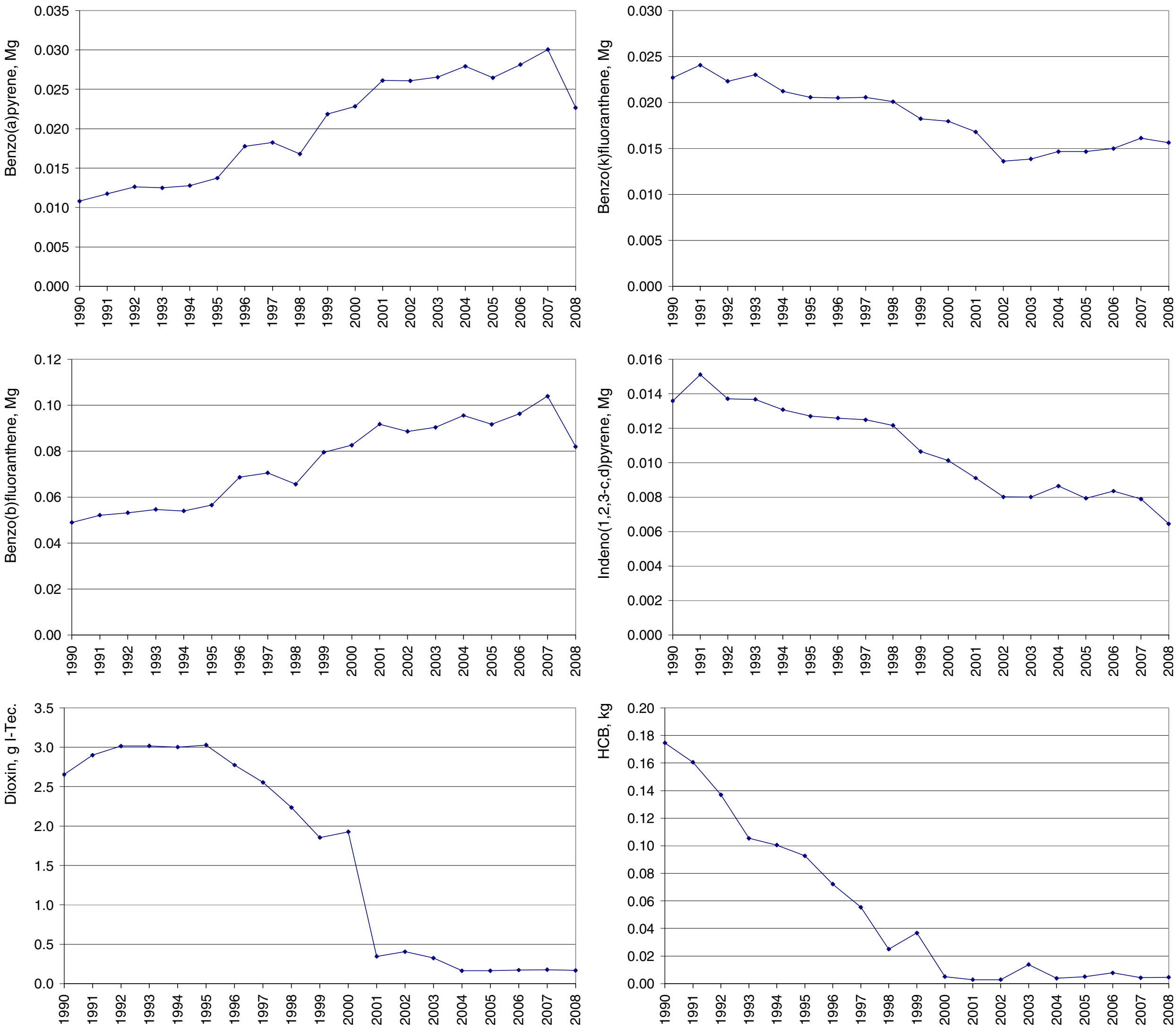


Figure 3.39 Time-series for PAH, dioxin and HCB emission, 1A2 Industry.

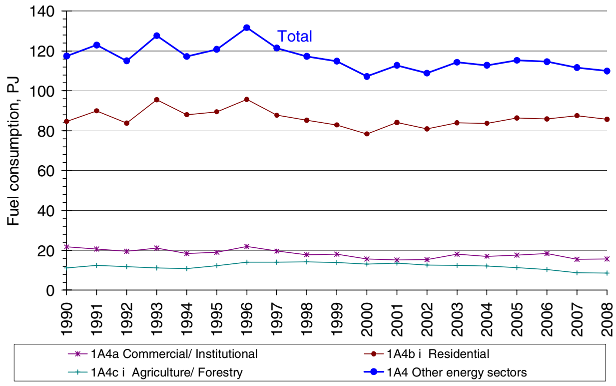
**1A4 Other Sectors**

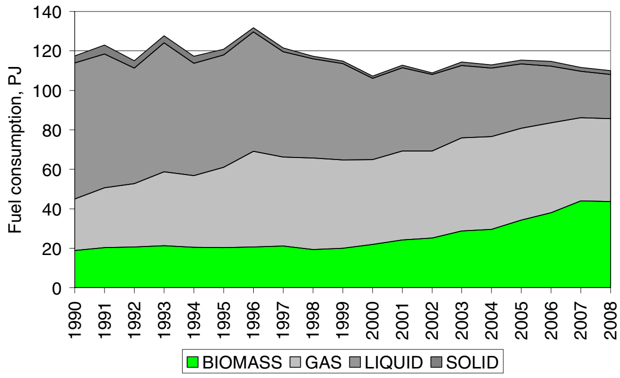
The emission source category *1A4 Other Sectors* consists of the subcategories:

- 1A4a Commercial/Institutional plants.
- 1A4b Residential plants.
- 1A1c Agriculture/Forestry.

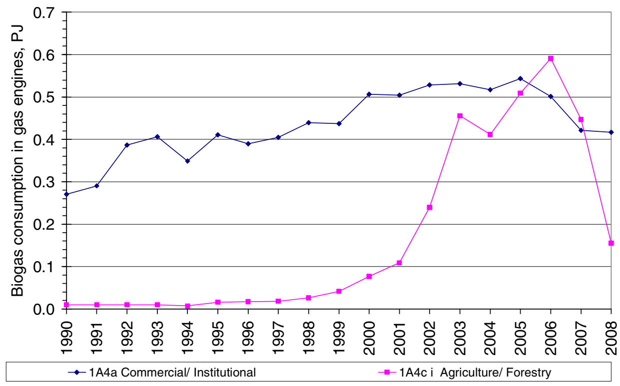
Figure 3.40 – 3.44 present time-series for this emission source category. Residential plants is the largest subcategory accounting for the largest part of all emissions. Time-series are discussed below for each subcategory.

1A4 Other Sectors

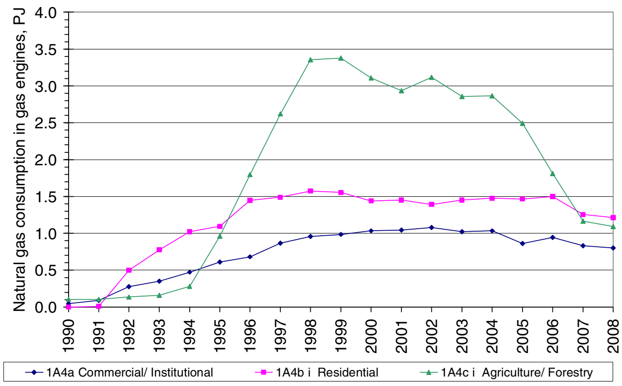


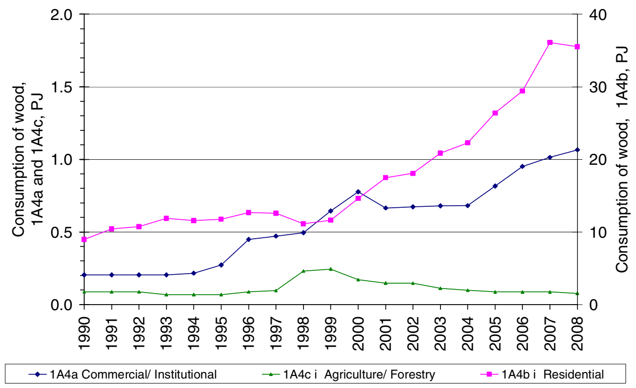

Gas engines, biogas (subsectors to Other Sectors)




Gas engines, natural gas (subsectors to Other Sectors)




Combustion of wood in Other Sectors




Combustion of straw in Other Sectors

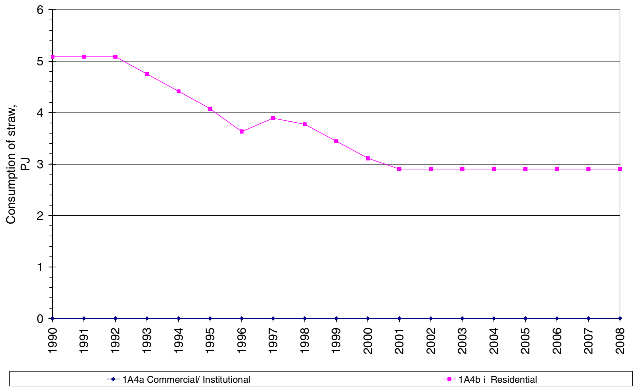



Figure 3.40 Time-series for fuel consumption, 1A4 Other Sectors.

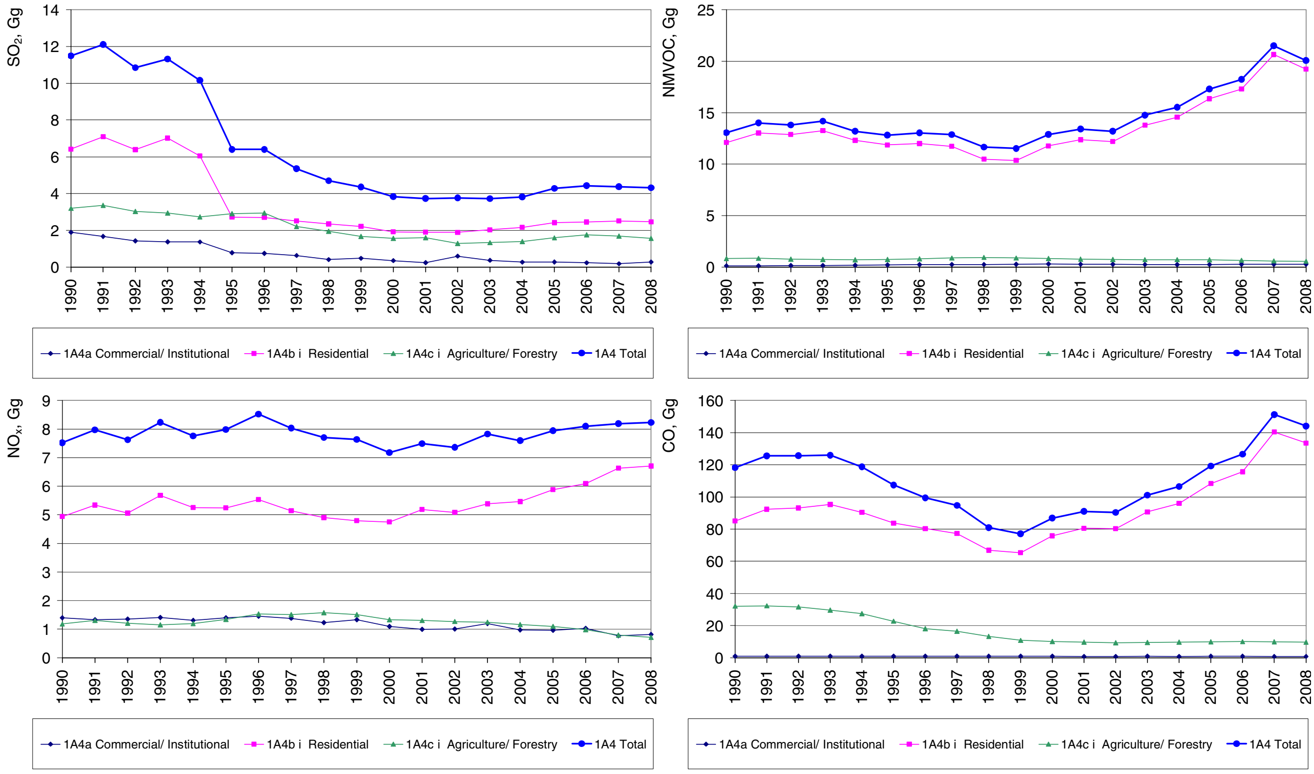



Figure 3.41 Time-series for $SO_2$, $NO_x$, NMVOC and CO emission, 1A4 Other Sectors.

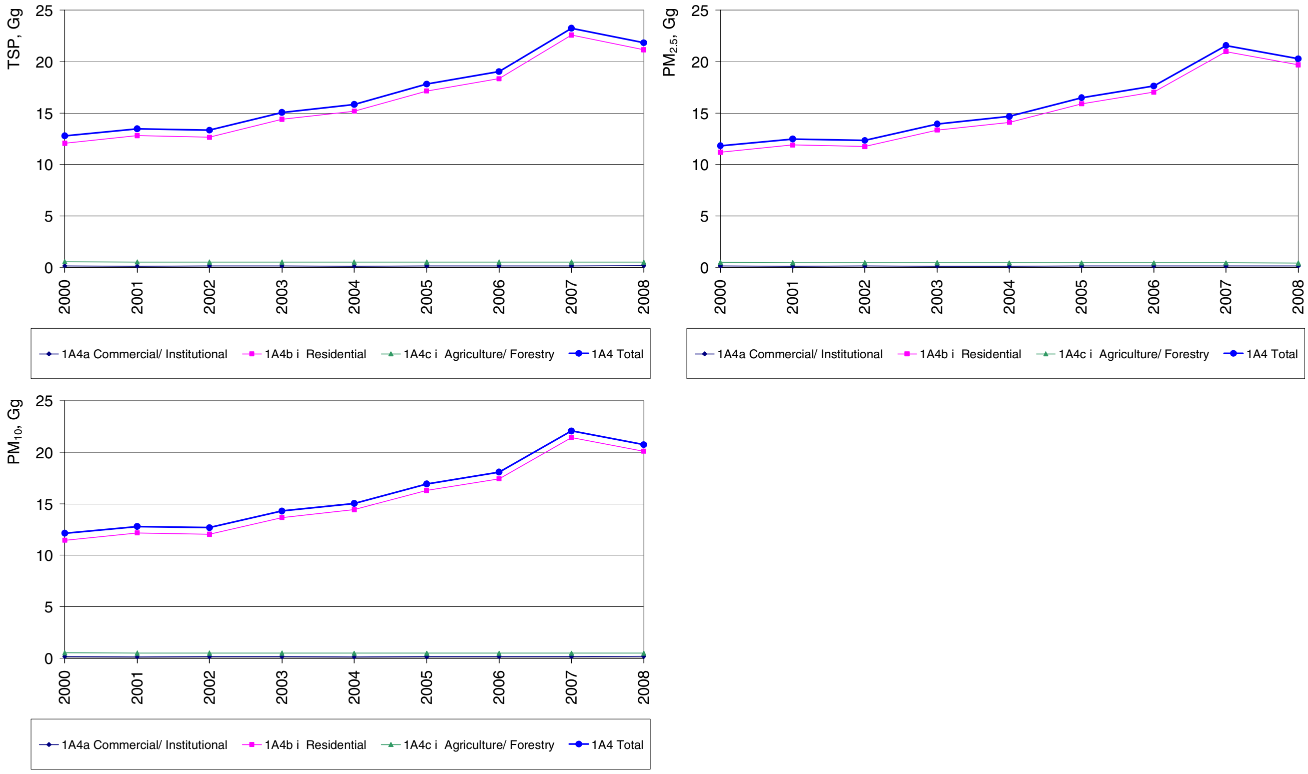



Figure 3.42 Time-series for PM emission, 1A4 Other Sectors.

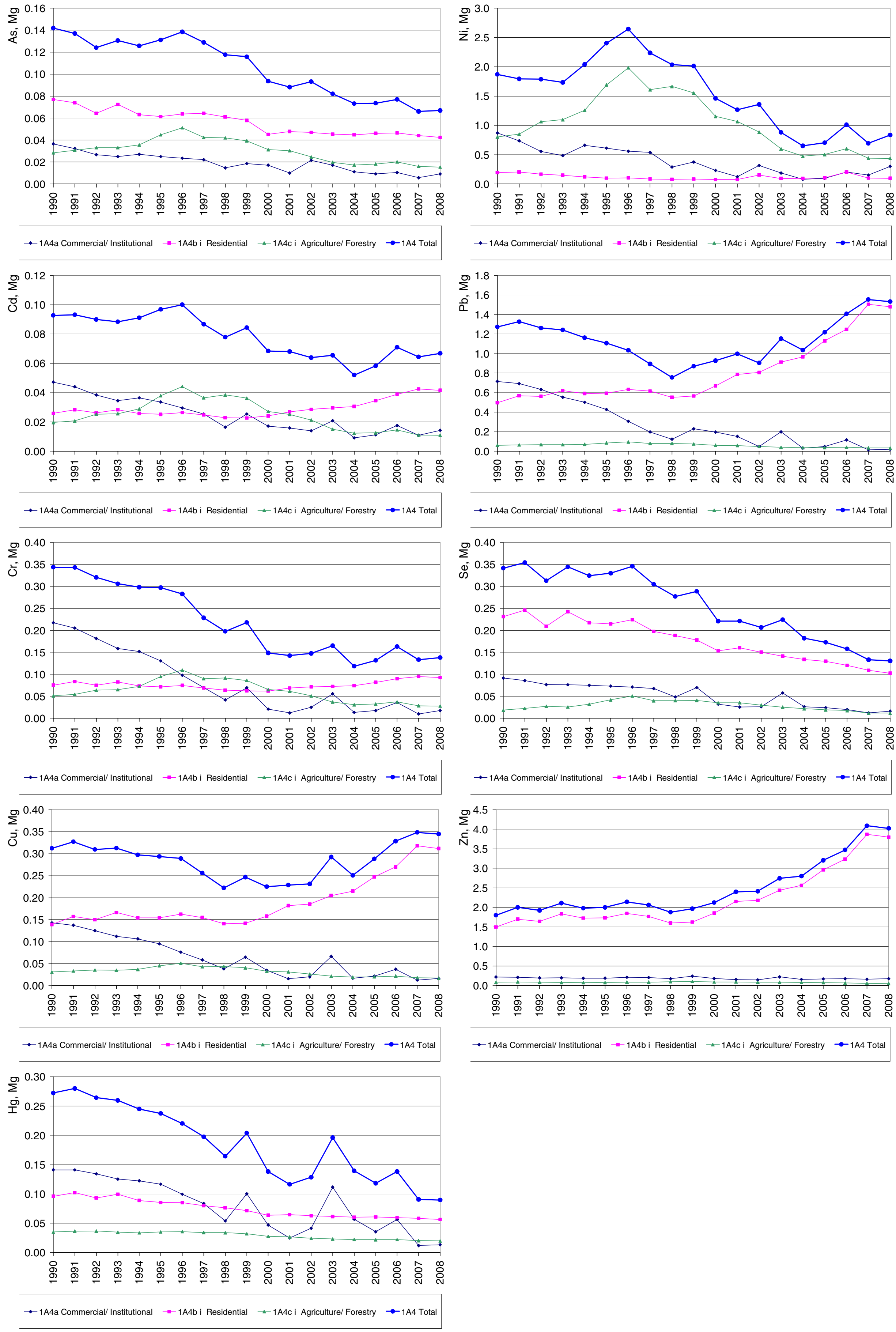



Figure 3.43 Time-series for HM emission, 1A4 Other Sectors.

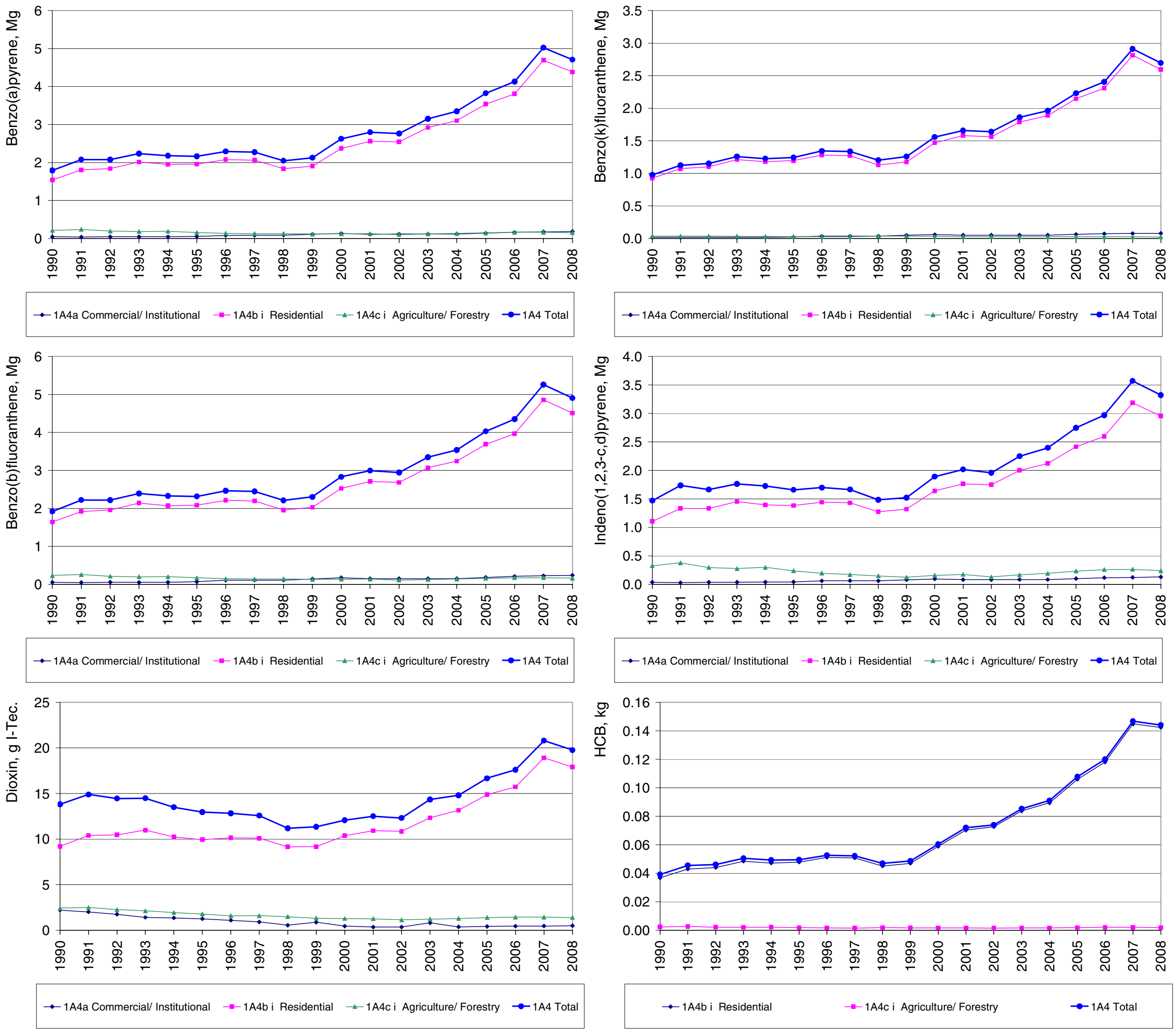



Figure 3.44 Time-series for PAH, dioxin and HCB emission, 1A4 Other Sectors.

*1A4a Commercial and institutional plants*

The subcategory *1A4a Commercial and institutional plants* has low fuel consumption and emissions compared to the other stationary combustion emission source categories. Figure 3.45 shows the time-series for fuel consumption and emissions.

The fuel consumption in commercial/institutional plants has decreased 28 % since 1990 and there has been a change of fuel type. The fuel consumption consists mainly of gas oil and natural gas. The consumption of gas oil has decreased and the consumption of natural gas has increased since 1990. The consumption of wood and biogas has also increased. The wood consumption in 2008 was five times the consumption in 1990.

The $SO_2$ emission has decreased 86 % since 1990. The decrease is a result of both the change of fuel from gas oil to natural gas and of the lower sulphur content in gas oil and in residual oil. The lower sulphur content (0.05 % for gas oil since 1995 and 0.7 % for residual oil since 1997) is a result of Danish tax laws (MST 1998).

The $NO_x$ emission was 42 % lower in 2008 than in 1990. The decrease is mainly a result of the lower fuel consumption but also the change from gas oil to natural gas has contributed to the decrease. The emission from gas engines and wood combustion has increased.

The NMVOC emission in 2008 was more than twice the 1990 emission level. The large increase is a result of the increased combustion of wood that is the main source of emission. The increased consumption of natural gas in gas engines also contribute to the increased NMVOC emission.

The CO emission has decreased 14 % since 1990. The emission from wood and from natural gas fuelled engines and boilers has increased whereas the emission from gas oil has decreased. This is a result of the change of fuels applied in the sector.

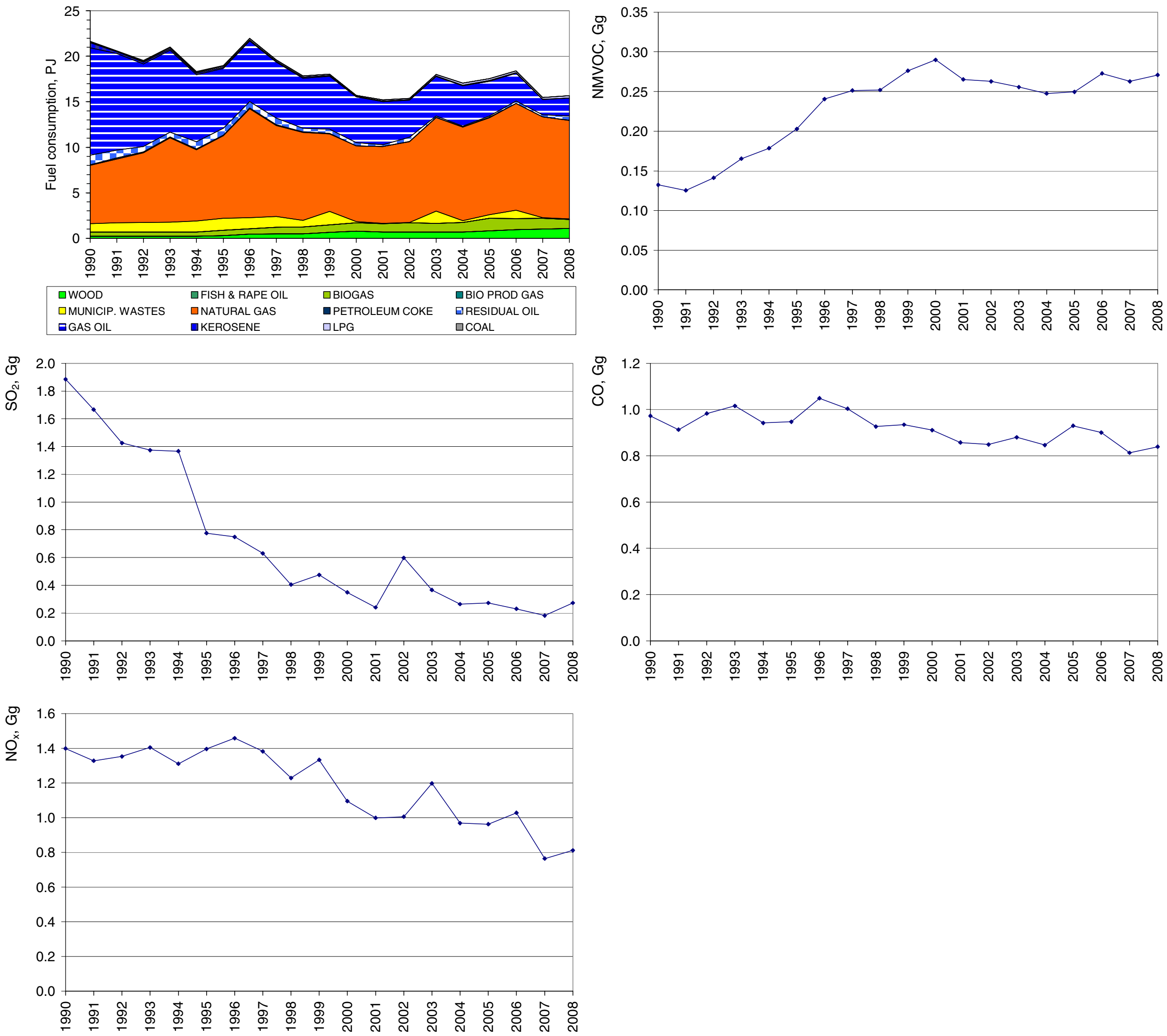



Figure 3.45 Time-series for 1A4a Commercial /institutional.

*1A4b Residential plants*

The emission source category *1A4b Residential plants* consists of both stationary and mobile sources. In this chapter only stationary sources are included. Figure 3.46 shows the time-series for fuel consumption and emissions.

For residential plants the total fuel consumption has been rather stable, and in 2008 the consumption was 1 % higher than in 1990. However, the consumption of gas oil has decreased since 1990 whereas the consumption of wood has increased considerably (four times the 1990 level). The consumption of natural gas has also increased since 1990.

The large decrease (62 %) of $SO_2$ emission from residential plants is mainly a result of a change of sulphur content in gas oil since 1995. The lower sulphur content (0.05 %) is a result of Danish tax laws (MST 1998).

The $NO_x$ emission has increased by 36 % since 1990 due to the increased emission from wood combustion. The emission factor for wood is higher than for gas oil.

The emission of NMVOC has increased 59 % since 1990 due to the increased combustion of wood. The emission factor for wood has decreased since 1990, but not as much as the increase in consumption of wood. The emission factor for wood and straw is higher than for liquid or gaseous fuels.

The CO emission has increased 57 % due to the increased use of wood that is the main source of emission. The emission from combustion of straw has decreased since 1990.

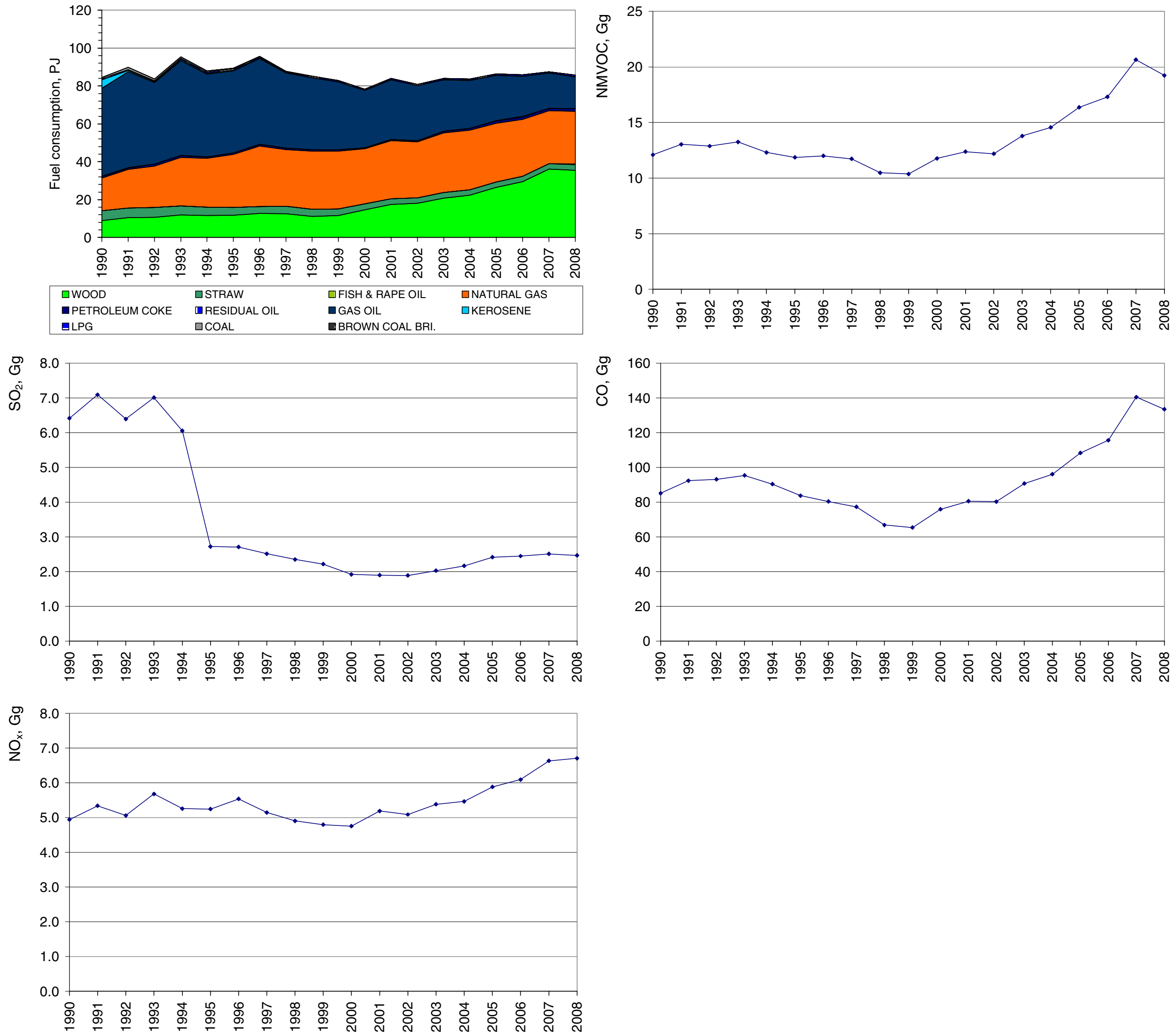



Figure 3.46 Time-series for 1A4b Residential plants.

### *1A4c Agriculture/forestry*

The emission source category *1A4c Agriculture/forestry* consists of both stationary and mobile sources. In this chapter only stationary sources are included. Figure 3.47 shows the time-series for fuel consumption and emissions.

For plants in agriculture/forestry the fuel consumption has decreased 23 % since 1990. A remarkable decrease of fuel consumption has taken place in recent years.

The type of fuel that has been applied has changed since 1990. In the years 1994-2004 the consumption of natural gas was high, but in recent years the consumption decreased again. A large part of the natural gas consumption has been applied in gas engines (Figure 3.40). Most CHP plants in agriculture/forestry based on gas engines came in operation in 1995-1999. The decrease in later years is a result of the liberalisation of the electricity market.

The consumption of straw has decreased since 1990. The consumption of both residual oil and gas oil has increased after 1990 but has decreased again in recent years.

The $SO_2$ emission was 51 % lower in 2008 than in 1990. The emission decreased from 1990 to 2002 and increased after 2002. The main emission sources are coal, residual oil and straw and it is mainly the increase of coal combustion in the sector that has caused the increase of $SO_2$ emission in recent years.

The emission of $NO_x$ was 39 % lower in 2008 than in 1990. This is in line with the decrease of fuel consumption.

The emission of NMVOC has decreased 31 % since 1990. The major emission source is combustion of straw. The consumption of straw has decreased since 1990. The emission from gas engines has increased mainly due to increased fuel consumption.

The CO emission has decreased 70 % since 1990. The major emission source is combustion of straw. In addition to the decrease of straw consumption the emission factor for straw has also decreased since 1990.

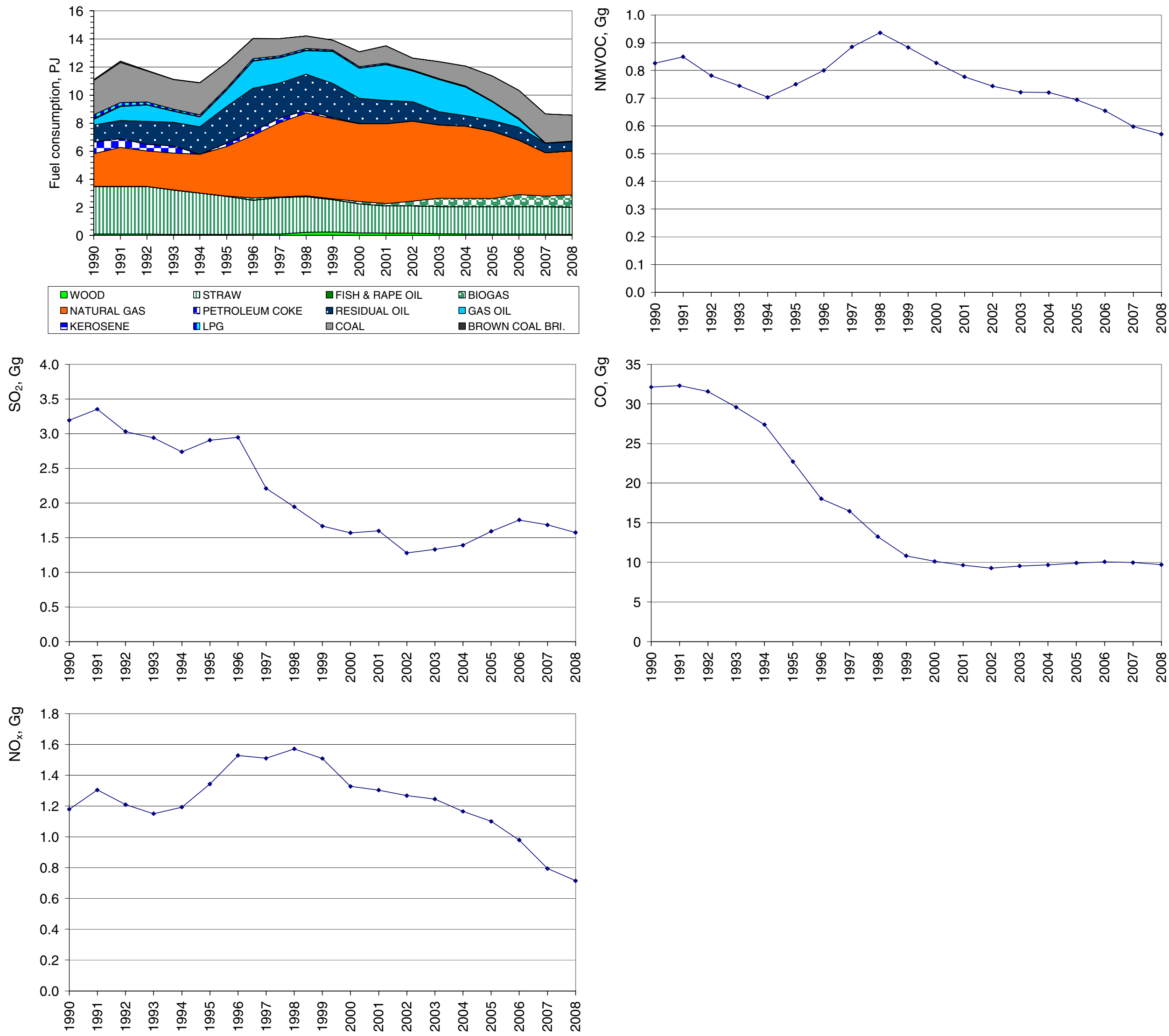



Figure 3.47 Time-series for 1A4c Agriculture/Forestry.

### 3.2.4 Methodological issues

The Danish emission inventory is based on the CORINAIR (CORe INventory on AIR emissions) system, which is a European program for air emission inventories. CORINAIR includes methodology structure and software for inventories. The methodology is described in the EMEP/CORINAIR Emission Inventory Guidebook 3rd edition, 2007 update, prepared by the UNECE/EMEP Task Force on Emissions Inventories and Projections (EEA 2007). Emission data are stored in an Access database, from which data are transferred to the reporting formats.

The emission inventory for stationary combustion is based on activity rates from the Danish energy statistics. General emission factors for various fuels, plants and sectors have been determined. Some large plants, such as power plants, are registered individually as large point sources and plant-specific emission data are used.

#### Tiers

The emission inventory is based on the methodology referred to as Tier 2 and Tier 3 in the IPCC Guidelines (IPCC 1996).

#### Large point sources

Large emission sources such as power plants, industrial plants and refineries are included as large point sources in the Danish emission database. Each point source may consist of more than one part, e.g. a power plant with several units. By registering the plants as point sources in the database it is possible to use plant-specific emission factors.

In the inventory for the year 2008, 70 stationary combustion plants are specified as large point sources. These point sources include:

- Power plants and decentralised CHP plants (combined heat and power plants).
- Municipal waste incineration plants.
- Large industrial combustion plants.
- Petroleum refining plants.

The criteria for selection of point sources consist of the following:

- All centralized power plants, including smaller units.
- All units with a capacity of above 25 $MW_e$.
- All district heating plants with an installed effect of 50 $MW_{th}$ or above and a significant fuel consumption.
- All waste incineration plants obliged to publish annual environmental reports according to Danish law (Miljøstyrelsen 2006).
- Industrial plants,
    - with an installed effect of 50 $MW_{th}$ or above and significant fuel consumption.
    - with a significant process related emission.

The fuel consumption of stationary combustion plants registered as large point sources in the 2008 inventory was 309 PJ. This corresponds to 58 % of the overall fuel consumption for stationary combustion.

A list of the large point sources for 2008 and the fuel consumption rates is provided in Annex 2A-6. The number of large point sources registered in the databases increased from 1990 to 2008.

The emissions from a point source are based either on plant specific emission data or, if plant specific data are not available, on fuel consumption data and the general Danish emission factors. Annex 2A-6 shows which of the emission data for large point sources are plant-specific and the corresponding share of the emission from stationary combustion.

$SO_2$ and $NO_x$ emissions from large point sources are often plant-specific based on emission measurements. Emissions of CO, NMVOC, PM, heavy metals and dioxin are also plant-specific for some plants. Plant-specific emission data are obtained from:

- Annual environmental reports.
- Annual plant-specific reporting of $SO_2$ and $NO_x$ from power plants >25MW$_e$ prepared for the Danish Energy Agency due to Danish legislatory requirement.
- Emission data reported by DONG Energy and Vattenfall, the two major electricity suppliers.
- Emission data reported from industrial plants.

Annual environmental reports for the plants include a considerable number of emission data sets. Emission data from annual environmental reports are, in general, based on emission measurements, but some emissions have potentially been calculated from general emission factors.

If plant-specific emission factors are not available, general area source emission factors are used.

#### Area sources

Fuels not combusted in large point sources are included as source category specific area sources in the emission database. Plants such as residential boilers, small district heating plants, small CHP plants and some industrial boilers are defined as area sources. Emissions from area sources are based on fuel consumption data and emission factors. Further information on emission factors is provided below.

#### Activity rates, fuel consumption

The fuel consumption rates are based on the official Danish energy statistics prepared by the Danish Energy Agency (DEA). The DEA aggregates fuel consumption rates to SNAP categories (DEA 2008a). Some fuel types in the official Danish energy statistics are added to obtain a less detailed fuel aggregation level cf. Annex 2A-3. The calorific values on which the energy statistics are based are also enclosed in Annex 2A-3. The correspondence list between the energy statistics and SNAP categories is enclosed in Annex 2A-9.

The fuel consumption of the NFR category *Manufacturing industries and construction* (corresponding to SNAP category *03 Combustion in manufacturing industries)* is not disaggregated into specific industries in the NERI emission database. So far disaggregation into specific industries is only estimated for the reporting to the Climate Convention.

Both traded and non-traded fuels are included in the Danish energy statistics. Thus, for example, estimation of the annual consumption of non-traded wood is included.

Petroleum coke purchased abroad and combusted in Danish residential plants (border trade of 251 TJ) is added to the apparent consumption of petroleum coke and the emissions are included in the inventory.

The fuel consumption data for large point sources refer to the EU Emission Trading Scheme (EU ETS) data for plants for which the Danish $CO_2$ emission inventory also refer to EU ETS.

For all other large point sources the fuel consumption refers to a DEA database (DEA 2008c). The DEA compiles a database for the fuel consumption of each district heating and power-producing plant, based on data reported by plant operators.

The fuel consumption of area sources is calculated as total fuel consumption minus fuel consumption of large point sources.

The Danish national energy statistics includes three fuels used for non-energy purposes, bitumen, white spirit and lubricants. The total consumption for non-energy purposes is relatively low, e.g. 11.1 PJ in 2008. The use of white spirit is included in the inventory in *Solvent and other product use*. The emissions associated with the use of bitumen and lubricants are included in *Industrial Processes.*

In Denmark all municipal waste incineration are utilised for heat and power production. Thus, incineration of waste is included as stationary combustion in the source category *Energy* (subcategories *1A1*, *1A2* and *1A4)*.

Fuel consumption data are presented in Chapter 3.2.1.

**Town gas**

Town gas has been included in the fuel category natural gas. The consumption of town gas in Denmark is very low, e.g. 0.4 PJ in 2008. In 1990 the town gas consumption was 1.5 PJ and the consumption has been steadily decreasing through out the time-series.

In Denmark town gas is produced based on natural gas. The use of coal for town gas production ceased in the early 1980s.

An indicative composition of town gas according to the largest supplier of town gas in Denmark is shown in Table 3.17 (KE, 2009).

Table 3.17 Composition of town gas currently used (KE, 2009).

| Component | Town gas, % (mol.) |
|---|---|
| Methane | 43.9 |
| Ethane | 2.9 |
| Propane | 1.1 |
| Butane | 0.5 |
| Carbon dioxide | 0.4 |
| Nitrogen | 40.5 |
| Oxygen | 10.7 |

In earlier years the composition of town gas was somewhat different. Table 3.18 is constructed with the input from Københavns Energi (KE) (Copenhagen Energy) and Danish Gas Technology Centre (DGC), (Jeppesen 2008 and Kristensen 2007). The data refer to three measurements performed several years apart; the first in 2000 and the latest in 2005.

Table 3.18 Composition of town gas, information from the period 2000-2005.

| Component | Town gas, % (mol.) |
|---|---|
| Methane | 22.3-27.8 |
| Ethane | 1.2-1.8 |
| Propane | 0.5-0.9 |
| Butane | 0.13-0.2 |
| Higher hydrocarbons | 0-0.6 |
| Carbon dioxide | 8-11.6 |
| Nitrogen | 15.6-20.9 |
| Oxygen | 2.3-3.2 |
| Hydrogen | 35.4-40.5 |
| Carbon monoxide | 2.6-2.8 |

Due to the scarce data available and the very low consumption of town gas compared to consumption of natural gas, the methodology will be applied unchanged in future inventories.

**Emission factors**

For each fuel and SNAP category (sector and e.g. type of plant) a set of general area source emission factors has been determined. The emission factors are either nationally referenced or based on the international guidebooks: EEA/CORINAIR Guidebook (EEA 2009)[6] and IPCC Reference Manual (IPCC 1996).

A complete list of emission factors including time-series and references is provided in Annex 2A-4.

***$SO_2$, $NO_x$, NMVOC and CO***

Emission factors for $SO_2$, $NO_x$, NMVOC and CO are listed in Annex 2A-4. The appendix includes references and time-series.

The emission factors refer to:

- The EMEP/CORINAIR Guidebook (EEA, 2007 and EEA, 2009).
- The IPCC Guidelines, Reference Manual (IPCC, 1996).
- Danish legislation:

[6] And former editions of the EMEP/Corinair Guidebook.

- Miljøstyrelsen , 2001 (Danish Environmental Protection Agency).
- Miljøstyrelsen, 1990 (Danish Environmental Protection Agency).
- Danish research reports including:
  - Two emission measurement program for decentralised CHP plants (Nielsen et al. 2010; Nielsen & Illerup, 2003).
  - Research and emission measurements programs for biomass fuels:
    - Nikolaisen et al. (1998).
    - Jensen & Nielsen (1990).
    - Serup et al. (1999).
    - Christiansen et al. (1997).
  - Research and environmental data from the gas sector:
    - Gruijthuijsen & Jensen (2000).
    - Danish Gas Technology Centre (DGC) (2001).
    - Wit & Andersen (2003).
- Aggregated emission factors for residential wood combustion based on technology distribution (Illerup et al. 2007) and technology specific emission factors (EEA 2009; DEPA 2010).
- Calculations based on plant-specific emissions from a considerable number of power plants.
- Calculations based on plant-specific emission data from a considerable number of municipal waste incineration plants. These data refer to annual environmental reports published by plant operators.
- Sulphur content data from oil companies and the Danish gas transmission company, Energinet.dk.
- Additional personal communication.

The emission factors for NMVOC that are not nationally referenced have been updated according to EEA (2009).

Emission factor time-series have been estimated for a considerable number of the emission factors. These are provided in Annex 2A-4.

*Particulate matter (PM)*

Emission factors for PM and references for the emission factors are listed in Annex 2A-4. The emission factors are based on:

- The TNO/CEPMEIP emission factor database (CEPMEIP 2001).

and a considerable number of country-specific factors referring to:

- Danish legislation:
  - MST (2001), Luftvejledningen (legislation from Danish Environmental Protection Agency).
  - MST (1990), Bekendtgørelse 698 (legislation from Danish Environmental Protection Agency).
- Calculations based on plant-specific emission data from a considerable number of municipal waste incineration plants.
- Aggregated emission factors for residential wood combustion based on technology distribution (Illerup et al. 2007) and technology specific emission factors (EEA 2009; DEPA 2010).

- Two emission measurement program for decentralised CHP plants (Nielsen et al. 2010; Nielsen & Illerup, 2003).
- An emission measurement program for large power plants (Livbjerg et al., 2001).
- Research leading to the first Danish PM emission inventory for stationary combustion (Nielsen et al. 2003)
- Additional personal communication concerning straw combustion in residential plants.

Emission factor time-series have been estimated for residential wood combustion and MSW incineration. All other emission factors have been considered constant in 2000-2008.

*Heavy metals*

Emission factors for 2008 for heavy metals (HM) are presented in Annex 2A-4. The appendix includes references and time-series. The emission factors refer to:

- Research concerning heavy metal emission factors representative for Denmark (Illerup et al., 1999).
- Two emission measurement programs carried out on Danish decentralised CHP plants (Nielsen et al. 2010; Nielsen & Illerup, 2003).

Time-series have been estimated for municipal waste incineration. For all other sources the same emission factors have been applied for 1990-2008.

The HM emission factors listed in Annex 2A-4 are only given for the categories where activity data are available. Missing emission factors for some categories and some years reflect that the aggregation level is different for different years.

*PAH*

Emission factors 2008 for PAH are shown in Annex 2A-4. The appendix includes references. The PAH emission factors refer to:

- Research carried out by TNO (Berdowski et al., 1995).
- Research carried out by Statistics Norway (Finstad et al., 2001).
- An emission measurement program performed on biomass fuelled plants. The project was carried out for the Danish Environmental Protection Agency (Jensen & Nielsen, 1996).
- Two emission measurement programs carried out on Danish decentralised CHP plants (Nielsen et al. 2010; Nielsen & Illerup, 2003).
- Additional information from the gas sector (Jensen, 2001).
- For residential wood combustion country specific emission factors have been aggregated based on technology distribution in the sector (Illerup et al., 2007) and guidebook emission factors (EEA, 2009).

Emission factor time-series have been estimated for residential wood combustion, natural gas fuelled engines, biogas fuelled engines and MSW incineration plants. All other emission factors have been considered constant from 1990 to 2008. In general, emission factors for PAH are uncertain.

*Dioxin*

Emission factors 2008 for dioxin are shown in Annex 2A-4.

The emission factor for residential wood combustion refers to technology specific emission factors (EEA 2009; DEPA 2010) and to updated technology distribution data (Illerup et al., 2007).

The emission factors for decentralised CHP plants[7] refer to an emission measurement program for these plants (Nielsen et al. 2010).

All other emission factors refer to research regarding dioxin emission carried out by NERI to prepare a new dioxin emission inventory (Henriksen et al., 2006).

Time-series for residential wood combustion and for combustion of municipal waste have been estimated. For all other sources the same emission factors have been applied for 1990-2008.

*HCB*

Emission factors 2008 for HCB are shown in Annex 2A-4. The emission factors for MSW incineration plants, CHP plants combusting straw, biogas fuelled engines, gas oil fuelled engines and engines combusting biomass producer gas refer to a Danish emission measurement programme for decentralised CHP plants (Nielsen et al. 2010). All other HCB emission factors refer to the EMEP/Corinair Guidebook (EEA, 2009). Time-series have been estimated for MSW incineration plants. All other emission factors have considered constant in 1990-2008.

*$NH_3$*

Emission factors have been included for residential wood combustion, residential straw combustion, MSW incineration in public power production and residential combustion of coal and coke oven coke. The emission factor for MSW incineration plants refers to a Danish emission measurement programme (Nielsen et al. 2010) and all other emission factors refer to the EMEP/EEA Guidebook (EEA 2009). Time-series have not been estimated.

**Implied emission factors**

A considerable part of the emission data for municipal waste incineration plants and large power plants are plant-specific. The area source emission factors do therefore not necessarily represent average values for these plant categories. To attain a set of emission factors that expresses the average emission for power plants combusting coal and for municipal waste incineration plants, implied emission factors have been calculated for these two plant categories. The implied emission factors are presented in Annex 2A-5. The implied emission factors are calculated as total emission divided by total fuel consumption.

[7] Natural gas fuelled engines, biogas fuelled engines, gasoil fuelled engines, engines fuelled by biomass producer gas, CHP plants combusting straw or wood and MSW incineration plants.

#### Disaggregation to specific industrial subcategories

The national statistics, on which the emission inventories are based, do not include a direct disaggregation to specific industrial subsectors.

Disaggregation to specific industrial subsectors has only been estimated for the Climate Convention reporting.

### 3.2.5 Uncertainty

According to the Good Practice Guidance for LRTAP Emission Inventories (Pulles & Aardenne, 2004) uncertainty estimates should be estimated.

Uncertainty estimates include uncertainty with regard to the total emission inventory as well as uncertainty with regard to trends.

#### Methodology

The Danish uncertainty estimates are based on the simple Tier 1 approach.

The uncertainty estimates are based on emission data for the base year and year 2008 as well as on uncertainties for fuel consumption and emission factors for each of the main SNAP source categories. For particulate matter 2000 is considered to be the base year, but for all other pollutants the base year is 1990. The applied uncertainties for activity rates and emission factors are default values referring to Pulles & Aardenne (2004). The uncertainty for PM is, however, estimated by NERI. The default uncertainties for emission factors are given in letter codes representing an uncertainty range. It has been assumed that the uncertainties were in the lower end of the range for all sources and pollutants. The applied uncertainties for emission factors are listed in Table 3.19. The uncertainty for fuel consumption in stationary combustion plants is assumed to be 2 %.

Table 3.19 Uncertainty rates for emission factors, %.

| SNAP source category | $SO_2$ | $NO_x$ | NMVOC | CO | PM | HM | PAH | HCB | Dioxin | $NH_3$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 01 | 10 | 20 | 50 | 20 | 50 | 100 | 100 | 1000 | 500 | 1000 |
| 02 | 20 | 50 | 50 | 50 | 500 | 1000 | 1000 | 1000 | 1000 | 1000 |
| 03 | 10 | 20 | 50 | 20 | 50 | 100 | 100 | 1000 | 1000 | 1000 |

#### Results

The uncertainty estimates for stationary combustion emission inventories are shown in Table 3.20. Detailed calculation sheets are provided in Annex 2A-7.

The total emission uncertainty is 7.5 % for $SO_2$, 16 % for $NO_x$, 45 % for NMVOC and 44 % for CO. For PM, heavy metals, HCB, dioxin and PAH the uncertainty estimates are larger than 100 %.

Table 3.20 Danish uncertainty estimates, tier 1 approach, 2008.

| Pollutant | Uncertainty Total emission, % | Trend 1990-2008, % | Uncertainty Trend, %-age points |
|---|---|---|---|
| $SO_2$ | 7.5 | -90 | ±0.6 |
| $NO_x$ | 16 | -56 | ±3 |
| NMVOC | 45 | +50 | ±8 |
| CO | 44 | +16 | ±4 |
| $NH_3$ | 731 | +3 | ±316 |
| TSP [1)] | 461 | +57 | ±59 |
| $PM_{10}$ [1)] | 469 | +59 | ±52 |
| $PM_{2.5}$ [1)] | 476 | +62 | ±42 |
| As | 174 | -72 | ±21 |
| Cd | 199 | -65 | ±36 |
| Cr | 177 | -87 | ±16 |
| Cu | 418 | -77 | ±76 |
| Hg | 135 | -75 | ±11 |
| Ni | 144 | -69 | ±13 |
| Pb | 501 | -80 | ±82 |
| Se | 104 | -65 | ±5 |
| Zn | 574 | -5 | ±314 |
| HCB | 709 | -83 | ±59 |
| Dioxin | 936 | -55 | ±316 |
| Benzo(b)fluoranthene | 978 | +152 | ±37 |
| Benzo(k)fluoranthene | 989 | +170 | 58 |
| Benzo(a)pyrene | 994 | +162 | 12 |
| Indeno(1,2,3-c,d)pyrene | 996 | +124 | 22 |

[1)] The base year for PM is year 2000.

### 3.2.6 Source specific QA/QC and verification

A QA/QC plan for the Danish emission inventories has been implemented. The quality manual (Sørensen et al. 2005) describes the concepts of quality work and definitions of sufficient quality, critical control points and a list of Point for Measuring (PM). Details about the source specific QA/QC is included in Annex 2A-11.

Documentation concerning verification of the Danish emission inventories has been published by Fauser et al. (2007).

The sector report for stationary combustion (Nielsen et al. 2009) has been reviewed by external experts in 2005, 2007 and 2009.

### 3.2.7 Source specific improvements and recalculations

Improvements and recalculations since the 2009 emission inventory submission include:

- The national energy statistics has been updated for the years 1980-2008. This has only resulted in small differences.
- Improved emission factors for decentralised CHP plants referring to a Danish emission measurement program (Nielsen et al. 2010) have been implemented.
- A time-series have been estimated for the HCB emission factor for MSW incineration.
- The NMVOC emission factors that are not country specific now all refer to EEA (2009). The emission factors for the key-sources are country specific and are not affected by this recalculation.
- For residential wood combustion emission factors for NMVOC, TSP, $PM_{10}$, $PM_{2.5}$ and PCDD/F have been updated for some technologies. For NMVOC the change in emission factor is for new stoves, for particulate matter the updated emission factors are for

old and new stoves and for dioxin the recalculations are done for new boilers with accumulation tank and for boilers using wood pellets. The recalculation is done for the years 2000-2007. The update in emission factors refer to a study funded by the Danish EPA. (DEPA, 2010)
- $NH_3$ emissions from residential plants have been estimated for the first time. The emission factors for coal, brown coal, coke and wood refer to the EMEP/EEA Guidebook.
- Sectoral trend time-series and discussions have been included.
- The IIR Chapter 3.2 and Annex 2A have been restructured.

### 3.2.8 Source specific planned improvements

A number of planned improvements to the emission inventories are discussed below.

1) Improved documentation for emission factors

The reporting of, and references for, the applied emission factors will be further developed in future inventories.

2) Implementation of emission factors from EEA 2009

Some emission factors refer to older versions of the EMEP/CORINAIR Guidebook. These emission factors will be updated according to EEA (2009).

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## 3.3 Transport and other mobile sources (NFR sector 1A2, 1A3, 1A4 and 1A5)

The emission inventory basis for mobile sources is fuel use information from the Danish energy statistics. In addition, background data for road transport (fleet and mileage), air traffic (aircraft type, flight numbers, origin and destination airports) and non-road machinery (engine no., engine size, load factor and annual working hours) are used to make the emission estimates sufficiently detailed. Emission data mainly comes from the EMEP/EEA Air Pollutant Emission Inventory Guidebook. However, for railways, measurements specific to Denmark are used.

In the Danish emission database, all activity rates and emissions are defined in SNAP sector categories (Selected Nomenclature for Air Pollution), according to the CollectER system. The emission inventories are prepared from a complete emission database based on the SNAP sectors. The aggregation to the sector codes used for both the UNFCCC and UNECE Conventions is based on a correspondence list between SNAP and CFR/NFR classification codes shown in Table 3.21 below (mobile sources only).

Table 3.21 SNAP – NFR correspondence table for transport.

| SNAP classification | CRF/NFR classification |
|---|---|
| 07 Road transport | 1A3b Transport-Road |
| 0801 Military | 1A5 Other |
| 0802 Railways | 1A3c Railways |
| 0803 Inland waterways | 1A3d Transport-Navigation |
| 080402 National sea traffic | 1A3d Transport-Navigation |
| 080403 National fishing | 1A4c Agriculture/forestry/fisheries |
| 080404 International sea traffic | 1A3d Transport-Navigation (international) |
| 080501 Dom. airport traffic (LTO < 1000 m) | 1A3a Transport-Civil aviation |
| 080502 Int. airport traffic (LTO < 1000 m) | 1A3a Transport-Civil aviation (international) |
| 080503 Dom. cruise traffic (> 1000 m) | 1A3a Transport-Civil aviation |
| 080504 Int. cruise traffic (> 1000 m) | 1A3a Transport-Civil aviation (international) |
| 0806 Agriculture | 1A4c Agriculture/forestry/fisheries |
| 0807 Forestry | 1A4c Agriculture/forestry/fisheries |
| 0808 Industry | 1A2f Industry-Other |
| 0809 Household and gardening | 1A4b Residential |

Military transport activities (land and air) refer to the CRF/NFR sector Other (1A5), while the Transport-Navigation sector (1A3d) comprises national sea transport (ship movements between two Danish ports) and recreational craft (SNAP code 0803).

For aviation, LTO (Landing and Take Off)[8] refers to the part of flying which is below 1000 m.

The working machinery and equipment in industry (SNAP code 0808) is grouped in Industry-Other (1A2f), while agricultural and forestry non-road machinery (SNAP codes 0806 and 0807) is ac-

[8] A LTO cycle consists of the flying modes approach/descent, taxiing, take off and climb out. In principle the actual times-in-modes rely on the actual traffic circumstances, the airport configuration, and the aircraft type in question.

counted for in the Agriculture/forestry/fisheries (1A4c) sector together with fishing activities.

For mobile sources, internal NERI databases for road transport, air traffic, sea transport and non road machinery have been set up in order to produce the emission inventories. The output results from the NERI databases are calculated in a SNAP format, as activity rates (fuel consumption) and emission factors, which are then exported directly to the central Danish CollectER database.

Apart from national inventories, the NERI databases are used also as a calculation tool in research projects, environmental impact assessment studies, and to produce basic emission information which requires various aggregation levels.

### 3.3.1 Source category description

The following description of source categories explains the development in fuel consumption and emissions for road transport and other mobile sources.

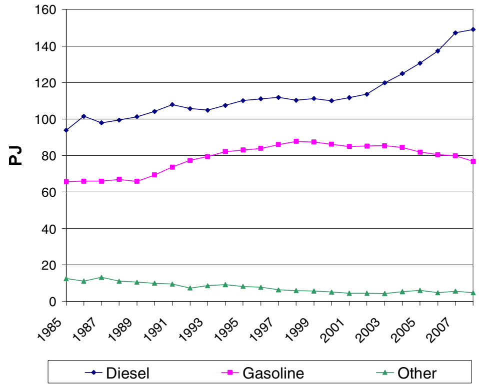
#### Fuel consumption

Table 3.22 Fuel use (PJ) for domestic transport in 2007 in NFR sectors.

| NFR ID | Fuel use (PJ) |
|---|---|
| Industry-Other (1A2f) | 15.2 |
| Civil Aviation (1A3a) | 2.3 |
| Road (1A3b) | 176.2 |
| Railways (1A3c) | 3.2 |
| Navigation (1A3d) | 6.1 |
| Residential (1A4b) | 3.3 |
| Agri./for./fish. (1A4c) | 22.9 |
| Military (1A5) | 1.5 |
| Total | 230.7 |

Table 3.22 shows the fuel use for domestic transport based on DEA statistics for 2008 in NFR sectors. The fuel use figures in time-series 1985-2008 are given in Annex 2.B.15 (NFR format) and are shown for 2008 in Annex 2.B.14 (CollectER format). Road transport has a major share of the fuel consumption for domestic transport. In 2008 this sector's fuel consumption share is 76 %, while the fuel consumption shares for Agriculture/forestry/fisheries and Industry-Other are 10 and 7 %, respectively. For the remaining sectors the total fuel consumption share is 7 %.

From 1985 to 2008, diesel and gasoline fuel use has increased by 59 % and 17 %, respectively, and in 2008 the fuel use shares for diesel and gasoline were 66 % and 33 %, respectively (Figures 3.48 and 3.49). Other fuels only have a 1 % share of the domestic transport total. Almost all gasoline is used in road transportation vehicles. Gardening machinery and recreational craft are merely small consumers. Regarding diesel, there is considerable fuel use in most of the domestic transport categories, whereas a more limited use of residual oil and jet fuel is being used in the navigation sector and by aviation (civil and military flights), respectively.



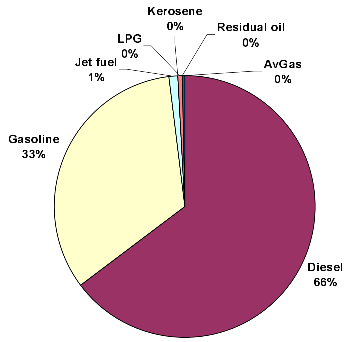




Figure 3.48 Fuel consumption pr fuel type for domestic transport 1985-2008.

Figure 3.49 Fuel use share pr fuel type for domestic transport in 2008.

**Road transport**

As shown in Figure3.50, the energy use for road transport has generally increased until 2007, except from a small fuel consumption decline noted in 2000. The fuel consumption development is due to a slight decreasing trend in the use of gasoline fuels from 1999 onwards combined with a steady growth in the use of diesel until 2007. Within sub-sectors, passenger cars represent the most fuel-consuming vehicle category, followed by heavy-duty vehicles, light duty vehicles and 2-wheelers, in decreasing order (Figure 3.50).

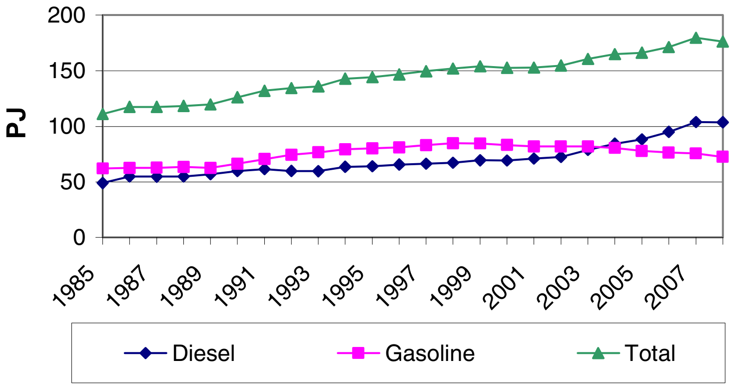



Figure 3.50 Fuel consumption pr fuel type and as totals for road transport 1985-2008.

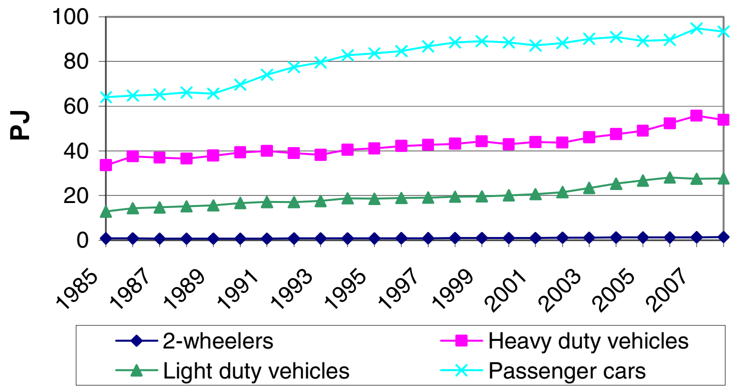



Figure 3.51 Total fuel consumption pr vehicle type for road transport 1985-2008.

As shown in Figure 3.52, fuel consumption for gasoline passenger cars dominates the overall gasoline consumption trend. The development in diesel fuel consumption in recent years (Figure 3.53) is characterised by increasing fuel consumption for diesel passenger cars and light duty vehicles, while a small drop in the fuel consumption for trucks and buses (heavy-duty vehicles) is noted for 2008.

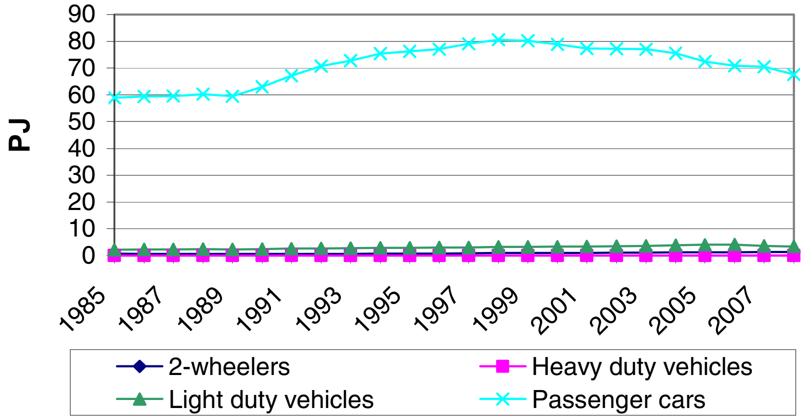



Figure 3.52 Gasoline fuel consumption pr vehicle type for road transport 1985-2008.

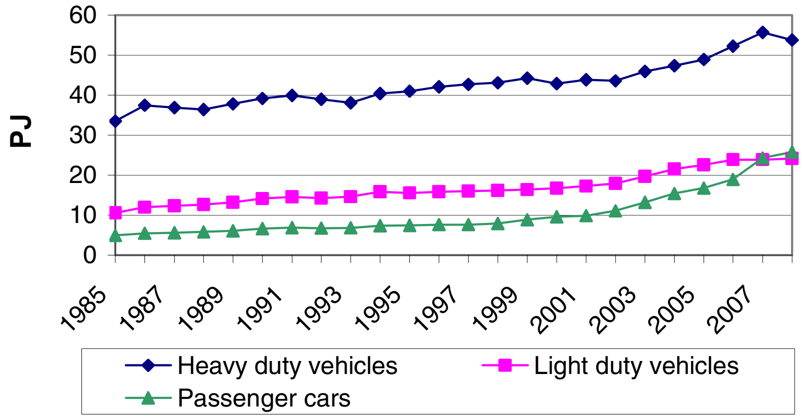



Figure 3.53 Diesel fuel consumption pr vehicle type for road transport 1985-2008.

In 2008, fuel consumption shares for gasoline passenger cars, heavy-duty vehicles, diesel passenger cars, diesel light duty vehicles and gasoline light duty vehicles were 37, 31, 15, 14 and 2 %, respectively (Figure 3.54).

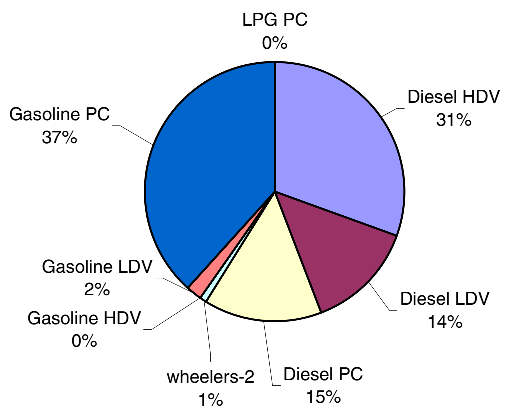



Figure 3.54 Fuel consumption share (PJ) pr vehicle type for road transport in 2008.

**Other mobile sources**

It must be noted that the fuel consumption figures behind the Danish inventory for mobile equipment in the agriculture, forestry, industry, household and gardening (residential), and inland waterways (part of navigation) sectors, are less certain than for other mobile sectors. For these types of machinery, the DEA statistical figures do not directly provide fuel consumption information, and fuel consumption totals are subsequently estimated from activity data and fuel consumption factors. For recreational craft the latest historical year is 2004.

As seen in Figure 3.55, classified according to CRF the most important sectors are Agriculture/forestry/fisheries (1A4c), Industry-other (mobile machinery part of 1A2f) and Navigation (1A3d). Minor fuel consuming sectors are Civil Aviation (1A3a), Railways (1A3c), Other (military mobile fuel consumption: 1A5) and Residential (1A4b).

The 1985-2008 time-series are shown pr fuel type in Figures 3.56-3.59 for diesel, gasoline and jet fuel, respectively.

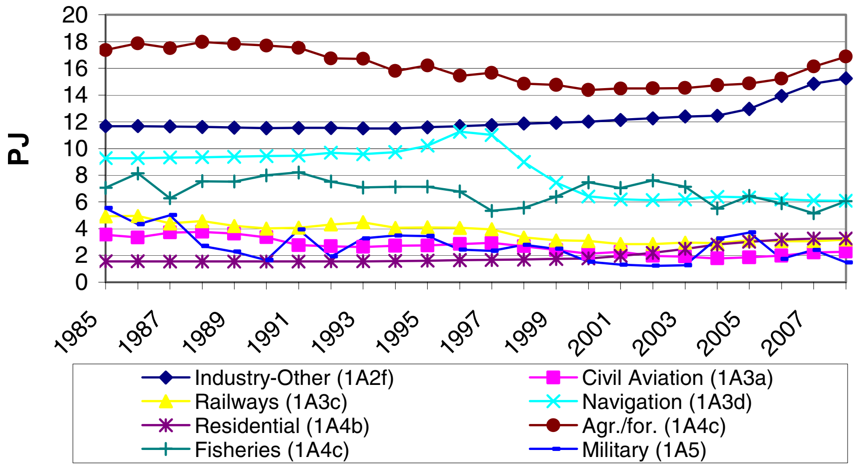



Figure 3.55 Total fuel consumption in CRF sectors for other mobile sources 1985-2008.

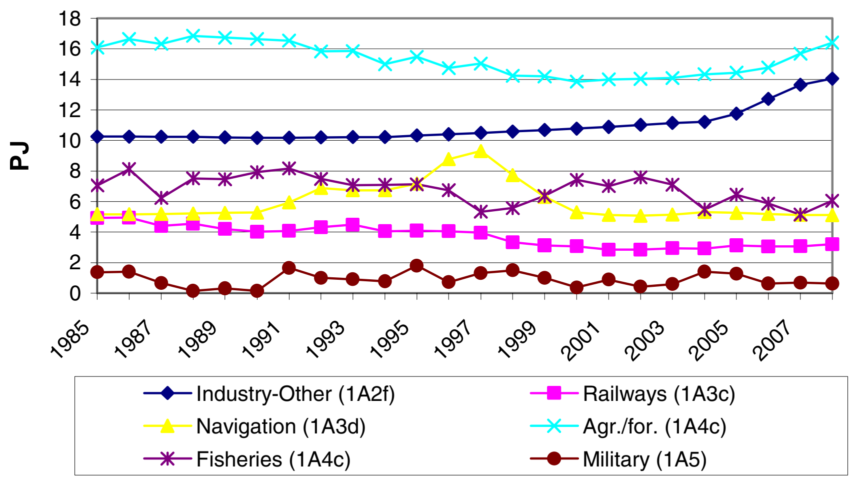



Figure 3.56 Diesel fuel consumption in CRF sectors for other mobile sources 1985-2008.

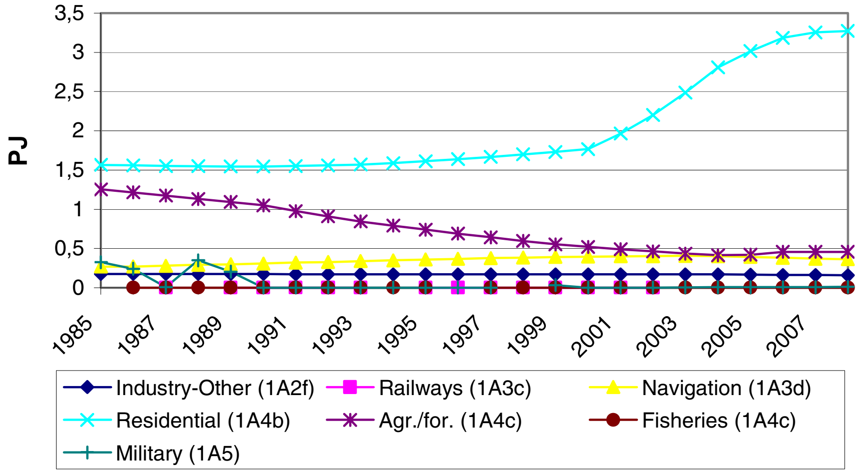



Figure 3.57 Gasoline fuel consumption in CRF sectors for other mobile source 1985-2008.

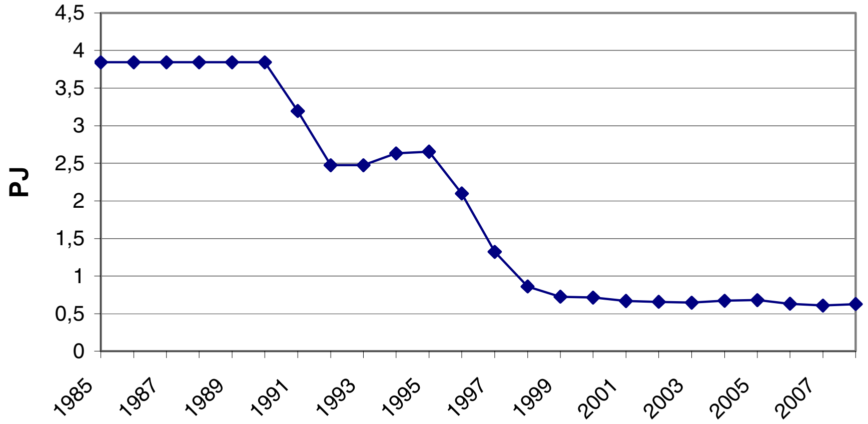



Figure 3.58 Residual oil fuel consumption in CRF sectors for other mobile sources 1985-2008.

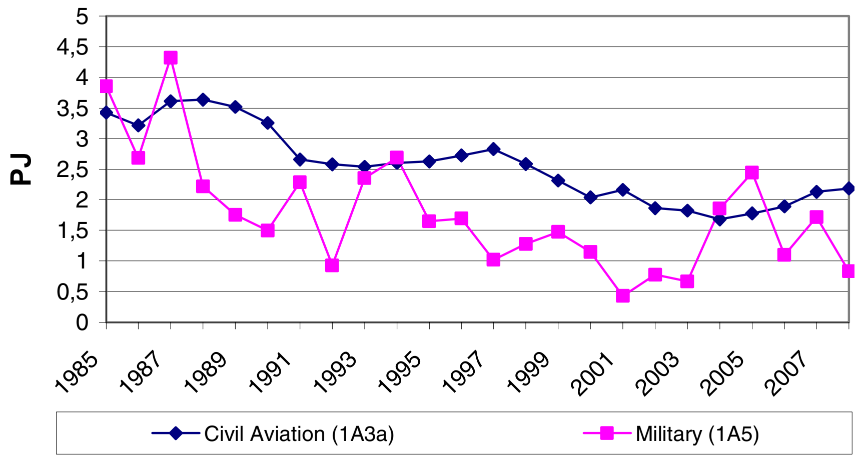



Figure 3.59 Jet fuel consumption in CRF sectors for other mobile sources 1985-2008.

In terms of diesel, the fuel consumption decreases for agricultural machines until 2000, due to fewer numbers of tractors and harvesters. After that, the increase in the engine sizes of new sold machines has more than outbalanced the trend towards smaller total stock numbers. The fuel consumption for industry has increased from the beginning of the 1990's, due to an increase in the activities for construction machinery. The fuel consumption increase has been very pronounced in 2005-2008. For fisheries, the development in fuel consumption reflects the activities in this sector.

The Navigation sector comprises national sea transport (fuel consumption between two Danish ports) and recreational craft. For the latter category, fuel consumption has increased significantly from 1990 to 2004 due to the rising number diesel-fuelled private boats. For national sea transport, the diesel fuel consumption curve reflects the combination of traffic and ferries in use for regional ferries. From 1998 to 2000, a significant decline in fuel consumption is apparent. The most important explanation here is the closing of ferry service routes in connection with the opening of the Great Belt Bridge in 1997. For railways, the gradual shift towards electrification explains the lowering trend in diesel fuel consumption and the emissions for this transport sector. The fuel consumed (and associated emissions) to produce electricity is accounted for in the stationary source part of the Danish inventories.

The largest gasoline fuel use is found for household and gardening machinery in the Residential (1A4b) sector. Especially from 2001-2006, a significant fuel consumption increase is apparent due to considerable growth in the machinery stock. The decline in gasoline fuel consumption for Agriculture/forestry/fisheries (1A4c) is due to the gradual phasing out of gasoline-fuelled agricultural tractors.

In terms of residual oil there has been a substantial decrease in the fuel consumption for regional ferries. The fuel consumption decline is most significant from 1990-1992 and from 1997-1999.

The considerable variations from one year to another in military jet fuel consumption are due to planning and budgetary reasons, and the passing demand for flying activities. Consequently, for some years, a certain amount of jet fuel stock-building might disturb the real picture of aircraft fuel consumption. Civil aviation has decreased until 2004, since the opening of the Great Belt Bridge in 1997, both in terms of number of flights and total jet fuel consumption. After 2004 an increase in the consumption of jet fuel is noted.

#### Bunkers

The residual oil and diesel oil fuel consumption fluctuations reflect the quantity of fuel sold in Denmark to international ferries, international warships, other ships with foreign destinations, transport to Greenland and the Faroe Islands, tank vessels and foreign fishing boats. For jet petrol, the sudden fuel use drop in 2002 is explained by the recession in the air traffic sector due to the events of September 11, 2001 and structural changes in the aviation business.

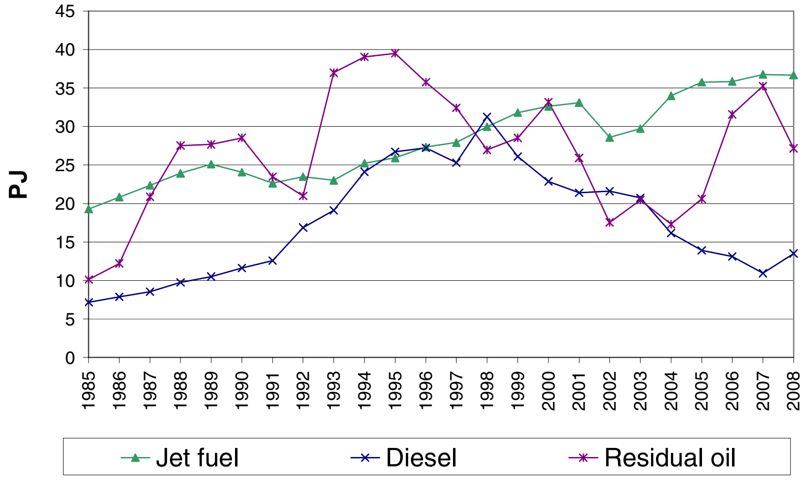



Figure 3.60 Bunker fuel consumption 1985-2008.

**Emissions of $SO_2$, $NO_X$, NMVOC, CO, $NH_3$, TSP, $PM_{10}$ and $PM_{2.5}$**

In Table 3.23 the $SO_2$, $NO_X$, NMVOC, CO $NH_3$, TSP, $PM_{10}$ and $PM_{2.5}$ emissions for road transport and other mobile sources are shown for 2008 in NFR sectors. For particulate matter (PM; TSP, $PM_{10}$ and $PM_{2.5}$), only the exhaust emission contributions are included in Table 3.23. Non-exhaust TSP, $PM_{10}$ and $PM_{2.5}$ emissions are treated in a separate section below. The emission figures in the time-series 1985-2008 are given in Annex 2.B.15 (NFR format) and are shown for 2008 in Annex 2.B.14 (CollectER format).

From 1985 to 2008, the road transport emissions of $SO_2$, $NO_X$, NMVOC, CO and PM (all size fractions) have decreased by 99, 34, 78, 75 and 44 %, respectively (Figures 3.61-3.65), whereas the $NH_3$ emissions have increased by 2456 % during the same time period (Figure 3.66).

For other mobile sources, the emission changes for $SO_2$, $NO_X$, NMVOC, CO and PM (all size fractions) are -93, -21, -16, -5 and -61 %, respectively (Figures 3.68)-3.72). The $NH_3$ emissions have increased by 18 % during the same time period (Figure 3.73).

Table 3.23 Emissions of $SO_2$, $NO_X$, NMVOC, CO $NH_3$, TSP, $PM_{10}$ and $PM_{2.5}$ in 2008 for road transport and other mobile sources.

| NFR ID | $SO_2$ | $NO_x$ | NMVOC | CO | $NH_3$ | TSP | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|---|---|---|---|
| | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes |
| Industry-Other (1A2f) | 33 | 10 100 | 1 375 | 7 060 | 3 | 861 | 861 | 861 |
| Civil Aviation (1A3a) | 52 | 704 | 148 | 828 | 0 | 3 | 3 | 3 |
| Railways (1A3c) | 1 | 2 920 | 205 | 526 | 1 | 101 | 101 | 101 |
| Navigation (1A3d) | 655 | 5 985 | 986 | 6 202 | 0 | 244 | 242 | 242 |
| Residential (1A4b) | 1 | 304 | 7 954 | 95 382 | 0 | 81 | 81 | 81 |
| Agri./for./fish. (1A4c) | 323 | 19 135 | 2 388 | 16 802 | 4 | 990 | 988 | 988 |
| Military (1A5) | 19 | 520 | 44 | 309 | 0 | 15 | 15 | 15 |
| Total other mobile | 1 085 | 39 667 | 13 099 | 127 111 | 8 | 2 294 | 2 292 | 2 291 |
| Road (1A3b) | 82 | 61 250 | 17 754 | 139 272 | 1 572 | 2 421 | 2 421 | 2 421 |
| Total mobile | 1 167 | 100 918 | 30 852 | 266 383 | 1 580 | 4 716 | 4 713 | 4 712 |

**Road transport**

The step-wise lowering of the sulphur content in diesel fuel has given rise to a substantial decrease in the road transport emissions of $SO_2$

(Figure 3.61). In 1999, the sulphur content was reduced from 500 ppm to 50 ppm (reaching gasoline levels), and for both gasoline and diesel the sulphur content was reduced to 10 ppm in 2005. Since Danish diesel and gasoline fuels have the same sulphur percentages, at present, the 2008 shares for $SO_2$ emissions and fuel use for passenger cars, heavy-duty vehicles, light-duty vehicles and 2-wheelers are the same in each case: 52, 31, 16 and 1 %, respectively (Figure3.67).

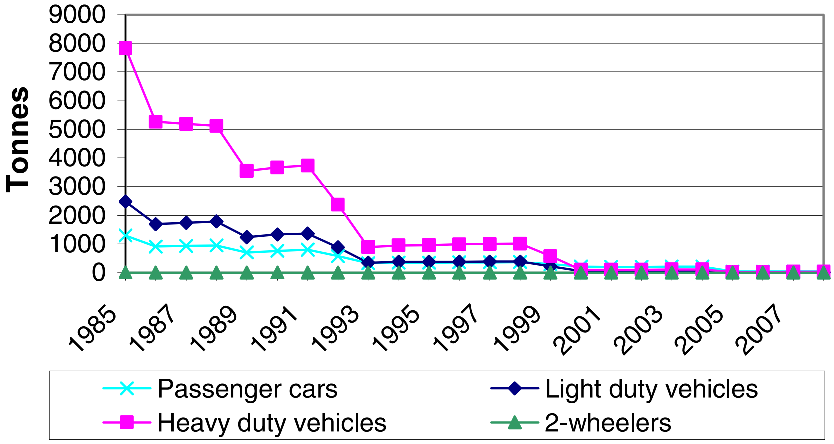



Figure 3.61 $SO_2$ emissions (tonnes) pr vehicle type for road transport 1985-2008.

Historically, the emission totals of NMVOC and CO have been very dominated by the contributions coming from private cars, as shown in Figures 3.63- 3.64. However, the NMVOC and CO (and $NO_x$) emissions from this vehicle type have shown a steady decreasing tendency since the introduction of private catalyst cars in 1990 (EURO I) and the introduction of even more emission-efficient EURO II, III and IV private cars (introduced in 1997, 2001 and 2006, respectively).

In the case of $NO_x$, the real traffic emissions for heavy duty vehicles do not follow the reductions as intended by the EU emission legislation. This is due to the so-called engine cycle-beating effect. Outside the legislative test cycle stationary measurement points, the electronic engine control for heavy duty Euro II and III engines switches to a fuel efficient engine running mode, thus leading to increasing $NO_x$ emissions (Figure 3.62).

Exhaust particulate emissions from road transportation vehicles are well below $PM_{2.5}$. The emissions from light- and heavy-duty vehicles have significantly decreased since the mid-1990s due to gradually stricter EURO emission standards. The environmental benefit of introducing diesel private cars with lower particulate emissions since 1990 is more than outbalanced by an increase in sales of new vehicles in recent years (Figure 3.65).

An undesirable environmental side effect of the introduction of catalyst cars is the increase in the emissions of $NH_3$ from the first two generations of catalyst cars (Euro I and II) compared to conventional cars. The emission factors for later catalytic converter technologies are considerably lower than the ones for Euro I and II, thus causing the emissions to decrease from 2001 onwards (Figure 3.63).

The 2008 emission shares for heavy-duty vehicles, passenger cars, light-duty vehicles and 2-wheelers for $NO_x$ (60, 28, 12 and 0 %), NMVOC (8, 64, 7 and 21 %), CO (6, 75, 7, 12 %), PM (37, 30, 31 and 2 %) and $NH_3$ (1, 95, 4 and 0 %), are also shown in Figure 3.67.

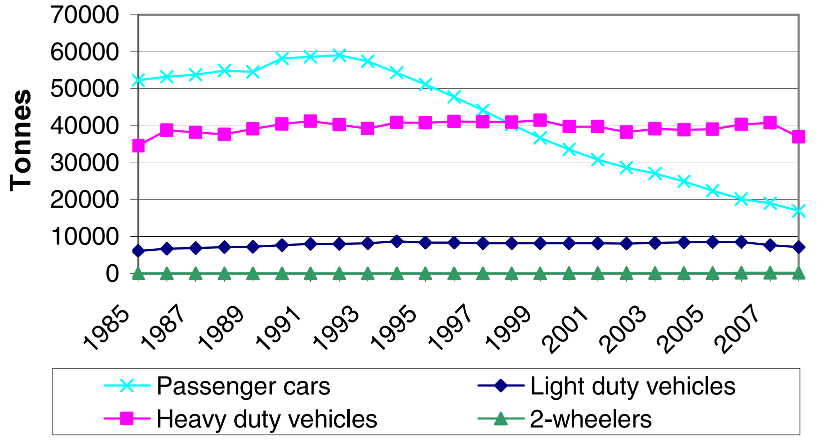



Figure 3.62 $NO_X$ emissions (tonnes) pr vehicle type for road transport 1985-2008.

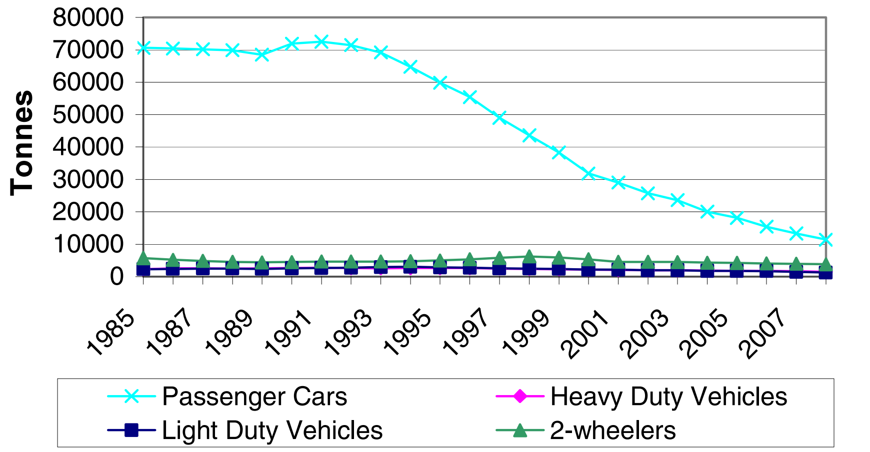



Figure 3.63 NMVOC emissions (tonnes) pr vehicle type for road transport 1985-2008.

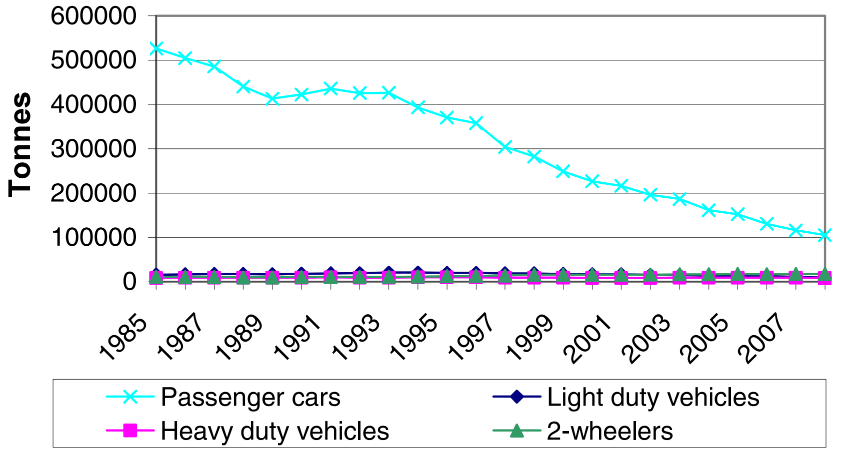



Figure 3.64 CO emissions (tonnes) pr vehicle type for road transport 1985-2008.

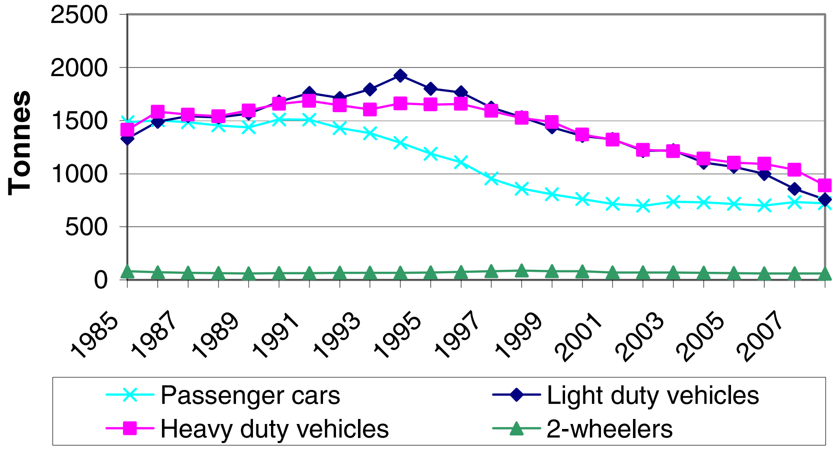



Figure 3.65 PM emissions (tonnes) pr vehicle type for road transport 1985-2008.

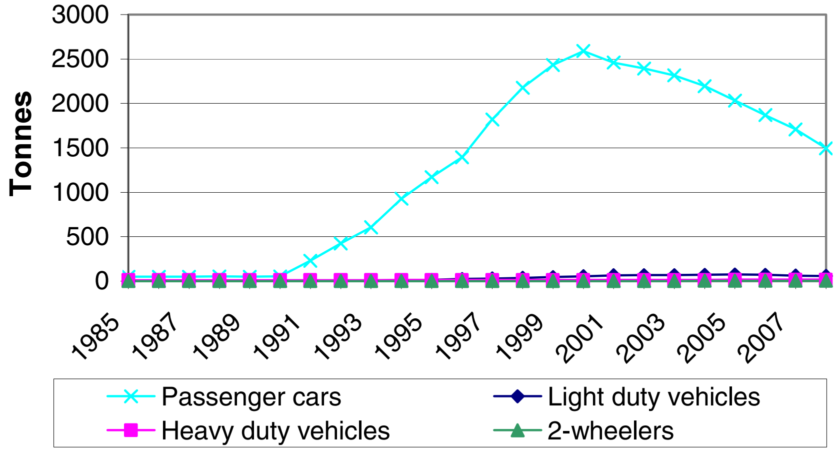



Figure 3.66 $NH_3$ emissions (tonnes) pr vehicle type for road transport 1985-2008.

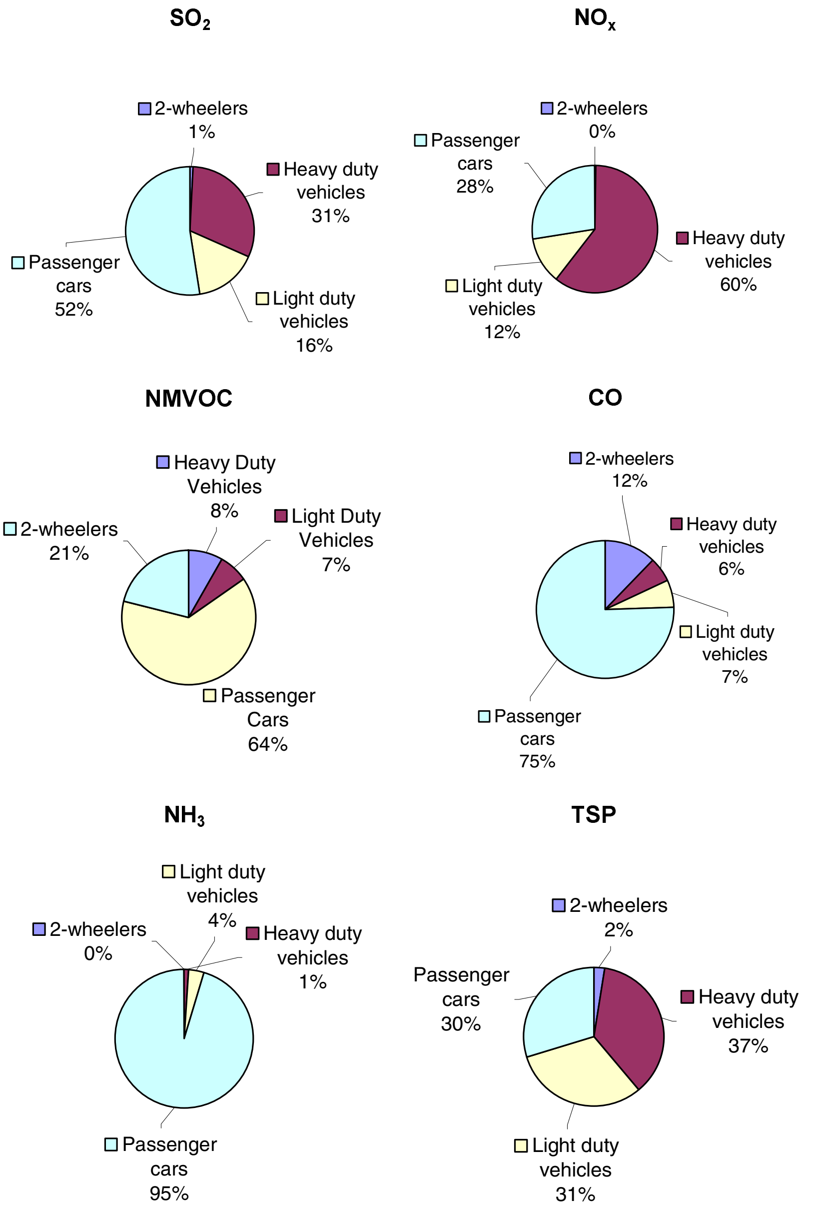



Figure 3.67 $SO_2$, $NO_X$, NMVOC, CO, $NH_3$ and PM emission shares pr vehicle type for road transport in 2008.

**Other mobile sources**

For $SO_2$ the trends in the Navigation (1A3d) emissions shown in Figure 3.68 mainly follow the development of the heavy fuel consumption (Figure 3.58). Though, from 1993 to 1995 relatively higher contents of sulphur in the fuel (estimated from sales) cause a significant increase in the emissions of $SO_2$. The $SO_2$ emissions for Fisheries (1A4c) correspond with the development in the consumption of marine gas oil. The main explanation for the development of the $SO_2$ emission curves for Railways (1A3c) and non-road machinery in Agriculture/forestry (1A4c) and Industry (1A2f), are the stepwise sulphur content reductions for diesel used by machinery in these sectors.

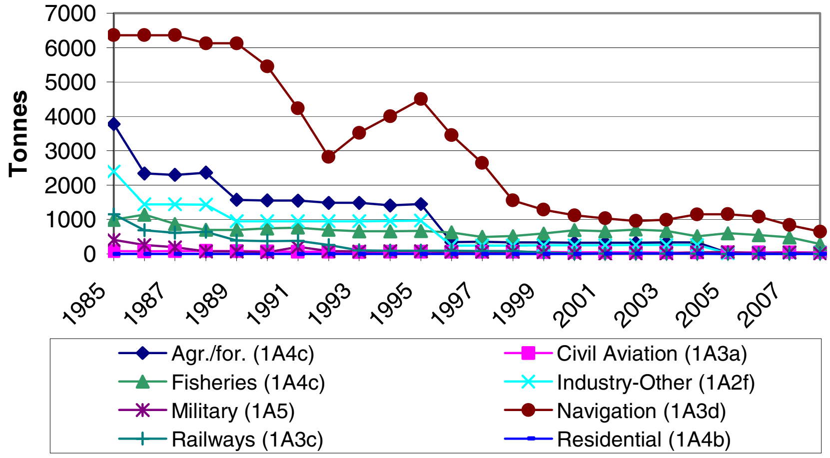



Figure 3.68 $SO_2$ emissions (k-tonnes) in NFR sectors for other mobile sources 1985-2008.

In general, the emissions of $NO_X$, NMVOC and CO from diesel-fuelled working equipment and machinery in agriculture, forestry and industry have decreased slightly since the end of the 1990s due to gradually strengthened emission standards given by the EU emission legislation directives.

$NO_X$ emissions mainly come from diesel machinery, and the most important sources are Agriculture/forestry/fisheries (1A4c), Industry (1A2f), Navigation (1A3d) and Railways (1A3c), as shown in Figure 3.67. The 2008 emission shares are 49, 25, 15 and 7 %, respectively (Figure 3.70). Minor emissions come from the sectors, Civil Aviation (1A3a), Military (1A5) and Residential (1A4b).

The $NO_X$ emission trend for Navigation, Fisheries and Agriculture is determined by fuel use fluctuations for these sectors, and the development of emission factors. For ship engines the emission factors tend to increase for new engines until mid-1990s. After that, the emission factors gradually reduce until 2000, bringing them to a level comparable with the emission limits for new engines in this year. For agricultural machines, there have been somewhat higher $NO_x$ emission factors for 1991-stage I machinery, and an improved emission performance for stage I and II machinery since the late 1990s.

The emission development for industry $NO_x$ is the product of a fuel consumption increase from 1985 to 2008, most pronounced from 2005 onwards, and a development in emission factors as explained for agricultural machinery. For railways, the gradual shift towards electrification explains the declining trend in diesel fuel use and $NO_X$ emissions for this transport sector until 2001.

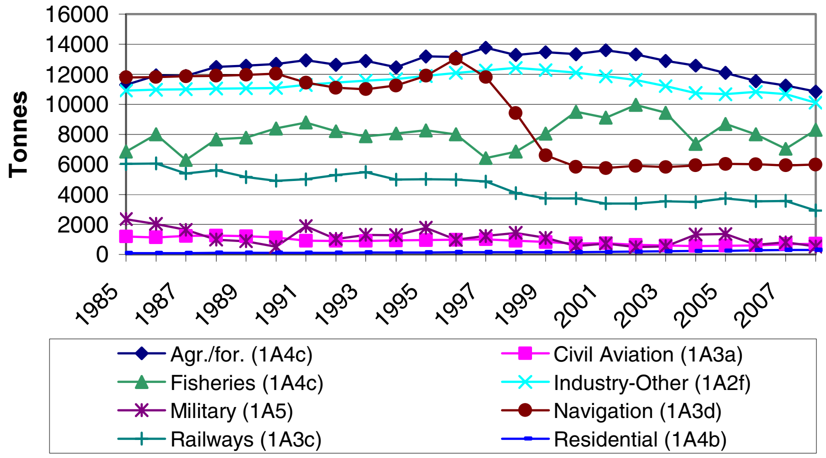



Figure 3.69 $NO_X$ emissions (tonnes) in NFR sectors for other mobile sources 1985-2008.

The 1985-2008 time-series of NMVOC and CO emissions are shown in Figures 3.68 and 3.69 for other mobile sources. The 2008 sector emission shares are shown in Figure 3.74. For NMVOC, the most important sectors are Residential (1A4b), Agriculture/forestry/fisheries (1A4c), Industry (1A2f) and Navigation (1A3d), with 2008 emission shares of 60, 19, 10 and 8 %, respectively. The same four sectors also contribute with most of the CO emissions in the same consecutive order; the emission shares are 75, 13, 6 and 5 %, respectively. Minor NMVOC and CO emissions come from Railways (1A3c), Civil Aviation (1A3a) and Military (1A5).

For NMVOC and CO, the significant emission increases for the residential sector after 2000 are due to the increased number of gasoline working machines. Improved NMVOC emission factors for diesel machinery in agriculture and gasoline equipment in forestry (chain saws) are the most important explanations for the NMVOC emission decline in the Agriculture/forestry/fisheries sector. This explanation also applies for the industrial sector, which is dominated by diesel-fuelled machinery. From 1997 onwards, the NMVOC emissions from Navigation decrease due to the gradually phase-out of the 2-stroke engine technology for recreational craft. The main reason for the significant 1985-2006 CO emission decrease for Agriculture/forestry-/fisheries is the phasing out of gasoline tractors.

As shown in Figure 3.74, for other mobile sources the largest TSP contributors in 2008 are Agriculture/forestry/fisheries (1A4c), Industry (1A2f) and Navigation (1A3d), with emission shares of 43, 37 and 11 %, respectively. The remaining sectors: Railways (1A3c), Civil aviation (1A3a), Military (1A5) and Residential (1A4b) represent only minor emission sources.

The 1985-2008 TSP emissions for navigation and fisheries are determined by the fuel use fluctuations in these years, and the development of the emission factors, which to a major extent is a function of the fuel sulphur content. The emission development for Agriculture/forestry is determined by the generally decreasing total diesel fuel consumption and gradually reducing emission factors over the time period.

The TSP emission development for industrial non-road machinery is the product of a fuel consumption increase from 1985 to 2007 and a development in emission factors, as explained for agricultural machinery. The TSP emission explanations for railways are the same as for $NO_x$ (Figure 3.69).

The amounts of $NH_3$ emissions calculated for other mobile sources are very small. The largest emission sources are Agriculture-/forestry/fisheries (1A4c), Industry (1A2f) and Railways (1A3c), with emission shares of 43, 34 and 8 %, respectively.

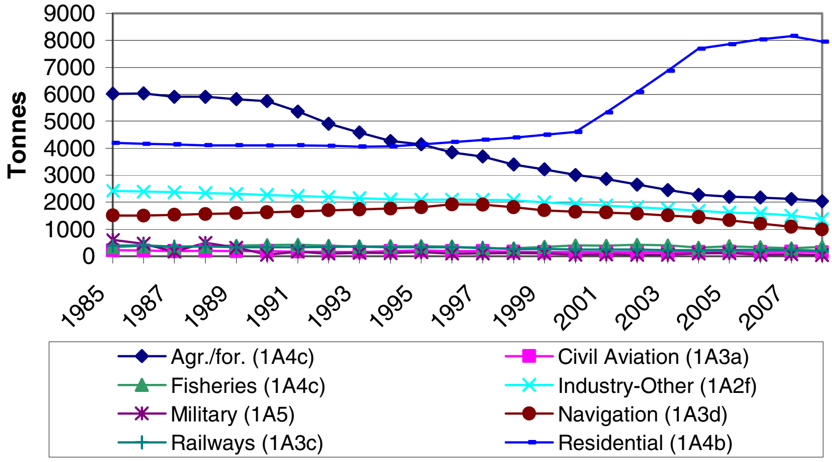



Figure 3.70 NMVOC emissions (tonnes) in NFR sectors for other mobile sources 1985-2008.

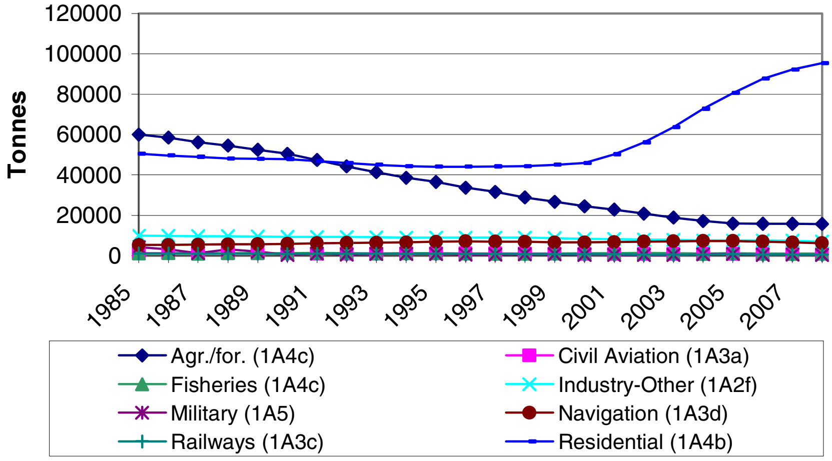



Figure 3.71 CO emissions (tonnes) in NFR sectors for other mobile sources 1985-2008.

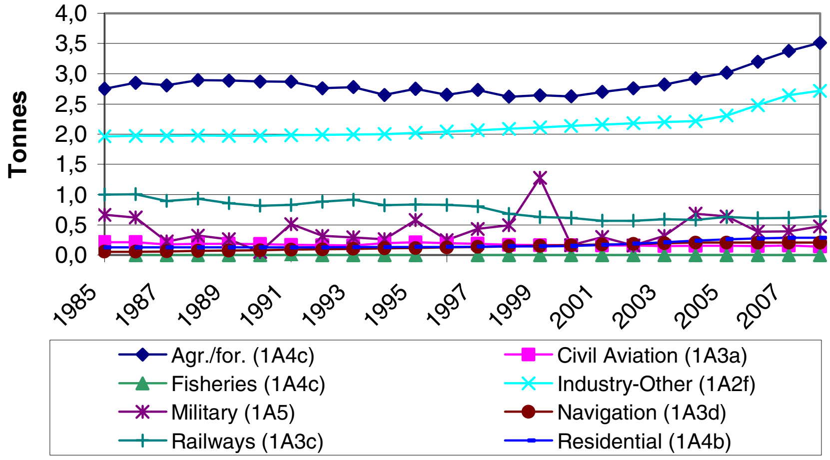



Figure 3.72 $NH_3$ emissions (tonnes) in NFR sectors for other mobile sources 1985-2008.

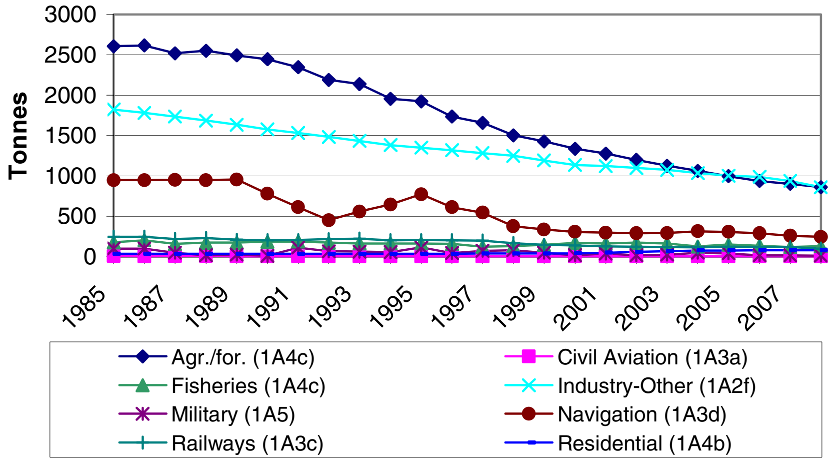



Figure 3.73 TSP emissions (tonnes) in NFR sectors for other mobile sources 1985-2008.

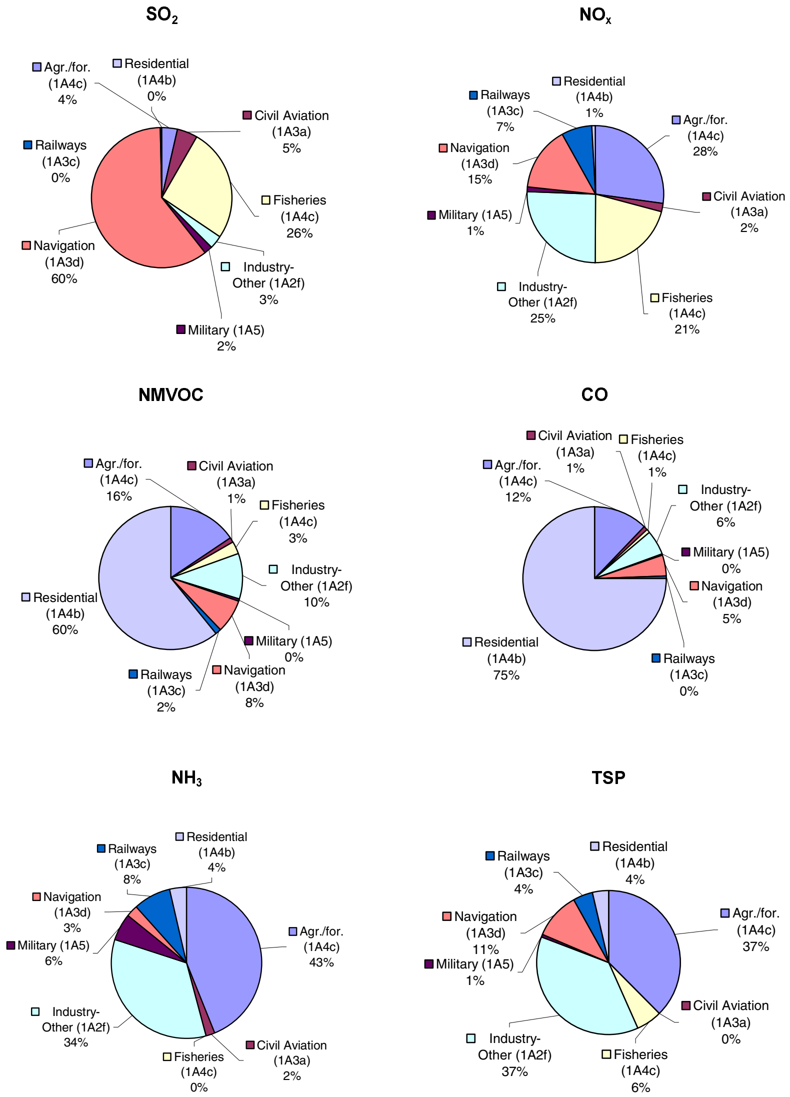



Figure 3.74 $SO_2$, $NO_X$, NMVOC, CO, $NH_3$ and PM emission shares pr vehicle type for other mobile sources in 2008.

**Non-exhaust emissions of TSP, $PM_{10}$ and $PM_{2.5}$**

Apart from the exhaust emission estimates of particulate matter (PM), the Danish emission inventories also comprise the non-exhaust PM emissions coming from road transport brake and tyre wear, and road abrasion.

In Table 3.24, the non-exhaust TSP, $PM_{10}$ and $PM_{2.5}$ emissions for road transport are shown for 2008 in NFR sectors. The activity data, emission factors are also shown in Annex 2.B.14.

Table 3.24 Emissions of TSP, $PM_{10}$ and $PM_{2.5}$ in 2008 from road transport and other mobile sources.

| NFR Sector | TSP tonnes | $PM_{10}$ tonnes | $PM_{2.5}$ tonnes |
|---|---|---|---|
| Road brake wear | 624 | 612 | 243 |
| Road tyre wear | 1 135 | 567 | 306 |
| Road abrasion | 985 | 591 | 414 |
| Total Road non-exhaust | 2 744 | 1 770 | 964 |

The respective source category distributions for TSP, $PM_{10}$ and $PM_{2.5}$ emissions are identical for each of the non-exhaust emission type's brake wear, tyre wear and road abrasion, and, hence, only the $PM_{10}$ distributions are shown in Figure 3.75. Passenger cars caused the highest emissions in 2008, followed by trucks, light-duty vehicles, buses and 2-wheelers.

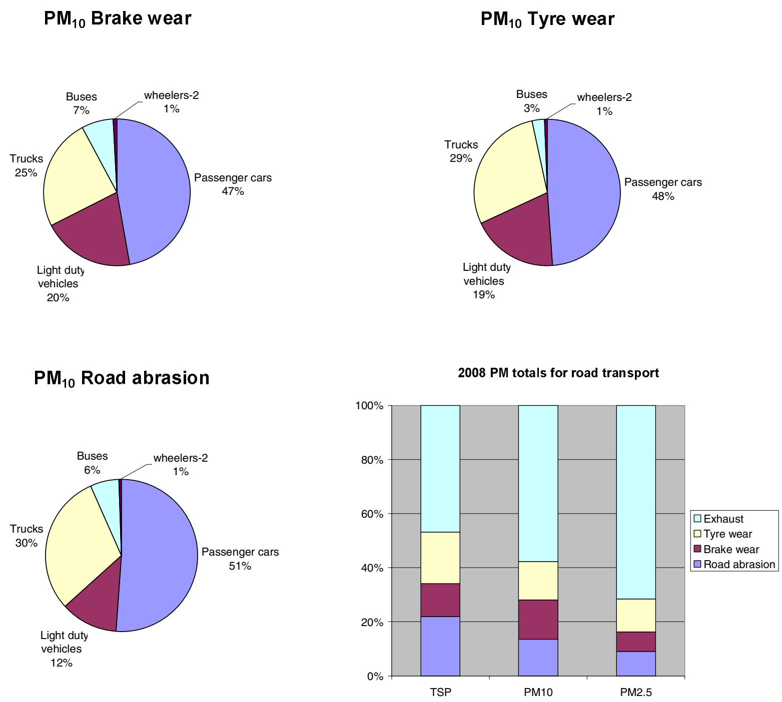



Figure 3.75 Brake and tyre wear and road abrasion $PM_{10}$ emission shares and PM exhaust/non-exhaust distributions for road traffic in 2008.

Figure 3.75 also shows the exhaust/non-exhaust distribution of the total particulate emissions from road transport, for each of the size classes TSP, $PM_{10}$ and $PM_{2.5}$. The exhaust emission shares of total road transport TSP, $PM_{10}$ and $PM_{2.5}$ are 47, 58 and 72 %, respectively, in 2008. For brake and tyre wear and road abrasion the TSP shares are 12, 19 and 22 %, respectively. The same three sources have $PM_{10}$ shares of 15, 14 and 14 %, respectively, and $PM_{2.5}$ shares of 7, 12 and 9 %, respectively. In general, the non-exhaust shares of total particulate emissions are expected to increase in the future as total exhaust emissions decline. The latter emission trend is due to the stepwise strengthening of exhaust emission standards for all vehicle types.

**Heavy metals**

In Table 3.25, the heavy metal emissions for road transport and other mobile sources are shown for 2008 in NFR sectors. The emission figures in the time-series 1990-2008 are given in Annex 2.B.15 (NFR format) and are shown for 1990 and 2008 in Annex 2.B.14 (CollectER format).

Table 3.25 Heavy metal emissions in 2008 for road transport and other mobile sources.

| NFR Sector | As | Cd | Cr | Cu | Hg | Ni | Pb | Se | Zn |
|---|---|---|---|---|---|---|---|---|---|
| | kg | kg | kg | kg | kg | kg | kg | kg | kg |
| Industry-Other (1A2f) | | 3 | 17 | 565 | | 23 | 0 | 3 | 333 |
| Civil Aviation (1A3a) | 0 | 1 | 3 | 88 | 0 | 4 | 1182 | 1 | 52 |
| Railways (1A3c) | | 1 | 4 | 127 | | 5 | | 1 | 75 |
| Navigation (1A3d) | 12 | 2 | 9 | 66 | 5 | 470 | 13 | 26 | 94 |
| Residential (1A4b) | | 1 | 4 | 127 | | 5 | 2 | 1 | 75 |
| Agri./for./fish. (1A4c) | 7 | 5 | 25 | 678 | 7 | 38 | 14 | 32 | 466 |
| Military (1A5) | 0 | 0 | 2 | 58 | 0 | 2 | 39 | 0 | 34 |
| Total other mobile | 20 | 13 | 62 | 1710 | 12 | 547 | 1251 | 64 | 1128 |
| Road (1A3b) | | 41 | 204 | 6942 | | 286 | 50 | 41 | 4083 |
| Total mobile | 20 | 53 | 266 | 8652 | 12 | 833 | 1300 | 104 | 5211 |

The road transport emissions of Cd, Cr, Cu and Zn account for around two thirds of the total for all mobile sources in 2008. No road transport emissions occur for As and Hg. Instead, the emissions of these species come from the use of marine diesel oil and residual oil in fisheries and navigation. The latter sector also contributes with a high emission of Ni (from residual oil), whereas the Se emission comes from agriculture/forestry/fisheries, road transport and navigation, in almost equal shares. The Figures 3.76 and 3.77 show the heavy metal emission distributions into vehicle categories and other mobile sectors, respectively.

The heavy metal emission factors are fuel related, and are taken from the EMEP/EEA guidebook. The emission factors are constant throughout the 1990-2008 periods, except for Pb where national data exists. For road transport, the emission factors for Cd, Cu, Ni, Se and Zn are the same for gasoline and diesel, and hence the emission distributions between vehicle categories are the same as for total fuel consumption contribution. The emission distributions for Cr and Pb are caused by higher emission factors for gasoline than for diesel (Cr), and no diesel related emissions (for Pb).

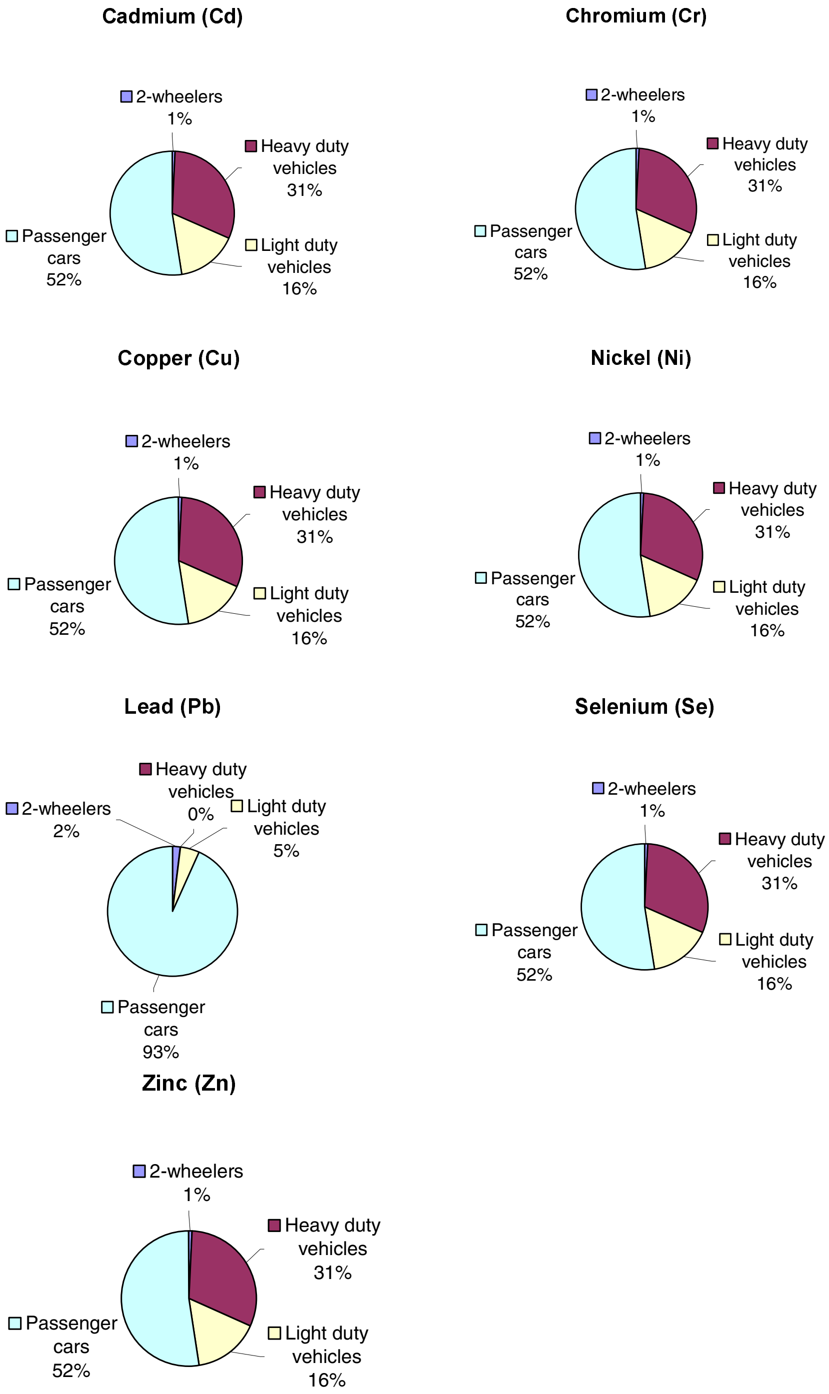



Figure 3.76 Heavy metal emission shares for road transport in 2008.

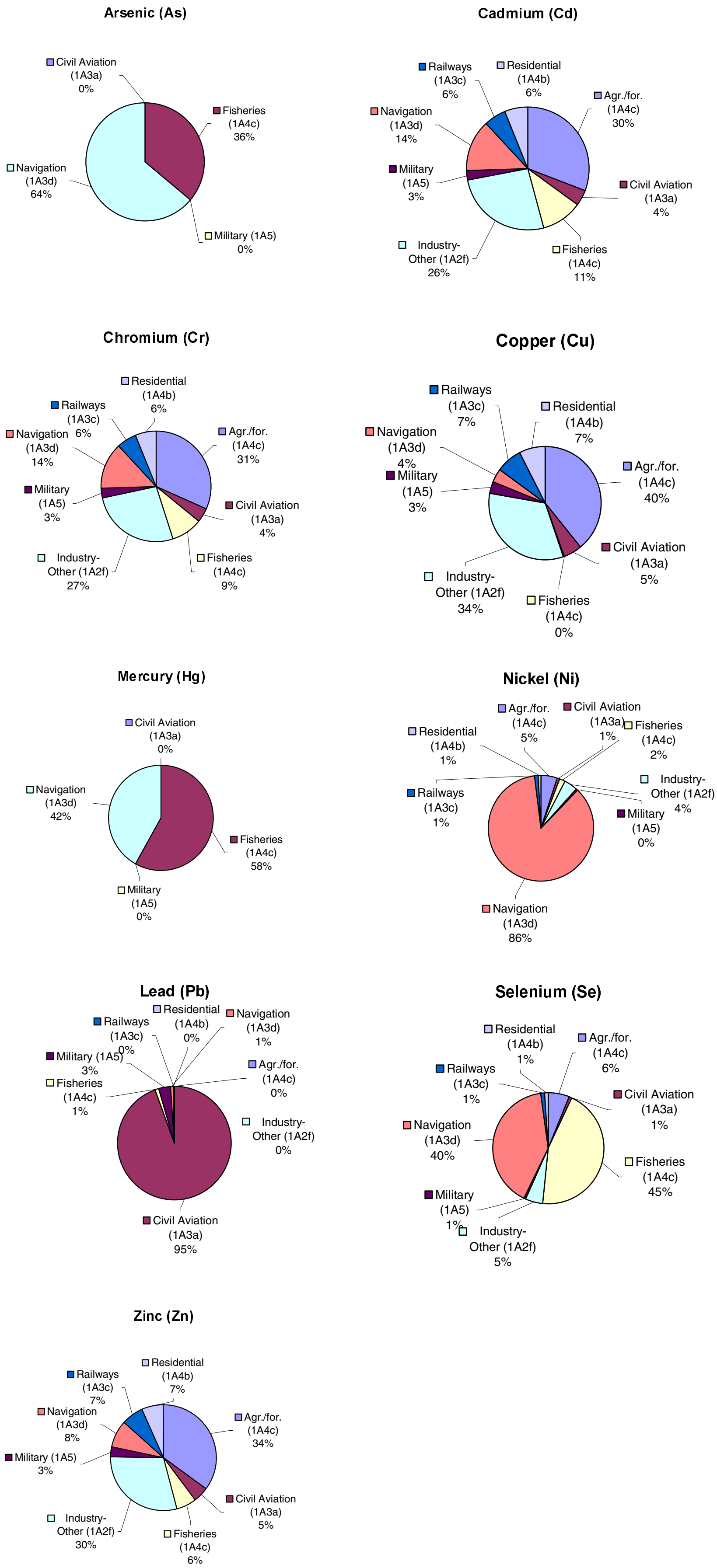



Figure 3.77 Heavy metal emission shares for other mobile sources in 2008.

Since the heavy metal emission factors (except Pb) are constant throughout the 1990-2008 periods, as a consequence, the emission development follows the trends in fuel use. The road transport emissions have increased by 40 % from 1990 to 2008. For Pb, however, there has been an almost 100 % emission decline, due to the phasing out of leaded gasoline fuels in 1994 (Figure 3.78).

For other mobile sources, heavy metal emissions generally decrease throughout the time period. The fuel quality of the gasoline used by road transportation vehicles and non road engines is the same, and hence a large decrease in Pb emissions (80 %) is calculated for other mobile sources also. In absolute figures, the largest emission declines are noted for the main gasoline fuel consumers, household and gardening equipment and recreational craft. In addition, from 1990 to 2007, gasoline fuel consumption reached zero for agricultural tractors. Lead is added to aviation gasoline used by piston engine aircraft, causing Civil aviation (1A3a) to be the largest mobile source of Pb emissions (Figure 3.79). The 81 % decline in Ni emissions is due to lower residual fuel use in navigation.

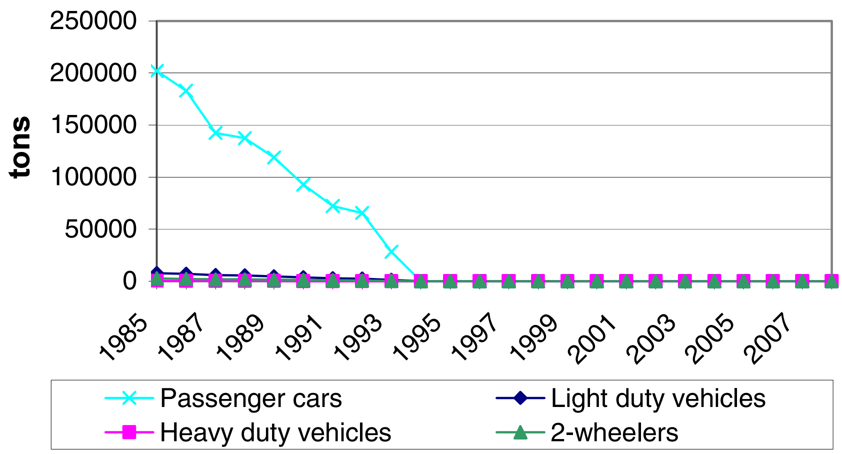



Figure 3.78 Pb emissions (kg) pr vehicle type for road transport 1985-2008.

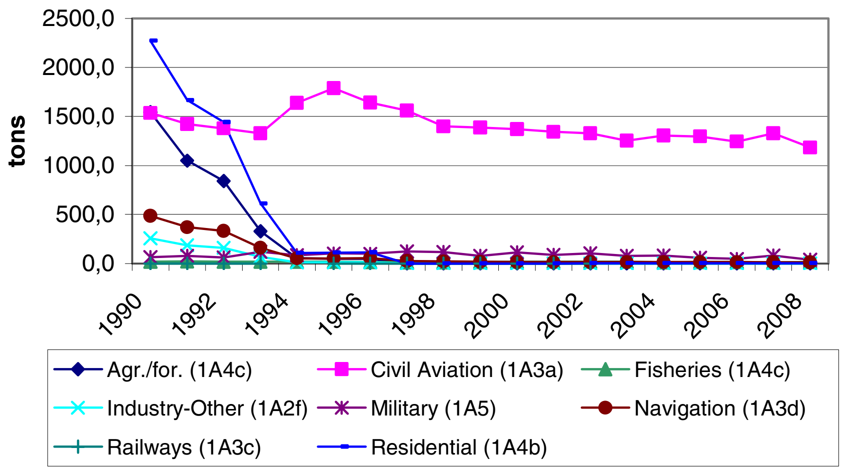



Figure 3.79 Pb emissions (kg) in NFR sectors for other mobile sources 1990-2008.

**Dioxin and PAH**

In Table 3.26, the dioxin and PAH emissions for road transport and other mobile sources are shown for 2008 in NFR sectors. The emission figures in the time-series 1990-2008 are given in Annex 2.B.15 (NFR format) and are shown for 1990 and 2008 in Annex 2.B.14 (CollectER format).

Table 3.26 Dioxin and PAH emissions in 2008 for road transport and other mobile sources.

| NFR ID | Dioxins/ Furans | Flouran- thene | Benzo(b) flouran- thene | Benzo(k) flouran- thene | Benzo(a) pyrene | Benzo- (g,h,i) perylene | Indeno (1,2,3-c,d) pyrene |
|---|---|---|---|---|---|---|---|
| | g | kg | kg | kg | kg | kg | kg |
| Industry-Other (1A2f) | 0.01 | 62 | 7 | 7 | 4 | 7 | 4 |
| Civil Aviation (1A3a) | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Railways (1A3c) | 0.00 | 5 | 1 | 1 | 0 | 0 | 0 |
| Navigation (1A3d) | 0.06 | 40 | 3 | 2 | 1 | 7 | 5 |
| Residential (1A4b) | 0.02 | 14 | 1 | 0 | 0 | 2 | 1 |
| Agri./for./fish. (1A4c) | 0.09 | 118 | 12 | 10 | 5 | 17 | 12 |
| Military (1A5) | 0.00 | 3 | 0 | 0 | 0 | 0 | 0 |
| Total other mobile | 0.18 | 242 | 25 | 21 | 10 | 33 | 22 |
| Road (1A3b) | 0.16 | 735 | 73 | 85 | 54 | 102 | 59 |
| Total mobile | 0.34 | 976 | 98 | 106 | 65 | 134 | 81 |

For mobile sources, road transport displays the largest emission of dioxins and PAH. The dioxin emission share for road transport is 48 % of all mobile emissions in 2008, whereas Agriculture/forestry-/fisheries and Navigation have smaller shares of 25 and 18 %. For the different PAH components, road transport shares are around 80 % of total emissions for mobile sources. The remaining emissions almost solely come from Agriculture/forestry-/fisheries, Navigation and Industry with Agriculture/forestry/fisheries as the largest source.

Figures 3.80 and 3.81 show the dioxin and PAH emission distributions into vehicle categories and other mobile sectors, respectively.

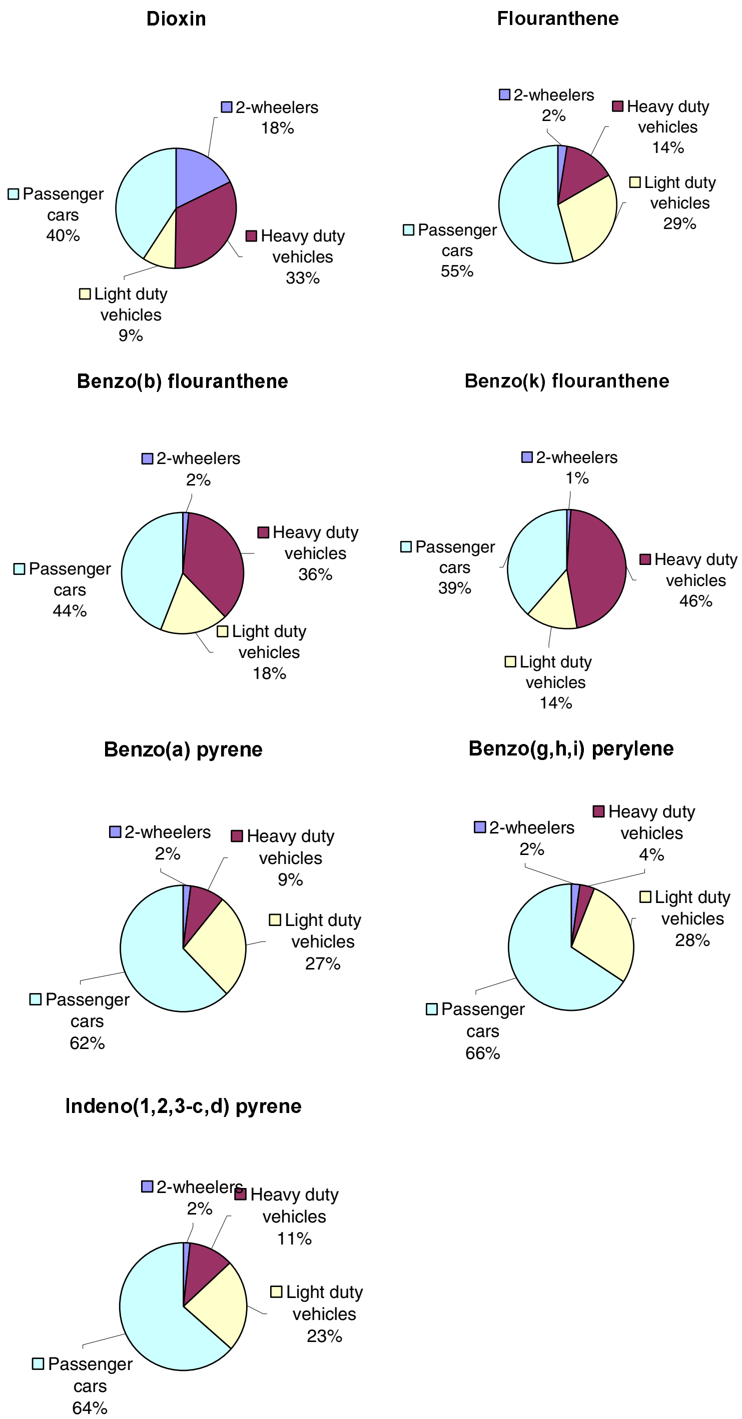



Figure 3.80 Dioxin and PAH emission shares for road transport in 2008.

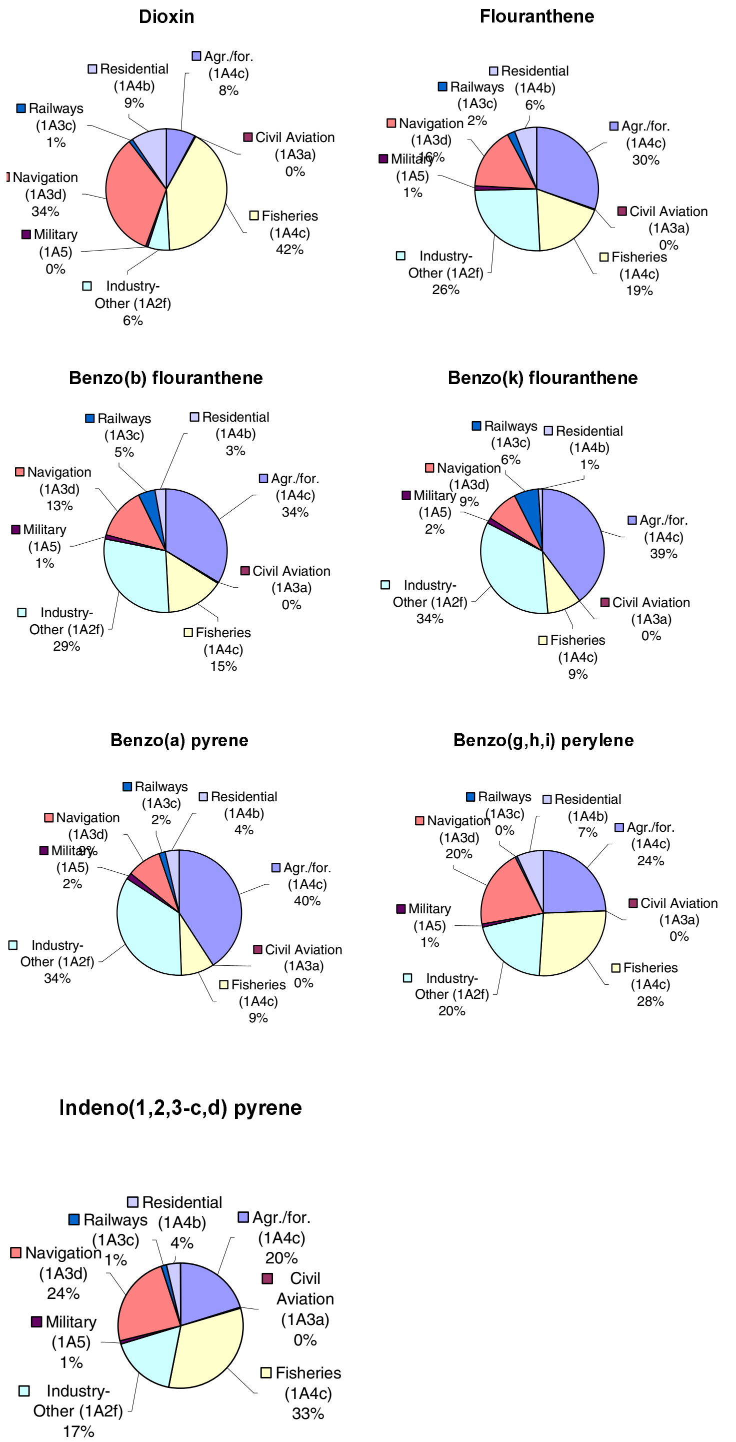



Figure 3.81 Dioxin and PAH emission shares for other mobile sources in 2008.

**Bunkers**

The most important emissions from bunker fuel use (fuel use for international transport) are SO2, NOX and CO2. However, compared with the Danish national emission total (all sources), the greenhouse gas emissions from bunkers are small. The bunker emission totals are shown in Table 3.27 for 2008, split into sea transport and civil aviation. All emission figures in the 1985-2008 time-series are given in Annex 2.B.16 (NFR format). In Annex 2.B.14, the emissions are also given in CollectER format for 2008.

Table 3.27 Emissions in 2008 for international transport.

| CRF sector | $SO_2$ | $NO_X$ | NMVOC | $CH_4$ | CO | $CO_2$ | $N_2O$ | $NH_3$ | TSP |
|---|---|---|---|---|---|---|---|---|---|
| | tonnes | tonnes | tonnes | tonnes | tonnes | k-tonnes | tonnes | tonnes | tonnes |
| Navigation int. (1A3d) | 20557 | 775 45 | 2433 | 75 | 8028 | 3118 | 196 | | 2025 |
| Civil Aviation int. (1A3a) | 844 | 11299 | 485 | 51 | 2003 | 2642 | 90 | 0 | 43 |
| International total | 20557 | 77545 | 2433 | 75 | 8028 | 3118 | 196 | | 2025 |

The differences in emissions between navigation and civil aviation are much larger than the differences in fuel consumption (and derived $CO_2$ emissions), and display a poor emission performance for international sea transport. In broad terms, the emission trends shown in Figure 3.82 are similar to the fuel-use development.

However, for navigation minor differences occur for the emissions of $SO_2$, $NO_X$ and $CO_2$ due to varying amounts of marine gas oil and residual oil, and for $SO_2$ and $NO_X$ the development in the emission factors also have an impact on the emission trends. For civil aviation, apart from the annual consumption of jet fuel, the development of the $NO_X$ emissions is also due to yearly variations in LTO/aircraft type (earlier than 2001) and city-pair statistics (2001 onwards).

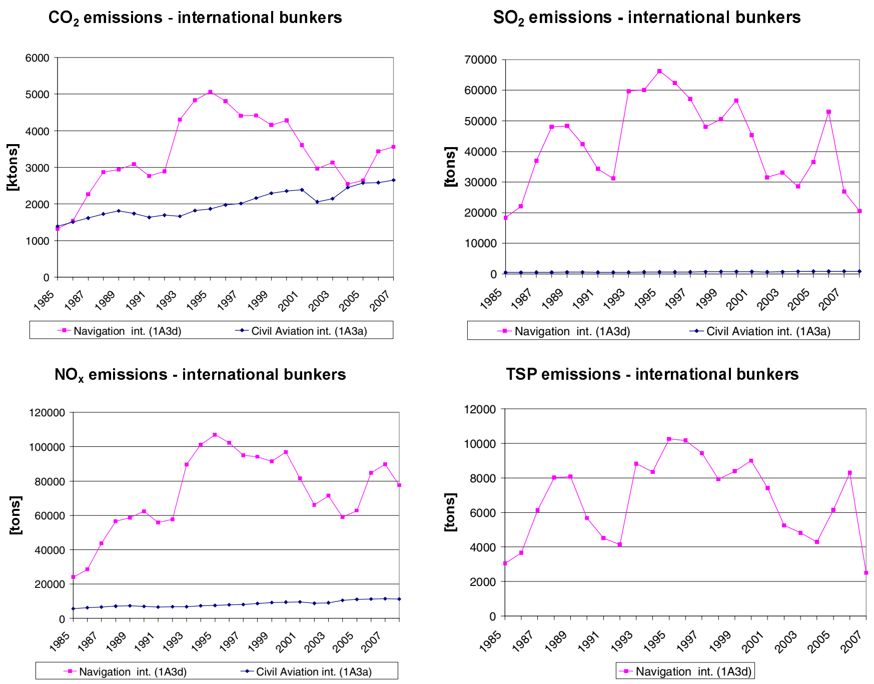



Figure 3.82 $CO_2$, $SO_2$, $NO_X$ and TSP emissions for international transport 1985-2008.

### 3.3.2 Methodological issues

The description of methodologies and references for the transport part of the Danish inventory is given in two sections: one for road transport and one for the other mobile sources.

**Methodology and references for Road Transport**

For road transport, the detailed methodology is used to make annual estimates of the Danish emissions, as described in the EMEP/EEA Air Pollutant Emission Inventory Guidebook (EMEP/EEA, 2009). The actual calculations are made with a model developed by NERI, using the European COPERT III model methodology, and updated fuel use and emission factors from the latest version of COPERT - COPERT IV. The latter model approach is explained in (EMEP/EEA, 2009). In COPERT, fuel use and emission simulations can be made for operationally hot engines, taking into account gradually stricter emission standards and emission degradation due to catalyst wear. Furthermore, the emission effects of cold-start and evaporation are simulated.

**Vehicle fleet and mileage data**

Corresponding to the COPERT III fleet classification, all present and future vehicles in the Danish fleet are grouped into vehicle classes, sub-classes and layers. The layer classification is a further division of vehicle sub-classes into groups of vehicles with the same average fuel use and emission behaviour, according to EU emission legislation levels. Table 3.28 gives an overview of the different model classes and sub-classes, and the layer level with implementation years are shown in Annex 2.B.1.

Table 3.28 Model vehicle classes and sub-classes, trip speeds and mileage split.

| | | | Trip speed [km pr h] | | | Mileage split [ %] | | |
|---|---|---|---|---|---|---|---|---|
| Vehicle classes | Fuel type | Engine size/weight | Urban | Rural | Highway | Urban | Rural | Highway |
| PC | Gasoline | < 1.4 l. | 40 | 70 | 100 | 35 | 46 | 19 |
| PC | Gasoline | 1.4 – 2 l. | 40 | 70 | 100 | 35 | 46 | 19 |
| PC | Gasoline | > 2 l. | 40 | 70 | 100 | 35 | 46 | 19 |
| PC | Diesel | < 2 l. | 40 | 70 | 100 | 35 | 46 | 19 |
| PC | Diesel | > 2 l. | 40 | 70 | 100 | 35 | 46 | 19 |
| PC | LPG | | 40 | 70 | 100 | 35 | 46 | 19 |
| PC | 2-stroke | | 40 | 70 | 100 | 35 | 46 | 19 |
| LDV | Gasoline | | 40 | 65 | 80 | 35 | 50 | 15 |
| LDV | Diesel | | 40 | 65 | 80 | 35 | 50 | 15 |
| Trucks | Gasoline | | 35 | 60 | 80 | 32 | 47 | 21 |
| Trucks | Diesel | 3.5 – 7.5 tonnes | 35 | 60 | 80 | 32 | 47 | 21 |
| Trucks | Diesel | 7.5 – 16 tonnes | 35 | 60 | 80 | 32 | 47 | 21 |
| Trucks | Diesel | 16 – 32 tonnes | 35 | 60 | 80 | 19 | 45 | 36 |
| Trucks | Diesel | > 32 tonnes | 35 | 60 | 80 | 19 | 45 | 36 |
| Urban buses | Diesel | | 30 | 50 | 70 | 51 | 41 | 8 |
| Coaches | Diesel | | 35 | 60 | 80 | 32 | 47 | 21 |
| Mopeds | Gasoline | | 30 | 30 | - | 81 | 19 | 0 |
| Motorcycles | Gasoline | 2 stroke | 40 | 70 | 100 | 47 | 39 | 14 |
| Motorcycles | Gasoline | < 250 cc. | 40 | 70 | 100 | 47 | 39 | 14 |
| Motorcycles | Gasoline | 250 – 750 cc. | 40 | 70 | 100 | 47 | 39 | 14 |
| Motorcycles | Gasoline | > 750 cc. | 40 | 70 | 100 | 47 | 39 | 14 |

Fleet numbers in total vehicle categories for 2008 has been obtained from Statistics Denmark (2009). Corresponding fleet figures have been provided annually by Statistics Denmark for the years before 2008, as input data for previous years inventory calculations.

The Danish fleet data is distributed into annual fleet numbers pr first registration year for the different vehicle categories in the inventory, by using the 1985-2004 baseline vehicle stock and annual mileage information obtained from the Danish Road Directorate (Ekman, 2005). For 2005-2008 the fleet data are split into vehicle categories-first registration years, by using the 2004 year distribution matrix together with appropriate assumptions of scrapping of new vehicles, and the use of simple fleet scaling factors in order to maintain the total fleet numbers.

Information of total mileage for passenger cars, light duty trucks, heavy duty trucks and buses are gathered by the Danish Road Directorate, and these mileage figures are publically available from Statistics Denmark (2009). For 2001-2004 the mileage data is derived from the Danish vehicle inspection programme, and backcasted mileage data for 1985-2000 are estimated by using appropriate assumptions. The total mileage per vehicle category from 2005-2008 have been estimated based on the traffic index development (derived from traffic counts on selected roads) from the Danish Road Directorate.

In addition new data prepared by DTU Transport for the Danish Infrastructure Commission has given information of the total mileage driven by foreign trucks on Danish roads. This mileage contribution has been added to the total mileage for Danish trucks on Danish roads, for trucks > 16 tonnes of gross vehicle weight. The data from DTU Transport was estimated for 2005, and by using appropriate assumptions the mileage have been backcasted to 1985 and forecasted to 2008.

The Danish mileage data is distributed into annual mileage numbers pr first registration year for the different vehicle categories in the inventory, by using the 1985-2004 baseline vehicle stock and annual mileage information obtained from the Danish Road Directorate (Ekman, 2005). For 2005-2008 the annual mileage data are split into vehicle categories-first registration years, by using the 2004 year distribution matrix. For all years the annual mileage pr first registration year is adjusted in order to maintain the total mileage figures

The data set from Ekman (2005) which underpinned the Danish 2004 emission inventory also cover information of the mileage split between urban, rural and highway driving, and the respective average speeds. Additional data for the moped fleet and motorcycle fleet disaggregation information is given by The National Motorcycle Association (Markamp, 2009).

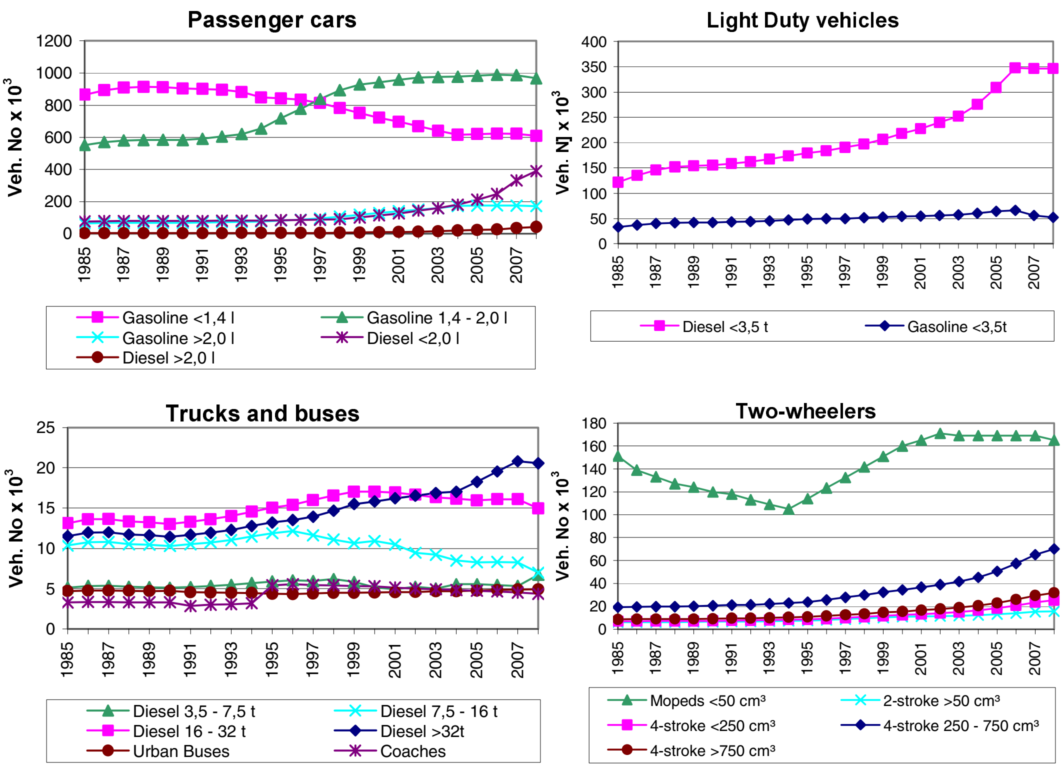



Figure 3.83 Number of vehicles in sub-classes in 1985-2008.

The vehicle numbers pr sub-class are shown in Figure 3.83. It must be noted that for 2005-2008, the 2004 stock shares are used to distribute the fleet into the different vehicle sub-categories for passenger cars and heavy duty trucks. Consequently, it gives less meaning to explain the fleet curves beyond 2004 for these vehicle types.

For passenger cars, the engine size differentiation is associated with some uncertainty. The increase in the total number of passenger cars is mostly due to a growth in the number of gasoline cars with engine sizes between 1.4 and 2 litres (from 1990-2002) and an increase in the number of gasoline cars (>2 litres) and diesel cars (< 2 litres). In the later years, there has been a decrease in the number of cars with an engine size smaller than 1.4 litres.

There has been a considerable growth in the number of diesel light-duty vehicles from 1985 to 2006, the number of vehicles has however decreased somewhat during 2007 and 2008. The two largest truck sizes have also increased in numbers during the 1990s. From 2000-2007, this growth has continued for trucks larger than 32 tonnes, whereas the number of trucks with gross vehicle weights between 16 and 32 tonnes has decreased slightly.

The number of urban buses has been almost constant between 1985 and 2008. The sudden change in the level of coach numbers from 1994 to 1995 is due to uncertain fleet data.

The reason for the significant growth in the number of mopeds from 1994 to 2002 is the introduction of the so-called Moped 45 vehicle type. For motorcycles, the number of vehicles has grown in general throughout the entire 1985-2008 period. The increase is, however, most visible from the mid-1990s and onwards.

The vehicle numbers are summed up in layers for each year (Figure 3.84) by using the correspondence between layers and first year of registration:

$$N_{j,y} = \sum_{i=FYear(j)}^{LYear(j)} N_{i,y} \quad (1)$$

Where N = number of vehicles, j = layer, y = year, i = first year of registration.

Weighted annual mileages pr layer are calculated as the sum of all mileage driven pr first registration year divided by the total number of vehicles in the specific layer.

$$M_{j,y} = \frac{\sum_{i=FYear(j)}^{LYear(j)} N_{i,y} \cdot M_{i,y}}{\sum_{i=FYear(j)}^{LYear(j)} N_{i,y}} \quad (2)$$

For heavy duty trucks, there is a slight deviation from the strict correspondence between EU emission layers and first registration year. In this case, specific information from the Danish Car Importers Association (Danske Bilimportører, DBI) of the Euro level for the trucks sold in Denmark between 2001 and 2007, is used to estimate a percentage new sales/Euro level matrix for truck engines for these inventory years. A full new sales matrix covering all relevant inventory years is subsequently made, based on a broader view of the 2001-2007 DBI data, and taking into account the actual starting dates for Euro 0-6 engines, see Annex 2.B.16.

Vehicle numbers and weighted annual mileages pr layer are shown in Annex 2.B.1 and 3.B.2 for 1985-2006. The trends in vehicle numbers pr layer are also shown in Figure 3.84. The latter figure shows how vehicles complying with the gradually stricter EU emission levels (EURO I, II, III, IV etc.) have been introduced into the Danish motor fleet.

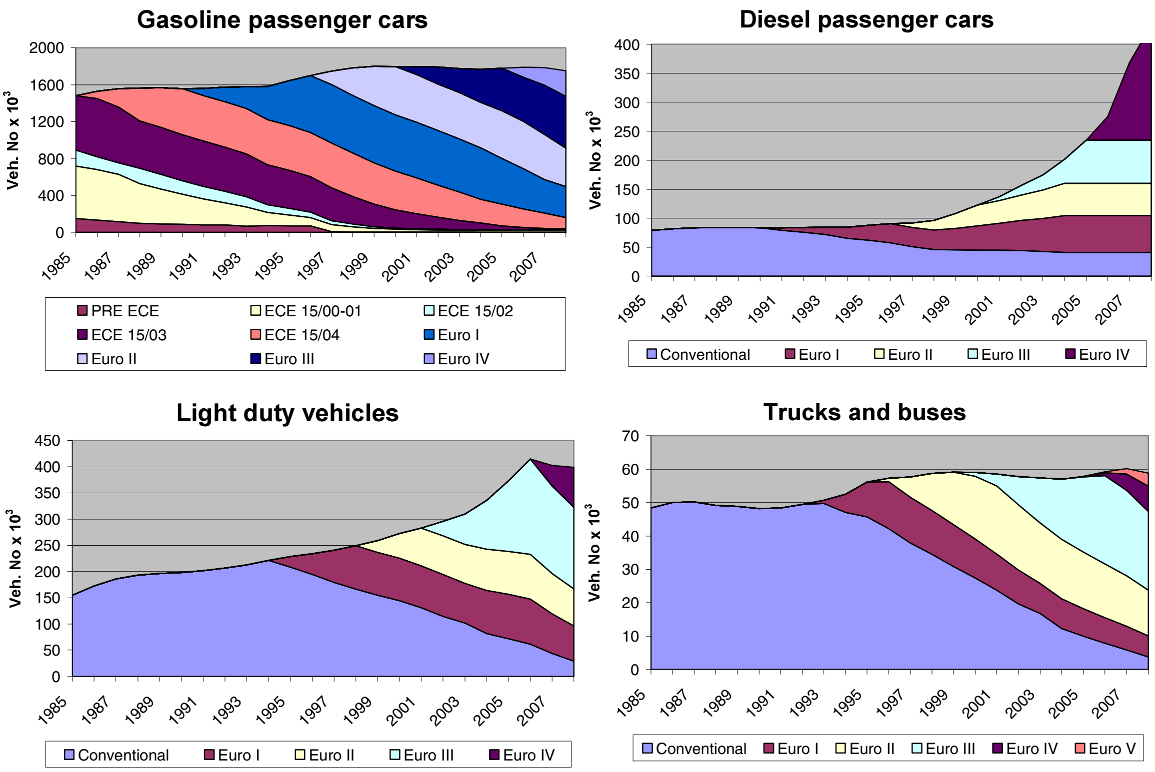



Figure 3.84 Layer distribution of vehicle numbers pr vehicle type in 1985-2008.

**Emission legislation**

For Euro 1-4 passenger cars and light duty trucks, the chassis dynamometer test cycle used in the EU for emission approval is the NEDC (New European Driving Cycle), see Nørgaard and Hansen (2004). The test cycle is also used also for fuel use measurements. The NEDC cycle consists of two parts, the first part being a 4-time repetition (driving length: 4 km) of the ECE test cycle. The latter test cycle is the so-called urban driving cycle[9] (average speed: 19 km pr h). The second part of the test is the run-through of the EUDC (Extra Urban Driving Cycle) test driving segment, simulating the fuel use under rural and highway driving conditions. The driving length of EUDC is 7 km at an average speed of 63 km pr h. More information regarding the fuel measurement procedure can be found in the EU-directive 80/1268/EØF.

For NOx, VOC (NMVOC + $CH_4$), CO and PM, the emissions from road transport vehicles have to comply with the different EU directives listed in Table 3.29. The emission directives distinguish between three vehicle classes according to vehicle reference mass[10]: Passenger cars and light duty trucks (<1305 kg), light duty trucks (1305-1760 kg) and light duty trucks (>1760 kg).The specific emission limits are shown in Annex 2.B.3.

In practice, the emissions from vehicles in traffic are different from the legislation limit values and, therefore, the latter figures are considered to be too inaccurate for total emission calculations. A major constraint is that the emission approval test conditions reflect only to

[9] For Euro 3 and on, the emission approval test procedure was slightly changed. The 40 s engine warm up phase before start of the urban driving cycle was removed.
[10] Reference mass: net vehicle weight + mass of fuel and other liquids + 100 kg.

a small degree the large variety of emission influencing factors in the real traffic situation, such as cumulated mileage driven, engine and exhaust after treatment maintenance levels and driving behaviour.

Therefore, in order to represent the Danish fleet and to support average national emission estimates, emission factors must be chosen which derive from numerous emissions measurements, using a broad range of real world driving patterns and a sufficient number of test vehicles. It is similar important to have separate fuel use and emission data for cold-start emission calculations and gasoline evaporation (hydrocarbons).

For heavy-duty vehicles (trucks and buses), the emission limits are given in g pr kWh and the measurements are carried out for engines in a test bench, using the EU ESC (European Stationary Cycle) and ETC (European Transient Cycle) test cycles, depending on the Euro norm and exhaust gas after-treatment system installed. A description of the test cycles is given by Nørgaard and Hansen, 2004). Measurement results in g pr kWh from emission approval tests cannot be directly used for inventory work. Instead, emission factors used for national estimates must be transformed into g pr km, and derived from a sufficient number of measurements which represent the different vehicle size classes, Euro engine levels and real world variations in driving behaviour.

In terms of the sulphur content in the fuels used by road transportation vehicles, the EU directive 2003/17/EF describes the fuel quality standards agreed by the EU. In Denmark, the sulphur content in gasoline and diesel was reduced to 10 ppm in 2005, by means of a fuel tax reduction for fuels with 10 ppm sulphur contents.

Table 3.29 Overview of the existing EU emission directives for road transport vehicles.

| Vehicle category | Emission layer | EU directive | First reg. date |
|---|---|---|---|
| Passenger cars (gasoline) | PRE ECE | | 0 |
| | ECE 15/00-01 | 70/220 - 74/290 | 1972[a] |
| | ECE 15/02 | 77/102 | 1981[b] |
| | ECE 15/03 | 78/665 | 1982[c] |
| | ECE 15/04 | 83/351 | 1987[d] |
| | Euro I | 91/441 | 1.10.1990[e] |
| | Euro II | 94/12 | 1.1.1997 |
| | Euro III | 98/69 | 1.1.2001 |
| | Euro IV | 98/69 | 1.1.2006 |
| | Euro V | 715/2007 | 1.1.2011 |
| | Euro VI | 715/2007 | 1.9.2015 |
| Passenger cars (diesel and LPG) | | Conventional | 0 |
| | ECE 15/04 | 83/351 | 1987[d] |
| | Euro I | 91/441 | 1.10.1990[e] |
| | Euro II | 94/12 | 1.1.1997 |
| | Euro III | 98/69 | 1.1.2001 |
| | Euro IV | 98/69 | 1.1.2006 |
| | Euro V | 715/2007 | 1.1.2011 |
| | Euro VI | 715/2007 | 1.9.2015 |
| Light duty trucks (gasoline and diesel) | | Conventional | 0 |
| | ECE 15/00-01 | 70/220 - 74/290 | 1972[a] |
| | ECE 15/02 | 77/102 | 1981[b] |
| | ECE 15/03 | 78/665 | 1982[c] |
| | ECE 15/04 | 83/351 | 1987[d] |
| | Euro I | 93/59 | 1.10.1994 |
| | Euro II | 96/69 | 1.10.1998 |
| | Euro III | 98/69 | 1.1.2002 |
| | Euro IV | 98/69 | 1.1.2007 |
| | Euro V | 715/2007 | 1.1.2012 |
| | Euro VI | 715/2007 | 1.9.2016 |
| Heavy duty vehicles | Euro 0 | 88/77 | 1.10.1990 |
| | Euro I | 91/542 | 1.10.1993 |
| | Euro II | 91/542 | 1.10.1996 |
| | Euro III | 1999/96 | 1.10.2001 |
| | Euro IV | 1999/96 | 1.10.2006 |
| | Euro V | 1999/96 | 1.10.2009 |
| | Euro VI | 595/2009 | 1.10.2014 |
| Mopeds | | Conventional | 0 |
| | Euro I | 97/24 | 2000 |
| | Euro II | 2002/51 | 2004 |
| Motor cycles | | Conventional | 0 |
| | Euro I | 97/24 | 2000 |
| | Euro II | 2002/51 | 2004 |
| | Euro III | 2002/51 | 2007 |

a,b,c,d: Expert judgement suggest that Danish vehicles enter into the traffic before EU directive first registration dates. The effective inventory starting years are a: 1970; b: 1979; c: 1981; d: 1986.
e: The directive came into force in Denmark in 1991 (EU starting year: 1993).

#### Fuel consumption and emission factors

Trip-speed dependent basis factors for fuel consumption and emissions are taken from the COPERT model using trip speeds as shown in Table 3.28. The factors are listed in Annex 2.B.4. For EU emission levels not represented by actual data, the emission factors are scaled according to the reduction factors given in Annex 2.B.5.

The fuel consumption and emission factors used in the Danish inventory come from the COPERT IV model. The scientific basis for COPERT IV is fuel consumption and emission information from the European 5th framework research projects ARTEMIS and Particulates. In cases where no updates are made for vehicle categories and fuel consumpt-ion/emission components, COPERT IV still uses COPERT III data; the source for these data are various European measurement programmes. In general the COPERT data are transformed into trip-speed dependent fuel consumption and emission factors for all vehicle categories and layers.

For passenger cars, real measurement results are behind the emission factors for Euro 1-4 vehicles (updated figures), and those earlier (COPERT III data). For light duty trucks the measurements represent Euro 1 and prior vehicle technologies from COPERT III. For mopeds and motorcycles, updated fuel consumption and emission figures are behind the conventional and Euro 1-3 technologies.

The experimental basis for heavy-duty trucks and buses is updated computer simulated emission factors for Euro 0-V engines. In COPERT IV the number of heavy duty vehicle categories has increased substantially, and from the traffic data side it is not possible to support all these new vehicle categories with consistent fleet and mileage data. Thus, the COPERT III vehicle size classification still remains as the Danish inventory basis for heavy duty vehicles.

However, in order to use the new COPERT IV fuel consumption and emission information, the decision is to calculate average fuel consumption and emission factors pr technology level (Euro O-V) from COPERT IV. The average factors comprise the specific COPERT IV size categories in overlap with a given COPERT III size category. Next, these average COPERT IV factors are scaled with the ratio of fuel consumption factors between COPERT III and "average COPERT IV" in order to end up with vehicle sizes corresponding to COPERT III weight classes.

For all vehicle categories/technology levels not represented by measurements, the emission factors are produced by using reduction factors. The latter factors are determined by assessing the EU emission limits and the relevant emission approval test conditions, for each vehicle type and Euro class.

#### Deterioration factors

For three-way catalyst cars the emissions of $NO_X$, NMVOC and CO gradually increase due to catalyst wear and are, therefore, modified as a function of total mileage by the so-called deterioration factors. Even though the emission curves may be serrated for the individual vehicles, on average, the emissions from catalyst cars stabilise after a given cut-off mileage is reached due to OBD (On Board Diagnostics) and the Danish inspection and maintenance programme.

For each forecast year, the deterioration factors are calculated pr first registration year by using deterioration coefficients and cut-off mileages, as given in EMEP/EEA (2009), for the corresponding layer. The deterioration coefficients are given for the two driving cycles: ”Urban Driving Cycle” (UDF) and ”Extra Urban Driving Cycle” (EUDF: urban and rural), with trip speeds of 19 and 63 km pr h, respectively.

Firstly, the deterioration factors are calculated for the corresponding trip speeds of 19 and 63 km pr h in each case determined by the total cumulated mileage less than or exceeding the cut-off mileage. The Formulas 3 and 4 show the calculations for the ”Urban Driving Cycle”:

$$UDF = U_A \cdot MTC + U_B \text{ , MTC < } U_{MAX} \quad (3)$$

$$UDF = U_A \cdot U_{MAX} + U_B \text{ , MTC >= } U_{MAX} \quad (4)$$

where UDF is the urban deterioration factor, $U_A$ and $U_B$ the urban deterioration coefficients, MTC = total cumulated mileage and $U_{MAX}$ urban cut-off mileage.

In the case of trip speeds below 19 km pr h the deterioration factor, DF, equals UDF, whereas for trip speeds exceeding 63 km pr h, DF=EUDF. For trip speeds between 19 and 63 km pr h the deterioration factor, DF, is found as an interpolation between UDF and EUDF. Secondly, the deterioration factors, one for each of the three road types, are aggregated into layers by taking into account vehicle numbers and annual mileage levels pr first registration year:

$$DF_{j,y} = \frac{\sum_{i=FYear(j)}^{LYear(j)} DF_{i,y} \cdot N_{i,y} \cdot M_{i,y}}{\sum_{i=FYear(j)}^{LYear(j)} DF_{i,y} \cdot N_{i,y}} \quad (5)$$

where DF is the deterioration factor.

For $N_2O$ and $NH_3$, COPERT IV takes into account deterioration as a linear function of mileage for gasoline fuelled EURO 1-4 passenger cars and light duty vehicles. The level of emission deterioration also relies on the content of sulphur in the fuel. The deterioration coefficients are given in EMEP/EEA (2009), for the corresponding layer. A cut-off mileage of 120.000 km (pers. comm. Ntziachristos, 2007) is behind the calculation of the modified emission factors, and for the Danish situation the low sulphur level interval is assumed to be most representative.

#### Emissions and fuel consumption for hot engines

Emissions and fuel-use results for operationally hot engines are calculated for each year and for layer and road type. The procedure is to combine fuel consumption and emission factors (and deterioration factors for catalyst vehicles), number of vehicles, annual mileage levels and the relevant road-type shares given in Table 3.28. For non-catalyst vehicles this yields:

$$E_{j,k,y} = EF_{j,k,y} \cdot S_k \cdot N_{j,y} \cdot M_{j,y} \quad (6)$$

Here E = fuel consumption/emission, EF = fuel consumption/emission factor, S = road type share and k = road type.

For catalyst vehicles the calculation becomes:

$$E_{j,k,y} = DF_{j,k,y} \cdot EF_{j,k,y} \cdot S_k \cdot N_{j,y} \cdot M_{j,y} \quad (7)$$

**Extra emissions and fuel consumption for cold engines**

Extra emissions of $NO_X$, VOC, $CH_4$, CO, PM, $NH_3$ and fuel consumption from cold start are simulated separately. For $SO_2$, the extra emissions are derived from the cold start fuel consumption results.

In terms of cold start data for $NO_X$, VOC, CO, PM and fuel consumption no updates are made to the COPERT IV methodology, and the calculation approach is the same as in COPERT III. Each trip is associated with a certain cold-start emission level and is assumed to take place under urban driving conditions. The number of trips is distributed evenly across the months. First, cold emission factors are calculated as the hot emission factor times the cold:hot emission ratio. Secondly, the extra emission factor during cold start is found by subtracting the hot emission factor from the cold emission factor. Finally, this extra factor is applied on the fraction of the total mileage driven with a cold engine (the β-factor) for all vehicles in the specific layer.

The cold:hot ratios depend on the average trip length and the monthly ambient temperature distribution. The Danish temperatures for 2008-2004 are given in Cappelen et al. (2009, 2008, 2007, 2006, 2005). For 2000-2003, 1990-1999 and 1980-1989 the temperature data are from Cappelen (2004, 2000 and 2003). The cold:hot ratios are equivalent for gasoline fuelled conventional passenger cars and vans and for diesel passenger cars and vans, respectively, see Ntziachristos et al. (2000). For conventional gasoline and all diesel vehicles the extra emissions become:

$$CE_{j,y} = \beta \cdot N_{j,y} \cdot M_{j,y} \cdot EF_{U,j,y} \cdot (CEr - 1) \quad (8)$$

Where CE is the cold extra emissions, β = cold driven fraction, CEr = Cold:Hot ratio.

For catalyst cars, the cold:hot ratio is also trip speed dependent. The ratio is, however, unaffected by catalyst wear. The Euro I cold:hot ratio is used for all future catalyst technologies. However, in order to comply with gradually stricter emission standards, the catalyst light-off temperature must be reached in even shorter periods of time for future EURO standards. Correspondingly, the β-factor for gasoline vehicles is reduced step-wise for Euro II vehicles and their successors.

For catalyst vehicles the cold extra emissions are found from:

$$CE_{j,y} = \beta_{red} \cdot \beta_{EUROI} \cdot N_{j,y} \cdot M_{j,y} \cdot EF_{U,j,y} \cdot (CEr_{EUROI} - 1) \quad (9)$$

where $\beta_{red}$ = the β reduction factor.

For $CH_4$, specific emission factors for cold driven vehicles are included in COPERT IV. The β and $\beta_{red}$ factors for VOC is used to calculate the cold driven fraction for each relevant vehicle layer. The NMVOC emissions during cold start are found as the difference between the calculated results for VOC and $CH_4$.

For $NH_3$, specific cold start emission factors are also proposed by COPERT IV. For catalyst vehicles, however, just like in the case of hot emission factors, the emission factors for cold start are functions of cumulated mileage (emission deterioration). The level of emission deterioration also relies on the content of sulphur in the fuel. The deterioration coefficients are given in EMEP/EEA (2009), for the corresponding layer. For cold start, the cut-off mileage and sulphur level interval for hot engines are used, as described in the deterioration factors paragraph.

#### Evaporative emissions from gasoline vehicles

For each year, evaporative emissions of hydrocarbons are simulated in the forecast model as hot and warm running losses, hot and warm soak loss and diurnal emissions. For evaporation, no updates are made to the COPERT IV methodology, and the calculation approach is the same as in COPERT III. All emission types depend on RVP (Reid Vapour Pressure) and ambient temperature. The emission factors are shown in Ntziachristos et al. (2000).

Running loss emissions originate from vapour generated in the fuel tank while the vehicle is running. The distinction between hot and warm running loss emissions depends on engine temperature. In the model, hot and warm running losses occur for hot and cold engines, respectively. The emissions are calculated as annual mileage (broken down into cold and hot mileage totals using the β-factor) times the respective emission factors. For vehicles equipped with evaporation control (catalyst cars), the emission factors are only one tenth of the uncontrolled factors used for conventional gasoline vehicles.

$$R_{j,y} = N_{j,y} \cdot M_{j,y} \cdot ((1-\beta) \cdot HR + \beta \cdot WR) \quad (10)$$

where R is running loss emissions and HR and WR are the hot and warm running loss emission factors, respectively.

In the model, hot and warm soak emissions for carburettor vehicles also occur for hot and cold engines, respectively. These emissions are calculated as number of trips (broken down into cold and hot trip numbers using the β-factor) times respective emission factors:

$$S_{j,y}^{\ C} = N_{j,y} \cdot \frac{M_{j,y}}{l_{trip}} \cdot ((1-\beta) \cdot HS + \beta \cdot WS) \quad (11)$$

where $S^C$ is the soak emission, $l_{trip}$ = the average trip length, and HS and WS are the hot and warm soak emission factors, respectively.

Since all catalyst vehicles are assumed to be carbon canister controlled, no soak emissions are estimated for this vehicle type. Average maximum and minimum temperatures pr month are used in combination with diurnal emission factors to estimate the diurnal emissions from uncontrolled vehicles $E^d(U)$:

$$E_{j,y}{}^{d}(U) = 365 \cdot N_{j,y} \cdot e^{d}(U) \quad (12)$$

Each year's total is the sum of each layer's running loss, soak loss and diurnal emissions.

#### Fuel use balance

The calculated fuel consumption in COPERT III must equal the statistical fuel sale totals according to the UNFCCC and UNECE emissions reporting format. The statistical fuel sales for road transport are derived from the Danish Energy Authority data (see DEA, 2009). The DEA data are further processed for gasoline in order to account for e.g. non road and recreational craft fuel consumption, which are not directly stated in the statistics, please refer to paragraph 1.1.4 for further information regarding the transformation of DEA fuel data.

The standard approach to achieve a fuel balance in annual emission inventories is to multiply the annual mileage with a fuel balance factor derived as the ratio between simulated and statistical fuel figures for gasoline and diesel, respectively. This method is also used in the present model.

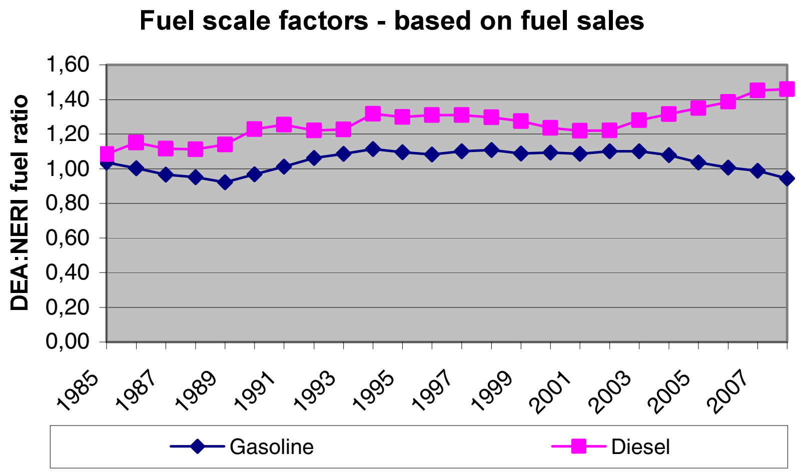



Figure 3.85 DEA:NERI Fuel ratios and diesel mileage adjustment factor based on DEA fuel sales data and NERI fuel consumption estimates.

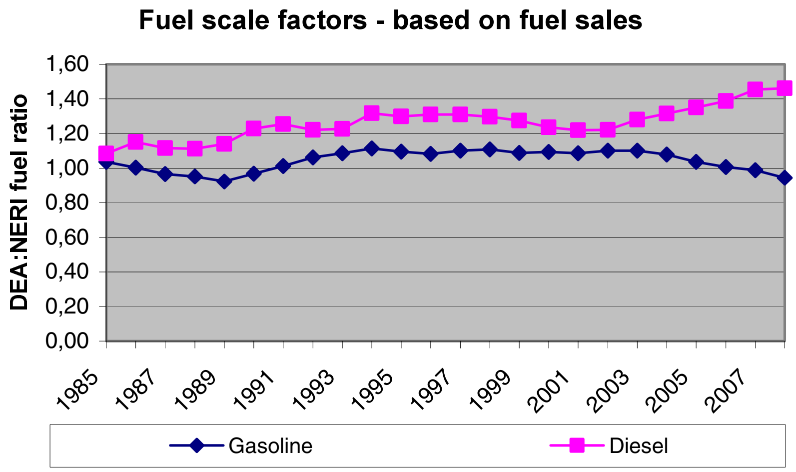



Figure 3.86 DEA:NERI Fuel ratios and diesel mileage adjustment factor based on DEA fuel consumption data and NERI fuel consumption estimates.

In the figures 3.85 and 3.86 the COPERT IV:DEA gasoline and diesel fuel use ratios are shown for fuel sales and fuel consumption from 1985-2008. The data behind the figures are also listed in Annex 3.B.8. The fuel consumption figures are related to the traffic on Danish roads.

Pr fuel type, all mileage numbers are equally scaled in order to obtain fuel equilibrium, and hence the mileage factors used are the reciprocal values of the COPERT IV:DEA fuel consumption: fuel sales ratio.

From the Figures3.85 and 3.86 it appears that the inventory fuel balances for gasoline and diesel would be improved, if the DEA statistical figures for fuel consumption were used instead of fuel sale numbers. The fuel difference for diesel is, however, increasing from 2003 onwards and reaches a level of 34 % in 2008. The reasons for this inaccuracy are a combination of the uncertainties related to COPERT IV fuel use factors, allocation of vehicle numbers in sub-categories, annual mileage, trip speeds and mileage splits for urban, rural and highway driving conditions.

For future inventories it is intended to use improved fleet and mileage data and improved data for trip speed and mileage split for urban, rural and highway driving. The update of road traffic fleet and mileage data will be made as soon as this information is provided from the Danish Ministry of Transport and Energy in a COPERT IV model input format.

The final fuel use and emission factors are shown in Annex 2.B.6 for 1985-2008. The total fuel use and emissions are shown in Annex 2.B.7, pr vehicle category and as grand totals, for 1985-2008 (and NFR format in Annex 2.B.15). In Annex 2.B.14, fuel-use and emission factors as well as total emissions are given in CollectER format for 2008.

In Table 3.30, the aggregated emission factors for $SO_2$, $NO_X$, NMVOC and TSP are shown in CollectER format for Danish road transport.

Table 3.30 Fuel-based emission factors for $SO_2$, $NO_X$, NMVOC, CO, $NH_3$ and TSP for road transport in Denmark (2007).

| SNAP ID | Category | Fuel type | Mode | Emission factors[1] [g pr GJ] | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | $SO_2$ | $NO_X$ | NMVOC | CO | $NH_3$ | TSP |
| 70101 | Passenger cars | Highway | Diesel | 0.47 | 302.40 | 7.32 | 28.01 | 0.49 | 22.84 |
| 70101 | Passenger cars | Highway | Gasoline | 0.46 | 174.91 | 41.80 | 791.07 | 29.46 | 1.27 |
| 70101 | Passenger cars | Highway | LPG | 0.00 | 1151.70 | 187.09 | 3914.25 | 0.00 | 10.06 |
| 70101 | Passenger cars | Rural | Diesel | 0.47 | 258.76 | 10.42 | 43.68 | 0.52 | 18.89 |
| 70101 | Passenger cars | Rural | Gasoline | 0.46 | 143.76 | 48.85 | 643.60 | 31.60 | 1.25 |
| 70102 | Passenger cars | Rural | LPG | 0.00 | 1248.46 | 305.18 | 1146.38 | 0.00 | 14.49 |
| 70102 | Passenger cars | Urban | Diesel | 0.47 | 257.64 | 29.19 | 97.20 | 0.39 | 30.93 |
| 70102 | Passenger cars | Urban | Gasoline | 0.46 | 143.62 | 232.30 | 2602.34 | 10.51 | 1.31 |
| 70102 | Passenger cars | Urban | LPG | 0.00 | 613.63 | 451.14 | 1361.56 | 0.00 | 11.66 |
| 70102 | Light duty vehicles | Highway | Diesel | 0.47 | 265.54 | 25.42 | 150.05 | 0.36 | 30.78 |
| 70103 | Light duty vehicles | Highway | Gasoline | 0.46 | 165.58 | 19.58 | 549.69 | 22.64 | 1.48 |
| 70103 | Light duty vehicles | Rural | Diesel | 0.47 | 278.53 | 28.50 | 132.75 | 0.40 | 26.53 |
| 70103 | Light duty vehicles | Rural | Gasoline | 0.46 | 144.76 | 28.98 | 416.66 | 21.62 | 1.33 |
| 70103 | Light duty vehicles | Urban | Diesel | 0.47 | 278.93 | 48.38 | 160.87 | 0.29 | 36.05 |
| 70103 | Light duty vehicles | Urban | Gasoline | 0.46 | 120.86 | 147.59 | 2844.03 | 5.79 | 0.91 |
| 70201 | Heavy duty vehicles | Highway | Diesel | 0.47 | 668.12 | 20.93 | 126.84 | 0.31 | 15.28 |
| 70201 | Heavy duty vehicles | Highway | Gasoline | 0.46 | 1037.78 | 474.61 | 7610.35 | 0.28 | 55.35 |
| 70201 | Heavy duty vehicles | Rural | Diesel | 0.47 | 691.61 | 25.39 | 131.55 | 0.32 | 15.55 |
| 70202 | Heavy duty vehicles | Rural | Gasoline | 0.46 | 1141.55 | 820.40 | 8371.39 | 0.30 | 60.88 |
| 70202 | Heavy duty vehicles | Urban | Diesel | 0.47 | 697.71 | 33.17 | 154.48 | 0.26 | 18.98 |
| 70202 | Heavy duty vehicles | Urban | Gasoline | 0.46 | 456.62 | 696.09 | 7102.99 | 0.20 | 40.59 |
| 70203 | Mopeds | Urban | Gasoline | 0.46 | 113.84 | 9177.91 | 9905.34 | 1.21 | 142.17 |
| 70203 | Motorcycles | Highway | Gasoline | 0.46 | 239.44 | 938.89 | 13244.99 | 1.19 | 21.83 |
| 70203 | Motorcycles | Rural | Gasoline | 0.46 | 183.54 | 1175.67 | 13028.29 | 1.50 | 27.44 |
| 70301 | Motorcycles | Urban | Gasoline | 0.46 | 106.67 | 1594.63 | 12062.59 | 1.50 | 27.47 |

[1] References. $SO_2$: Country specific; $NO_X$ and NMVOC: COPERT III (conventional passenger cars, light duty trucks, LPG passenger cars); PM: COPERT III (conventional diesel passenger cars, light duty diesel trucks) and COPERT IV (remaining vehicle layers).

**Non-exhaust particulate emissions from road transport**

The TSP, $PM_{10}$ and $PM_{2.5}$ emissions arising from tyre and brake wear (SNAP 0707) and road abrasion (SNAP 0708) are estimated for the years 2000-2008 as prescribed by the UNECE convention reporting format. The emissions are calculated by multiplying the total annual mileage pr vehicle category with the correspondent average emission factors for each source type. The calculation procedure is consistent with the COPERT III model approach used to estimate the Danish national emissions coming from exhaust. A more thorough explanation of the calculations is given by Winther (2004), and emission factors are taken from EMEP/EEA (2009). The emission factors and total emissions for 2008 are shown in Annex 2.B.14.

**Methodologies and references for other mobile sources**

Other mobile sources are divided into several sub-sectors: sea transport, fishery, air traffic, railways, military, and working machinery and materiel in the industry, forestry, agriculture and household and gardening sectors. The emission calculations are made using the detailed method as described in the EMEP/EEA Air Pollutant Emission Inventory Guidebook (EMEP/EEA, 2009) for air traffic, off-road working machinery and equipment, and ferries, while for the remaining sectors the simple method is used.

### 3.3.3 Activity data

**Air traffic**

The activity data for air traffic consists of air traffic statistics provided by the Danish Civil Aviation Agency (CAA-DK) and Copenhagen Airport. Fuel statistics for jet fuel use and aviation gasoline are obtained from the Danish energy statistics (DEA, 2009).

For 2001 onwards, pr flight records are provided by CAA-DK as data codes for aircraft type, and origin and destination airports (city-pairs).

Subsequently the aircraft types are separated by NERI into larger aircraft using jet fuel (jet engines, turbo props, helicopters) and small aircraft types with piston engines using aviation gasoline. This is done by using different aircraft dictionaries, internet look-ups and by communication with the CAA-DK. Each of the larger aircraft type is then matched with a representative type for which fuel consumption and emission data are available from the EMEP/EEA databank. Relevant for this selection is aircraft maximum take off mass, engine types, and number of engines. A more thorough explanation is given in Winther (2001a, b).

The ideal flying distance (great circle distance) between the city-pairs is calculated by NERI in a separate database. The calculation algorithm uses a global latitude/altitude coordinate table for airports. In cases when airport coordinates are not present in the NERI database, these are looked up on the internet and entered into the database accordingly.

For inventory years prior to 2001, detailed LTO/aircraft type statistics are obtained from Copenhagen Airport (for this airport only), while information of total take-off numbers for other Danish airports is provided by CAA-DK. The assignment of representative aircraft types for Copenhagen Airport is done as described above. For the remaining Danish airports representative aircraft types are not directly assigned. Instead appropriate average assumptions are made relating to the fuel consumption and emission data part.

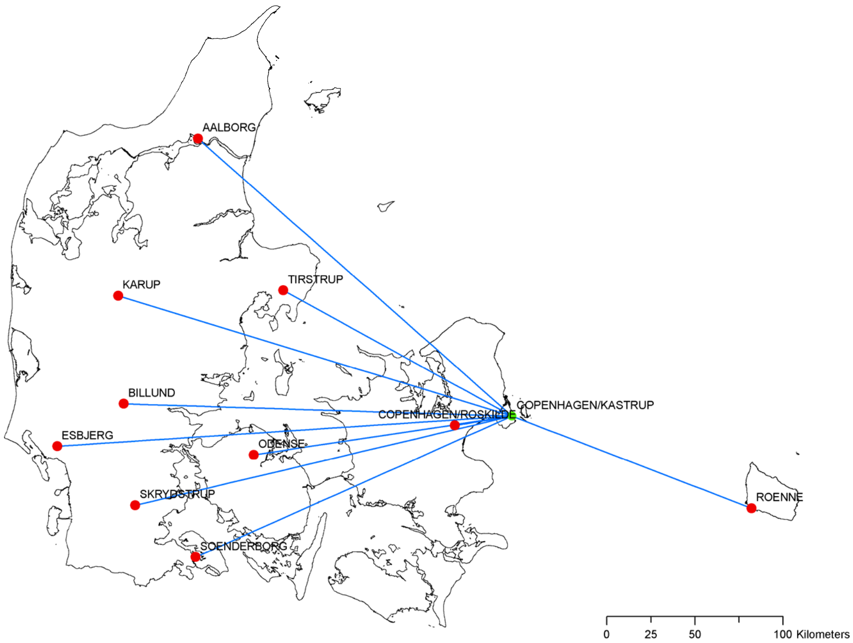


Figure 3.87 Most frequent domestic flying routes for large aircraft in Denmark.

Copenhagen Airport is the starting or end point for most of the domestic aviation made by large aircraft in Denmark (Figure 3.87). Even though many domestic flights not touching Copenhagen Airport are also reported in the flight statistics kept by CAA-DK, these flights, however, are predominantly made with small piston engine aircraft using aviation gasoline. Hence, the consumption of jet fuel by flights not using Copenhagen is merely marginal.

**Non-road working machinery and equipment**

Non-road working machinery and equipment are used in agriculture, forestry and industry, for household/gardening purposes and in inland waterways (recreational craft). Information on the number of different types of machines, their respective load factors, engine sizes and annual working hours has been provided by Winther et al. (2006). The stock development from 1985-2008 for the most important types of machinery are shown in Figures 3.88-3.95 below. The stock data are also listed in Annex 2.B.10, together with figures for load factors, engine sizes and annual working hours. As regards stock data for the remaining machinery types, please refer to (Winther et al., 2006).

For agriculture, the total number of agricultural tractors and harvesters pr year are shown in the Figures 3.88-3.89, respectively. The figures clearly show a decrease in the number of small machines, these being replaced by machines in the large engine-size ranges.

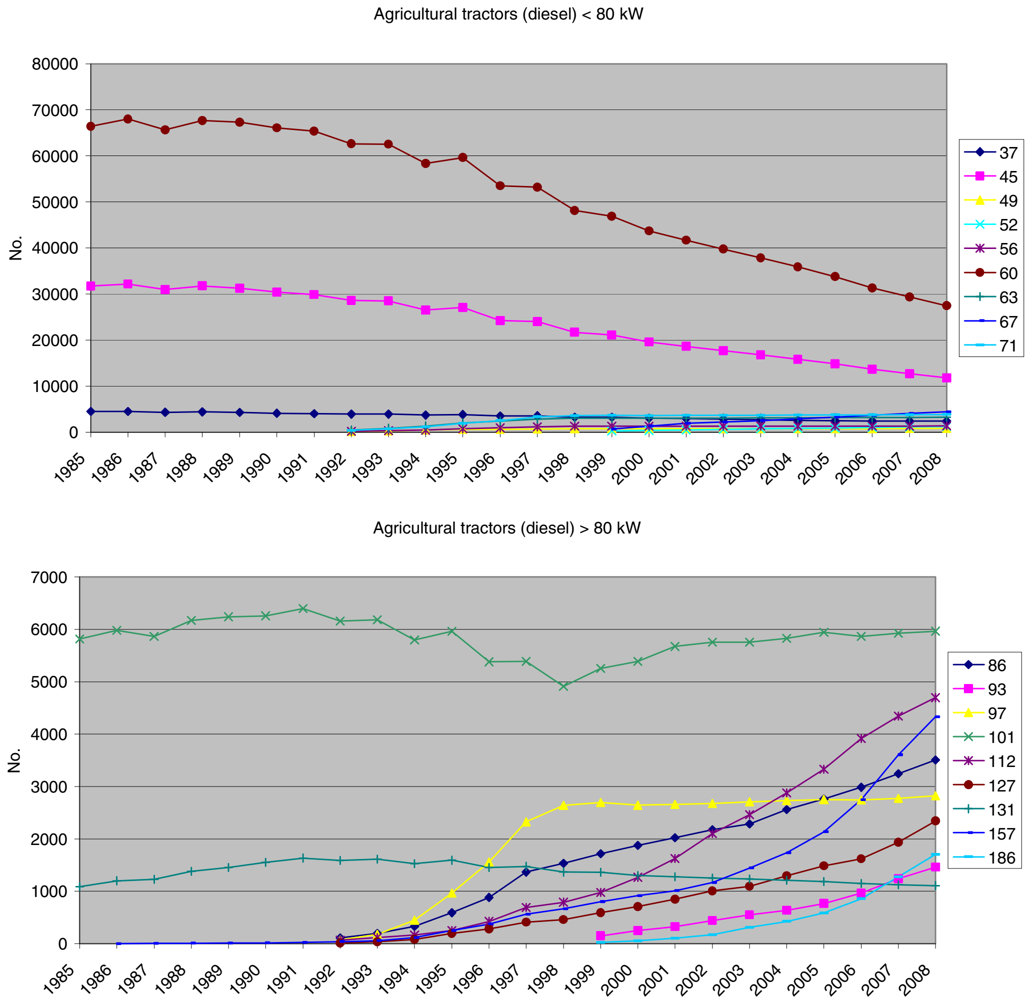



Figure 3.88 Total numbers in kW classes for tractors from 1985 to 2008.

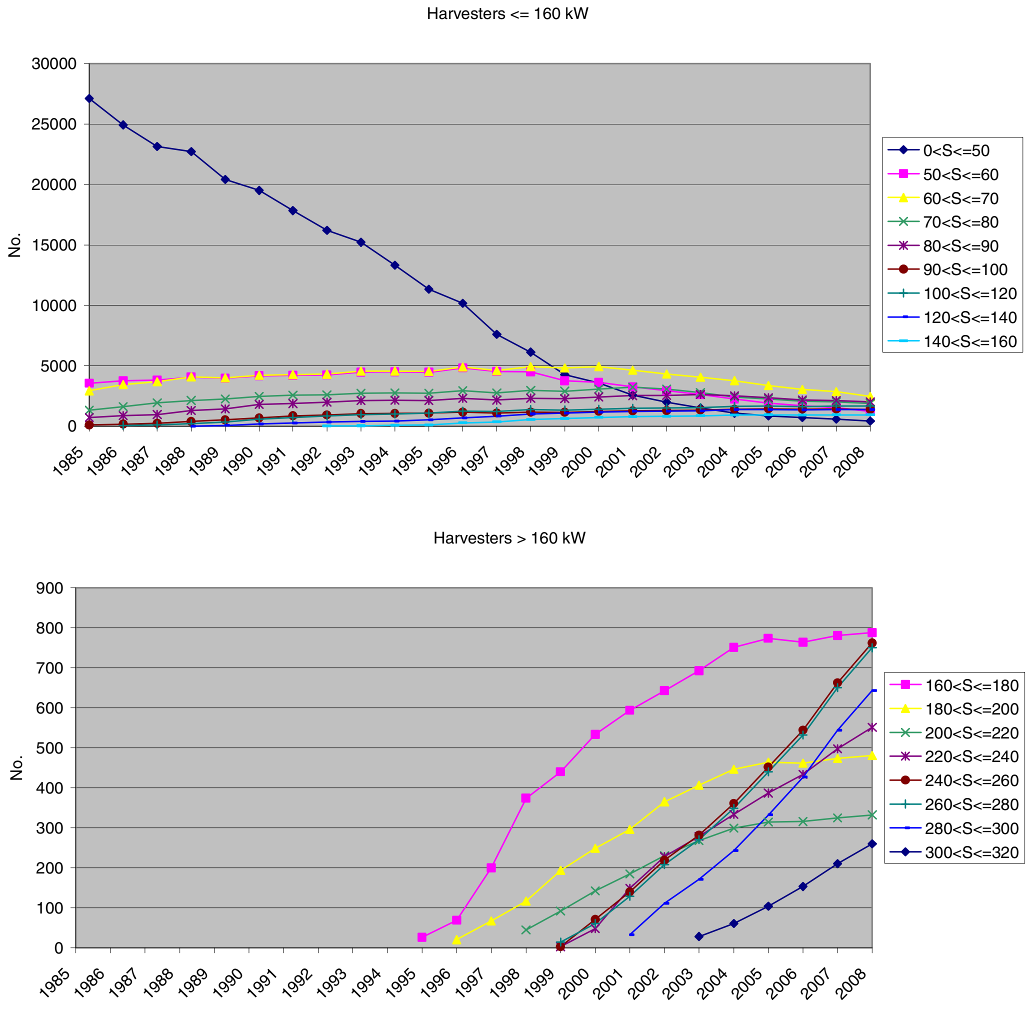



Figure 3.89 Total numbers in kW classes for harvesters from 1985 to 2008.

The tractor and harvester developments towards fewer vehicles and larger engines, shown in Figure 3.90, are very clear. From 1985 to 2008, tractor and harvester numbers decrease by around 20 % and 50 %, respectively, whereas the average increase in engine size for tractors is 27 %, and 147 % for harvesters, in the same time period.

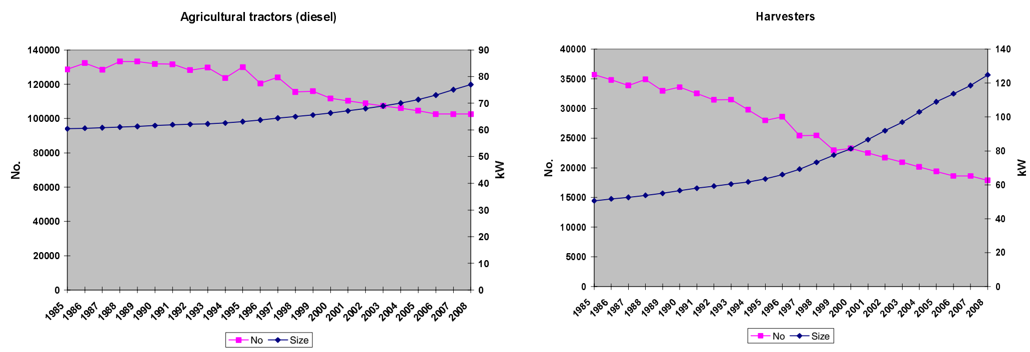



Figure 3.90 Total numbers and average engine size for tractors and harvesters from 1985 to 2008.

The most important machinery types for industrial use are different types of construction machinery and fork lifts. The Figures 3.91 and 3.92 show the 1985-2007 stock development for specific types of construction machinery and diesel fork lifts. Due to lack of data, the construction machinery stock for 1990 is used also for 1985-1989. For most of the machinery types there is an increase in machinery numbers from 1990 onwards, due to increased construction activities. It is assumed that track type excavators/wheel type loaders (0-5 tonnes), and telescopic loaders first enter into use in 1991 and 1995, respectively.

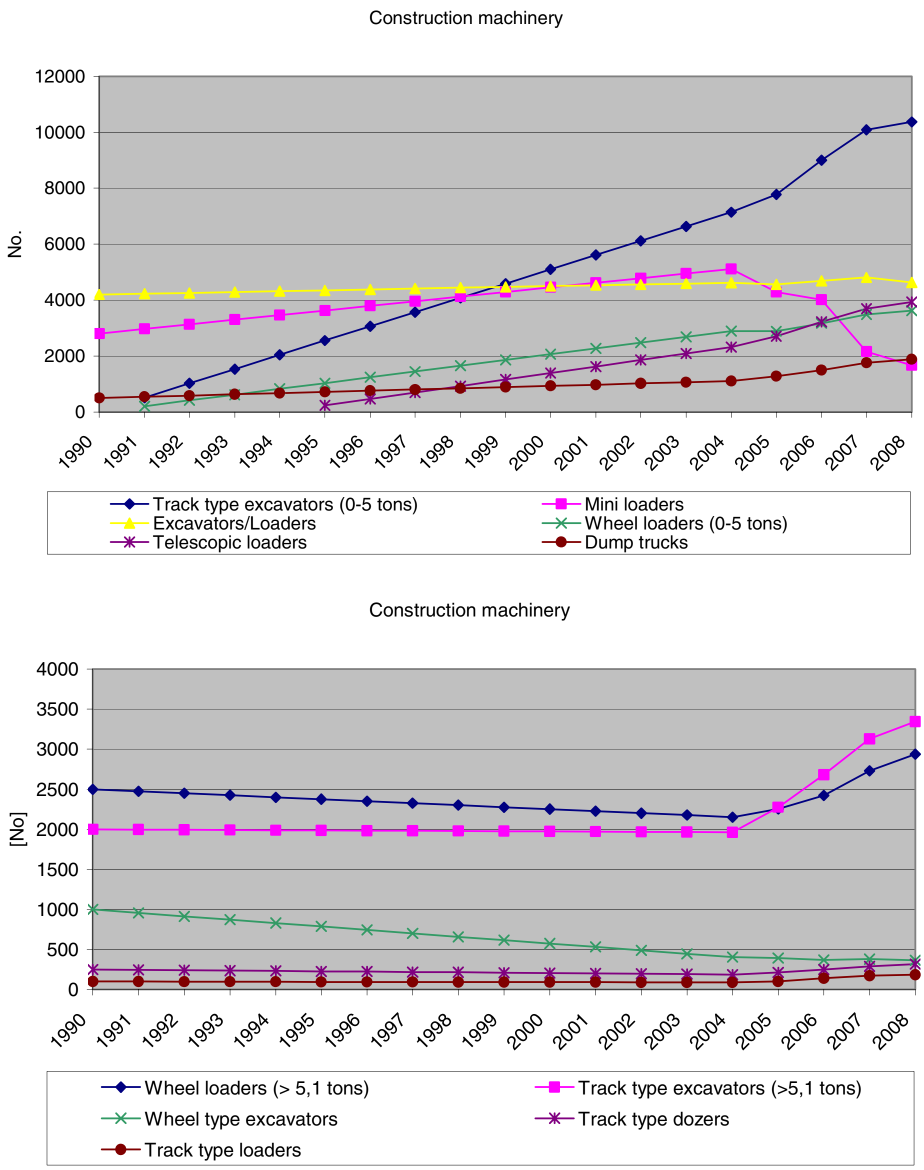



Figure 3.91 1985-2008 stock development for specific types of construction machinery.

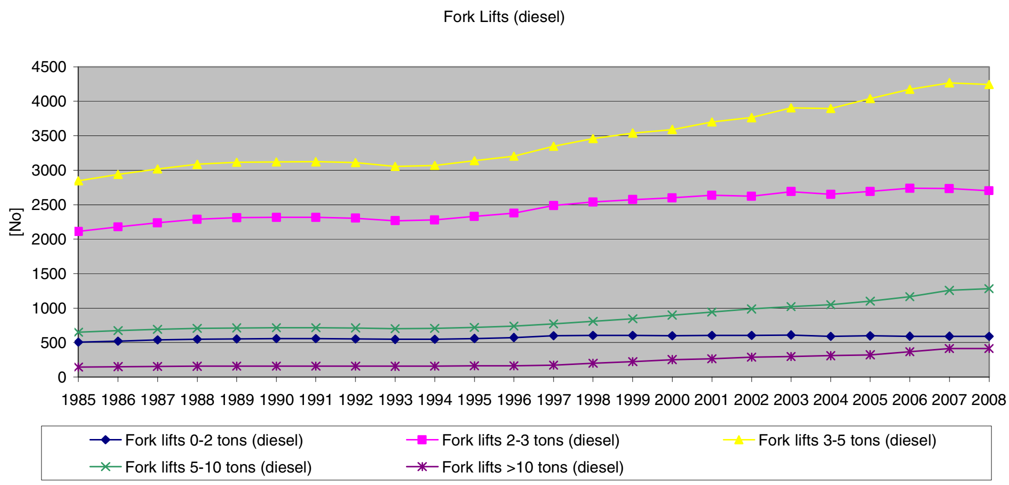



Figure 3.92 Total numbers of diesel fork lifts in kW classes from 1985 to 2008.

The emission level shares for tractors, harvesters, construction machinery and diesel fork lifts are shown in Figure 3.93, and present an overview of the penetration of the different pre-Euro engine classes, and engine stages complying with the gradually stricter EU stage I and II emission limits. The average lifetimes of 30, 25, 20 and 10 years for tractors, harvesters, fork lifts and construction machinery, respectively, influence the individual engine technology turn-over speeds.

The EU emission directive Stage I and II implementation years relate to engine size, and for all four machinery groups the emission level shares for the specific size segments will differ slightly from the picture shown in Figure 3.93. Due to scarce data for construction machinery, the emission level penetration rates are assumed to be linear and the general technology turnover pattern is as shown in Figure 3.93.

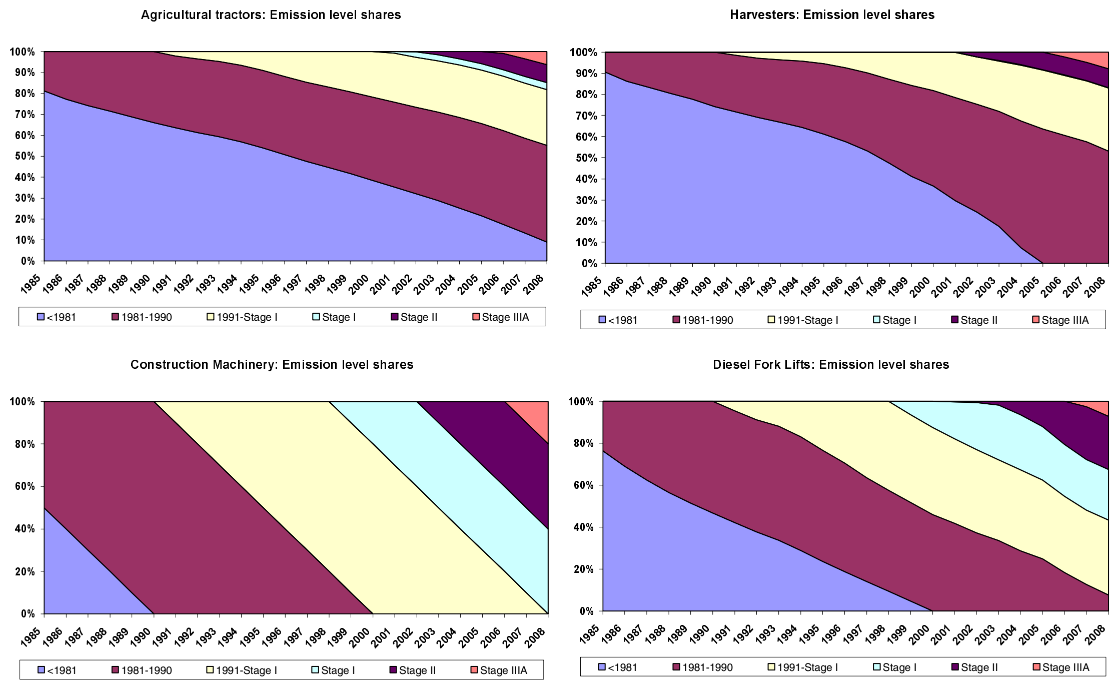



Figure 3.93 Emission level shares for tractors, harvesters, construction machinery and diesel fork lifts (1985 to 2008).

The 1985-2008 stock development for the most important household and gardening machinery types is shown in Figure 3.94.

For lawn movers and cultivators, the machinery stock remains approximately the same for all years, whereas the stock figures for riders, chain saws, shrub clearers, trimmers and hedge cutters increase from 1990 onwards. The yearly stock increases, in most cases, become larger after 2000. The lifetimes for gasoline machinery are short and, therefore, there new emission levels (not shown) penetrate rapidly.

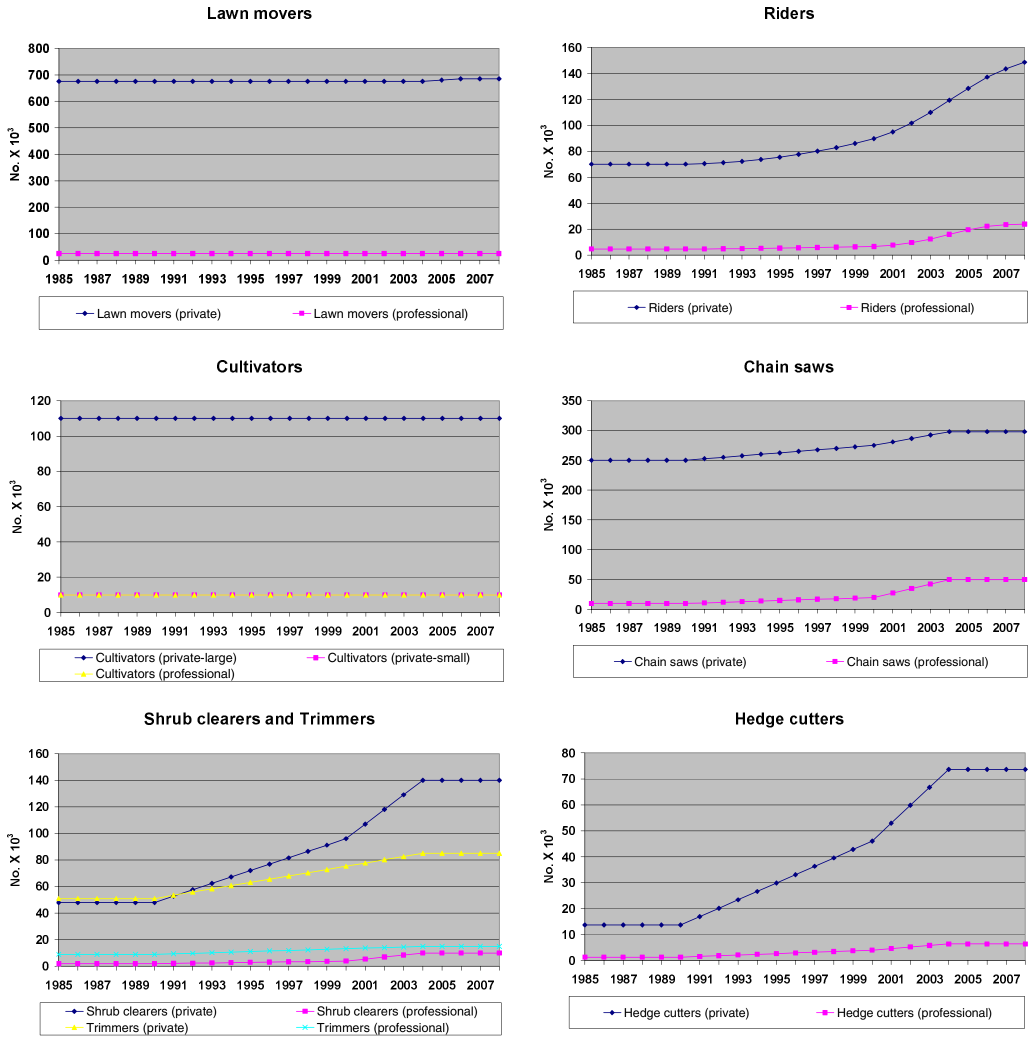



Figure 3.94 Stock development 1985-2008 for the most important household and gardening machinery types.

Figure 3.95 shows the development in numbers of different recreational craft from 1985-2008. The 2004 stock data for recreational craft are repeated for 2005-2008, since no new fleet information has been obtained.

For diesel boats, increases in stock and engine size are expected during the whole period, except for the number of motor boats (< 27 ft.) and the engine sizes for sailing boats (<26 ft.), where the figures remain unchanged. A decrease in the total stock of sailing boats (<26 ft.) by 21 % and increases in the total stock of yawls/cabin boats and other boats (<20 ft.) by around 25 % are expected. Due to a lack of information specific to Denmark, the shifting rate from 2-stroke to 4-

stroke gasoline engines is based on a German non-road study (IFEU, 2004).

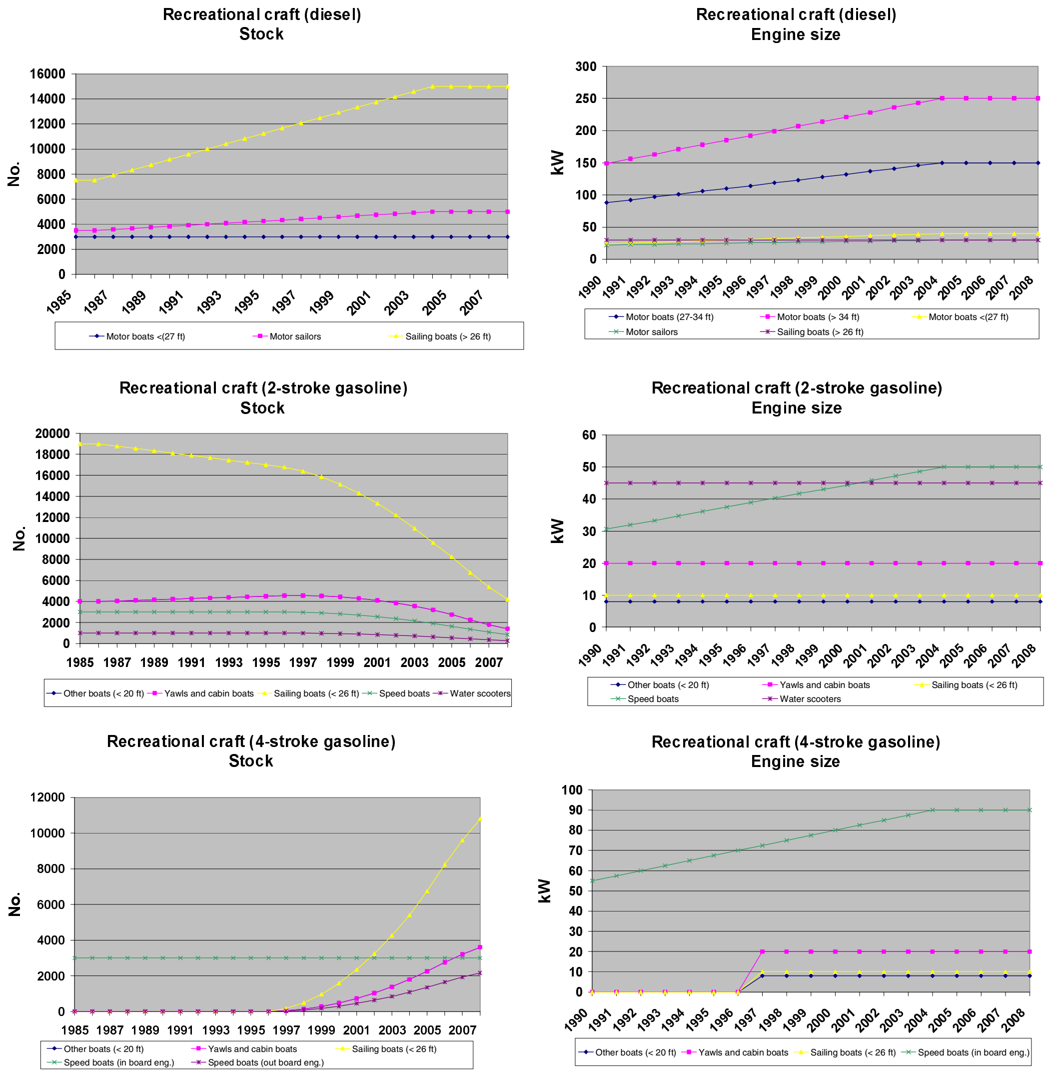



Figure 3.95   1985-2008 Stock and engine size development for recreational craft.

**National sea transport**

A new methodology is used to estimate the fuel consumption figures for national sea transport, based on fleet activity estimates for regional ferries, local ferries and other national sea transport (Winther, 2008a).

Table 3.31 lists the most important domestic ferry routes in Denmark in the period 1990-2008. For these ferry routes and the years 1990-2005, the following detailed traffic and technical data have been gathered by Winther (2008a): Ferry name, year of service, engine size (MCR), engine type, fuel type, average load factor, auxiliary engine size and sailing time (single trip).

For 2006 and 2007, the above mentioned traffic and technical data for specific ferries have been provided by Kristensen (2008) in the case of Mols-Linien (Sjællands Odde-Ebeltoft, Sjællands Odde-Århus, Kalundborg-Århus), by Hjortberg (2008) for Bornholmstrafikken (Køge-Rønne) and by Simonsen (2008) for Langelandstrafikken A/S

(Tårs-Spodsbjerg). The data for 2007 have been repeated for the year 2008.

Table 3.31 Domestic ferry routes comprised in the Danish inventory.

| Ferry service | Service period |
|---|---|
| Halsskov-Knudshoved | 1990-1999 |
| Hundested-Grenaa | 1990-1996 |
| Kalundborg-Juelsminde | 1990-1996 |
| Kalundborg-Samsø | 1990- |
| Kalundborg-Århus | 1990- |
| Korsør-Nyborg, DSB | 1990-1997 |
| Korsør-Nyborg, Vognmandsruten | 1990-1999 |
| København-Rønne | 1990-2004 |
| Køge-Rønne | 2004- |
| Sjællands Odde-Ebeltoft | 1990- |
| Sjællands Odde-Århus | 1999- |
| Tårs-Spodsbjerg | 1990- |

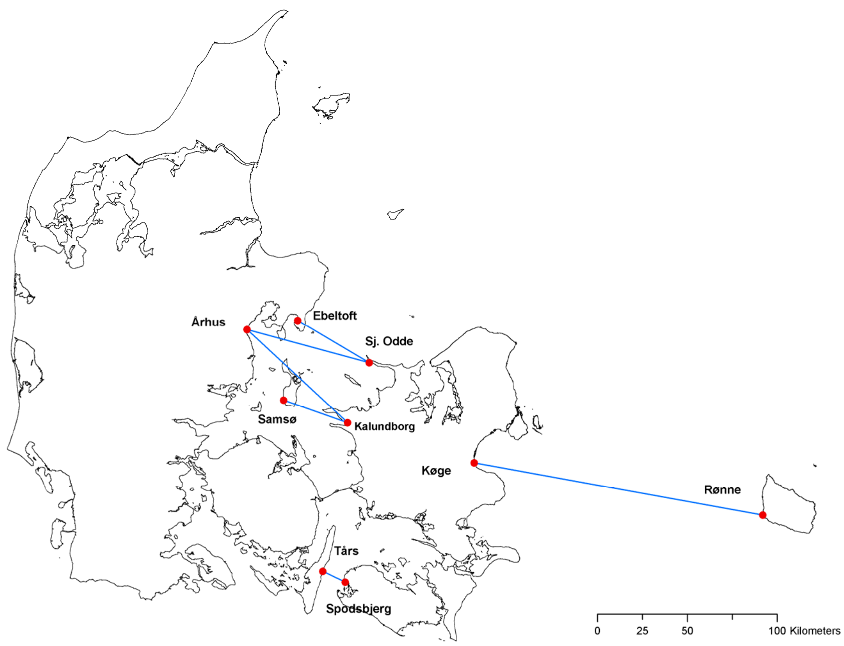



Figure 3.96 Domestic regional ferry routes in Denmark (2008).

The number of round trips pr ferry route from 1990 to 2008 is provided by Statistics Denmark (2009), see Figure 3.97. The traffic data are also listed in Annex 3.B.11, together with different ferry specific technical and operational data.

For each ferry, Annex 3.B.12 lists the relevant information as regards ferry route, name, year of service, engine size (MCR), engine type, fuel type, average load factor, auxillary engine size and sailing time (single trip). There is a lack of historical traffic data for 1985-1989, and hence, data for 1990 is used for these years, to support the fuel use and emission calculations.

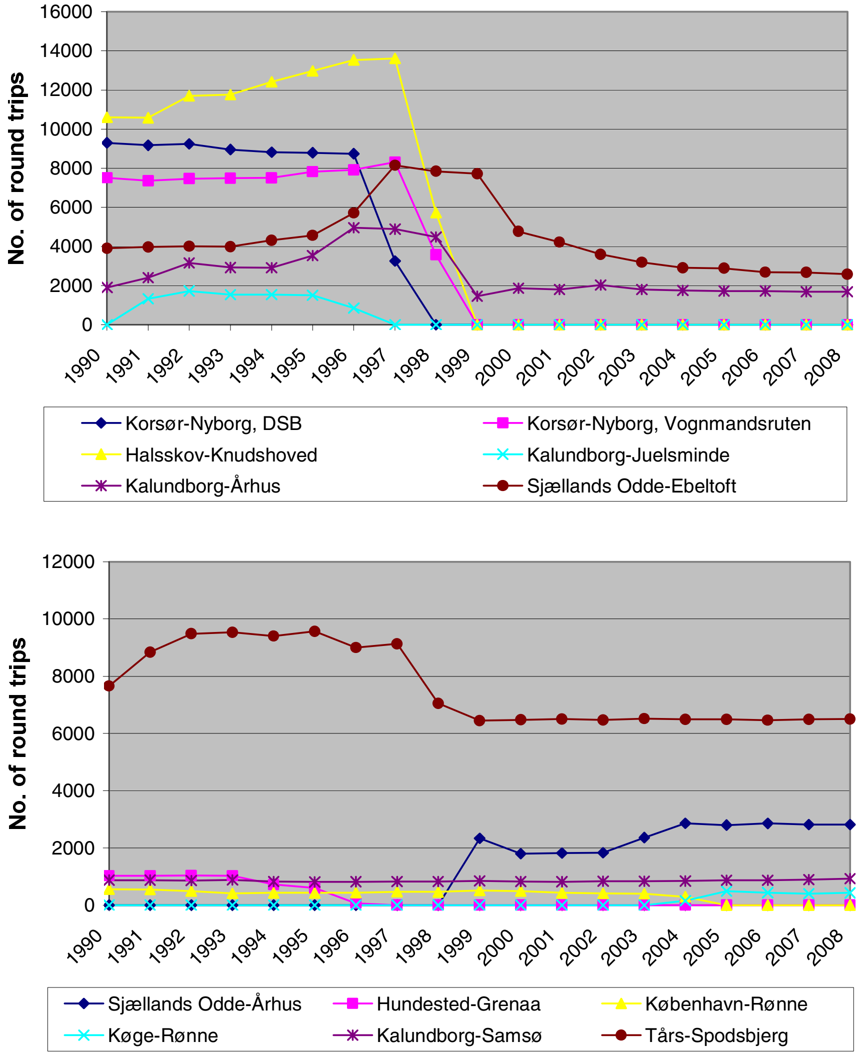



Figure 3.97 No. of round trips for the most important ferry routes in Denmark 1990-2008.

It is seen from Table 3.31 (and Figure 3.97) that several ferry routes were closed in the time period from 1996-1998, mainly due to the opening of the Great Belt Bridge (connecting Zealand and Funen) in 1997. Hundested-Grenaa and Kalundborg-Juelsminde was closed in 1996, Korsør-Nyborg (DSB) closed in 1997, and Halsskov-Knudshoved and Korsør-Nyborg (Vognmandsruten) was closed in 1998. The ferry line København-Rønne was replaced by Køge-Rønne in 2004 and from 1999 a new ferry connection was opened between Sjællands Odde and Århus.

For the local ferries, a bottom-up estimate of fuel consumption for 1996 has been taken from the Danish work in Wismann (2001). The latter project calculated fuel consumption and emissions for all sea transport in Danish waters in 1995/1996 and 1999/2000. In order to cover the entire 1990-2006 inventory period, the fuel figure for 1996 has been adjusted according to the developments in local ferry route traffic shown in Annex 3.B.11.

For the remaining part of the traffic between two Danish ports, other national sea transport, new bottom-up estimates for fuel consumption have been calculated for the years 1995 and 1999 by Wismann (2007). The calculations use the database set up for Denmark in the

Wismann (2001) study, with actual traffic data from the Lloyd's LMIS database (not including ferries). The database was split into three vessel types: bulk carriers, container ships, and general cargo ships; and five size classes: 0-1000, 1000-3000, 3000-10000, 10000-20000 and >20000 DTW. The calculations assume that bulk carriers and container ships use heavy fuel oil, and that general cargo ships use gas oil. For further information regarding activity data for local ferries and other national sea transport, please refer to Winther (2008a).

The fleet activity data for regional ferries, and the fleet activity based fuel consumption estimates for local ferries and other national sea transport provided by Winther (2008a) replace the previous fuel based activity data which originated directly from the DEA statistics.

#### Other sectors

The activity data for military, railways, international sea transport and fishery consists of fuel consumption information from DEA (2008). For international sea transport, the basis is fuel sold in Danish ports for vessels with a foreign destination, as prescribed by the IPCC guidelines.

For fisheries, the calculation methodology described by Winther (2008a) remains fuel based. However, the input fuel data differ from the fuel sales figures previously used. The changes are the result of further data processing of the DEA reported gas oil sales for national sea transport and fisheries, prior to inventory input. For years when the fleet activity estimates of fuel consumption for national sea transport are smaller than reported fuel sold, fuel is added to fisheries in the inventory. Conversely, lower fuel sales in relation to bottom-up estimates for national sea transport means that fuel is being subtracted from the original fisheries fuel sales figure in order to make up the final fuel consumption input for fisheries.

The updated fuel consumption time series for national sea transport lead, in turn, to changes in the energy statistics for fisheries (gas oil) and industry (heavy fuel oil), so the national energy balance can remain unchanged.

For all sectors, fuel-use figures are given in Annex 2.B.14 for 2008 in CollectER format.

#### Emission legislation

For non-road working machinery and equipment, and recreational craft and railway locomotives/motor cars, the emission directives list specific emission limit values (g pr kWh) for CO, VOC, $NO_x$ (or VOC + $NO_x$) and TSP, depending on engine size (kW for diesel, ccm for gasoline) and date of implementation (referring to engine market date).

For diesel, the directives 97/68 and 2004/26 relate to non-road machinery other than agricultural and forestry tractors, and the directives have different implementation dates for machinery operating under transient and constant loads. The latter directive also comprises emission limits for railway machinery. For tractors the relevant directives are 2000/25 and 2005/13. For gasoline, the directive

2002/88 distinguishes between hand-held (SH) and not hand-held (NS) types of machinery.

For engine type approval, the emissions (and fuel use) are measured using various test cycles (ISO 8178). Each test cycle consists of a number of measurement points for specific engine loads during constant operation. The specific test cycle used depends on the machinery type in question and the test cycles are described in more details in the directives.

Table 3.32 Overview of EU emission directives relevant for diesel fuelled non-road machinery.

| Stage/Engine size [kW] | CO | VOC | $NO_x$ | $VOC+NO_x$ | PM | Diesel machinery | | | Tractors | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Implement. date | | EU | Implement. |
| | | | [g pr kWh] | | | EU Directive | Transient | Constant | directive | date |
| Stage I | | | | | | | | | | |
| 37<=P<75 | 6.5 | 1.3 | 9.2 | - | 0.85 | 97/68 | 1/4 1999 | - | 2000/25 | 1/7 2001 |
| Stage II | | | | | | | | | | |
| 130<=P<560 | 3.5 | 1 | 6 | - | 0.2 | 97/68 | 1/1 2002 | 1/1 2007 | 2000/25 | 1/7 2002 |
| 75<=P<130 | 5 | 1 | 6 | - | 0.3 | | 1/1 2003 | 1/1 2007 | | 1/7 2003 |
| 37<=P<75 | 5 | 1.3 | 7 | - | 0.4 | | 1/1 2004 | 1/1 2007 | | 1/1 2004 |
| 18<=P<37 | 5.5 | 1.5 | 8 | - | 0.8 | | 1/1 2001 | 1/1 2007 | | 1/1 2002 |
| Stage IIIA | | | | | | | | | | |
| 130<=P<560 | 3.5 | - | - | 4 | 0.2 | 2004/26 | 1/1 2006 | 1/1 2011 | 2005/13 | 1/1 2006 |
| 75<=P<130 | 5 | - | - | 4 | 0.3 | | 1/1 2007 | 1/1 2011 | | 1/1 2007 |
| 37<=P<75 | 5 | - | - | 4.7 | 0.4 | | 1/1 2008 | 1/1 2012 | | 1/1 2008 |
| 19<=P<37 | 5.5 | - | - | 7.5 | 0.6 | | 1/1 2007 | 1/1 2011 | | 1/1 2007 |
| Stage IIIB | | | | | | | | | | |
| 130<=P<560 | 3.5 | 0.19 | 2 | - | 0.025 | 2004/26 | 1/1 2011 | - | 2005/13 | 1/1 2011 |
| 75<=P<130 | 5 | 0.19 | 3.3 | - | 0.025 | | 1/1 2012 | - | | 1/1 2012 |
| 56<=P<75 | 5 | 0.19 | 3.3 | - | 0.025 | | 1/1 2012 | - | | 1/1 2012 |
| 37<=P<56 | 5 | - | - | 4.7 | 0.025 | | 1/1 2013 | - | | 1/1 2013 |
| Stage IV | | | | | | | | | | |
| 130<=P<560 | 3.5 | 0.19 | 0.4 | - | 0.025 | 2004/26 | 1/1 2014 | | 2005/13 | 1/1 2014 |
| 56<=P<130 | 5 | 0.19 | 0.4 | - | 0.025 | | 1/10 2014 | | | 1/10 2014 |

Table 3.33 Overview of the EU Emission Directive 2002/88 for gasoline fuelled non-road machinery.

| | Category | Engine size [ccm] | CO [g pr kWh] | HC [g pr kWh] | $NO_x$ [g pr kWh] | $HC+NO_x$ [g pr kWh] | Implementation date |
|---|---|---|---|---|---|---|---|
| | Stage I | | | | | | |
| Hand held | SH1 | S<20 | 805 | 295 | 5.36 | - | 1/2 2005 |
| | SH2 | 20=<S<50 | 805 | 241 | 5.36 | - | 1/2 2005 |
| | SH3 | 50=<S | 603 | 161 | 5.36 | - | 1/2 2005 |
| Not hand held | SN3 | 100=<S<225 | 519 | - | - | 16.1 | 1/2 2005 |
| | SN4 | 225=<S | 519 | - | - | 13.4 | 1/2 2005 |
| | Stage II | | | | | | |
| Hand held | SH1 | S<20 | 805 | - | - | 50 | 1/2 2008 |
| | SH2 | 20=<S<50 | 805 | - | - | 50 | 1/2 2008 |
| | SH3 | 50=<S | 603 | - | - | 72 | 1/2 2009 |
| Not hand held | SN1 | S<66 | 610 | - | - | 50 | 1/2 2005 |
| | SN2 | 66=<S<100 | 610 | - | - | 40 | 1/2 2005 |
| | SN3 | 100=<S<225 | 610 | - | - | 16.1 | 1/2 2008 |
| | SN4 | 225=<S | 610 | - | - | 12.1 | 1/2 2007 |

For recreational craft, Directive 2003/44 comprises the emission legislation limits for diesel engines, and for 2-stroke and 4-stroke gasoline engines, respectively. The CO and VOC emission limits depend on engine size (kW) and the inserted parameters presented in the calculation formulas in Table 3.34. For $NO_x$, a constant limit value is given for each of the three engine types. For TSP, the constant emission limit regards diesel engines only.

Table 3.34 Overview of the EU Emission Directive 2003/44 for recreational craft.

| Engine type | Impl. date | $CO=A+B/P^n$ | | | $HC=A+B/P^n$ | | | $NO_x$ | TSP |
|---|---|---|---|---|---|---|---|---|---|
| | | A | B | n | A | B | n | | |
| 2-stroke gasoline | 1/1 2007 | 150.0 | 600.0 | 1.0 | 30.0 | 100.0 | 0.75 | 10.0 | - |
| 4-stroke gasoline | 1/1 2006 | 150.0 | 600.0 | 1.0 | 6.0 | 50.0 | 0.75 | 15.0 | - |
| Diesel | 1/1 2006 | 5.0 | 0.0 | 0 | 1.5 | 2.0 | 0.5 | 9.8 | 1.0 |

Tabel 3.35 Overview of the EU Emission Directive 2004/26 for railway locomotives and motorcars.

| | Engine size [kW] | | CO [g pr kWh] | HC [g pr kWh] | NOx [g pr kWh] | $HC+NO_X$ [g pr kWh] | PM [g pr kWh] | Implementation date |
|---|---|---|---|---|---|---|---|---|
| Locomotives | Stage IIIA | | | | | | | |
| | 130<=P<560 | RL A | 3.5 | - | - | 4 | 0.2 | 1/1 2007 |
| | 560<P | RH A | 3.5 | 0.5 | 6 | - | 0.2 | 1/1 2009 |
| | 2000<=P and piston displacement >= 5 l/cyl. | RH A | 3.5 | 0.4 | 7.4 | - | 0.2 | 1/1 2009 |
| | Stage IIIB | RB | 3.5 | - | - | 4 | 0.025 | 1/1 2012 |
| Motor cars | Stage IIIA | | | | | | | |
| | 130<P | RC A | 3.5 | - | - | 4 | 0.2 | 1/1 2006 |
| | Stage IIIB | | | | | | | |
| | 130<P | RC B | 3.5 | 0.19 | 2 | - | 0.025 | 1/1 2012 |

Aircraft engine emissions of $NO_x$, CO, VOC and smoke are regulated by ICAO (International Civil Aviation Organization). The engine emission certification standards are contained in Annex 16 — Environmental Protection, Volume II — Aircraft Engine Emissions to the Convention on International Civil Aviation (ICAO Annex 16, 1993). The emission standards relate to the total emissions (in grams) from the so-called LTO (Landing and Take Off) cycle divided by the rated engine thrust (kN). The ICAO LTO cycle contains the idealised aircraft movements below 3000 ft (915 m) during approach, landing, airport taxiing, take off and climb out.

For smoke all aircraft engines manufactured from 1 January 1983 have to meet the emission limits agreed by ICAO. For $NO_x$, CO, VOC The emission legislation is relevant for aircraft engines with a rated engine thrust larger than 26.7 kN. In the case of CO and VOC, the ICAO regulations apply for engines manufactured from from 1 January 1983.

For $NO_x$, the emission regulations fall in four categories

a) For engines of a type or model for which the date of manufacture of the first individual production model is on or before 31 December 1995, and for which the production date of the individual engine is on or before 31 December 1999.

b) For engines of a type or model for which the date of manufacture of the first individual production model is after 31 December 1995, or for individual engines with a production date after 31 December 1999.
c) For engines of a type or model for which the date of manufacture of the first individual production model is after 31 December 2003.
d) For engines of a type or model for which the date of manufacture of the first individual production model is after 31 December 2007.

The regulations published by ICAO are given in the form of the total quantity of pollutants ($D_p$) emitted in the LTO cycle divided by the maximum sea level thrust ($F_{oo}$) and plotted against engine pressure ratio at maximum sea level thrust.

The limit values for $NO_x$ are given by the formulae in Table 3.36.

Table 3.36 Current certification limits for $NO_x$ for turbo jet and turbo fan engines.

| | Engines first produced before 31.12.1995 & for engines manufactured up to 31.12.1999 | Engines first produced after 31.12.1995 & for engines manufactured after 31.12.1999 | Engines for which the date of manufacture of the first individual production model was after 31 December 2003 | Engines for which the date of manufacture of the first individual production model was after 31 December 2007 |
|---|---|---|---|---|
| Applies to engines >26.7 kN | $Dp/F_{oo} = 40 + 2\pi_{oo}$ | $Dp/F_{oo} = 32 + 1.6\pi_{oo}$ | | |
| Engines of pressure ratio less than 30 | | | | |
| Thrust more than 89 kN | | | $Dp/F_{oo} = 19 + 1.6\pi_{oo}$ | $Dp/F_{oo} = 16.72 + 1.4080\pi_{oo}$ |
| Thrust between 26.7 kN and not more than 89 kN | | | $Dp/F_{oo} = 37.572 + 1.6\pi_{oo} - 0.208F_{oo}$ | $Dp/F_{oo} = 38.54862 + (1.6823\pi_{oo}) – (0.2453F_{oo}) – (0.00308\pi_{oo}F_{oo})$ |
| Engines of pressure ratio more than 30 and less than 62.5 | | | | |
| Thrust more than 89 kN | | | $Dp/F_{oo} = 7+2.0\pi_{oo}$ | $Dp/F_{oo} = -1.04+ (2.0*\pi_{oo})$ |
| Thrust between 26.7 kN and not more than 89 kN | | | $Dp/F_{oo} = 42.71 +1.4286\pi_{oo} -0.4013F_{oo} +0.00642\pi_{oo}F_{oo}$ | $Dp/F_{oo} = 46.1600 + (1.4286\pi_{oo}) – (0.5303F_{oo}) – (0.00642\pi_{oo}F_{oo})$ |
| Engines with pressure ratio 82.6 or more | | | $Dp/F_{oo} = 32+1.6\pi_{oo}$ | $Dp/F_{oo} = 32+1.6\pi_{oo}$ |

Source: International Standards and Recommended Practices, Environmental Protection, ICAO Annex 16 Volume II Part III Paragraph 2.3.2, 2nd edition July 1993, plus amendments: Amendment 3 (20 March 1997),Amendment 4 (4 November 1999),Amendment 5 (24 November 2005).

where:

$D_p$ = the sum of emissions in the LTO cycle in g.

$F_{oo}$ = thrust at sea level take-off (100 %).

$\pi_{oo}$ = pressure ratio at sea level take-off thrust point (100 %).

The equivalent limits for HC and CO are $D_p/F_{oo}$ = 19.6 for HC and $D_p/F_{oo}$ = 118 for CO (ICAO Annex 16 Vol. II paragraph 2.2.2). Smoke is limited to a regulatory smoke number = 83 $(F_{oo})^{-0.274}$ or a value of 50, whichever is the lower.

A further description of the technical definitions in relation to engine certification as well as actual engine exhaust emission measurement data can be found in the ICAO Engine Exhaust Emission Database. The latter database is accessible from http://www.caa.co.uk, hosted by the UK Civil Aviation Authority.

For seagoing vessels, $NO_x$ emissions are regulated as explained in Marpol 73/78 Annex VI, formulated by IMO (International Maritime Organisation). The legislation is relevant for diesel engines with a power output higher than 130 kW, which are installed on a ship constructed on or after 1 January 2000 and diesel engines with a power output higher than 130 kW which undergo major conversion on or after 1 January 2000.

The $NO_x$ emission limits for ship engines in relation to their rated engine speed (n) given in RPM (Revolutions Pr Minute) are the following:

- 17 g pr kWh, n < 130 RPM
- 45 x n-0.2 g pr kWh, 130 ≤ n < 2000 RPM
- 9.8 g pr kWh, n ≥ 2000 RPM

Further, the Marine Environment Protection Committee (MEPC) of IMO has agreed amendments to MARPOL Annex VI in October 2008 in order to strengthen the emission standards for $NO_x$ and the sulphur contents of heavy fuel oil used by ship engines.

For $NO_x$ emission regulations, a three tiered approach is considered, which comprises the following:

- Tier I: Diesel engines (> 130 kW) installed on a ship constructed on or after 1 January 2000 and prior to 1 January 2011.
- Tier II: Diesel engines (> 130 kW) installed on a ship constructed on or after 1 January 2011.
- Tier III[11]: Diesel engines (> 130 kW) installed on a ship constructed on or after 1 January 2016.

As for the existing $NO_x$ emission limits, the new Tier I-III $NO_x$ legislation values rely on the rated engine speeds. The emission limit equations are shown in Table 3.37.

Table 3.37 Tier I-III NOx emission limits for ship engines (amendments to MARPOL Annex VI).

| | $NO_x$ limit | RPM (n) |
|---|---|---|
| Tier I | 17 g pr kWh | n < 130 |
| | 45 · n-0.2 g pr kWh | 130 ≤ n < 2000 |
| | 9,8 g pr kWh | n ≥ 2000 |
| Tier II | 14.4 g pr kWh | n < 130 |
| | 44 · n-0.23 g pr kWh | 130 ≤ n < 2000 |
| | 7.7 g pr kWh | n ≥ 2000 |
| Tier III | 3.4 g pr kWh | n < 130 |
| | 9 · n-0.2 g pr kWh | 130 ≤ n < 2000 |
| | 2 g pr kWh | n ≥ 2000 |

[11] For ships operating in a designated Emission Control Area. Outside a designated Emission Control Area, Tier II limits apply.

The Tier I emission limits are identical with the existing emission limits from MARPOL Annex VI.

Also agreed by IMO in October 2008, the $NO_x$ Tier I limits are to be applied for existing engines with a power output higher than 5000 kW and a displacement pr cylinder at or above 90 litres, installed on a ship constructed on or after 1 January 1990 but prior to 1 January 2000.

In relation to the sulphur content in heavy fuel and marine gas oil used by ship engines, Table 3.38 shows the current legislation in force, and the amendment of MARPOL Annex VI agreed by IMO in October 2008.

Table 3.38 Current legislation in relation to marine fuel quality.

| Legislation | | Heavy fuel oil | | Gas oil | |
|---|---|---|---|---|---|
| | | S- % | Impl. date (day/month/year) | S- % | Impl. date |
| EU-directive 93/12 | | None | | 0.2[1] | 1.10.1994 |
| EU-directive 1999/32 | | None | | 0.2 | 1.1.2000 |
| EU-directive 2005/33[2] | SECA - Baltic sea | 1.5 | 11.08.2006 | 0.1 | 1.1.2008 |
| | SECA - North sea | 1.5 | 11.08.2007 | 0.1 | 1.1.2008 |
| | Outside SECA's | None | | 0.1 | 1.1.2008 |
| MARPOL Annex VI | SECA – Baltic sea | 1.5 | 19.05.2006 | | |
| | SECA – North sea | 1.5 | 21.11.2007 | | |
| | Outside SECA | 4.5 | 19.05.2006 | | |
| MARPOL Annex VI amendments | SECA's | 1 | 01.03.2010 | | |
| | SECA's | 0.1 | 01.01.2015 | | |
| | Outside SECA's | 3.5 | 01.01.2012 | | |
| | Outside SECA's | 0.5 | 01.01.2020[3] | | |

[1] Sulphur content limit for fuel sold inside EU.

[2] From 1.1.2010 fuel with a sulphur content higher than 0.1 % must not be used in EU ports for ships at berth exceeding two hours

[3] Subject to a feasibility review to be completed no later than 2018. If the conclusion of such a review becomes negative the effective date would default 1 January 2025.

For non-road machinery, the EU directive 2003/17/EC gives a limit value of 50 ppm sulphur in diesel (from 2005).

**Emission factors**

The $SO_2$ emission factors are fuel related, and rely on the sulphur contents given in the relevant EU fuel directives or in the Danish legal announcements. However, for jet fuel the default factor from IPCC (1996) is used. Road transport diesel is assumed to be used by engines in military and railways, and road transport gasoline is assumed to be used by non road working machinery and recreational craft. Hence, these types of machinery have the same $SO_2$ emission factors, as for road transport.

For all mobile sources, the emission factor source for $NH_3$, heavy metals and PAH is the EMEP/EEA guidebook (EMEP/EEA, 2009).

For military ground equipment, aggregated emission factors for gasoline and diesel are derived from road traffic emission simulations. For piston engine aircraft using aviation gasoline, aggregated emission factors for conventional cars are used.

For railways, specific Danish measurements from the Danish State Railways (DSB) (Delvig, 2009) are used to calculate the emission factors of $NO_x$, VOC, CO and TSP, and a $NMVOC/CH_4$ split is made based on own judgment.

For agriculture, forestry, industry, household gardening and inland waterways, the $NO_x$, VOC, CO and TSP emission factors are derived from various European measurement programmes; see IFEU (2004) and Winther et al. (2006). The $NMVOC/CH_4$ split is taken from USEPA (2004).

For national sea transport and fisheries, the $NO_x$ emission factors predominantly come from the engine manufacturer MAN Diesel, as a function of engine production year. The CO, VOC and TSP emission factors come from the Danish TEMA2000 emission model (Trafikministeriet, 2000), whereas the $PM_{10}$ and $PM_{2.5}$ size fractions are obtained from MAN Diesel.

Specifically for the ferries used by Mols Linjen new $NO_x$ , VO and CO emission factors are provided by Kristensen (2008), originating from measurement results by Hansen et al. (2004), Wismann (1999) and PHP (1996).

For ship engines $VOC/CH_4$ splits are taken from EMEP/EEA (2009), and all emission factors are shown in Annex 2.B.12.

The source for aviation (jet fuel) emission factors is the EMEP/EEA guidebook (EMEP/EEA, 2009).

For all sectors, emission factors are given in CollectER format in Annex 2.B.14 for 2008. Table 3.39 shows the emission factors for $SO_2$, $NO_X$, NMVOC, CO, $NH_3$ and TSP in CollectER format used to calculate the emissions from other mobile sources in Denmark.

#### Factors for deterioration, transient loads and gasoline evaporation for non road machinery

The emission effects of engine wear are taken into account for diesel and gasoline engines by using the so-called deterioration factors. For diesel engines alone, transient factors are used in the calculations, to account for the emission changes caused by varying engine loads. The evaporative emissions of NMVOC are estimated for gasoline fuelling and tank evaporation. The factors for deterioration, transient loads and gasoline evaporation are taken from IFEU(2004), and are shown in Annex 2.B.9. For more details regarding the use of these factors, please refer to paragraph 3.1.4 or Winther et al. (2006).

Table 3.39 Fuel based emission factors for $SO_2$, $NO_X$, NMVOC, CO, $NH_3$ and TSP for other mobile sources in Denmark (2008).

| | | | Emission factors[1] [g pr GJ] | | | | | |
|---|---|---|---|---|---|---|---|---|
| SNAP ID | Category | Fuel type | $SO_2$ | $NO_X$ | NMVOC | CO | $NH_3$ | TSP |
| 080100 | Military | Diesel | 0.47 | 486.62 | 26.51 | 120.80 | 0.35 | 21.90 |
| 080100 | Military | Jet fuel | 22.99 | 250.57 | 24.94 | 229.89 | 0.00 | 1.16 |
| 080100 | Military | Gasoline | 0.46 | 149.10 | 206.88 | 1747.51 | 21.17 | 2.10 |
| 080100 | Military | AvGas | 22.99 | 859.00 | 1242.60 | 6972.00 | 1.60 | 10.00 |
| 080200 | Railways | Diesel | 0.47 | 912.90 | 63.95 | 164.49 | 0.20 | 31.64 |
| 080300 | Inland waterways | Diesel | 93.68 | 851.39 | 164.23 | 446.96 | 0.17 | 100.90 |
| 080300 | Inland waterways | Gasoline | 0.46 | 495.52 | 1576.18 | 14675.43 | 0.10 | 61.17 |
| 080402 | National sea traffic | Residual oil | 586.80 | 1853.24 | 61.96 | 204.41 | 0.00 | 51.05 |
| 080402 | National sea traffic | Diesel | 46.84 | 923.31 | 51.92 | 79.00 | 0.00 | 21.55 |
| 080403 | Fishing | Diesel | 46.84 | 1365.96 | 56.98 | 187.98 | 0.00 | 21.55 |
| 080403 | Fishing | Kerosene | 2.30 | 50.00 | 3.00 | 20.00 | 0.00 | 5.00 |
| 080403 | Fishing | LPG | 0.00 | 1249.00 | 384.94 | 443.00 | 0.00 | 0.20 |
| 080404 | International sea traffic | Residual oil | 733.50 | 2085.30 | 61.67 | 203.45 | 0.00 | 63.83 |
| 080404 | International sea traffic | Diesel | 46.84 | 1547.73 | 56.16 | 185.25 | 0.00 | 21.55 |
| 080501 | Air traffic, Dom. < 3000 ft., other airports | Jet fuel | 22.99 | 307.88 | 22.64 | 139.67 | 0.00 | 1.16 |
| 080501 | Air traffic, Dom. < 3000 ft., other airports | AvGas | 22.83 | 859.00 | 1242.60 | 6972.00 | 1.60 | 10.00 |
| 080502 | Air traffic, Int. < 3000 ft., other airports | Jet fuel | 22.99 | 294.41 | 28.63 | 179.88 | 0.00 | 1.16 |
| 080502 | Air traffic, Int. < 3000 ft., other airports | AvGas | 22.83 | 859.00 | 1242.60 | 6972.00 | 1.60 | 10.00 |
| 080503 | Air traffic, Dom. > 3000 ft., other airports | Jet fuel | 22.99 | 283.13 | 15.67 | 116.30 | 0.00 | 1.16 |
| 080504 | Air traffic, Int. > 3000 ft., other airports | Jet fuel | 22.99 | 238.25 | 7.21 | 52.58 | 0.00 | 1.16 |
| 080600 | Agriculture | Diesel | 2.34 | 659.21 | 66.65 | 365.48 | 0.18 | 51.55 |
| 080600 | Agriculture | Gasoline | 0.46 | 107.65 | 1143.24 | 22029.44 | 1.41 | 29.26 |
| 080700 | Forestry | Diesel | 2.34 | 510.08 | 38.83 | 261.75 | 0.18 | 29.45 |
| 080700 | Forestry | Gasoline | 0.46 | 86.32 | 6899.22 | 16933.82 | 0.09 | 77.69 |
| 080800 | Industry | Diesel | 2.34 | 618.51 | 69.85 | 341.87 | 0.18 | 60.74 |
| 080800 | Industry | Gasoline | 0.46 | 204.01 | 1523.99 | 13519.54 | 0.10 | 15.48 |
| 080800 | Industry | LPG | 0.00 | 1328.11 | 146.09 | 104.85 | 0.21 | 4.89 |
| 080900 | Household and gardening | Gasoline | 0.46 | 92.92 | 2429.63 | 29136.13 | 0.09 | 24.64 |
| 080501 | Air traffic, Dom. < 3000 ft., Copenhagen | Jet fuel | 22.99 | 296.09 | 28.55 | 181.39 | 0.00 | 1.16 |
| 080501 | Air traffic, Dom. < 3000 ft., Copenhagen | AvGas | 22.83 | 859.00 | 1242.60 | 6972.00 | 1.60 | 10.00 |
| 080502 | Air traffic, Int. < 3000 ft., Copenhagen | Jet fuel | 22.99 | 338.31 | 42.63 | 239.83 | 0.00 | 1.16 |
| 080502 | Air traffic, Int. < 3000 ft., Copenhagen | AvGas | 22.83 | 859.00 | 1242.60 | 6972.00 | 1.60 | 10.00 |
| 080503 | Air traffic, Dom. > 3000 ft., Copenhagen | Jet fuel | 22.99 | 283.56 | 15.44 | 61.39 | 0.00 | 1.16 |
| 080504 | Air traffic, Int. > 3000 ft., Copenhagen | Jet fuel | 22.99 | 313.19 | 10.58 | 33.66 | 0.00 | 1.16 |

[1] References. $SO_2$: Country-specific; Military: Aggregated emission factors for road transport; Railways ($NO_x$, NMVOC and TSP): Danish State Railways; Agriculture, forestry, industry, household gardening and inland waterways ($NO_x$, VOC and TSP): IFEU (2004); National sea transport and fishing: MAN B&W ($NO_x$) and TEMA2000 (NMVOC, TSP); Aviation - jet fuel ($NO_X$, NMVOC and TSP): EMEP/EEA; Aviation - av.gasoline: Aggregated emission factors for conventional gasoline cars.

### 3.3.4 Calculation method

**Air traffic**

For aviation, the domestic and international estimates are made separately for landing and take-off (LTOs < 3000 ft), and cruising (> 3000 ft).

The fuel consumption for one LTO cycle is calculated according to the following sum formula:

$$FC^{a}_{LTO} = \sum_{m=1}^{4} t_m \cdot ff_{a,m} \quad (13)$$

Where FC = fuel consumption (kg), m = LTO mode (approach/landing, taxiing, take off, climb out), t = times in mode (s), ff = fuel flow (kg pr s), a = representative aircraft type.

The emissions for one LTO cycle are estimated as follows:

$$E^{a}_{LTO} = \sum_{m=1}^{4} FC_{a,m} \cdot EI_{a,m} \quad (14)$$

Due to lack of specific airport data, for approach/descent, take off and climb out, standardised times-in-modes of 4, 0.7 and 2.2 mins are used as defined by ICAO (ICAO, 1995), whereas for taxiing the appropriate time interval is 13 mins in Copenhagen Airport and 5 mins in other airports present in the Danish inventory.

To estimate cruise results, fuel consumption and emissions for standard flying distances from EMEP/EEA (2009) are interpolated or extrapolated – in each case determined by the great circle distance between the origin and the destination airports.

If the great circle distance, y, is smaller than the maximum distance for which fuel consumption and emission data are given in the EMEP/EEA data bank the fuel consumption or emission E (y) becomes:

$$E(y) = E_{x_i} + \frac{(y - x_i)}{x_{i+1} - x_i} \cdot (E_{x_{i+1}} - E_{x_i}) \quad y<x_{max},\ i = 0,1,2\ldots max\text{-}1 \quad (15)$$

In (5.3) $x_i$ and $x_{max}$ denominate the separate distances and the maximum distance, respectively, with known fuel use and emissions. If the flight distance y exceeds $x_{max}$ the maximum figures for fuel use and emissions must be extrapolated and the equation then becomes:

$$E(y) = E_{x_{max}} + \frac{(y - x_{max})}{x_{max} - x_{max-1}} \cdot (E_{x_{max}} - E_{x_{max-1}}) \quad y>x_{max} \quad (16)$$

Total results are summed up and categorised according to each flight's airport and country codes.

The overall fuel precision in the model is around 0.8, derived as the fuel ratio between model estimates and statistical sales. The fuel difference is accounted for by adjusting cruising fuel use and emissions in the model according to domestic and international cruising fuel shares.

Prior to 2001, the calculation procedure was first to estimate each year's fuel use and emissions for LTO. Secondly, total cruising fuel use was found year by year as the statistical fuel use total minus the calculated fuel use for LTO. Lastly, the cruising fuel use was split into a domestic and international part by using the results from a Danish city-pair emission inventory in 1998 (Winther, 2001a). For more details of this latter fuel allocation procedure, see Winther (2001b).

**Non-road working machinery and recreational craft**

Prior to adjustments for deterioration effects and transient engine operations, the fuel use and emissions in year X, for a given machinery type, engine size and engine age, are calculated as:

$$E_{Basis}(X)_{i,j,k} = N_{i,j,k} \cdot HRS_{i,j,k} \cdot P \cdot LF_i \cdot EF_{y,z} \quad (17)$$

where $E_{Basis}$ = fuel use/emissions in the basic situation, N = number of engines, HRS = annual working hours, P = average rated engine size in kW, LF = load factor, EF = fuel use/emission factor in g pr kWh, i = machinery type, j = engine size, k = engine age, y = engine-size class and z = emission level. The basic fuel use and emission factors are shown in Annex 2.B.9.

The deterioration factor for a given machinery type, engine size and engine age in year X depends on the engine-size class (only for gasoline), y, and the emission level, z. The deterioration factors for diesel and gasoline 2-stroke engines are found from:

$$DF_{i,j,k}(X) = \frac{K_{i,j,k}}{LT_i} \cdot DF_{y,z} \quad (18)$$

where DF = deterioration factor, K = engine age, LT = lifetime, i = machinery type, j = engine size, k = engine age, y = engine-size class and z = emission level.

For gasoline 4-stroke engines the deterioration factors are calculated as:

$$DF_{i,j,k}(X) = \sqrt{\frac{K_{i,j,k}}{LT_i}} \cdot DF_{y,z} \quad (19)$$

The deterioration factors inserted in (18) and (19) are shown in Annex 2.B.9. No deterioration is assumed for fuel use (all fuel types) or for LPG engine emissions and, hence, DF = 1 in these situations.

The transient factor for a given machinery type, engine size and engine age in year X, relies only on emission level and load factor, and is denominated as:

$$TF_{i,j,k}(X) = TF_z \quad (20)$$

Where i = machinery type, j = engine size, k = engine age and z = emission level.

The transient factors inserted in (20) are shown in Annex 2.B.9. No transient corrections are made for gasoline and LPG engines and, hence, $TF_z = 1$ for these fuel types.

The final calculation of fuel use and emissions in year X for a given machinery type, engine size and engine age, is the product of the expressions 17-20:

$$E(X)_{i,j,k} = E_{Basis}(X)_{i,j,k} \cdot TF(X)_{i,j,k} \cdot (1 + DF(X)_{i,j,k}) \quad (21)$$

The evaporative hydrocarbon emissions from fuelling are calculated as:

$$E_{Evap,fueling,i} = FC_i \cdot EF_{Evap,fueling} \quad (22)$$

Where $E_{Evap,fueling}$, = hydrocarbon emissions from fuelling, i = machinery type, FC = fuel consumption in kg, $EF_{Evap,fueling}$ = emission factor in g NMVOC pr kg fuel.

For tank evaporation, the hydrocarbon emissions are found from:

$$E_{Evap,\tan k,i} = N_i \cdot EF_{Evap,\tan k,i} \quad (23)$$

Where $E_{Evap,tank,i}$ = hydrocarbon emissions from tank evaporation, N = number of engines, i = machinery type and $EF_{Evap,fueling}$ = emission factor in g NMVOC pr year.

#### Ferries, other national sea transport and fisheries

The fuel use and emissions in year X, for regional ferries are calculated as:

$$E(X) = \sum_i N_i \cdot T_i \cdot S_{i,j} \cdot P_i \cdot LF_j \cdot EF_{k,l,y} \quad (24)$$

Where E = fuel use/emissions, N = number of round trips, T = sailing time pr round trip in hours, S = ferry share of ferry service round trips, P = engine size in kW, LF = engine load factor, EF = fuel use/emission factor in g pr kWh, i = ferry service, j = ferry, k = fuel type, l = engine type, y = engine year.

For the remaining navigation categories, the emissions are calculated using a simplified approach:

$$E(X) = \sum_i EC_{i,k} EF_{k,l,y} \quad (25)$$

Where E = fuel use/emissions, EC = energy consumption, EF = fuel use/emission factor in g pr kg fuel, i = category (local ferries, other national sea, fishery, international sea), k = fuel type, l = engine type, y = average engine year.

The emission factor inserted in (25) is found as an average of the emission factors representing the engine ages which are comprised by the average lifetime in a given calculation year, X:

$$EF_{k,l,y} = \frac{\sum_{year=X}^{year=X-LT} EF_{k,l}}{LT_{k,l}} \quad (26)$$

**Other sectors**

For military and railways, the emissions are estimated with the simple method using fuel-related emission factors and fuel use from the DEA:

$$E = FC \cdot EF \quad (27)$$

where E = emission, FC = fuel consumption and EF = emission factor. The calculated emissions for other mobile sources are shown in CollectER format in Annex 2.B.14 for the years 2008 and as time-series 1985-2008 in Annex 2.B.15 (NFR format).

**Energy balance: DEA statistics and NERI estimates**

Following convention rules, the DEA statistical fuel sales figures are behind the full Danish inventory. However, in some cases for mobile sources the DEA statistical sectors do not fully match the inventory sectors. This is the case for non road machinery, where relevant DEA statistical sectors also include fuel consumed by stationary sources.

In other situations, fuel consumption figures estimated by NERI from specific bottom-up calculations are regarded as more reliable than DEA reported sales. This is the case for national sea transport.

In the following the transferral of fuel consumption data from DEA statistics into inventory relevant categories is explained for national sea transport and fisheries, non road machinery and recreational craft, and road transport. A full list of all fuel consumption data, DEA figures as well as intermediate fuel consumption data, and final inventory input figures is shown in Annex 2.B.13.

**National sea transport and fisheries**

For national sea transport in Denmark, the new fuel consumption estimates obtained by NERI (Winther, 2008a) are regarded as much more accurate than the DEA fuel sales data, since the large fluctuations in reported fuel sales cannot be explained by the actual development in the traffic between different national ports. As a consequence, the new bottom-up estimates replace the previous fuel based figures for national sea transport.

There are different potential reasons for the differences between estimated fuel consumption and reported sales for national sea transport in Denmark. According to the DEA, the latter fuel differences are most likely explained by inaccurate costumer specifications made by the oil suppliers. This inaccuracy can be caused by a sector misallocation in the sales statistics between national sea transport and fisheries for gas oil, and between national sea transport and industry for heavy fuel oil (Peter Dal, DEA, personal communication, 2007).

Following this, for fisheries and industry the updated fuel consumption time series for national sea transport lead, in turn, to changes in the fuel activity data for fisheries (gas oil) and industry (heavy fuel oil), so the national energy balance can remain unchanged.

For fisheries, fuel investigations made prior to the initiation of the work made by Winther (2008a) have actually pointed out a certain area of inaccuracy in the DEA statistics. No engines installed in fishing vessels use heavy fuel oil, even though a certain amount of heavy fuel oil is listed in the DEA numbers for some statistical years (H. Amdissen, Danish Fishermen's Association, personal communication, 2006). Hence, for fisheries small amounts of fuel oil are transferred to national sea transport, and in addition small amounts of gasoline and diesel are transferred to recreational craft.

#### Non road machinery and recreational craft

For diesel and LPG, the non-road fuel consumption estimated by NERI is partly covered by the fuel-use amounts in the following DEA sectors: agriculture and forestry, market gardening, and building and construction. The remaining quantity of non-road diesel and LPG is taken from the DEA industry sector.

For gasoline, the DEA residential sector, together with the DEA sectors mentioned for diesel and LPG, contribute to the non-road fuel consumption total. In addition, a certain amount of fuel from road transport is needed to reach the fuel-use goal.

The amount of diesel and LPG in DEA industry not being used by non-road machinery is included in the sectors, "Combustion in manufacturing industry" (0301) and "Non-industrial combustion plants" (0203) in the Danish emission inventory.

For recreational craft, the calculated fuel-use totals for diesel and gasoline are subsequently subtracted from the DEA fishery sector. For gasoline, the DEA reported fuel consumption for fisheries is far too small to fill the fuel gap, and hence the missing fuel amount is taken from the DEA road transport sector.

#### Bunkers

The distinction between domestic and international emissions from aviation and navigation should be in accordance with the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. For the national emission inventory this, in principle, means that fuel sold (and associated emissions) for flights/sea transportation starting from a seaport/airport in the Kingdom of Denmark, with destinations inside or outside the Kingdom of Denmark, are regarded as domestic or international, respectively.

#### Aviation

For aviation, the emissions associated with flights inside the Kingdom of Denmark are counted as domestic. The flights from Denmark to Greenland and the Faroe Islands are classified as domestic flights in the inventory background data. In Greenland and the Faroe Islands, the jet fuel sold is treated as domestic. This decision can be considered sensible since in the real world almost no fuel is bunkered in Greenland/Faroe Islands by flights other than those going to Denmark.

**Navigation**

In DEA statistics, the domestic fuel total consists of fuel sold to Danish ferries and other ships sailing between two Danish ports. The DEA international fuel total consists of the fuel sold in Denmark to international ferries, international warships, other ships with foreign destinations, transport to Greenland and the Faroe Islands, tank vessels and foreign fishing boats.

In Greenland, all marine fuel sales are treated as domestic. In the Faroe Islands, fuel sold in Faroese ports for Faroese fishing vessels and other Faroese ships is treated as domestic. The fuel sold to Faroese ships bunkering outside Faroese waters and the fuel sold to foreign ships in Faroese ports or outside Faroese waters is classified as international (Lastein and Winther, 2003).

To comply with the IPCC classification rules, the fuel used by vessels sailing to Greenland and the Faroe Islands should form part of the domestic total. To improve the fuel data quality for Greenland and the Faroe Islands, the fuel sales should be grouped according to vessel destination and IPCC classifications subsequently be made.

Conclusively, the domestic/international fuel split (and associated emissions) for navigation is not determined with the same precision as for aviation. It is considered, however, that the potential of incorrectly allocated fuel quantities is only a small part of the total fuel sold for navigational purposes in the Kingdom of Denmark.

### 3.3.5 Uncertainties and time-series consistency

Emission uncertainty estimates are made for road transport and other mobile sources using the guidelines formulated in the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000). However, for TSP the latter source indicates no uncertainty factor and, instead, this factor is based on own judgement.

The activity data uncertainty factor is assumed to be 2 and 10 % for road transport and other mobile sources, respectively, based on own judgement.

The uncertainty estimates should be regarded as preliminary only and may be subject to changes in future inventory documentation. The calculations are shown in Annex 2.B.16 for all emission components.

Table 3.40 Uncertainties for activity data, emission factors and total emissions in 2008 and as a trend.

| Pollutant | Emission factor uncertainties [ %] Road | Emission factor uncertainties [ %] Other | Emission uncertainties [ %] Overall 2008 | Emission uncertainties [ %] Trend |
|---|---|---|---|---|
| $SO_2$ | 50 | 50 | 48 | 2 |
| $NO_x$ | 50 | 100 | 50 | 6 |
| NMVOC | 50 | 100 | 51 | 10 |
| CO | 50 | 100 | 55 | 14 |
| $NH_3$ | 1000 | 1000 | 995 | 2194 |
| TSP | 50 | 100 | 46 | 9 |
| $PM_{10}$ | 50 | 100 | 48 | 7 |
| $PM_{2.5}$ | 50 | 100 | 50 | 6 |
| Arsenic | 1000 | 1000 | 1000 | 4 |
| Cadmium | 1000 | 1000 | 800 | 176 |
| Chromium | 1000 | 1000 | 801 | 186 |
| Copper | 1000 | 1000 | 826 | 89 |
| Mercury | 1000 | 1000 | 1000 | 10 |
| Nickel | 1000 | 1000 | 741 | 105 |
| Lead | 1000 | 1000 | 963 | 16 |
| Selenium | 1000 | 1000 | 724 | 191 |
| Zinc | 1000 | 1000 | 813 | 119 |
| Dioxins | 1000 | 1000 | 708 | 131 |
| Flouranthene | 1000 | 1000 | 792 | 5 |
| Benzo(b) flouranthene | 1000 | 1000 | 787 | 55 |
| Benzo(k) flouranthene | 1000 | 1000 | 828 | 83 |
| Benzo(a) pyrene | 1000 | 1000 | 854 | 47 |
| Benzo(g,h,i) perylene | 1000 | 1000 | 795 | 48 |
| indeno(1,2,3-c,d) pyrene | 1000 | 1000 | 779 | 158 |

As regards time-series consistency, background flight data cannot be made available on a city-pair level from 2000 or earlier. However, aided by LTO/aircraft statistics for these years and the use of proper assumptions, a sound level of consistency is still obtained in this part of the transport inventory.

The time-series of emissions for mobile machinery in the agriculture, forestry, industry, household and gardening (residential), and inland waterways (part of navigation) sectors are less certain than time-series for other sectors, since DEA statistical figures do not explicitly provide fuel use information for working equipment and machinery.

### 3.3.6 Quality assurance/quality control (QA/QC)

It is the intention to publish every second year a sector report for road transport and other mobile sources. The last sector report concerned the 2006 inventory (Winther, 2008b).

The QA/QC descriptions of the Danish emission inventories for transport are given in Nielsen et al. (2009).

### 3.3.7 Recalculations

The following recalculations and improvements of the emission inventories have been made since the emission reporting in 2009.

### Road transport

The total mileage per vehicle category from 2005-2008 have been updated based on the traffic index development (derived from traffic counts on selected roads) from the Danish Road Directorate. In addition new data prepared by DTU Transport for the Danish Infrastructure Commission has given information of the total mileage driven by foreign trucks on Danish roads. This mileage contribution has been added to the total mileage for Danish trucks on Danish roads, for trucks > 16 tonnes of gross vehicle weight. The data from DTU Transport was estimated for 2005, and by using appropriate assumptions the mileage have been backcasted to 1985 and forecasted to 2008.

For passenger cars the new division of total mileage into gasoline and diesel made by the Danish Road Directorate is regarded as very broad. Hence in the subsequent model calculations, the fuel and emission results for diesel passenger cars are adjusted with the overall sales/calculated fuel ratio, being applied to the estimates for the other diesel vehicle categories as well. This is a change compared to previous year's inventory submissions for which the diesel passenger car results remain unadjusted.

For heavy duty vehicles an error for the NMVOC emission factors for Euro 0-III trucks and buses has been corrected giving somewhat smaller emission factors.

For mopeds and motorcycles, updated first registration year information for 2005+ and 2000+, respectively, has caused some changes in the fleet/technology mix and the resulting emissions.

The minimum and maximum percentage difference and year of numeric maximum differences (min %, max %, year of max %) for the different emission components are: Particulates (-2.5 %, -9.1 %, 2007), $NO_x$ (0.5 %, 5 %, 2007), $SO_2$ (0 %, - 0.1 %, 2007), NMVOC (0.1 %, -0.9 %, 2005), CO (-0.1 %, -1.8 %, 2007) and $NH_3$ (0 %, 0.8 %, 2003).

### National sea transport

No changes have been made.

### Fishery

No changes have been made.

### Military

Emission factors derived from the new road transport simulations have caused some emission changes from 1985-2007. The minimum and maximum emission differences (min %, max %) for the different emission components are: Particulates (-3 %, -9 %), $NO_x$ (0 %, 3 %), NMVOC (0 %, -5 %), CO (0 %, -2 %) and $NH_3$ (0 %, -1 %).

### Residential

The number of riders has been updated for 2007. Thus, the emission increases are 1 % for NMVOC and particulates, 2 % for $SO_2$, $NO_x$, $CH_4$ and $CO_2$, and 3 % for CO, $N_2O$ and $NH_3$.

#### Industrial non road machinery

The number of wheel type excavators has been updated for 2007. The fuel consumption and emission increases are insignificant.

#### Agricultural non road machinery

The number of machine pool tractors, harvesters and self-propelled vehicles has been updated for 2007. The fuel consumption and emission increases are less than 1 %.

#### Railways

No changes have been made.

#### Aviation

En error for 2007 has been corrected. Erroneously, the flights between Denmark and Greenland/Faroe Islands were treated as international flights. As a result of this correction the fuel consumption and emissions change substantially. The fuel consumption increases by 51%, whereas particulates, $NO_x$, NMVOC and CO emissions increase by 34 %, 39 %, 7 % and 4 %, respectively.

Very small emission changes between 0 % and 2 % occur for the years 2001-2006, due to inclusion of new representative aircraft types.

### 3.3.8 Improvements

#### Heavy metals

It is the intention this year to update the heavy metal emission inventories for road transport.

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## 3.4 Fugitive emissions (NFR sector 1B)

This chapter includes fugitive emissions in the NFR sector 1B.

### 3.4.1 Source category description

According to the categorization in the reporting format for the UNECE CLRTAP fugitive emissions is a sub-category under the main-category Energy (Sector 1). Fugitive emissions (Sector 1B) is segmented into sub-categories covering emissions from solid fuels (1B1), oil (1B2a), natural gas (1B2b) and from venting and flaring (1B2c). The sub-sectors relevant for the Danish emission inventory are shortly described below according to Danish conditions:

- 1B1c Fugitive emission from solid fuels: Emissions from solid fuels are only relevant for the Danish national emission inventories in the case of particulate emissions. Other components are not occurring, as these emissions should be included in the inventory for the nation housing the coalmines.
- 1B2a Fugitive emissions from oil include emissions from offshore activities and refineries.
- 1B2b Fugitive emissions from natural gas include emissions from transmission and distribution of natural gas. Emissions from gas storage are included in the transmission.
- 1B2c Venting and flaring include both offshore flaring, flaring in gas storage and treatment plants and in refineries. In Denmark venting of gas is assumed to be negligible as controlled venting enters the gas flare system.

Activity data, emission factors and emissions are stored in the Danish emission database on SNAP sector categories (Selected Nomenclature for Air Pollution). In Table 3.41 the corresponding SNAP codes and

NFR sectors relevant to fugitive emissions are shown. Further, the table holds the SNAP names for the SNAP codes and the overall activity (e.g. oil and natural gas)

Table 3.41 List of NFR sectors relevant for fugitive emissions, and the corresponding SNAP codes and emission sources.

| NFR sector | SNAP ID | SNAP name | Source |
|---|---|---|---|
| | 04 | Production processes | |
| 1 B 2 a | 040101 | Petroleum products processing | Oil |
| 1 B 2 a | 040103 | Other | Oil |
| | 05 | Extraction and distribution of fossil fuels and geothermal energy | |
| 1 B 1 a | 050103 | Storage of solid fuel | Coal mining and handling |
| 1 B 2 a | 050201 | Land-based activities | Oil |
| 1 B 2 a | 050202 * | Off-shore activities | Oil |
| 1 B 2 a | 050503 | Service stations (including refuelling of cars) | Oil |
| 1 B 2 b | 050601 | Pipelines | Natural gas / transmission |
| 1 B 2 b | 050602 | Distribution networks | Natural gas / distribution |
| | 09 | Waste treatment and disposal | |
| 1 B 2 c | 090203 | Flaring in oil refinery | Venting and flaring |
| 1 B 2 c | 090206 | Flaring in oil and gas extraction | Venting and flaring |

* In the Danish emission inventory emissions from extraction of gas are united under “Extraction, 1st treatment and loading of liquid fossil fuels / Off-shore activities” (NFR 1B2a / SNAP 050202).

Table 3.42 summarizes the Danish fugitive emissions in 2008. The methodologies, activity data and emission factors used for calculation are described in the following chapters.

Table 3.42 Summary of the Danish fugitive emission in 2008. P refers to point source and A to area source.

| IPCC code | SNAP code | Source | Pollutant | Emission | Unit |
|---|---|---|---|---|---|
| 1B2a iv | 040101 | P | $SO_2$ | 0* | Mg |
| 1B2a iv | 040101 | P | NMVOC | 3784 | Mg |
| 1B2a iv | 040103 | P | $SO_2$ | 794 | Mg |
| 1B1a | 050103 | A | TSP | 1135 | Mg |
| 1B1a | 050103 | A | $PM_{10}$ | 454 | Mg |
| 1B1a | 050103 | A | $PM_{2.5}$ | 45 | Mg |
| 1B2a i | 050201 | A | NMVOC | 5551 | Mg |
| 1B2a i | 050202 | A | NMVOC | 2437 | Mg |
| 1B2a v | 050503 | A | NMVOC | 1210 | Mg |
| 1B2b | 050601 | A | NMVOC | 4 | Mg |
| 1B2b | 050601 | P | NMVOC | 27 | Mg |
| 1B2b | 050603 | A | NMVOC | 42 | Mg |
| 1B2c | 090203 | P | $SO_2$ | 380 | Mg |
| 1B2c | 090203 | P | $NO_x$ | 30 | Mg |
| 1B2c | 090203 | P | NMVOC | 38 | Mg |
| 1B2c | 090203 | P | CO | 88 | Mg |
| 1B2c | 090203 | P | TSP | 0.4 | Mg |
| 1B2c | 090203 | P | $PM_{10}$ | 0.4 | Mg |
| 1B2c | 090203 | P | $PM_{2.5}$ | 0.4 | Mg |
| 1B2c | 090203 | P | As | <0.1 | kg |
| 1B2c | 090203 | P | Cd | 0.2 | kg |
| 1B2c | 090203 | P | Cr | 0.3 | kg |
| 1B2c | 090203 | P | Cu | 0.2 | kg |
| 1B2c | 090203 | P | Hg | <0.1 | kg |
| 1B2c | 090203 | P | Ni | 0.5 | kg |
| 1B2c | 090203 | P | Pb | 0.1 | kg |
| 1B2c | 090203 | P | Se | <0.1 | kg |
| 1B2c | 090203 | P | Zn | 6.9 | kg |
| 1B2c | 090203 | P | dioxin | <0.01 | g |
| 1B2c | 090203 | P | Flouranthene | <0.01 | kg |
| 1B2c | 090203 | P | Benzo(b)flouranthene | <0.01 | kg |
| 1B2c | 090203 | P | Benzo(k)flouranthene | <0.01 | kg |
| 1B2c | 090203 | P | Benzo(a)pyrene | <0.01 | kg |
| 1B2c | 090203 | P | Benzo(g,h,i)perylene | <0.01 | kg |
| 1B2c | 090203 | P | indeno(1,2,3-c,d)pyrene | <0.01 | kg |
| 1B2c | 090206 | A | $SO_2$ | 2 | Mg |
| 1B2c | 090206 | A | $NO_x$ | 158 | Mg |
| 1B2c | 090206 | A | NMVOC | 13 | Mg |
| 1B2c | 090206 | A | CO | 129 | Mg |
| 1B2c | 090206 | A | TSP | 5 | Mg |
| 1B2c | 090206 | A | $PM_{10}$ | 5 | Mg |
| 1B2c | 090206 | A | $PM_{2.5}$ | 5 | Mg |
| 1B2c | 090206 | A | As | 0.5 | kg |
| 1B2c | 090206 | A | Cd | 3.0 | kg |
| 1B2c | 090206 | A | Cr | 4.1 | kg |
| 1B2c | 090206 | A | Cu | 2.3 | kg |
| 1B2c | 090206 | A | Hg | 0.6 | kg |
| 1B2c | 090206 | A | Ni | 5.9 | kg |
| 1B2c | 090206 | A | Pb | 1.2 | kg |
| 1B2c | 090206 | A | Se | 0.1 | kg |
| 1B2c | 090206 | A | Zn | 82.4 | kg |
| 1B2c | 090206 | A | dioxin | <0.01 | g |
| 1B2c | 090206 | A | Flouranthene | <0.01 | kg |

| Continued | | | | | |
|---|---|---|---|---|---|
| 1B2c | 090206 | A | Benzo(b)flouranthene | <0.01 | kg |
| 1B2c | 090206 | A | Benzo(k)flouranthene | <0.01 | kg |
| 1B2c | 090206 | A | Benzo(a)pyrene | <0.01 | kg |
| 1B2c | 090206 | A | Benzo(g,h,i)perylene | <0.01 | kg |
| 1B2c | 090206 | A | indeno(1,2,3-c,d)pyrene | <0.01 | kg |
| 1B2c | 090206 | P | $SO_2$ | <0.1 | Mg |
| 1B2c | 090206 | P | $NO_x$ | 6 | Mg |
| 1B2c | 090206 | P | NMVOC | 4 | Mg |
| 1B2c | 090206 | P | CO | 1 | Mg |
| 1B2c | 090206 | P | TSP | 0.1 | Mg |
| 1B2c | 090206 | P | $PM_{10}$ | 0.1 | Mg |
| 1B2c | 090206 | P | $PM_{2.5}$ | 0.1 | Mg |
| 1B2c | 090206 | P | As | <0.1 | kg |
| 1B2c | 090206 | P | Cd | <0.1 | kg |
| 1B2c | 090206 | P | Cr | <0.1 | kg |
| 1B2c | 090206 | P | Cu | <0.1 | kg |
| 1B2c | 090206 | P | Hg | <0.1 | kg |
| 1B2c | 090206 | P | Ni | 0.1 | kg |
| 1B2c | 090206 | P | Pb | 0.0 | kg |
| 1B2c | 090206 | P | Se | <0.1 | kg |
| 1B2c | 090206 | P | Zn | 0.8 | kg |
| 1B2c | 090206 | P | dioxin | <0.01 | g |
| 1B2c | 090206 | P | Flouranthene | <0.01 | kg |
| 1B2c | 090206 | P | Benzo(b)flouranthene | <0.01 | kg |
| 1B2c | 090206 | P | Benzo(k)flouranthene | <0.01 | kg |
| 1B2c | 090206 | P | Benzo(a)pyrene | <0.01 | kg |
| 1B2c | 090206 | P | Benzo(g,h,i)perylene | <0.01 | kg |
| 1B2c | 090206 | P | indeno(1,2,3-c,d)pyrene | <0.01 | kg |

* $SO_2$ from SNAP 040101 is included in SNAP 010306

### 3.4.2 Methodological issues

The following chapters give descriptions on the methods of calculation used in the Danish emission inventory. Further, the activity data and emission factors that form the basis for the calculations are described according to data source and values.

#### Fugitive emissions from solid fuels

The emissions of particulate matter from storage of coal are estimated on basis of the imported amount of coal (equation 3.4.1).

$$E_{coal\_storage} = EMF_{coal\_storage} \cdot I_{coal} \quad \text{(Eq. 3.4.1)}$$

where $EMF_{coal\_storage}$ is the emission factor for storage of coal in coal piles and $I_{coal}$ is the amount of coal imported in the actual year.

#### Fugitive emissions from oil

The emissions from oil derive from offshore activities, service stations and refineries. Emissions from offshore activities include emissions from extraction, onshore oil tanks and onshore and offshore loading of ships. In the case of service stations emissions from reloading of tankers and refuelling of vehicles are included. The emissions from refineries derive from petroleum products processing (oil refining). Emissions from flaring in refineries are included in the chapters concerning flaring.

**Offshore activities**

Fugitive emissions from oil include emissions from offshore extraction, from onshore oil tanks and from onshore and offshore loading of ships.

The total emission can be expressed as:

$$E_{total} = E_{extraction} + E_{ship} + E_{oil\ tanks} \quad \text{(Eq. 3.4.2)}$$

**Fugitive emissions from extraction**

According to the EMEP/EEA Guidebook (EMEP/EEA, 2009) the total fugitive emissions of volatile organic components (VOC) from extraction of oil and gas can be estimated by means of equation 3.4.3.

$$E_{extraction,VOC} = 40.2 \cdot N_P + 1.1 \cdot 10^{-2} P_{gas} + 8.5 \cdot 10^{-6} \cdot P_{oil} \quad \text{(Eq. 3.4.3)}$$

where $E_{extraction,VOC}$ is the emission of VOC in Mg/year, $N_P$ is the number of platforms, $P_{gas}$ is the production of gas, $10^6$ $Nm^3$ and $P_{oil}$ is the production of oil, $10^6$ tonnes.

It is assumed that the VOC contains 75 % $CH_4$ and 25 % NMVOC and in consequence the total emission of NMVOC for extraction of oil and gas can be calculated as:

$$E_{extraction,NMVOC} = 0.25 \cdot E_{extraction,VOC} \quad \text{(Eq. 3.4.4)}$$

**Loading of ships**

Fugitive emissions of NMVOC from loading of ships include the transfer of oil from storage tanks or directly from the well into ships. The activity also includes losses during transport. When oil is loaded hydrocarbon vapour will be displaced by oil and new vapour will be formed, both leading to emissions. The emissions from ships are calculated by equation 3.4.5.

$$E_{ships} = EMF_{ships,onshore} \cdot L_{oil,onshore} + EMF_{ships,offshore} \cdot L_{oil,ofshore} \quad \text{(Eq. 3.4.5)}$$

where $EMF_{ships}$ is the emission factor for loading of ships and $L_{oil}$ is the amount of oil loaded.

***Oil tanks***

The NMVOC emissions for storage of oil are given in the environmental reports from DONG Energy for 2008 (DONG Energy, 2009). An implied emission factor is calculated on the basis of the amount of oil transported in pipelines according to equation 3.4.6.

$$IEF_{tanks} = E_{tanks} \div T_{oil} \quad \text{(Eq. 3.4.6)}$$

where $IEF_{tanks}$ is the implied emission factor for storage of raw oil in tanks, $E_{tanks}$ is the emission and $T_{oil}$ is the amount of oil transported in pipelines.

**Service stations**

NMVOC emissions from service stations are estimated as outlined in equation 3.4.7.

$$E_{service\ stations} = \left(EMF_{reloading} \cdot T_{fuel}\right) + \left(EMF_{refuelling} \cdot T_{fuel}\right) \quad \text{(Eq. 3.4.7)}$$

where $EMF_{reloading}$ is the emission factor for reloading of tankers to underground storage tanks at the service stations, $EMF_{refuelling}$ is the emission factor for refuelling of vehicles and $T_{fuel}$ is the amount of gasoline used for road transport.

**Oil refining**

When oil is processed in the refineries, part of the volatile organic components (VOC) is emitted to the atmosphere. The VOC emissions from the petroleum refinery process include non-combustion emissions from handling and storage of feedstock (raw oil), from the petroleum product processing and from handling and storage of products. Emissions from flaring in refineries are included under "Flaring". Emissions related to process furnaces in refineries are included in stationary combustion with the relevant emission factors. In cases where only the total VOC emission is given by the refinery the emission of NMVOC is estimated due to the assumption that 1 % of VOC is $CH_4$ and the remaining 99 % is NMVOC.

Both the non-combustion processes including product processing and sulphur recovery plants emit $SO_2$. The $SO_2$ emissions are calculated by the refineries and implemented in the emission inventory without further calculation.

**Transmission and distribution of gas**

The fugitive emission from transmission, storage and distribution is based on information from the gas companies. The transmission and distribution companies give data on the transported amount and length and material of the pipeline systems. The fugitive losses from pipelines are only given for some companies, here among the transmission company. The available distribution data are used for the remaining companies too. From the fugitive losses from transmission and distribution pipelines the emissions of NMVOC are calculated due to the gas quality measured by Energinet.dk.

**Flaring**

Emissions from flaring are estimated from the amount of gas flared offshore, in gas treatment/storage plants and in refineries and from the corresponding emission factors. From 2006 the offshore flaring is given in the reports for the European Union Greenhouse Gas Emission Trading System (EU ETS) and thereby flaring can be split to the individual production units. Before 2006 only the summarized flared amount are available.

### 3.4.3 Activity data

**Coal storage**

The activity data is the imported amounts and the calorific values of coal (Danish Energy Agency, 2009b). In 2008 the imported amount was 7570 Gg (Figure 3.98) which is a slight decrease since 2007.

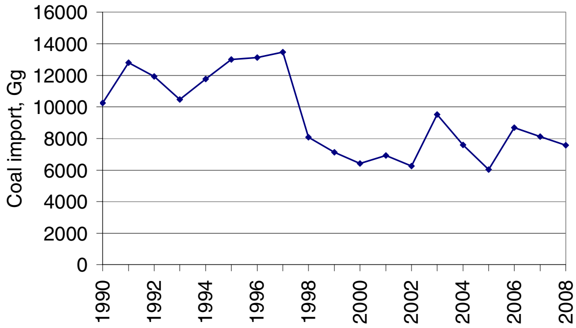


Figure 3.98 Amounts of imported coal.

**Extraction of oil and gas and loading of ships**

Activity data used in the calculations of the emissions from oil and gas production and loading of ships are shown in Table 3.43. Data are based on information from the Danish Energy Agency (2009a) and from the environmental reports from DONG Energy (DONG Energy, 2009).

Table 3.43 Activity data for 2008.

| Activity | Symbols | Amounts | Data source |
|---|---|---|---|
| Number of platforms | $N_p$ | 55 | Danish Energy Agency, 2009a |
| Produced gas, $10^6$ $Nm^3$ | $P_{gas}$ | 9 879 | Danish Energy Agency, 2009a |
| Produced oil, $10^3$ $m^3$ | $P_{oil,vol}$ | 16 672 | Danish Energy Agency, 2009a |
| Produced oil, $10^3$ tonnes | $P_{oil}$ | 14 338 | Danish Energy Agency, 2009a |
| Oil loaded, $10^3$ $m^3$ | $L_{oil\ off\text{-}shore}$ | 2 158 | Danish Energy Agency, 2009a |
| Oil loaded, $10^3$ tonnes | $L_{oil\ off\text{-}shore}$ | 1 856 | Danish Energy Agency, 2009a |
| Oil loaded, $10^3$ $m^3$ | $L_{oil\ on\text{-}shore}$ | 11 200 | DONG Energy, 2009 |
| Oil loaded, $10^3$ tonnes | $L_{oil\ on\text{-}shore}$ | 9 632 | DONG Energy, 2009 |

Mass weight raw oil = 0.86 tonnes per $m^3$

As seen in Figure 3.99 the production of oil and gas in the North Sea have generally increased in the years 1990-2004. Since 2004 the production has decreased. The number of platforms is yet still increasing (Figure 3.100). Five major platforms were completed in 1997-1999, which is the main reason for the great increase in the oil production in the years 1998-2000.

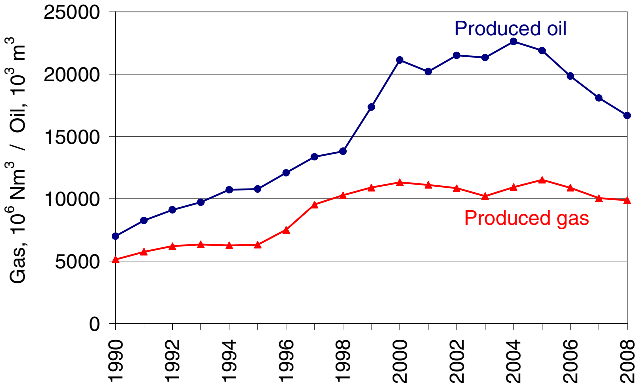


Figure 3.99 Production of oil and gas in the Danish part of the North Sea.

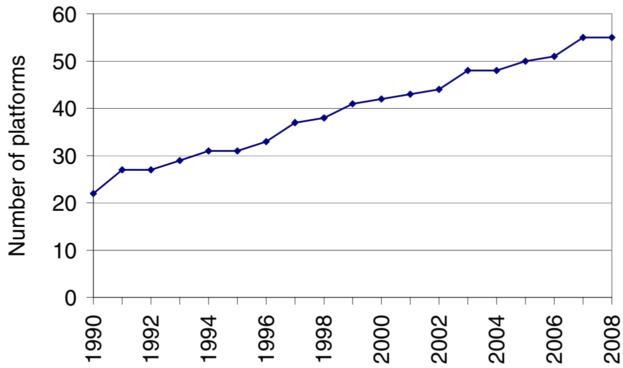


Figure 3.100 The number of platforms in the Danish part of the North Sea.

The amounts of oil loaded offshore on ships roughly follow the trend of the oil and gas production (Figure 3.101). In case of onshore loading of ships the trend is more smoothed.

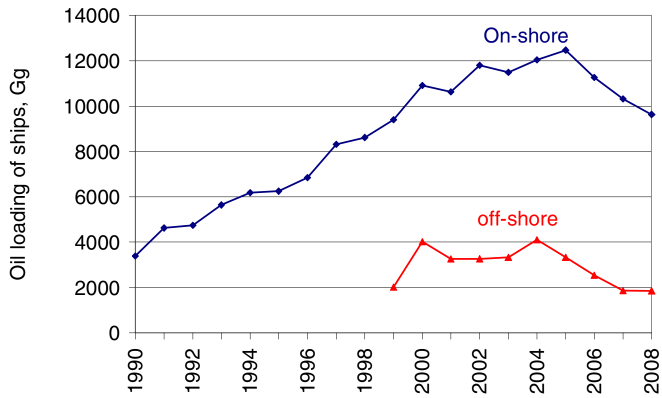


Figure 3.101 Onshore and offshore loading of ships.

**Oil refining**

Data on the amount of crude oil processed in the two Danish refineries are given by the refineries in their annual environmental report (A/S Dansk Shell, 2009 and Statoil A/S, 2009). Data are shown in Table 3.44. In the last years the amount of crude oil being processed has been slightly decreasing to 7 933 Gg in 2008.

Table 3.44 Oil refineries. Processed crude oil in the two Danish refineries.

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| Crude oil, 1000 Mg | 7 263 | 7 798 | 8 324 | 8 356 | 8 910 | 9 802 | 10 522 | 7 910 | 7 906 | 8 252 |
| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| Crude oil, 1000 Mg | 8 508 | 8 284 | 8 045 | 8 350 | 8 264 | 8 033 | 8 179 | 7 963 | 7 933 | |

**Service stations**

The Danish Energy statistics holds data on the sale of gasoline that is the basis for estimating emissions of NMVOC from service stations. The gasoline sales show an increase from 1990-1998 and a slightly decreasing trend from 1999-2008 as shown in Figure 3.102. In 2008 the gasoline sale was 1 748 516 Mg.

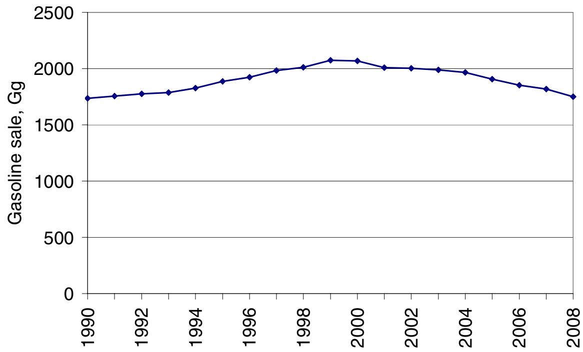

Figure 3.102 Gasoline sales in Denmark 1990-2008.

**Transmission, storage and distribution of gas**

The activity data used in the calculation of the emissions from natural gas is shown in Table 3.45. Transmission rates for 1990-1997 refer to the Danish energy statistics and to the annual environmental report of DONG Energy for 1998. The distribution rates for 1990-1998 are estimated according to the transmission rates. Transmissions and distribution rates for 1999-2006 refers to Dong Energy, Danish Gas Technology Centre and the Danish gas distribution companies. In 2007-2008 the transmission rate stems from the annual environmental report by Energinet.dk. The distribution rates for 2007-2008 are given by the distribution companies, either in their annual reports or through personal communication.

Table 3.45 Activity data on transmission and distribution of gas. Town gas is included in distribution.

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| Transmission, $Mm^3$ * | 2 739 | 3 496 | 3 616 | 3 992 | 4 321 | 4 689 | 5 705 | 6 956 | 6 641 | 6 795 |
| Distribution, $Mm^3$ ** | 1905 | 2145 | 2252 | 2516 | 2693 | 3089 | 3585 | 3607 | 3734 | 3627 |
| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| Transmission, $Mm^3$ * | 7 079 | 7 289 | 7 287 | 7 275 | 7 384 | 7 600 | 7 600 | 6 400 | 7 565 | |
| Distribution, $Mm^3$ ** | 3511 | 4005 | 3749 | 3749 | 3579 | 3297 | 3593 | 3388 | 3355 | |

* In 1990-1997 transmission rates refer to Danish energy statistics, in 1998 the transmission rate refers to the annual environmental report of DONG Energy, in 1999-2006 emissions refer to DONG/Danish Gas Technology Centre (Karll 2003, Karll 2005, Oertenblad 2006, Oertenblad 2007). Since 2007 transmission data refer to the annual environmental report by Energinet.dk.

**) In 1990-98 distribution rates are estimated from the Danish energy statistics. Distribution rates are assumed to equal total Danish consumption rate minus the consumption rates of sectors that receive the gas at high pressure. The following consumers are assumed to receive high pressure gas: town gas production companies, production platforms and power plants. In 1999-2006 distribution rates refer to DONG Energy / Danish Gas Technology Centre / Danish gas distribution companies (Karll 2003, Karll 2005, Oertenblad 2006, Oertenblad 2007). Since 2007 the distribution rates are given by the companies. The distribution of town gas is based on the available data from the Danish town gas distribution companies of which more are closed down today.

In 2008 the gas transmission rate was 7 565 $Mm^3$ and the distribution rate was 3 355 $Mm_n^3$, hereof 22 $Mm_n^3$ town gas (Figure 3.103). The increase compared to 2007 owes to a mild winter and because Denmark had import of electricity from Norway and Sweden in 2007.

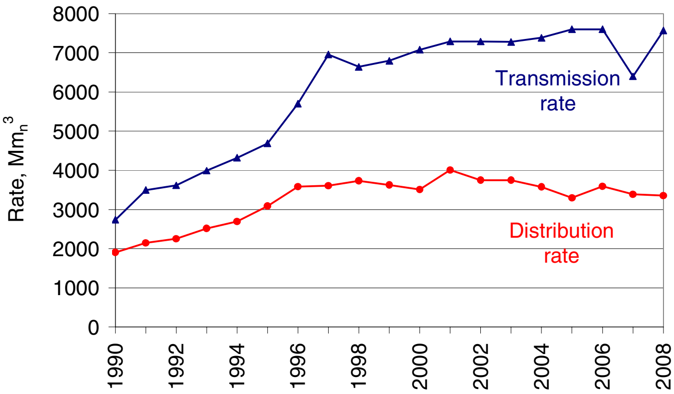


Figure 3.103 Rates for transmission and distribution of gas. Distribution cowers both natural gas and town gas.

Data on the transmission pipelines excluding offshore pipelines and on the distribution network are given by Energinet.dk, DGC and the distribution companies concerning length and material. In 2008 the length of the transmission pipelines was 860 km. Because the distribution system in Denmark is relatively new most of the distribution network is made of PE. In 2008 the length of the distribution network was 16 618 km. The major part is made of plastic (approximately 90 %) and the remaining part is made of steel. For this reason the fugitive emission is negligible under normal circumstances as the PE distribution system is basically tight with only minimal fugitive losses. However, the PE pipes are vulnerable and therefore most of the fugitive emissions from the pipes are caused by losses due to excavation damages and construction and maintenance activities performed by the gas companies. These losses are either measured or estimated by calculation in each case by the gas companies. About 6 % of the distribution network is used town gas. This part of the network is older and the fugitive losses are greater. The fugitive losses from this network are associated with more uncertainty as it is estimated as a percentage (15 %) of the meter differential. This assumption is based on expert judgement from one of the town gas companies. It must be noted that more town gas distribution companies are now closed (one in 2004 and another in 2006), and therefore the data availability is scarce.

In Denmark there are two natural gas storage facilities. Both are obligated to make an environmental report on annual basis. Data on gas input and withdrawal are included and were 740 $Mm^3$ and 725 $Mm^3$ in 2008, respectively. Until 2000 emissions from storage of gas were included in transmission in the inventories.

**Flaring**

Offshore flaring amounts are given in Denmark's oil and gas production (Danish Energy Agency, 2009a) while flaring in treatment/storage plants are given in DONG Energy's environmental reports (Dong Energy, 2009). Flaring rates for the two Danish refineries are given in their environmental reports and additional data. From 2006 flaring amounts are given in the EU ETS reporting.

The flaring rates are shown in Figure 3.104 and 3.105. Flaring rates in gas treatment and gas storage plants are not available until 1995. The mean value for the following ten years (1995 to 2004) has been adopted as basis for the emission calculation for the years 1990-1994.

The amount of flared gas is high in 2007 because of larger maintenance work at the gas treatment plant. In 2008 there has also been one situation with flaring of a larger amount of gas.

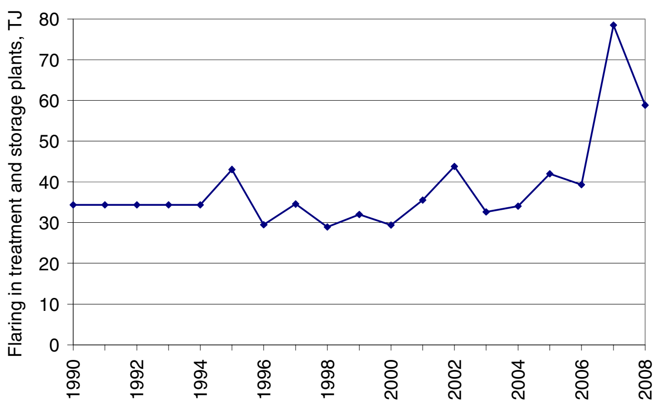


Figure 3.104 Amount flared in gas treatment and storage plants (DONG Energy, 2009).

The offshore flaring amounts have been decreasing over the last four years in accordance with the decrease in production as seen in Figure 3.99. Further, there is focus on reduction of the amount being flared for environmental reasons.

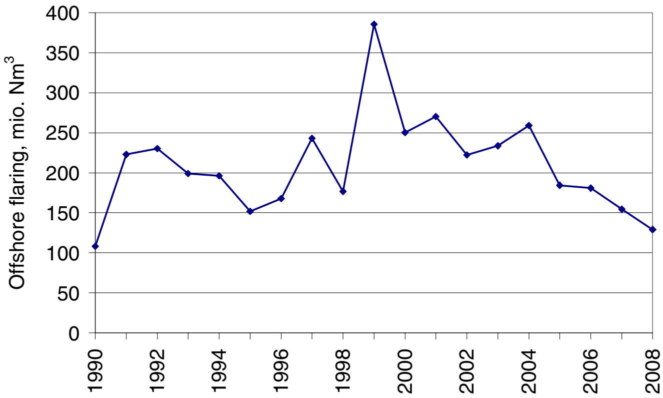

Figure 3.105 Amounts of gas flared offshore at exploration facilities (Danish Energy Agency, 2009b).

### 3.4.4 Emission factors

**Coal storage**

Emissions of particulate matter (PM) from coal storage are estimated by the emission factors used in the emission inventory of Poland (Olendry´nski et al., 2004). The emission factors are listed in Table 3.46.

Table 3.46 Emission factors used to estimate particulate emissions from coal storage.

| Emission factor | TSP | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|
| Emission factor, g pr Mg | 150 | 60 | 6 |

**Loading of ships**

In the EMEP/EEA Guidebook standard emission factors for different countries are given. In the Danish emission inventory the Norwegian emission factors are used for estimation of fugitive emissions from loading of ships onshore and offshore (EMEP/EEA, 2009). The emission factors are listed in Table 3.47.

Table 3.47 Emission factors for loading of ships onshore and offshore.

| | NMVOC, fraction of loaded | Reference |
|---|---|---|
| Ships off-shore | 0.001 | EMEP/EEA, 2009 |
| Ships on-shore | 0.0002 | EMEP/EEA, 2009 |

**Oil refining**

The refineries deliver information on consumption of fuel gas and fuel oil. The calorific values are given by the refineries in the reporting for EU ETS from 2006. Before 2006 the calorific values given by the refineries were used when available. When not available standard calorific values given in the basic data tables from the Danish Energy Agency combined with the conversion factor between fuel gas and fuel oil given by the refinery were used for calculation.

The emissions are given by the refineries for $SO_2$, $NO_x$ and VOC. Only one of the two refineries has made a split between NMVOC and $CH_4$. For the other refinery it is assumed that 1 % of the VOC emission is $CH_4$ and the remaining 99 % is NMVOC.

**Service stations**
NMVOC from service stations is calculated by use of different emission factors for the time series as shown in Table 3.48. In 1994 the emission factors for NMVOC from service stations were investigated by Fenhann and Kilde (1994) for the years 1990, 1991 and 1992, individually. The emission factors reported for reloading and refuelling for 1990 were used for the years 1985-1990, while the emission factors for 1991 was used for that year only. For the years 1992-1995 only emission factor for refuelling reported by Fenhann and Kilde (1994) was used in the Danish emission inventory. For reloading of tankers the British emission factor - as given in the UK Emission Factor Database - was adopted for the years 1992-2000. For 2008 the emission factors from the EMEP/EEA guidebook (2009) are used for reloading and refuelling. For the years 2001-2007 and 1996-2007 the emission factors for reloading and refuelling, respectively, are estimated by using interpolation.

Table 3.48 Emission factors used for estimating NMVOC from service stations.

| Year | Reloading of tankers, kg NMVOC pr tonnes gasoline | Refuelling of vehicles, kg NMVOC pr tonnes gasoline | Sum of reloading and refuelling, kg NMVOC pr tonnes gasoline | Source |
|---|---|---|---|---|
| 1985-1990 | 1.28 | 1.52 | 2.80 | Fenhann & Kilde,1994 |
| 1991 | 0.64 | 1.52 | 2.16 | Fenhann & Kilde,1994 |
| 1992-1995 | 0.08 | 1.52 | 1.60 | UK emf. database / Fenhann & Kilde,1994 |
| 1996 | 0.08 | 1.45 | 1.53 | UK emf. database / interpolation 1995-2008 |
| 1997 | 0.08 | 1.39 | 1.47 | UK emf. database / interpolation 1995-2008 |
| 1998 | 0.08 | 1.32 | 1.40 | UK emf. database / interpolation 1995-2008 |
| 1999 | 0.08 | 1.25 | 1.33 | UK emf. database / interpolation 1995-2008 |
| 2000 | 0.08 | 1.19 | 1.27 | UK emf. database / interpolation 1995-2008 |
| 2001 | 0.077 | 1.12 | 1.20 | Interpolation 2000-2008 / 1995-2008 |
| 2002 | 0.073 | 1.05 | 1.13 | Interpolation 2000-2008 / 1995-2008 |
| 2003 | 0.070 | 0.99 | 1.05 | Interpolation 2000-2008 / 1995-2008 |
| 2004 | 0.067 | 0.92 | 0.98 | Interpolation 2000-2008 / 1995-2008 |
| 2005 | 0.063 | 0.85 | 0.91 | Interpolation 2000-2008 / 1995-2008 |
| 2006 | 0.060 | 0.78 | 0.84 | Interpolation 2000-2008 / 1995-2008 |
| 2007 | 0.056 | 0.72 | 0.77 | Interpolation 2000-2008 / 1995-2008 |
| 2008 | 0.053 | 0.65 | 0.70 | EMEP/EEA 2009 |

**Transmission, storage and distribution of gas**
The fugitive emissions from transmission, storage and distribution of natural gas are based on data on gas losses from the companies and on the average yearly natural gas composition given by Energinet.dk.

**Flaring**
**Flaring in refineries**
The composition of fuel gas is given for 2008 by one of the two refineries. As the composition for fuel gas is marked different than the composition of natural gas, which has been used in earlier year's calculations, the same fuel gas composition is used in calculations for the other Danish refinery.

The emission factor for NMVOC have been included in the inventory for all years (1990-2008) as the 2008 fuel gas composition is assumed to be more accurate for the emission calculation than the yearly composition for natural gas being distributed in Denmark used in previous emission inventories. For $NO_x$ and CO the emission factors from the EMEP/EEA guidebook 2009 are used. For trace metals, dioxin and PAHs the emission factors given in the guidebook (EMEP/EEA, 2009) for stationary combustion Tier 1 are adopted for flaring in refineries. The refinery emission factors are listed in Table 3.49.

Table 3.49 Emission factors for flaring in refineries.

| Pollutant | Emission factor | Unit |
|---|---|---|
| $NO_x$ * | 32.2 | g pr GJ |
| NMVOC | 76.5 | g pr GJ |
| CO | 177 | g pr GJ |
| TSP | 0.90 | g pr GJ |
| $PM_{10}$ | 0.90 | g pr GJ |
| $PM_{2.5}$ | 0.90 | g pr GJ |
| As | 0.09 | mg pr GJ |
| Cd | 0.50 | mg pr GJ |
| Cr | 0.70 | mg pr GJ |
| Cu | 0.40 | mg pr GJ |
| Hg | 0.10 | mg pr GJ |
| Ni | 1.00 | mg pr GJ |
| Pb | 0.20 | mg pr GJ |
| Se | 0.01 | mg pr GJ |
| Zn | 14.0 | mg pr GJ |
| Dioxin | 0.05 | ng pr GJ |
| Benzo(b)fluoranthene | 0.08 | µg pr GJ |
| Benzo(k)fluoranthene | 0.08 | µg pr GJ |
| Benzo(a)pyrene | 0.06 | µg pr GJ |
| Indeno(1,2,3-c,d)pyrene | 0.08 | µg pr GJ |

*The emission of $NO_x$ is given for one refinery why the emission factor is used for one refinery only.

**Flaring offshore**

The emission factors for offshore flaring are shown in Table 3.50. The dioxin emission factor originates from a Danish study by Henriksen et al. (2006) and is, like emission factors for PM and $SO_2$, the same as the emission factors used for combustion of natural gas in Danish public power plants.

The $NO_x$ emission factor is based on the conclusion in a Danish study of $NO_x$ emissions from offshore flaring carried out by the Danish Environmental Protection Agency (2008). The recommended $NO_x$ emission factor (31 008 g pr GJ or 0.0015 tonnes $NO_x$ pr tonnes gas) corresponds well with the emission factors used to estimate $NO_x$ emission in other countries with oil production in the North Sea (Netherlands: approximately 0.0014 tonnes $NO_x$ pr tonnes gas and United Kingdom: approximately 0.0013 tonnes $NO_x$ pr tonnes gas). Emission factors for NMVOC and CO are based on the EMEP/EEA Guidebook.

For trace metals, dioxin and PAH's the emission factors given in the guidebook (EMEP/EEA, 2009) for stationary combustion Tier 1 are adopted for flaring in refineries. Emissions from flaring in gas treatment and storage plants are calculated from the same emission factors which are used for offshore flaring.

Table 3.50 Emission factors for offshore flaring.

| Pollutant | Emission factor | Unit |
|---|---|---|
| $SO_2$ | 0.014 | g pr $Nm^3$ |
| $NO_x$ | 1.227 | g pr $Nm^3$ |
| NMVOC | 0.100 | g pr $Nm^3$ |
| CO | 1.000 | g pr $Nm^3$ |
| TSP | 0.041 | g pr $Nm^3$ |
| $PM_{10}$ | 0.041 | g pr $Nm^3$ |
| $PM_{2.5}$ | 0.041 | g pr $Nm^3$ |
| As | 0.004 | mg pr $Nm^3$ |
| Cd | 0.023 | mg pr $Nm^3$ |
| Cr | 0.032 | mg pr $Nm^3$ |
| Cu | 0.018 | mg pr $Nm^3$ |
| Hg | 0.005 | mg pr $Nm^3$ |
| Ni | 0.046 | mg pr $Nm^3$ |
| Pb | 0.009 | mg pr $Nm^3$ |
| Se | 0.0005 | mg pr $Nm^3$ |
| Zn | 0.639 | mg pr $Nm^3$ |
| Dioxin | 0.023 | ng pr $Nm^3$ |
| Benzo(b)fluoranthene | 0.037 | μg pr $Nm^3$ |
| Benzo(k)fluoranthene | 0.037 | μg pr $Nm^3$ |
| Benzo(a)pyrene | 0.027 | μg pr $Nm^3$ |
| Indeno(1,2,3-c,d)pyrene | 0.037 | μg pr $Nm^3$ |

### 3.4.5 Emissions

**Coal storage**

The emission from storage of coal is 1 135 Mg TSP in 2008 (454 Mg $PM_{10}$ and 45 Mg $PM_{2.5}$). The coal consumption and the related emissions vary from year to year mainly due to the extent of electricity import/export and temperature variations (Table 3.51). Note that PM was only included in the inventory from 2000.

Table 3.51 $PM_{10}$ from storage of solid fuels.

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| $PM_{10}$, Mg | 385 | 415 | 376 | 571 | 456 | 362 | 521 | 487 | 454 |

**Extraction of oil and gas and loading of ships**

From the activity data in Table 3.43, equation 3.4.3 the fugitive emissions of NMVOC from extraction are calculated. Corresponding emissions from loading of ships can be estimated by Table 3.43, Table 3.47 and equation 3.4.5. The emissions are listed in Table 3.52 along with the emissions from storage of oil given in the environmental reports from DONG Energy (2009).

Table 3.52 NMVOC emissions for 2008.

| | NMVOC, Mg |
|---|---|
| Onshore loading of ships | 1 926 |
| Oil tanks | 3 625 |
| Fugitive emissions from extraction | 581 |
| Offshore loading of ships | 1 856 |
| Total | 7 988 |

The emissions from extraction of oil and gas are aggregated in two sources; emissions related to onshore and offshore activities, respectively. The time-series for onshore and offshore activities related to extraction of oil and natural gas are shown in Table 3.53 and Table 3.54.

Table 3.53 NMVOC from onshore activities related to extraction of oil and natural gas (onshore loading of ships and oil tanks).

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| NMVOC, Mg | 2404 | 2961 | 3199 | 3520 | 3876 | 3913 | 4304 | 4918 | 5078 | 5582 |
| continued | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| NMVOC, Mg | 6183 | 6126 | 6761 | 6698 | 6908 | 6994 | 6403 | 5981 | 5551 | |

The increase for NMVOC emission from offshore activities in 1999-2000 owe to offshore loading as there were no offshore loading in the years 1990-1998.

Table 3.54 NMVOC from offshore activities related to extraction of oil and natural gas (offshore loading of ships and extraction).

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| NMVOC, Mg | 236 | 288 | 289 | 310 | 330 | 330 | 353 | 400 | 412 | 2465 |
| continued | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| NMVOC, Mg | 4476 | 3726 | 3742 | 3836 | 4620 | 3873 | 3087 | 2442 | 2437 | |

**Oil refining**

In Table 3.55 the emissions of NMVOC from oil refining at the two Danish refineries are listed for the years 1990-2008. Further, the emissions of $SO_2$ from oil refining and sulphur recovery in refineries are shown. The emission of $SO_2$ has shown a pronounced decrease since 1990 because of technical improvements at the refineries. Note that $SO_2$ from refining and recovery prior to 1994 was summarized and reported as an area source in category 1B2a vi. Note also that $SO_2$ from oil refining from 2001 are included in stationary combustion.

Table 3.55 Oil Refineries. Emissions of NMVOC and $SO_2$ from oil refining and $SO_2$ from sulphur recovery.

| | 1990[1] | 1991[1] | 1992[1] | 1993[1] | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| NMVOC, Mg | 3 667 | 3 937 | 4 203 | 4 219 | 5 855 | 4 546 | 5 875 | 4 547 | 4 558 | 4 558 |
| $SO_2$, oil refining, Mg | 3 335 | 2 713 | 3 147 | 2 526 | 934 | 585 | 167 | 216 | 253 | 234 |
| $SO_2$, sulphur recovery, Mg | | | | | 3 332 | 2 437 | 2 447 | 1 766 | 1 188 | 1 125 |
| *Continued* | 2000 | 2001[2] | 2002[2] | 2003[2] | 2004[2] | 2005[2] | 2006[2] | 2007[2] | 2008[2] | |
| NMVOC, Mg | 4 983 | 4 338 | 4 302 | 3 708 | 3 732 | 3 550 | 3 837 | 3 761 | 3 784 | |
| $SO_2$, oil refining Mg | 178 | | | | | | | | | |
| $SO_2$, sulphur recovery Mg | 803 | 672 | 332 | 246 | 119 | 255 | 679 | 610 | 794 | |

1) Prior to 1994 $SO_2$ emissions from oil refining and sulphur recovery are reported as area sources in category 1B2a vi.

2) From 2001 $SO_2$ emissions from oil refining are included in stationary combustion.

**Service stations**

Emissions from service stations are calculated using the emission factors in Table 3.48 and the sales of gasoline given by the Danish Energy statistics. The NMVOC emissions are listed in Table 3.56.

Table 3.56 Emissions of NMVOC from service stations 1990-2008.

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| NMVOC, Mg | 4 856 | 3 792 | 2 832 | 2 854 | 2 916 | 3 016 | 2 949 | 2 906 | 2 813 | 2 760 |
| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| NMVOC, Mg | 2 616 | 2 399 | 2 252 | 2 094 | 1 933 | 1 742 | 1 563 | 1 405 | 1 210 | |

**Transmission, storage and distribution of gas**

The gas transmission company gives emissions of $CH_4$. The $CH_4$ emissions for transmission are estimated on the basis of registered loss in the transmission grid and the emission from the natural gas consumption in the pressure regulating stations. The distribution companies give data on fugitive losses, and the $CH_4$ emissions are estimated due to the gas quality given by Energinet.dk. The emissions of NMVOC are calculated on the basis of the $CH_4$ emission according to the gas quality measured by Energinet.dk (equation 3.4.8).

$$E_{NMVOC} = E_{CH_4} \times \left( w_{NMVOC} / w_{CH_4} \right) \qquad \text{(eq. 3.4.8)}$$

where $w_{NMVOC}$ is the weight-% NMVOC and $w_{CH4}$ is the weight-% $CH_4$ according to the gas quality of the current year.

For the years before 2000 emissions from transmission and storage have not been estimated separately and storage is included in the transmission category. The decrease in NMVOC emission from transmission in 2007 is caused by the completion of a greater construction work and rerouting of a major pipeline (Table 3.57). As the pipelines in Denmark are relatively new, most emissions are due to construction and maintenance. There have been no significant construction or renovation work in 2007 and therefore a low emission. The increase in $CH_4$ emission in 2008 owe to a minor increase in these work activities.

The increased emission from distribution in 2004 owes to venting of the distribution network. The reason for the decrease in 2007 is not mentioned in the environmental report for the given company.

Table 3.57 NMVOC emission from transmission, storage and distribution. NMVOC emissions are estimated from the $CH_4$ emission according to the gas quality given by Energinet.dk.

| NMVOC emission | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| Transmission, Mg | 74 | 94 | 28 | 57 | 46 | 163 | 63 | 72 | 45 | 56 |
| Storage, Mg | | | | | | | | | | |
| Distribution, Mg | 57 | 62 | 62 | 61 | 61 | 71 | 72 | 55 | 56 | 61 |
| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| Transmission, Mg | 26 | 45 | 23 | 25 | 23 | 36 | 37 | 2 | 4 | |
| Storage, Mg | 25 | 21 | 20 | 19 | 23 | 14 | 18 | 18 | 27 | |
| Distribution, Mg | 59 | 62 | 57 | 53 | 75 | 59 | 63 | 70 | 42 | |

**Flaring**

As shown in Figure 3.106 there was a marked increase in the amount of offshore flaring in 1997 and especially in 1999. The increase in 1997 was due to the new Dan field and the completion of the Harald field. The increase in 1999 was due to the opening of the three new fields Halfdan, Siri and Syd Arne.

The time-series for the emission of $CO_2$ from offshore flaring fluctuates due to the fluctuations in the fuel rate and to a minor degree due to the $CO_2$ emission factor. The latter rests on gas quality measurements. From 2006 the calorific values for flaring are given at installation level in the EU ETS. This information is incorporated in the inventory for the years 2006-2008. This has lead to an increase of the $CO_2$ emission factor. The average of the emission factors for 2006-2008 is adopted for 1990-2005. Fuel rate and $CO_2$ emission are shown in Figure 3.106.

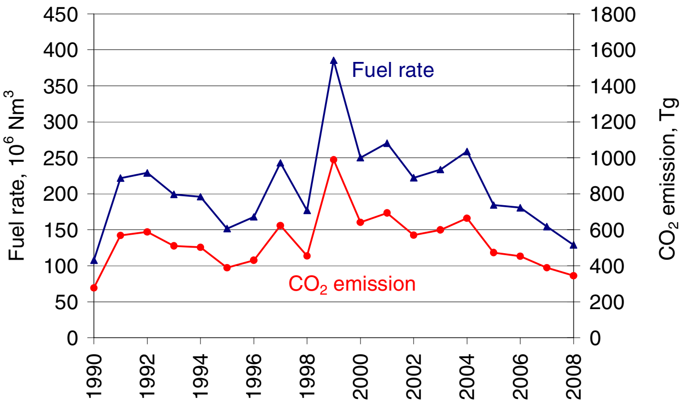


Figure 3.106 Fuel rate and $CO_2$ emission from offshore flaring of gas 1990-2008.

The emissions from offshore flaring are estimated from the same set of emission factors for all years in the time-series and the variations reflect only the variations in the flared amounts. Emissions of selected components are shown in Table 3.58.

Table 3.58 Emissions from flaring in refineries.

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes |
| $SO_2$ | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 5 |
| $NO_x$ | 132 | 272 | 281 | 244 | 240 | 199 | 211 | 303 | 217 | 476 |
| NMVOC | 11 | 22 | 23 | 20 | 20 | 19 | 19 | 27 | 20 | 41 |
| CO | 108 | 222 | 229 | 199 | 196 | 160 | 174 | 250 | 183 | 392 |
| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | |
| $SO_2$ | 4 | 4 | 3 | 3 | 4 | 3 | 3 | 2 | 2 | |
| $NO_x$ | 310 | 336 | 277 | 291 | 322 | 231 | 226 | 197 | 165 | |
| NMVOC | 28 | 30 | 26 | 27 | 29 | 22 | 21 | 22 | 17 | |
| CO | 256 | 277 | 231 | 240 | 266 | 193 | 189 | 170 | 130 | |

Besides in the offshore sector flaring also takes place in refineries and gas treatment/storage plants. Flaring in refineries is a significant fugitive emission source for $SO_2$. In 1990-1993 emissions from petroleum product processing were included in emissions from flaring in refineries (1B2c). From 1994 the data delivery format was changed, which made it possible to split the emissions into contributions from flaring and processing, respectively. Emissions from processing are from 1994 included in 1B2a iv.

Emissions of selected components are shown in Table 3.59. The decreasing emissions of $SO_2$ from 1995 to 1998 are due to technical improvements of the sulphur recovery system at one of the two Danish refineries. The increase in $SO_2$ from flaring in refineries in 2005 and 2007 was due to planned shutdowns due to inspection and maintenance at one of the two refineries. Further, in 2007 the same refinery had problems with the ATS system leading to an increased $SO_2$ emission from flaring.

Table 3.59 Emissions from flaring in refineries.

| | 1990* | 1991* | 1992* | 1993* | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes |
| $SO_2$ * | 943 | 926 | 935 | 1 190 | 520 | 203 | 218 | 138 | 70 | 50 |
| $NO_x$ | 41 | 41 | 41 | 41 | 230 | 21 | 36 | 18 | 25 | 31 |
| NMVOC | 34 | 34 | 34 | 34 | 32 | 32 | 32 | 20 | 26 | 25 |
| CO | 5 | 5 | 5 | 5 | 49 | 49 | 49 | 47 | 60 | 57 |
| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | tonnes | |
| $SO_2$ | 51 | 46 | 68 | 96 | 53 | 296 | 257 | 526 | 380 | |
| $NO_x$ | 32 | 21 | 39 | 23 | 30 | 26 | 22 | 24 | 30 | |
| NMVOC | 26 | 17 | 31 | 19 | 24 | 32 | 31 | 33 | 38 | |
| CO | 60 | 39 | 72 | 44 | 56 | 73 | 73 | 77 | 88 | |

*In 1990-1993 emissions from petroleum product processing were included in flaring in refineries due to the data delivery form. From 1994 emissions from petroleum product processing were given in 1B2a iv.

### 3.4.6 Uncertainties and time-series consistency

**Methodology**

The applied methodology for uncertainty estimates refers to Pulles & Aardenne (2004). The Danish uncertainty estimates are based on the simple Tier 1 approach described in IPCC Good Practice Guidance (IPCC, 2000).

The uncertainty estimates are based on the calculated emissions for the base year and for the latest inventory year (2008) and on the uncertainty rates for both activity data and emission factors. Data is aggregated for the NFR category 1 B - Fugitive Emissions from Fuels. Base year refers to 2000 for particulate matter and to 1990 for the remaining components.

The uncertainty rates are based on the EMEP/EEA emission inventory guidebook (2009), on uncertainty estimates from a minor number of companies and on estimates and assumptions by NERI. The applied uncertainty levels for activity data and emission factors are given in Table 3.60. The uncertainty rates vary between pollutants because the emission sources vary as well.

Table 3.60 Uncertainty levels for activity data and emission factors.

| Pollutant | Activity Data Uncertainty level % | Emission Factor Uncertainty level % |
|---|---|---|
| $SO_2$ | 10 | 25 |
| $NO_x$ | 8 | 15 |
| NMVOC | 15 | 40 |
| CO | 8 | 125 |
| TSP | 2 | 50 |
| $PM_{10}$ | 2 | 50 |
| $PM_{2.5}$ | 2 | 50 |
| As | 8 | 225 |
| Cd | 8 | 225 |
| Cr | 8 | 225 |
| Cu | 8 | 125 |
| Hg | 8 | 75 |
| Ni | 8 | 125 |
| Pb | 8 | 225 |
| Se | 8 | 200 |
| Zn | 8 | 200 |
| Benzo(b) | 8 | 200 |
| Benzo(k) | 8 | 200 |
| Benzo(a) | 8 | 200 |
| Indeno | 8 | 200 |

**Results**

The uncertainty model estimates uncertainty for both the emission and the trend. The emission uncertainty for $SO_2$, $NO_x$, NMVOC and CO is 27 %, 17 %, 43 % and 125 %, respectively. For PM the uncertainty is 50 % and for most heavy metals and PAHs the uncertainty is around 200 %. A list of the individual uncertainty estimates for the fugitive emission inventory is shown in Table 3.61.

Table 3.61 Estimated emission uncertainty and trend uncertainty for fugitive emissions. The trend refers to the years 1990-2008 for all pollutants except PM where the trend refers to 2000-2008.

| Pollutant | Emission uncertainty % | Trend uncertainty % |
|---|---|---|
| SO2 | 27 | 4 |
| NOx | 17 | 12 |
| NMVOC | 43 | 25 |
| CO | 125 | 20 |
| TSP | 50 | 3 |
| PM10 | 50 | 3 |
| PM2.5 | 50 | 3 |
| As | 225 | 14 |
| Cd | 225 | 14 |
| Cr | 225 | 14 |
| Cu | 125 | 14 |
| Hg | 75 | 14 |
| Ni | 125 | 14 |
| Pb | 225 | 14 |
| Se | 200 | 14 |
| Zn | 200 | 14 |
| Benzo(b) | 200 | 14 |
| Benzo(k) | 200 | 14 |
| Benzo(a) | 200 | 14 |
| Indeno | 200 | 14 |

### 3.4.7 Source specific QA/QC and verification

In relation to fugitive emissions the following procedures are carried out to ensure the data quality:

- Checking of time-series in the IPCC and SNAP source categories. Considerable changes are controlled and explained.
- Comparison with the inventory of the previous year. Any major changes are verified.
- Total emission, when aggregated to IPCC and LRTAP reporting tables, is compared with totals based on SNAP source categories (control of data transfer).
- A manual log table in the emission databases is applied to collect information about recalculations.
- The emission from the large point sources (refineries, gas treatment and gas storage plants) are compared with the emission reported the previous year.
- Some automated checks have been prepared for the emission databases:
  - Check of units for fuel rate, emission factor and plant-specific emissions
  - Check of emission factors for large point sources. Emission factors for pollutants that are not plant-specific should be the same as those defined for area sources.
  - Additional checks on database consistency
- Most emission factor references are now incorporated in the emission database, itself.

- Most data sources are implemented in the fugitive emission model.
- Annual environmental reports are kept for subsequent control of plant-specific emission data.

The QC work will continue in future years.

**Data deliveries**

Table 3.62 lists the external data deliveries used for the inventory of fugitive emissions. Further the table holds information on the contacts at the data delivery companies.

Table 3.62 List of external data sources.

| Source | Data description | Activity data, emission factors or emissions | Reference | Contact(s) | Data agreement/ Comment |
|---|---|---|---|---|---|
| Offshore extraction | Gas and oil production. Dataset for production of oil, gas and number of platforms. CRF 1B2a | Activity data | The Danish Energy Agency (DEA) | Jan H. Andersen | No formal data agreement. |
| Gas distribution | Natural gas from the distribution company, sales and losses (meter differences) | Activity data | DONG Energy, HNG and MN, Naturgas Fyn | Ida Pernille Schou, Gert Nielsen | No formal data agreement. |
| Gas transmission | Natural gas from the transmission company, sales and losses (meter differences) | Activity data | Energinet.dk | Christian Friberg B. Nielsen | Not necessary due to obligation by law |
| Environmental report from DONG Energy | Environmental report from DONG Energy. Oil and gas production. The amount of oil loaded onshore and emissions from raw oil tanks. CRF 1B2a | Activity data and emission data | DONG Energy | | Not necessary due to obligation by law |
| Air emissions from refinery | Fuel consumption and emission data. CRF 1B2a. | Activity data and emission data | Statoil, Shell | Anette Holst, Lis Rønnow Rasmussen | No formal data agreement. |
| Service stations | Data on gasoline sales from the Danish energy statistics. | Activity data | The Danish Energy Agency (DEA) | | Data agreement |
| Storage and treatment of gas | Environmental reports from plants defined as large point sources (Lille Torup, Stenlille, Nybro) | Activity data | Various plants. | | Not necessary due to obligation by law |
| Offshore flaring | Flaring offshore in oil and gas extraction | Activity data | The Danish Energy Agency | | Data agreement |
| Emission factors | Emission factors origin from a large number of sources | Emission factors | See chapter regarding emission factors | | |

### 3.4.8 Source specific recalculations

In the emission inventory for 2008 there have been some recalculations as listed below.

Coal import: The amounts of imported coal used for calculation of fugitive emissions from storage of solid fuels (SNAP 050103) have been updated according to the Energy Statistics for 2008 for the years 1980-2002.

Gasoline sales: The amounts of gasoline sales used for calculation of fugitive emissions from service stations (SNAP 050503) have been updated according to the Energy Statistics for 2008 for the years 1983-2007.

Service stations: The emission factors for NMVOC from service stations have been updated for both reloading of tankers and refuelling of vehicles for the years 2000-2008.

Data storage improvements for 1B2a2: This year the data storage Level 2 has been improved for 1B2a2 (SNAP 050201 – Land-based activities and SNAP 050202 – offshore activities). Data at SNAP-level have been split into two sources for each snap category; "Oil loading and transport", and "Pipelines" for land-based activities (SNAP 050201) and Extraction of oil and natural gas" and "Oil loading and transport" for offshore activities. Thereby the implied emission factors now refer to the sources separately instead of referring to a mix of sources. Emissions from the four sources are calculated on basis of the same activity data; Mg crude oil produced. . This does not change the emissions but only the activity data and the implied emission factors in the NFR tables.

Town gas: Emissions from distribution of town gas have been included in the emission inventory for the years 1985-2008. The input data are sparse as more of the distribution companies have been closed down. Only in the cities of Copenhagen and Aalborg town gas is still being distributed. Another two distribution companies are included in the inventory. Those were closed in 2004 and 2006, respectively. To complete the time-series interpolation and extrapolation has been used on basis of the available data. The uncertainties are expected to be large both regarding the distribution for years without data, the distribution loss and the gas composition.

Offshore flaring: The amounts of offshore flaring for the time-series have been reviewed and some changes have been carried out. As the calorific values and gas composition is not known for years before 2006 the emission calculations are changed so that they are now based on the flared amounts given in Nm3 instead of GJ as used in earlier emission inventories. The emission factors are still based on the EMEP/EEA guidebook, but contrary to earlier years the emission factors are not converted according to the gas quality data for Danish natural gas, which has been the best obtainable conversion factor. For $SO_2$, particulate matter, dioxin and PAHs the TIER 1 emission factors from the EMEP/EEA guidebook (2009) are used as is the case for natural gas combustion in CHP plants. As those factors are given per energy units they have to be converted to emissions per volume gas. This conversion is based on the average calorific value of the gas flared offshore in 2006-2008 which again is based on data from the ETS reports.

Flaring in storage and treatment plants: The same emission factors are adopted for flaring in storage and treatment plants as for offshore flaring for the components $SO_2$, $NO_x$, CO, particulate matter, dioxin and PAHs. The emissions of NMVOC are given by the plants in the environmental reports.

Flaring in refineries: The emission factors for flaring in refineries have been updated. The emission factors for NMVOC are based on new information from one of the refineries on the fuel gas composition. The same emission factors are adopted for the second Danish refinery. Emission factors from the EMEP/EEA guidebook (2009) are used to calculate emissions of $NO_x$ and CO. For $SO_2$, particulate matter, dioxin and PAHs the TIER 1 emission factors for stationary combustion from the EMEP/EEA guidebook (2009) are used.

### 3.4.9 Source specific planned improvements

The following future improvements are suggested.

Emissions from storage of fuels in tank facilities: The recent edition of the Danish emission inventory holds emissions from extraction of fuels, combustion of fuels and from service stations. To make the inventory complete emissions from storage of fuels in tank facilities should be included in the future if data is available. Work is going on to locate greater tank facilities in Denmark and collect the available data. In cases where no emission estimates or measurements are available a set of emission factors have to be set up.

Emissions from offshore extraction of oil and gas: The fugitive emissions from extraction of oil and gas are based on a standard formula. If a better estimate becomes available it will be implemented.

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# 4 Industrial processes (NFR sector 2)

## 4.1 Overview of the sector

The present sector *"Industrial processes"* (NFR sector 2) comprises combustion processes combined with *"process emissions"* (combustion in manufacturing industry - processes with contact) as well as process emissions without any contact with energy-related emissions. This means that the energy source may be power from central power plants or process heat from e.g. natural gas-fired boilers, turbines or stationary engines. The presentation is outlined as follows:

- Mineral products (NFR 2A) including "Other" (NFR 1A2f)
- Chemical industry (NFR 2B)
- Metal production (NFR 2C) including "Iron and steel" (NFR 1A2a) and "Non-ferrous metals" (NFR 1A2b)
- Other production i.e. food and drink (NFR 2D)

The industrial processes included in the Danish inventory are those in large companies, e.g. cement factories or steelworks, as well as a number of smaller companies e.g. iron foundries.

Table 4.1 presents a survey of sources and groups of pollutants included in the present survey as well as pollutants and sources that will be included in the survey. Explanations to the abbreviations are given below the table. Table 4.1 indicates that some groups of substances are planned to be included in the inventory. In addition to the indicated groups of substances some groups do not include all relevant substances or the time-series are not complete. Detailed information on this subject can be found in the following table with an indication of which substances that will be completed/improved in the inventory.

Table 4.1 Survey of industrial sector with SNAP-code and NFR-code included in the Danish inventory.

| Industrial sector | SNAP | NFR | Energy | $SO_X$/ $NO_X$/ $NH_3$ | NMVOC/CO | TSP/ $PM_{10/2.5}$ | HM | POP |
|---|---|---|---|---|---|---|---|---|
| Grey iron foundries | 030303 | 1A2a | i.e. | + | + | x | x | - |
| Secondary lead production | 030307 | 1A2b | i.e. | - | - | x | x | - |
| Secondary zinc production | 030308 | 1A2b | i.e. | - | - | x | + | - |
| Secondary aluminium production | 030310 | 1A2b | i.e. | - | - | x | + | - |
| Cement | 030311 | 1A2f | y | x | x | x | x | - |
| Lime (incl. iron, steel and paper pulp industry) | 030312 | 1A2f | i.e. | + | - | x | + | - |
| Asphalt concrete plants | 030313 | 1A2f | + | + | + | + | - | +/? |
| Container glass | 030315 | 1A2f | y | x | x | x | x | - |
| Glass wool | 030316 | 1A2f | i.e. | x/+ | - | x | + | - |
| Mineral wool | 030318 | 1A2f | y | x/+ | x | x | + | - |
| Paper mill industry | 030321 | 1A2d | y | - | + | x | - | - |
| Electric arc furnace | 040207 | 2C1 | - | - | - | x | x | +/? |
| Allied metal manufacturing | 040306 | 2C5 | - | - | - | + | x | - |
| Sulphuric acid | 040401 | 2B5 | - | x | - | - | - | - |
| Nitric acid | 040402 | 2B2 | y | x | - | x | - | - |
| NPK-fertiliser | 040407 | 2B5 | - | x | i.e. | x | i.e. | - |
| Other (catalysts) | 040416 | 2B5 | y | x | - | x | -/? | - |
| Pesticide production | 040525 | 2B5 | - | + | x | + | - | +/? |
| Biscuits, cakes and other bakery products | 040605 | 2D2 | i.e. | - | x | - | - | - |
| Bread (rye and wheat) | 040605 | 2D2 | i.e. | - | x | - | - | - |
| Beer | 040607 | 2D2 | i.e. | - | x | - | - | - |
| Ethanol, technical | 040608 | 2D2 | i.e. | - | x | - | - | - |
| Spirits, other | 040608 | 2D2 | i.e. | - | x | - | - | - |
| Sugar production | 040608 | 2D2 | y | - | x | - | - | - |
| Meat curing, fish and shellfish | 040627 | 2D2 | i.e. | - | x | - | - | - |
| Meat curing, meat | 040627 | 2D2 | i.e. | - | x | - | - | - |
| Meat curing, poultry | 040627 | 2D2 | i.e. | - | x | - | - | - |
| Margarine and solid cooking fats | 040698 | 2D2 | i.e. | - | x | - | - | - |
| Coffee roasting | 040699 | 2D2 | i.e. | - | x | - | - | - |
| Roof covering with asphalt materials | 040610 | 2A5 | - | - | x | - | - | +/? |
| Road paving with asphalt | 040611 | 2A6 | - | + | x | - | - | +/? |
| Cement (decarbonising) | 040612 | 2A1 | - | i.e. | - | - | + | - |
| Glass (decarbonising) | 040613 | 2A7 | - | i.e. | - | - | + | - |
| Lime (decarbonising) | 040614 | 2A2 | - | i.e. | - | - | + | - |
| Other (sugar, chemical ingredients, slaughterhouse waste) | 040617 | 2A7 | y | x/+ | x | x | - | +/? |
| Limestone and dolomite use | 040618 | 2A3 | - | i.e. | + | i.e. | i.e. | - |

x Included in the present inventory.
+ Will be included.
- Not included/not relevant.
i.e. Included elsewhere.
y Included in the present inventory.

## 4.2 Mineral products (NFR 1A2f/2A)

### 4.2.1 Source category description

The sub-sector *Mineral products* (NFR 1A2f/2A) cover the following processes:

- Production of cement (SNAP 030311/040612)
- Production of lime (quicklime) (SNAP 030312/040614)

- Production of container glass/glass wool (SNAP 030315/030316/040613)
- Production of mineral wool (SNAP 030318)
- Limestone and dolomite use (SNAP 040618)
- Roof covering with asphalt (SNAP 040610)
- Road paving with asphalt (SNAP 040611)
- Other (SNAP 040617; Danisco ingredients/Slaughterhouse waste)

The time-series for emission of acidifying substances, heavy metals, NMVOC and particulate matter from *Mineral products* (NFR 1A2f/2A) are presented in Table 4.2 and Table 4.3.

The emission of $SO_2$, $NO_X$ and CO from the production of cement depends on raw materials, fuels and combustion conditions. Emissions of $NO_X$ are, among other things, a consequence of high temperature processes and the emission shows only minor fluctuations. The emission follows the activity, with a minor decrease in recent years. The emission of $SO_2$ depends on the S-content in fuels and raw materials. However, the process acts as a sink for acidifying gases due to the alkaline conditions in the rotary kiln; see Figure 4.1. The emission of CO displays significant fluctuations that cannot be explained by known factors.

The emission of $NO_X$ from production of container glass is increasing slightly until 2004 and the decreasing significantly whereas the emission of CO is decreasing in the period 1990-2008. In the same period of time, the activity is nearly constant. Emissions of both substances are related to combustion/process conditions and will be investigated further. Emissions of the heavy metals lead, selenium and zinc are related to the raw materials used. Recycled glass constitutes a considerable part of raw materials and, therefore, the quality/purity of the glass is a determining factor. Emission of lead shows a decreasing trend that is in accordance with the attempts to avoid lead in glass as well as in wine bottle seals.

Production of glass wool is expected to result in emission of approximately the same pollutants as in production of container glass. $NH_3$ shows a decreasing trend from 1996-2008 as can be verified by the decreasing emission pr amount produced. Potential emissions of $NO_X$, CO and heavy metals are planned to be investigated and included in the inventory.

Table 4.2 Time-series for pollutants from *Mineral products 1A2f* (combustion/process emissions; metals: kg and other pollutants: tonnes).

| Pollutants | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SO_2$ | 2 128 | 2 467 | 2 655 | 2 680 | 2 682 | 2 706 | 2 804 | 3 631 | 3 372 | 2 186 |
| $NO_x$ | 6 953 | 8 468 | 9 329 | 9 450 | 9 443 | 9 569 | 10 138 | 10 306 | 10 478 | 9 583 |
| NMVOC | 98.3 | 116 | 124 | 125 | 131 | 136 | 132 | 136 | 129 | 113 |
| $NH_3$ | 489 | 489 | 489 | 489 | 489 | 489 | 475 | 561 | 552 | 560 |
| CO | 12 260 | 12 601 | 12 795 | 12 822 | 12 820 | 12 848 | 12 462 | 13 506 | 16 993 | 15 353 |
| TSP | | | | | | | | | | |
| $PM_{10}$ | | | | | | | | | | |
| $PM_{2.5}$ | | | | | | | | | | |
| As | 52.1 | 78.1 | 79.1 | 78.6 | 80.9 | 82.1 | 68.0 | 57.4 | 58.3 | 54.5 |
| Cd | 35.9 | 61.7 | 59.0 | 57.9 | 60.8 | 58.0 | 38.0 | 19.1 | 19.4 | 18.0 |
| Cr | 410 | 783 | 718 | 697 | 743 | 697 | 362 | 29.3 | 29.9 | 28.0 |
| Cu | 115 | 211 | 196 | 191 | 203 | 194 | 111 | 30.1 | 30.7 | 28.8 |
| Hg | 105 | 136 | 147 | 149 | 150 | 152 | 154 | 165 | 167 | 155 |
| Ni | 344 | 644 | 595 | 579 | 616 | 582 | 318 | 58.5 | 59.5 | 55.7 |
| Pb | 1 180 | 1 101 | 950 | 879 | 879 | 1 540 | 730 | 205 | 452 | 594 |
| Se | 339 | 316 | 276 | 255 | 271 | 464 | 227 | 290 | 91.8 | 236 |
| Zn | 245 | 243 | 227 | 211 | 217 | 292 | 200 | 171 | 187 | 184 |

| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| $SO_2$ | 1 692 | 2 156 | 1 431 | 1 470 | 1 929 | 1 827 | 2 209 | 2 161 | 1 875 |
| $NO_x$ | 10 451 | 10 300 | 9 417 | 8 624 | 8 685 | 8 660 | 8 378 | 7 348 | 6 178 |
| NMVOC | 118 | 108 | 107 | 89 | 102 | 103 | 106 | 105 | 125 |
| $NH_3$ | 497 | 444 | 358 | 334 | 363 | 335 | 337 | 353 | 374 |
| CO | 15 302 | 13 545 | 10 340 | 9 574 | 10 754 | 9 927 | 9 654 | 11 028 | 10 234 |
| TSP | 532 | 567 | 446 | 429 | 422 | 368 | 427 | 381 | 368 |
| $PM_{10}$ | 467 | 497 | 386 | 373 | 369 | 321 | 374 | 332 | 322 |
| $PM_{2.5}$ | 270 | 287 | 235 | 234 | 232 | 203 | 224 | 196 | 190 |
| As | 55.3 | 56.0 | 56.5 | 53.1 | 59.8 | 56.5 | 59.3 | 61.7 | 53.5 |
| Cd | 18.4 | 18.7 | 19.0 | 17.9 | 20.1 | 19.0 | 20.0 | 20.7 | 17.9 |
| Cr | 28.3 | 28.6 | 28.8 | 27.1 | 30.5 | 28.8 | 30.2 | 31.5 | 27.3 |
| Cu | 29.1 | 29.4 | 29.4 | 27.6 | 31.1 | 29.4 | 30.8 | 32.2 | 27.9 |
| Hg | 158 | 161 | 163 | 154 | 173 | 164 | 172 | 178 | 154 |
| Ni | 56.4 | 57.1 | 57.4 | 54.0 | 60.8 | 57.4 | 60.2 | 62.8 | 54.5 |
| Pb | 362 | 204 | 204 | 302 | 470 | 179 | 45.0 | 50.7 | 48.2 |
| Se | 359 | 290 | 290 | 252 | 245 | 126 | 79.3 | 74.1 | 64.3 |
| Zn | 198 | 167 | 168 | 160 | 177 | 168 | 175 | 182 | 161 |

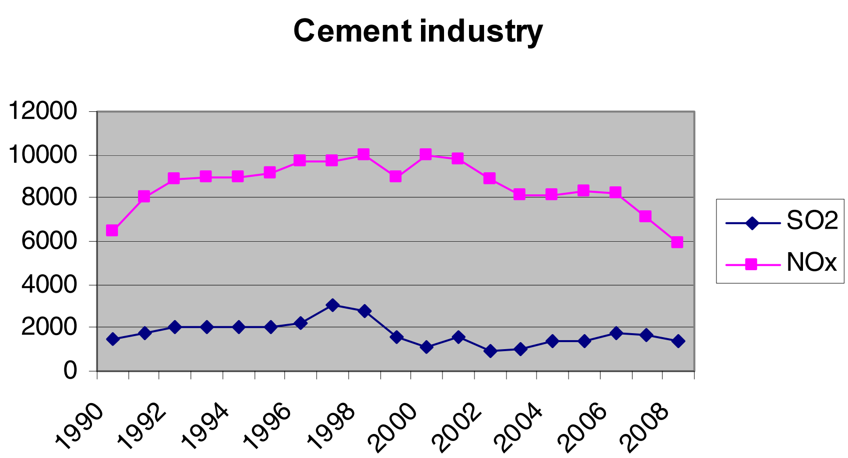


Figure 4.1 Emission of $NO_x$ and $SO_2$ from cement production.

Table 4.3 Time-series for pollutants from *Mineral products 2A* (process emissions; tonnes).

| Polluntants | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| $CH_4$ | 16.0 | 16.0 | 16.8 | 17.5 | 15.8 | 16.3 | 16.3 | 16.3 | 14.3 | 15.5 |
| CO | 241 | 241 | 252 | 263 | 237 | 245 | 245 | 245 | 215 | 234 |
| NMVOC | 654 | 655 | 656 | 658 | 654 | 655 | 656 | 648 | 654 | 617 |
| $NH_3$ | 24.2 | 32.4 | 32.2 | 35.1 | 32.1 | 31.5 | 31.2 | 30.0 | 31.4 | 36.3 |
| TSP | | | | | | | | | | |
| $PM_{10}$ | | | | | | | | | | |
| $PM_{2.5}$ | | | | | | | | | | |
| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| $CH_4$ | 14.8 | 13.0 | 13.0 | 13.3 | 18.5 | 18.2 | 18.2 | 23.1 | 20.7 | |
| CO | 223 | 196 | 196 | 199 | 278 | 275 | 274 | 347 | 311 | |
| NMVOC | 594 | 565 | 563 | 561 | 578 | 576 | 577 | 588 | 1 132 | |
| $NH_3$ | 34.0 | 31.9 | 47.9 | 157 | 167 | 132 | 96.4 | 112 | 112 | |
| TSP | 191 | 189 | 172 | -[1] | -[1] | -[1] | -[1] | -[1] | -[1] | |
| $PM_{10}$ | 47.8 | 47.3 | 43.0 | -[1] | -[1] | -[1] | -[1] | -[1] | -[1] | |
| $PM_{2.5}$ | 7.64 | 7.56 | 6.88 | -[1] | -[1] | -[1] | -[1] | -[1] | -[1] | |

1 Emission of TSP, $PM_{10}$, $PM_{2.5}$ are related to energy consumption from 2003.

The emission of NMVOC from production of chemical ingredients shows a decreasing trend and can probably be explained by the decreasing emission pr amount produced.

### 4.2.2 Methodological issues

The emissions of $SO_2$, $NO_X$, CO and TSP from the production of cement are measured yearly from 1997 to 2008 (TSP from 2000 to 2007) (Aalborg Portland, 2009). $PM_{10}$ and $PM_{2.5}$ are estimated from the distribution between TSP, $PM_{10}$ and $PM_{2.5}$ from CEPMEIP (2003). For the years 1990-1996, the emission has been estimated from the production of cement, expressed as TCE (total cement equivalents[12]), and emission factors from the company Aalborg Portland (Aalborg Portland, 2009). The emissions of heavy metals are measured in 1997 (Illerup et al., 1999) and estimated for the other years from emission factors (based on the measurements) and TCE. The activity has varied from 1.6 million tonne TCE in 1990 to 2.55 million tonne TCE in 2008.

The emission of $NO_X$, CO, TSP, lead, selenium, and zinc from production of container glass is measured yearly from 1997 to 2008 (TSP from 2000 to 2008) (Ardagh Glass Holmegaard, 2009). $PM_{10}$ and $PM_{2.5}$ are estimated from the distribution between TSP, $PM_{10}$ and $PM_{2.5}$ from CEPMEIP (2003). For 1990 to 1996, emissions of arsenic, cadmium, chromium, copper, mercury and nickel are estimated from standard emission factors and activity data. For 1997 to 2008, the energy related emissions are estimated from emission factors and the actual energy consumption. This change in methodology results in inconsistency in the emission trend that cannot be explained by natural factors. Emission factors for lead, selenium, and zinc from 1990 to

[12] TCE (total cement equivalent) express the total amount of cement produced for sale and the theoretical amount of cement from the produced amount of clinker for sale.

1996 are estimated by interpolation from the 1990 and 1997 figures (Illerup et al., 1999).

The emission of $NH_3$ and TSP from the production of glass wool has been measured yearly from 1996 to 2008 (TSP from 2000 to 2008) (Saint-Gobain Isover, 2009). $PM_{10}$ and $PM_{2.5}$ are estimated from the distribution between TSP, $PM_{10}$ and $PM_{2.5}$ from CEPMEIP (2003). The activity has varied between 33 600 and 41 318 tonnes glass wool from 1996 to 2008 and, during the same period, the emission decreased from approximately 300 to 155 tonne $NH_3$.

The emission of NMVOC from production of chemical ingredients has been measured from 1996 to 2008 (Danisco Grindsted, 2009). The emission has decreased from 100 to 15 tonnes NMVOC in this period. However, no explanation can be given on these conditions, as information on activity is not available.

The emissions from asphalt roofing and road paving have been estimated from production statistics compiled by Statistics Denmark and default emission factors presented by IPCC/Corinair. The default emission factors are presented in Table 4.4.

Table 4.4 Default emission factors for application of asphalt products.

| | | Road paving with asphalt | Use of cutback asphalt | Asphalt Roofing |
|---|---|---|---|---|
| $CH_4$ | g pr tonnes | 5 | 0 | 0 |
| CO | g pr tonnes | 75 | 0 | 10 |
| NMVOC | g pr tonnes | 15 | 64 935 | 80 |
| Carbon content fraction of NMVOC | % | 0.667 | 0.667 | 0.8 |

### 4.2.3 Uncertainties and time-series consistency

The time-series are presented in Table 4.2 and Table 4.3. The methodologies applied for the different sources within *Mineral products* are considered to be consistent either as measurements or emission factors based on the measurements. However, not all the sources are considered to be complete regarding pollutants and these are expected to be completed in the next inventory, either by use of company-specific information or by application of general emission factors.

The time-series for emissions from production of cement are based on measurements combined with emissions factors based on the measurements.

### 4.2.4 Source specific QA/QC and verification

The emission factors have been verified and the order of magnitude confirmed by comparison with standard emission factors (EMEP/CORINAIR, 2007; CEPMEIP, 2003). Detailed discussion of QA/QC can be found in Nielsen et al. (2008).

### 4.2.5 Source specific recalculations

No source specific recalculation has been performed for the sector *Mineral products*.

### 4.2.6 Source specific planned improvements

The inventory will be improved regarding coverage of pollutants included. Especially glass wool, mineral wool, chemical ingredients and production of sugar will be extended. The incomplete time-series will also be completed. The inconsistent methodology applied for emission of As, Cd, Cr, Cu, Hg, and Ni from glass production will be improved.

## 4.3 Chemical industry (NFR 2B)

### 4.3.1 Source category description

The sub-sector *Chemical industry* (NFR 2B) covers the following processes:

- Production of nitric acid/fertiliser (SNAP 040402/040407)
- Production of catalysts/fertilisers (SNAP 040416/040407)
- Production of pesticides (SNAP 040525)

The time-series for emission of acidifying substances, NMVOC and particulate matter from *Chemical industry* (NFR 2B) are presented in Table 4.5.

Table 4.5 Time-series for pollutants from *Chemical industry 2B* (tonnes).

| Pollutant | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SO_2$ | 636 | 496 | 600 | 461 | 514 | 406 | 247 | 397 | 408 | 487 |
| $NO_x$ | 842 | 778 | 691 | 619 | 636 | 648 | 543 | 611 | 472 | 509 |
| $NH_3$ | 25.0 | 35.0 | 48.0 | 62.0 | 104 | 75.0 | 75.0 | 50.0 | 25.0 | 33.0 |
| NMVOC | 390 | 150 | 62.0 | 40.0 | 54.0 | 57.0 | 113 | 44.0 | 40.0 | 41.0 |
| TSP | | | | | | | | | | |
| $PM_{10}$ | | | | | | | | | | |
| $PM_{2.5}$ | | | | | | | | | | |
| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| $SO_2$ | 421 | 449 | 436 | 321 | 340 | 402 | 258 | 36.0 | 13.0 | |
| $NO_x$ | 447 | 422 | 419 | 475 | 302 | 30.2 | 37.0 | 18.0 | 19.0 | |
| $NH_3$ | 27.0 | 101 | 93.0 | 113 | 101 | 79.0 | 88.0 | 107 | 111 | |
| NMVOC | 29.0 | 29.0 | 26.7 | 25.4 | 31.4 | 25.7 | 25.3 | 24.0 | 23.9 | |
| TSP | 362 | 346 | 310 | 323 | 192 | -[1] | -[1] | -[1] | -[1] | |
| $PM_{10}$ | 290 | 277 | 248 | 258 | 153 | -[1] | -[1] | -[1] | -[1] | |
| $PM_{2.5}$ | 217 | 208 | 186 | 194 | 115 | -[1] | -[1] | -[1] | -[1] | |

1 Nitric acid production ceased in 2004.

The time-series for $SO_2$ follows the amount of sulphuric acid produced, i.e. the fluctuation follows the activity until the activity ceased in 1997. The same is the case for $NO_X$ from production of nitric acid; however, the emission of $NO_X$ pr amount produced is decreasing from 1994 to 2004; see Figure 4.2. The emission of $NH_3$ does not follow the activity as it appears from the fluctuation in the emission pr amount produced. The production of nitric acid and fertiliser stopped in the middle of 2004.

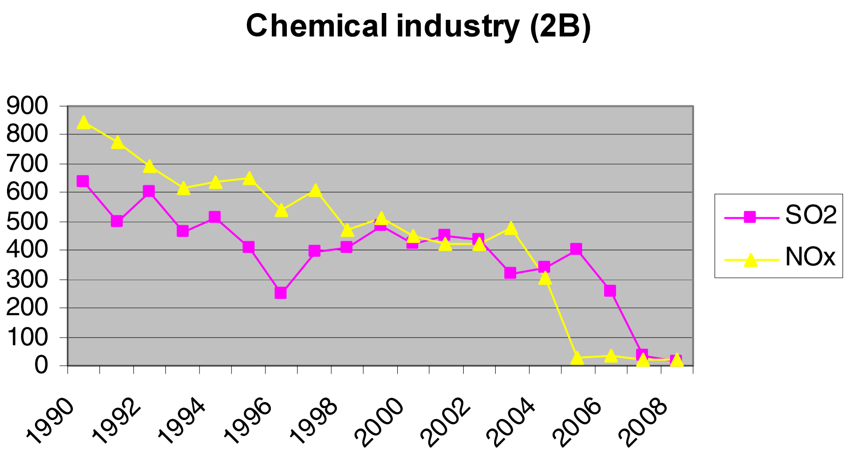


Figure 4.2 Emission of $NO_x$ and $SO_2$ from Chemical industry (2B).

The emission of $NO_X$ from production of catalysts/fertilisers decreases from 1996 to 2007, whereas the emission of $NH_3$ increases. Fluctuations and the increase in the "emission factor" can explain the increase in $NH_3$ emission.

The emission of NMVOC from production of pesticides reduced significantly from 1990 to 2008 (Cheminova, 2009). The decrease can probably be explained by introduction of flue gas cleaning equipment rather than any decrease in activity. The emission of $SO_2$ is from the sulfur regeneration plant (Claus plant).

The time-series will be explained further in the following section.

### 4.3.2 Methodological issues

The emission of $SO_2$, $NO_X$, $NH_3$ and TSP from production of sulfuric acid, nitric acid and fertiliser is measured yearly or estimated, from 1990 to 2004 (TSP from 2000 to 2004) (Kemira GrowHow, 2005). $PM_{10}$ and $PM_{2.5}$ are estimated from the distribution between TSP, $PM_{10}$ and $PM_{2.5}$ from CEPMEIP (2003). The emission for $SO_2$ and $NO_X$ for 1991 to 1993 was estimated by using interpolated emission factors and activity data. Production of sulphuric acid was stopped in 1997. The emission factor for $SO_2$ fluctuated and the emission factor for $NO_X$ decreased from 1990 to 2004. Production of sulphuric acid decreased from approximately 150 000 to 60 000 tonnes from 1990 to 1996, and production of nitric acid decreased from approximately 450 000 to 229 000 tonnes from 1990 to 2004. Overall, production of fertiliser decreased from approximately 800 000 to approximately 395 000 tonnes from 1990 to 2004.

The emission of $NH_3$, $NO_X$ and TSP from production of catalysts and fertilisers is measured yearly from 1996 to 2008 (TSP from 2000 to 2008) (Haldor Topsøe, 2009). $PM_{10}$ and $PM_{2.5}$ are estimated from the distribution between TSP, $PM_{10}$ and $PM_{2.5}$ from CEPMEIP (2003). The process-related $NO_X$ emission has been estimated as 80 % of the total $NO_X$ emission; Haldor Topsøe reports this assumption in their environmental report. The emission of $NH_3$ shows an increasing trend and varies between 13 and 111 tonne from 1990 to 2008. In the same period, the production of catalysts and fertilisers increased from approximately 33 000 to 59 000 tonnes.

The emission of NMVOC from production of pesticides is measured yearly from 1990 to 2000 (Cheminova, 2009) and estimated for 2001 to 2008. An emission factor based on 2000 figures is used for estimation of 2001 to 2008 emissions. The emission of NMVOC shows a decreasing trend from 1990 to 2008.

### 4.3.3 Uncertainties and time-series consistency

The time-series are either based on specific measurements or by using company-specific emission factors and activity data. Therefore, the time-series are considered to be consistent.

### 4.3.4 Source specific QA/QC and verification

The emission factors for production of nitric acid and sulphuric acid have been verified by comparison with standard emission factors (EMEP/CORINAIR, 2007). Detailed discussion of QA/QC can be found in Nielsen et al. (2008).

### 4.3.5 Source specific recalculations

No source specific recalculation has been performed for the sector *Chemical industry*.

### 4.3.6 Source specific planned improvements

No source specific improvements are planned.

## 4.4 Metal production (NFR 1A2/2C)

### 4.4.1 Source category description

The sub-sector *Metal production* (NFR 1A2/2C) covers the following processes:

- Steelworks (SNAP 040207)
- Iron foundries (SNAP 030303)
- Secondary lead production (SNAP 030307)
- Secondary zinc production (SNAP 030308)
- Secondary aluminium production (SNAP 030310)
- Allied metal manufacturing (SNAP 040306)

The time-series for emission of heavy metals and particulate matter from *Metal production* (NFR 1A2/2C) are presented in Table 4.6 and Table 4.7.

The emission inventory for metal production is based on specific emissions from steelworks and secondary aluminium manufacturing as well as average emission factors for iron foundries, secondary lead and zinc manufacturing, and allied metal manufacturing. Regarding the steelworks that use iron and steel scrap as raw material, the emissions to a large degree depend on the quality of the scrap. This fact may result in large annual variations for one or more of the heavy metals. This may be the case for iron foundries, as they also use scrap as raw material, but they have not been subject to the same requirements to analyse emissions of heavy metals to air.

Table 4.6 Time-series for pollutants from *Metal production 1A2ab* (combustion/process emissions; metals: kg and other pollutants: tonnes).

| Pollutant | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| TSP | | | | | | | | | | |
| $PM_{10}$ | | | | | | | | | | |
| $PM_{2.5}$ | | | | | | | | | | |
| As | 30.9 | 30.1 | 29.3 | 28.6 | 27.8 | 27.1 | 26.3 | 25.5 | 25.7 | 25.8 |
| Cd | 14.5 | 14.1 | 13.8 | 13.4 | 13.1 | 12.7 | 12.3 | 12.0 | 12.1 | 12.1 |
| Cr | 113 | 110 | 108 | 105 | 102 | 99.2 | 96.4 | 93.6 | 94.4 | 94.6 |
| Cu | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 |
| Hg | ne | ne | ne | ne | ne | ne | ne | ne | ne | ne |
| Ni | 134 | 131 | 127 | 124 | 121 | 117 | 114 | 111 | 112 | 112 |
| Pb | 750 | 732 | 713 | 695 | 676 | 658 | 639 | 621 | 627 | 628 |
| Se | 515 | 502 | 489 | 477 | 464 | 451 | 438 | 426 | 429 | 430 |
| Zn | 515 | 502 | 489 | 477 | 464 | 451 | 438 | 426 | 429 | 430 |
| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| TSP | 227 | 206 | 207 | 200 | 204 | 205 | 192 | 187 | 188 | |
| $PM_{10}$ | 88.7 | 82.6 | 81.8 | 75.6 | 74.9 | 79.7 | 78.7 | 79.4 | 79.9 | |
| $PM_{2.5}$ | 22.8 | 22.0 | 21.3 | 18.6 | 17.8 | 20.6 | 21.7 | 22.8 | 23.0 | |
| As | 28.9 | 25.7 | 26.2 | 26.2 | 27.2 | 26.2 | 23.6 | 22.2 | 22.2 | |
| Cd | 13.6 | 12.1 | 12.3 | 12.3 | 12.8 | 12.3 | 11.1 | 10.5 | 10.5 | |
| Cr | 106 | 94.3 | 96.0 | 96.0 | 100 | 96.0 | 86.4 | 81.5 | 81.5 | |
| Cu | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | |
| Hg | ne | ne | ne | ne | ne | ne | ne | ne | ne | |
| Ni | 125 | 111 | 113 | 113 | 118 | 113 | 102 | 96.4 | 39.4 | |
| Pb | 703 | 626 | 637 | 637 | 661 | 637 | 574 | 542 | 542 | |
| Se | 482 | 429 | 437 | 437 | 453 | 436 | 393 | 371 | 371 | |
| Zn | 482 | 429 | 437 | 437 | 453 | 436 | 393 | 371 | 371 | |

Ne: not estimated.

Table 4.7 Time-series for pollutants from *Metal production 2C* (process emissions; metals: kg and other pollutants: tonnes).

| Pollutant | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| TSP | | | | | | | | | | |
| $PM_{10}$ | | | | | | | | | | |
| $PM_{2.5}$ | | | | | | | | | | |
| Cd | 42.6 | 42.7 | 42.8 | 46.3 | 49.8 | 49.5 | 46.4 | 34.5 | 42.6 | 6.96 |
| Cr | 6.75 | 6.75 | 6.75 | 7.35 | 7.95 | 7.89 | 7.00 | 0.00 | 1.00 | 0.00 |
| Cu | 39.0 | 39.9 | 40.8 | 41.7 | 42.6 | 43.5 | 44.0 | 45.3 | 45.3 | 45.3 |
| Hg | 136 | 136 | 136 | 148 | 160 | 158 | 147 | 84.0 | 60.6 | 49.5 |
| Ni | 272 | 272 | 272 | 296 | 320 | 318 | 294 | 228 | 112 | 86.1 |
| Pb | 731 | 733 | 734 | 795 | 856 | 851 | 794 | 704 | 441 | 735 |
| Zn | 5 891 | 5 905 | 5 917 | 6 404 | 6 892 | 6 852 | 6 398 | 5 656 | 3 050 | 2 755 |
| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| TSP | 41.0 | 93.0 | -[1] | -[1] | -[1] | 32.5 | -[1] | -[1] | -[1] | |
| $PM_{10}$ | 39.0 | 88.0 | -[1] | -[1] | -[1] | 30.8 | -[1] | -[1] | -[1] | |
| $PM_{2.5}$ | 25.0 | 56.0 | -[1] | -[1] | -[1] | 19.6 | -[1] | -[1] | -[1] | |
| Cd | 24.5 | 40.5 | 4.53 | 4.53 | 4.53 | 4.53 | 4.53 | 4.53 | 4.53 | |
| Cr | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| Cu | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45,3 | |
| Hg | 90.0 | 184 | -[1] | -[1] | -[1] | 63.9 | -[1] | -[1] | -[1] | |
| Ni | 60.0 | 123 | -[1] | -[1] | -[1] | 42.6 | -[1] | -[1] | -[1] | |
| Pb | 508 | 939 | 68.0 | 68.0 | 68.0 | 370 | 68.0 | 68.0 | 68.0 | |
| Zn | 2 024 | 3 420 | 634 | 634 | 634 | 1 600 | 634 | 634 | 634 | |

1 Steelwork was closed 2002-2004 and from 2006 .

The steelworks closed in the beginning of 2002 and re-opened at the end of 2004. The electro steelwork has been closed again from 2006; whereas manufacturing of steel sheets has continued separated from the electro steelwork.

### 4.4.2 Methodological issues

The emission of heavy metals and TSP from the production of steel bars and sheets from steel scrap are based on measurements from the company Stålvalseværket (Stålvalseværket, 2002). $PM_{10}$ and $PM_{2.5}$ are estimated from the distribution between TSP, $PM_{10}$ and $PM_{2.5}$ from CEPMEIP (2003). The distribution of metals for 1995/96 (Illerup et al., 1999) is used in estimation of the different metals for the following years. The activity has varied between approximately 600 000 and 800 000 tonnes from 1990 to 2001. The production ceased in the beginning of 2002 and restarted at the end of 2004 with regard to melting of steel scrap in the electric arc furnace. The production of steel bars at the steelwork is assumed to be 1/3 of the production in 2001; the steelwork has been closed from end of 2005/beginning of 2006.

The emission of heavy metals from iron foundries is based on standard emission factors and yearly production statistics from The Association of Danish Foundries. The emission of TSP and distribution between TSP, $PM_{10}$ and $PM_{2.5}$ is obtained from CEPMEIP (2003).

The emission of heavy metals from production of secondary lead and allied metal manufacturing is based on average emission factors for Danish producers (Illerup et al., 1999) and activity data from Statistics Denmark. The emission of TSP and distribution between TSP, $PM_{10}$ and $PM_{2.5}$ is obtained from CEPMEIP (2003).

### 4.4.3 Uncertainties and time-series consistency

The time-series are either based on specific measurements, company-specific emission factors combined with activity data or on standard emission factors combined with public statistics. The same methodology has been applied for the entire time-series and, therefore, the time-series are considered to be consistent.

### 4.4.4 Source specific recalculations

No source specific recalculation has been performed for the sector *Metal production*.

### 4.4.5 Source specific QA/QC and verification

Detailed discussion of QA/QC can be found in Nielsen et al. (2008)

### 4.4.6 Source specific planned improvements

The time-series will be completed and new emission factors for the latest years will be established, if possible. Especially for secondary aluminium and zinc production, potential emissions of heavy metals will be investigated.

## 4.5 Other production (NFR 2D)

### 4.5.1 Source category description

The sub-sector *Other production* (NFR 2D) covers the following process:

- Bread (SNAP 040605)
- Beer (SNAP 040607)
- Spirits (SNAP 040608)
- Sugar production (SNAP 040625)
- Meat (fish etc. frying/curing) (SNAP 040627)
- Margarine and solid cooking fats (SNAP 040698)
- Coffee roasting (SNAP 040699)

Table 4.1 and Table 4.2 present the emission of NMVOC from production of food and beverage. The emissions are presented for relevant subsectors.

Table 4.1 Emission of NMVOC from production of beer and spirits (tonne NMVOC).

| | 1990[1] | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| Beer | 581.5 | 604.5 | 611.0 | 589.7 | 588.1 | 619.0 | 599.5 | 573.8 | 502.7 | 512.8 |
| Spirits | 32.10 | 31.73 | 29.90 | 29.89 | 38.74 | 31.29 | 29.21 | 26.75 | 26.38 | 23.88 |
| Ethanol, technical | 51.91 | 53.78 | 67.74 | 72.98 | 80.82 | 77.35 | 88.76 | 88.22 | 85.35 | 69.10 |
| Sum | 665.5 | 690.0 | 708.6 | 692.6 | 707.7 | 727.6 | 717.4 | 688.8 | 614.4 | 605.8 |
| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| Beer | 465.9 | 452.1 | 512.7 | 522.0 | 534.4 | 542.5 | 510.6 | 478.6 | 404.6 | |
| Spirits | 23.57 | 23.44 | 24.96 | 25.52 | 23.77 | 22.07 | 20.07 | 16.56 | 11.90 | |
| Ethanol, technical | 72.24 | 78.22 | 76.73 | 72.39 | 70.74 | 83.12 | 81.34 | 62.65 | 76.78 | |
| Sum | 561.7 | 553.7 | 614.3 | 619.9 | 628.9 | 647.7 | 612.0 | 557.8 | 493.3 | |

Table 4.2 Emission of NMVOC from production of bread and cookies, meat curing (meat, poultry, fish, and shellfish), production of margarine and solid cooking fats, roasting of coffee (tonne NMVOC).

| | 1990[1] | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| Biscuits, cookies and other bakery products | 98.57 | 123.4 | 128.8 | 135.8 | 138.1 | 148.2 | 163.6 | 163.0 | 149.6 | 130.9 |
| Bread (rye and wheat) | 1 516 | 1 641 | 1 565 | 1 664 | 1 743 | 1 846 | 1 702 | 1 917 | 1 978 | 1 873 |
| Meat | 443.3 | 464.8 | 499.3 | 538.5 | 539.0 | 527.6 | 526.9 | 534.8 | 564.2 | 565.5 |
| Poultry | 39.42 | 41.67 | 46.53 | 50.19 | 51.75 | 51.90 | 51.03 | 52.77 | 57.15 | 60.72 |
| Fish and shellfish | 493.1 | 582.0 | 674.2 | 578.2 | 668.7 | 708.0 | 580.3 | 641.2 | 571.8 | 543.7 |
| Liquid fats and oils | - | - | - | - | - | - | - | - | - | - |
| Solid fats and oils | 2 307 | 2 360 | 2 379 | 2 210 | 2 005 | 1 983 | 1 934 | 2 171 | 2 269 | 2 045 |
| Coffee, not roasted, not decaffeinated, supply | 28.65 | 27.82 | 30.65 | 30.32 | 30.38 | 26.88 | 30.30 | 28.70 | 30.34 | 33.13 |
| Total emission | 4 927 | 5 241 | 5 324 | 5 207 | 5 177 | 5 292 | 4 988 | 5 509 | 5 621 | 5 252 |
| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| Biscuits, cookies and other bakery products | 138.5 | 145.6 | 150.6 | 156.0 | 165.1 | 157.2 | 148.7 | 136.4 | 124.2 | |
| Bread (rye and wheat) | 1 952 | 2 166 | 2 017 | 1 973 | 2 047 | 2 060 | 2 164 | 2 050 | 2 035 | |
| Meat | 559.2 | 587.3 | 600.8 | 599.3 | 615.5 | 602.8 | 587.5 | 604.8 | 573.8 | |
| Poultry | 60.51 | 64.83 | 65.28 | 59.91 | 57.87 | 56.25 | 51.33 | 51.72 | 52.86 | |
| Fish and shellfish | 578.0 | 568.6 | 551.7 | 450.0 | 452.7 | 404.5 | 370.5 | 313.8 | 295.3 | |
| Liquid fats and oils | - | - | - | - | - | - | - | - | - | |
| Solid fats and oils | 1 957 | 1 782 | 2 250 | 2 090 | 2 103 | 2 002 | 1 817 | 1 914 | 1 911 | |
| Coffee, not roasted, not decaffeinated, supply | 30.59 | 32.42 | 31.27 | 28.05 | 30.05 | 20.11 | 19.32 | 18.22 | 18.55 | |
| Total emission | 5 276 | 5 346 | 5 667 | 5 356 | 5 471 | 5 302 | 5 158 | 5 089 | 5 011 | |

The emission of NMVOC from production of food and beverage follows the activity as the same emission factors have been used for the entire period. The emission factors are presented in Table 4.3

### 4.5.2 Methodological issues

The emission of NMVOC from production of food and beverage is estimated from production statistics (Statistics Denmark) and standard emission factors from the IPCC guidelines (IPCC (1997) Vol. 3, Table 2-24/2-25) combined with the UNECE Guidebook (EMEP/CORINAIR, 2007 and Gibson et al., 1995); see Table 4.3.

Table 4.3 Emission factors for NMVOC applied within production of food and beverage; activity is given as 1 000 l or tonne of product.

| Beverage | kg NMVOC/1 000 l |
|---|---|
| Beer | 0.625 |
| Spirits | 4 |
| Ethanol, technical | 4 |
| Food | kg NMVOC/tonne |
| Meat, fish and poultry | 0.3 |
| Sugar | 10 |
| Margarine and solid cooking fats | 10 |
| Cakes, biscuits and breakfast cereals | 1 |
| Bread | 8 |
| Coffee roasting | 0.55 |

The activity data used in the estimates are presented in Table 4.4 and Table 4.5.

Table 4.4 Production of beer and spirits (1000 l) (Statistics Denmark, 2009).

| | 1990[1] | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| Beer | 930 405 | 967 177 | 977 541 | 943 504 | 941 020 | 990 321 | 959 132 | 918 055 | 804 354 | 820 502 |
| Spirits | 8 026 | 7 933 | 7 474 | 7 472 | 9 684 | 7 823 | 7 303 | 6 687 | 6 596 | 5 969 |
| Ethanol, technical | 12 977 | 13 444 | 16 936 | 18 245 | 20 204 | 19 338 | 22 190 | 22 056 | 21 336 | 17 276 |
| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| Beer | 745 492 | 723 311 | 820 242 | 835 184 | 854 988 | 868 041 | 816 890 | 765 789 | 647 402 | |
| Spirits | 5 893 | 5 861 | 6 240 | 6 379 | 5 943 | 5 518 | 5 018 | 4 140 | 2 976 | |
| Ethanol, technical | 18 059 | 19 556 | 19 183 | 18 097 | 17 686 | 20 780 | 20 336 | 15 663 | 19 195 | |

Table 4.5 Production statistics for production (or supply of) of bread and cookies, meat curing (meat, poultry, fish, and shellfish), production of margarine and solid cooking fats, roasting of coffee (tonne) (Statistics Denmark, 2009).

| | 1990[1] | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| Biscuits, cookies and other bakery products | 98 574 | 123 393 | 128 792 | 135 796 | 138 136 | 148 247 | 163 634 | 162 958 | 149 580 | 130 944 |
| Bread (rye and wheat) | 189 562 | 205 111 | 195 648 | 207 987 | 217 932 | 230 762 | 212 701 | 239 621 | 247 309 | 234 153 |
| Meat | 1 477 700 | 1 549 400 | 1 664 300 | 1 795 000 | 1 796 600 | 1 758 800 | 1 756 200 | 1 782 700 | 1 880 500 | 1 884 900 |
| Poultry | 131 400 | 138 900 | 155 100 | 167 300 | 172 500 | 173 000 | 170 100 | 175 900 | 190 500 | 202 400 |
| Fish and shellfish | 1 643 648 | 1 940 020 | 2 247 327 | 1 927 206 | 2 228 849 | 2 360 076 | 1 934 419 | 2 137 490 | 1 905 973 | 1 812 459 |
| Liquid fats and oils | 348 919 | 402 268 | 407 585 | 404 052 | 427 384 | 494 388 | 425 774 | 357 637 | 386 604 | 389 959 |
| Solid fats and oils | 230 705 | 236 014 | 237 921 | 221 026 | 200 548 | 198 274 | 193 380 | 217 120 | 226 929 | 204 485 |
| Coffee, not roasted, not decaffeinated, supply | 52 086 | 50 588 | 55 725 | 55 126 | 55 235 | 48 870 | 55 097 | 52 177 | 55 169 | 60 243 |

| *Continued* | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| Biscuits, cookies and other bakery products | 138 488 | 145 566 | 150 596 | 156 018 | 165 139 | 157 214 | 148 683 | 136 397 | 124 170 |
| Bread (rye and wheat) | 244 060 | 270 707 | 252 163 | 246 639 | 255 813 | 257 444 | 270 493 | 256 265 | 254 373 |
| Meat | 1 864 000 | 1 957 600 | 2 002 500 | 1 997 600 | 2 051 500 | 2 009 400 | 1 958 200 | 2 016 100 | 1 912 800 |
| Poultry | 201 700 | 216 100 | 217 600 | 199 700 | 192 900 | 187 500 | 171 100 | 172 400 | 176 200 |
| Fish and shellfish | 1 926 516 | 1 895 372 | 1 838 940 | 1 500 075 | 1 508 929 | 1 348 424 | 1 235 158 | 1 046 152 | 984 407 |
| Liquid fats and oils | 386 832 | 313 581 | 338 622 | 411 321 | 497 364 | 539 074 | 622 761 | 595 785 | 534 976 |
| Solid fats and oils | 195 679 | 178 171 | 225 037 | 208 980 | 210 337 | 200 170 | 181 654 | 191 405 | 191 082 |
| Coffee, not roasted, not decaffeinated, supply | 55 617 | 58 947 | 56 857 | 51 009 | 54 638 | 36 555 | 35 134 | 33 121 | 33 720 |

### 4.5.3 Uncertainties and time-series consistency

The time-series is based on the same methodology throughout, using public statistics and standard emission factors. Therefore, the time-series is considered to be consistent.

### 4.5.4 Source specific recalculations

The sector *Other production* has been extended to include production of bread, spirits, sugar, margarine and cooking fats, meat curing and coffee roasting.

### 4.5.5 Source specific QA/QC and verification

No source specific QA/QC and verification has been performed for the sector *Other production*.

### 4.5.6 Source specific planned improvements

The time-series for emission of NMVOC from production of beer is planned to be completed. Furthermore, production of bread and other food products are planned to be included in the next inventory.

## 4.6 Uncertainty estimates

Uncertainty estimates for industrial processes (SNAP 04) are presented in Table 4.9. The uncertainty estimates are based on standard uncertainty factors (EMEP/CORINAIR, 2007).

Table 4.9 Uncertainty estimates for industrial processes (%).

| | Activity data uncertainty | Emission factor uncertainty | Overall 2005 | Trend |
|---|---|---|---|---|
| $SO_2$ | 2 | 20 | 20.100 | 0.575 |
| $NO_x$ | 2 | 50 | 50.040 | 0.064 |
| NMVOC | 50 | 50 | 70.711 | 63.985 |
| CO | 50 | 100 | 50.040 | 3.652 |
| $NH_3$ | 2 | 1000 | 1000.002 | 12.80 |
| Cadmium | 2 | 1000 | 1000.002 | 0.299 |
| Copper | 2 | 1000 | 1000.002 | 3.291 |
| Lead | 2 | 1000 | 1000.002 | 0.064 |
| Zinc | 2 | 1000 | 1000.002 | 0.149 |

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# 5 Solvents and other product use (NFR sector 3)

## 5.1 Overview of the sector

This report presents the Danish methodology used for calculating $CO_2$, $N_2O$ and NMVOC emissions from use of solvents in industrial processes and households that are related the source categories Paint application (NFR sector 3A), Degreasing and dry cleaning (NFR sector 3B), Chemical products, manufacture and processing (NFR sector 3C) and Other (NFR sector 3D). NMVOCs are not considered direct greenhouse gases but once emitted in the atmosphere they will over a period of time oxidise to $CO_2$. Furthermore NMVOCs act as precursors to the formation of ozone.

Solvents are chemical compounds that are used on a global scale in industrial processes and as constituents in final products to dissolve e.g. paint, cosmetics, adhesives, ink, rubber, plastic, pesticides, aerosols or are used for cleaning purposes, i.e. degreasing. NMVOCs are main components in solvents - and solvent use in industries and households is typically the dominant source of anthropogenic NMVOC emissions (UNFCCC, 2008; Pärt, 2005; Karjalainen, 2005). In industrial processes where solvents are produced or used NMVOC emissions to air and as liquid can be recaptured and either used or destroyed. Solvent containing products are used indoor and outdoor and the majority of solvent sooner or later evaporate. A small fraction of the solvent ends up in waste or as emissions to water and may finally also contribute to air pollution by evaporation from these compartments. Emission inventories for solvents are based on model estimates, as direct and continuous emissions are only measured from a limited number of pollutants and sources, e.g. $SO_2$ and NOx from central power plants.

In this section the methodology for the Danish NMVOC emission inventory for solvent use is presented and the results for the period 1995 – 2008 are summarised. The method is based on the detailed approach described in EMEP/CORINAIR (2004) and emissions are calculated for industrial sectors, households in the NFR sectors mentioned above, as well as for individual chemicals.

## 5.2 Source category emissions

Table 5.1 and Figure 5.1 show the emissions of chemicals from 1985 to 2008, where the used amounts of single chemicals have been assigned to specific products and NFR sectors. The methodological approach for finding emissions in the period 1995 - 2008 is described in the following section. A linear extrapolation is made for the period 1985 – 1994. A general decrease is seen throughout the sectors. Table 5.2 shows the used amounts of chemicals for the same period. Table 5.1 is derived from Table 5.2 by applying emission factors relevant to individual chemicals and production or use activities. Table 5.3 showing the used amount of products is derived from Table 5.2, by assessing the amount of chemicals that is comprised within products belonging to each of the four source categories. The $CO_2$ conversion factor for each chemical is shown in Table 5.4.

In Table 5.4 the emission for 2008 is split into individual chemicals. The most abundantly used solvents are ethanol, turpentine, or white spirit defined as a mixture of stoddard solvent and solvent naphtha and propylalcohol. Ethanol is used as solvent in the chemical industry and as windscreen washing agent. Turpentine is used as thinner for paints, lacquers and adhesives. Propylalcohol is used in cleaning agents in the manufacture of electrical equipment, flux agents for soldering, as solvent and thinner and as windscreen washing agent. Household emissions are dominated by propane and butane, which are used as aerosols in spray cans, primarily in cosmetics. For some chemicals the emission factors are precise but for others they are rough estimates. Emission factors are divided into four categories: 1) chemical industry (lowest EF), 2) other industry, 3) non-industrial activities, 4) domestic and other diffuse use (highest EF). This implies that high emission factors are applicable for use of solvent containing products and lower emission factors are applicable for use in industrial processes.

Table 5.1 Emission of chemicals in Gg pr year.

| Total emissions Gg pr year | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Paint application (3A) | 11.6 | 11.3 | 11.0 | 10.6 | 10.3 | 9.93 | 9.59 | 9.24 | 8.90 | 8.56 | 6.89 | 8.46 |
| Degreasing and dry cleaning (3B) | 1.0E-04 | 1.0E-04 | 9.6E-05 | 9.1E-05 | 8.7E-05 | 8.3E-05 | 7.9E-05 | 7.4E-05 | 7.0E-05 | 6.6E-05 | 7.7E-05 | 7.4E-05 |
| Chemical products, manufac-turing and processing (3C) | 11.2 | 11.0 | 10.7 | 10.4 | 10.1 | 9.83 | 9.55 | 9.26 | 8.98 | 8.70 | 9.11 | 9.20 |
| Other (3D) | 40.4 | 39.4 | 38.4 | 37.3 | 36.3 | 35.3 | 34.3 | 33.3 | 32.3 | 31.3 | 28.7 | 31.2 |
| Total NMVOC | 63.3 | 61.6 | 60.0 | 58.4 | 56.7 | 55.1 | 53.5 | 51.8 | 50.2 | 48.6 | 44.7 | 48.8 |
| Total $CO_2$ | 155 | 151 | 147 | 143 | 139 | 135 | 131 | 126 | 122 | 118 | 107 | 119 |
| *Continued* | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| Paint application (3A) | 7.16 | 6.99 | 7.55 | 7.44 | 6.08 | 6.08 | 5.95 | 5.40 | 4.89 | 4.07 | 3.39 | 3.67 |
| Degreasing and dry cleaning (3B) | 4.5E-05 | 5.5E-05 | 3.4E-05 | 2.9E-05 | 1.3E-05 | 3.0E-05 | 2.9E-05 | 2.4E-05 | 1.8E-05 | 1.5E-05 | 2.2E-05 | 1.5E-05 |
| Chemical products, manufac-turing and processing (3C) | 7.82 | 7.45 | 7.07 | 6.74 | 6.10 | 6.39 | 4.76 | 5.90 | 6.12 | 5.94 | 6.07 | 5.85 |
| Other (3D) | 29.3 | 26.6 | 25.6 | 26.5 | 23.7 | 23.3 | 21.3 | 20.5 | 19.9 | 20.2 | 17.6 | 17.9 |
| Total NMVOC | 44.2 | 41.0 | 40.2 | 40.6 | 35.9 | 35.7 | 32.0 | 31.8 | 31.0 | 30.2 | 27.0 | 27.4 |
| Total $CO_2$ | 107 | 99.8 | 98.8 | 98.8 | 86.9 | 87.1 | 78.9 | 77.0 | 74.4 | 70.6 | 63.2 | 64.8 |

Table 5.2 Used amounts of chemicals in Gg pr year.

| Used amounts of chemical Gg pr year | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Paint application (3A) | 24.8 | 24.1 | 23.5 | 22.8 | 22.1 | 21.5 | 20.8 | 20.2 | 19.5 | 18.9 | 15.3 | 18.5 |
| Degreasing and dry cleaning (3B) | 1.04 | 1.00 | 0.959 | 0.917 | 0.874 | 0.832 | 0.789 | 0.746 | 0.704 | 0.661 | 0.767 | 0.738 |
| Chemical products, manufac-turing and processing (3C) | 53.4 | 57.2 | 60.9 | 64.6 | 68.4 | 72.1 | 75.9 | 79.6 | 83.3 | 87.1 | 101 | 105 |
| Other (3D) | 63.0 | 61.6 | 60.3 | 58.9 | 57.58482 | 56.2 | 54.9 | 53.6 | 52.2 | 50.9 | 47.8 | 50.0 |
| Total NMVOC | 142 | 144 | 146 | 147 | 149 | 151 | 152 | 154 | 156 | 157 | 165 | 174 |
| *Continued* | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| Paint application (3A) | 16.0 | 16.2 | 16.8 | 17.3 | 14.2 | 14.3 | 13.4 | 12.8 | 12.1 | 10.2 | 8.76 | 9.19 |
| Degreasing and dry cleaning (3B) | 0.446 | 0.548 | 0.345 | 0.293 | 0.125 | 0.298 | 0.289 | 0.240 | 0.183 | 0.146 | 0.217 | 0.150 |
| Chemical products, manufac-turing and processing (3C) | 104 | 106 | 97.7 | 114 | 110 | 108 | 103 | 127 | 148 | 150 | 163 | 155 |
| Other (3D) | 48.0 | 45.1 | 43.4 | 44.4 | 39.8 | 42.3 | 35.5 | 35.2 | 39.7 | 35.1 | 31.8 | 33.0 |
| Total NMVOC | 168 | 167 | 158 | 175 | 165 | 165 | 152 | 175 | 200 | 196 | 204 | 197 |

Table 5.3 Used amounts of products in Gg pr year.

| Used amounts of products Gg pr year | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Paint application (3A) | 165 | 161 | 156 | 152 | 148 | 143 | 139 | 135 | 130 | 126 | 102 | 123 |
| Degreasing and dry cleaning (3B) | 2.09 | 2.00 | 1.92 | 1.83 | 1.75 | 1.66 | 1.58 | 1.49 | 1.41 | 1.32 | 1.53 | 1.48 |
| Chemical products, manufac-turing and processing (3C) | 267 | 286 | 305 | 323 | 342 | 361 | 379 | 398 | 417 | 435 | 505 | 524 |
| Other (3D) | 315 | 308 | 301 | 295 | 288 | 281 | 274 | 268 | 261 | 254 | 239 | 250 |
| Total products | 749 | 757 | 764 | 772 | 779 | 787 | 794 | 802 | 809 | 817 | 848 | 898 |
| *Continued* | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| Paint application (3A) | 107 | 108 | 112 | 115 | 94.7 | 95.4 | 89.5 | 85.2 | 80.9 | 67.7 | 58.4 | 61.2 |
| Degreasing and dry cleaning (3B) | 0.892 | 1.10 | 0.690 | 0.586 | 0.251 | 0.597 | 0.578 | 0.481 | 0.366 | 0.292 | 0.433 | 0.299 |
| Chemical products, manufac-turing and processing (3C) | 519 | 528 | 488 | 568 | 552 | 541 | 514 | 635 | 742 | 751 | 816 | 774 |
| Other (3D) | 240 | 225 | 217 | 222 | 199 | 211 | 178 | 176 | 199 | 176 | 159 | 165 |
| Total products | 867 | 863 | 818 | 905 | 846 | 848 | 781 | 896 | 1022 | 995 | 1035 | 1001 |

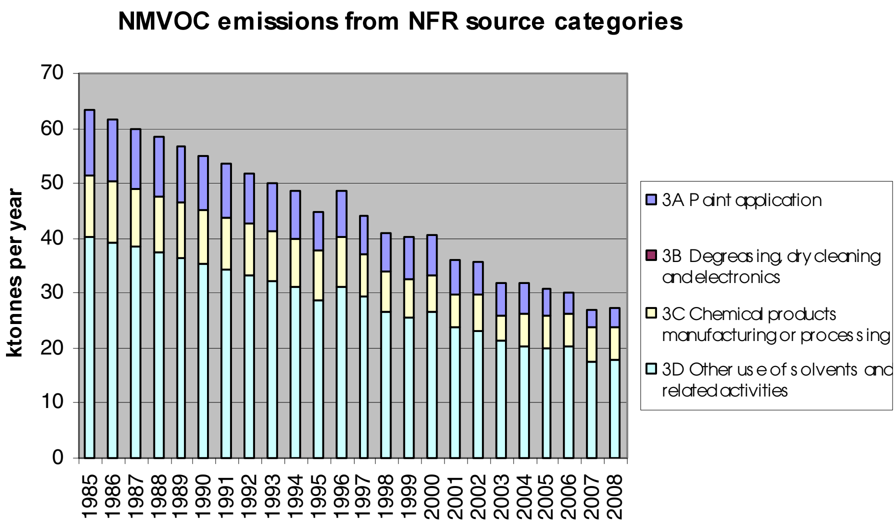


Figure 5.1 Emissions of chemicals in ktonnes pr year (equal to Gg pr year). The methodological approach for finding emissions in the period 1995 – 2008 is described in the text, and a linear extrapolation is made for 1985 – 1994. Figures can be seen in Table 5.1.

Table 5.4 Chemicals with highest emissions 2008, and $CO_2$ conversion factors assuming that all carbon molecules in the NMVOC molecule are converted to $CO_2$.

| Chemical | CAS no | Emissions 2008 (tonnes) | $CO_2$-conversion factor (g $CO_2$ pr g NMVOC) |
|---|---|---|---|
| ethanol | 64-17-5 | 5865 | 1.91 |
| turpentine (white spirit: stoddard solvent and solvent naphtha) | 64742-88-7<br>8052-41-3 | 5653 | 2.79 |
| propylalcohol | 67-63-0 | 4377 | 2.20 |
| pentane | 109-66-0 | 2134 | 3.06 |
| methanol | 67-56-1 | 1327 | 1.38 |
| propylenglycol | 57-55-6 | 1183 | 1.74 |
| cyanates | 79-10-7 | 891 | 1.83 |
| xylene | 1330-20-7<br>95-47-6<br>108-38-3<br>106-42-3 | 890 | 3.32 |
| acetone | 67-64-1 | 822 | 2.28 |
| glycolethers | 110-80-5<br>107-98-2<br>108-65-6<br>34590-94-8<br>112-34-5<br>and others | 688 | 1.95 |
| butanone | 78-93-3 | 671 | 2.45 |
| propane | 74-98-6 | 654 | 2.86 |
| butane | 106-97-8 | 654 | 2.93 |
| formaldehyde | 50-00-0 | 263 | 1.47 |
| phenol | 108-95-2 | 263 | 2.81 |
| toluene | 108-88-3 | 214 | 3.35 |
| ethylenglycol | 107-21-1 | 148 | 1.42 |
| cyclohexanones | 108-94-1 | 148 | 2.69 |
| 1-butanol | 71-36-3 | 146 | 2.38 |
| acyclic aldehydes | 78-84-2<br>111-30-8<br>and others | 116 | 2.31 |
| methyl methacrylate | 80-62-6 | 103 | 2.20 |
| styrene | 100-42-5 | 48.4 | 3.39 |
| ethylacetate | 141-78-6 | 43.8 | 2.00 |
| butanoles | 78-92-2<br>2517-43-3<br>and others | 43.2 | 2.24 |
| butylacetate | 123-86-4 | 33.9 | 2.28 |
| triethylamine | 121-44-8 | 20.3 | 2.61 |
| naphthalene | 91-20-3 | 16.0 | 3.44 |
| acyclic monoamines | 75-31-0<br>and others | 7.45 | 2.24 |
| tetrachloroethylene | 127-18-4 | 2.46 | 0.531 |
| Total 2007 | | 27426 | |

## 5.3 Other use ($N_2O$)

Five companies sell $N_2O$ in Denmark and only one company produces $N_2O$. $N_2O$ is primarily used in anaesthesia by dentists, veterinarians and in hospitals and in minor use as propellant in spray cans and in the production of electronics. Due to confidentiality no data on produced amount are available and thus the emissions related to $N_2O$ production are unknown. An emission factor of 1 is assumed for all uses, which equals the sold amount to the emitted amount. Sold amounts are obtained from the respective companies and the produced amount is estimated from communication with the company.

Total sold and estimated produced $N_2O$ for sale in Denmark, which equals the emissions, is shown in Table 5.5.

Table 5.5 $N_2O$ emissions. EF = 1, i.e. sale in Denmark equals emissions.

| | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|
| $N_2O$ sale = emissions (Gg) | 0.0453 | 0.122 | 0.119 | 0.0881 |

## 5.4 Methodology

Until 2002 the Danish solvent emission inventory was based on questionnaires, which were sent to selected industries and sectors requiring information on solvent use. In 2003 it was decided to implement a method that is more complete, accurate and transparent with respect to including the total amount of used solvent, attributing emissions to industrial sectors and households and establishing a reliable model that is readily updated on a yearly basis.

Emission modelling of solvents can basically be done in two ways: 1) By estimating the amount of (pure) solvents consumed, or 2) By estimating the amount of solvent containing products consumed, taking account of their solvent content (EMEP/CORINAIR, 2004).

In 1) all relevant solvents must be estimated, or at least those together representing more than 90 % of the total NMVOC emission, and in 2) all relevant source categories must be inventoried or at least those together contributing more than 90 % of the total NMVOC emission. A simple approach is to use a pr capita emission for each category, whereas a detailed approach is to get all relevant consumption data (EMEP/CORINAIR, 2004).

The detailed method 1) is used in the Danish emission inventory for solvent use, thus representing a chemicals approach, where each chemical (NMVOC) is estimated separately. The sum of emissions of all estimated NMVOCs used as solvents equals the NMVOC emission from solvent use. See Figure 1 for methodological overview.

### 5.4.1 Chemical list

Some of the chemical compounds that are stated for reporting to the Climate and CLRTAP Conventions are not relevant for use of solvents. NMVOC is the most important chemical group especially in relation to the CLRTAP. There is also some use of $N_2O$ and due to the high greenhouse warming potential (GWP) of $N_2O$, yielding a $CO_2$-equivalent of 1 g $N_2O$ = 310 g $CO_2$ (IPCC 2000), $N_2O$ is important in relation to the Climate Convention. Only NMVOC, $N_2O$ and $CO_2$ are considered in the present reporting to the Climate Convention, CLRTAP and the NEC Directive. However, minor emissions may apply to use of other chemicals and e.g. mercury, PAHs, dioxins and PCBs will be assessed in coming inventories.

The definitions of solvents and VOC that are used in the Danish inventory (Nielsen et al., 2009) are as defined in the solvent directive (Directive 1999/13/EC) of the EU legislation: "Organic solvent shall mean any VOC which is used alone or in combination with other agents, and without undergoing a chemical change, to dissolve raw materials, products or waste materials, or is used as a cleaning agent to dissolve contaminants, or as a dissolver, or as a dispersion medium, or as a viscosity adjuster, or as a surface tension adjuster, or a plasticiser, or as a preservative". VOCs are defined as follows: "Volatile organic compound shall mean any organic compound having at 293,15 K a vapour pressure of 0,01 kPa or more, or having a corresponding volatility under the particular condition of use".

This implies that some chemicals, e.g. ethylenglycol, that have vapour pressures just around 0.01 kPa at 20 C, may only be defined as VOCs at use conditions with higher temperature. However, use conditions under elevated temperature are typically found in industrial processes. Here the capture of solvent fumes is often efficient, thus resulting in small emissions (communication with industries).

The Danish list of chemicals comprises 33 chemicals or chemical groups representing more than 95 % of the total NMVOC emission from solvent use of the known NMVOCs, cf. Table 6. $CO_2$ conversion factors, where all C-molecules in a NMVOC molecule are converted to $CO_2$, are also listed in Table 6.

### 5.4.2 Activity data

For each chemical a mass balance is formulated:

$$\text{Consumption} = (\text{production} + \text{import}) - (\text{export} + \text{destruction/disposal} + \text{hold-up}) \quad \text{(Eq. 1)}$$

Data concerning production, import and export amounts of solvents and solvent containing products are collected from StatBank DK (2008), which contains detailed statistical information on the Danish society. Manufacturing and trading industries are committed to reporting production and trade figures to the Danish Customs & Tax Authorities in accordance with the Combined Nomenclature. Import and export figures are available on a monthly basis from 1995 to present and contain trade information from 272 countries world-wide. Production figures are reported quarterly as "industrial commodity statistics by commodity group and unit" from 1995 to present.

Destruction and disposal of solvents lower the NMVOC emissions. In principle this amount must be estimated for each NMVOC in all industrial activity and for all uses of NMVOC containing products. At present the solvent inventory only considers destruction and disposal for a limited number of NMVOCs. For some NMVOCs it is inherent in the emission factor, and for others the reduction is specifically calculated from information obtained from the industry or literature.

Hold-up is the difference in the amount in stock in the beginning and at the end of the year of the inventory. No information on solvents in stock has been obtained from industries. Furthermore, the inventory spans over several years so there will be an offset in the use and production, import and export balance over time.

In some industries the solvents are consumed in the process, e.g. in the graphics and plastic industry, whereas in the production of paints and lacquers the solvents are still present in the final product. These products can either be exported or used in the country. In order not to double count consumption amounts of NMVOCs it is important to keep track of total solvent use, solvents not used in products and use of solvent containing products. Furthermore some chemicals may be represented as individual chemicals and also in chemical groups, e.g. "o-xylene", "mixture of xylenes" and "xylene". Some chemicals are better inventoried as a group of NMVOCs rather than individual NMVOCs, due to missing information on use or emission for the individual NMVOCs. The Danish inventory considers single NMVOCs, with a few exceptions.

Activity data for chemicals are thus primarily calculated from Equation 1 with input from StatBank DK (2008). When StatBank (2008) holds no information on production, import and export or when more reliable information is available from industries, scientific reports or expert judgements the data can be adjusted or even replaced.

### 5.4.3 Emission factors

For each chemical the emission is calculated by multiplying the consumption with the fraction emitted (emission factor), according to:

Emission = consumption * emission factor

The present Danish method uses emission factors that represent specific industrial activities, such as processing of polystyrene, dry cleaning etc. or that represent use categories, such as paints and detergents. Some chemicals have been assigned emission factors according to their water solubility. Higher hydrophobicity yields higher emission factors, since a lower amount ends in waste water, e.g. ethanol (hydrophilic) and turpentine (hydrophobic).

Emission factors are categorised in four groups in ascending order: (1) Lowest emission factors in the chemical industry, e.g. lacquer and paint manufacturing, due to emission reducing abatement techniques and destruction of solvent containing waste, (2) Other industrial processes, e.g. graphic industry, have higher emission factors, (3) Non-industrial use, e.g. auto repair and construction, have even higher emission factors, (4) Diffuse use of solvent containing products, e.g. painting, where practically all the NMVOC present in the products will be released during or after use.

For a given chemical the consumed amount can thus be attributed with two or more emission factors; one emission factor representing the emissions occurring at a production or processing plant and one emission factor representing the emissions during use of a solvent containing product. If the chemical is used in more processes and/or is present in several products more emission factors are assigned to the respective chemical amounts.

Emission factors can be defined from surveys of specific industrial activities or as aggregated factors from industrial branches or sectors. Furthermore, emission factors may be characteristic for the use pattern of certain products. The emission factors used in the Danish inventory also rely on the work done in the joint Nordic project (Fauser et al. 2009).

### 5.4.4 Source allocation

The Danish Working Environment Authority (WEA) is administrating the registrations of chemicals and products to the Danish product register. All manufacturers and importers of products for occupational and commercial use are obliged to register. The following products are comprised in the registration agreement:

- Chemicals and materials that are classified as dangerous according to the regulations set up by the Danish Environmental Protection Agency (EPA).
- Chemicals and materials that are listed with a limit value on the WEA "limit value list".
- Materials, containing 1 % or more of a chemical, which is listed on the WEA "limit value list".
- Materials, containing 1 % or more of a chemical, which are classified as hazardous to humans or the environment according to the EPA rules on classification.

There are the following important exceptions for products, which does not need to be registered:

- Products exclusively for private use.
- Pharmaceuticals ready for use.
- Cosmetic products.

The Danish product register does therefore not comprise a complete account of used chemicals. Source allocations of exceptions from the duty of declaration are done based on information from trade organisations, industries, scientific reports and information from the internet.

Outputs from the inventory are

- a list where the 34 most predominant NMVOCs are ranked according to emissions to air,
- specification of emissions from industrial sectors and from households,
- contribution from each NMVOC to emissions from industrial sectors and households,
- yearly trend in NMVOC emissions, expressed as total NMVOC and single chemical, and specified in industrial sectors and households.

## 5.5 Uncertainties and time-series consistency

Tier 1 uncertainty analysis:

Overall uncertainty in 2008: 8.3%

Trend uncertainty 1990 – 2008: 3.9%

Tier 2 uncertainty analysis:

Overall uncertainty in 2008: 28% (-24%, +34%)

Trend uncertainty 1990 – 2008: 30% (-3.6%, +0.25%)

Important uncertainty issues related to the mass-balance approach are

(i) Identification of chemicals that qualify as NMVOCs. Although a tentative list of 650 chemicals from NAI (2000) has been used, it is possible that relevant chemicals are not included, e.g. chemicals that are not listed with their name in Statistics Denmark (StatBank DK, 2008) but as a product.

(ii) Collection of data for quantifying production, import and export of single chemicals and products where the chemicals are comprised. For some chemicals no data are available in StatBank DK (2008). This can be due to confidentiality or that the amount of chemicals must be derived from products wherein they are comprised. For other chemicals the amount is the sum of the single chemicals *and* product(s) where they are included. The data available in StatBank DK (2008) is obtained from Danish Customs & Tax Authorities and they have not been verified in this assessment.

(iii) Distribution of chemicals on products, activities, sectors and households. The present approach is based on amounts of single chemicals. To differentiate the amounts into industrial sectors it is necessary to identify and quantify the associated products and activities and assign these to the industrial sectors and households. No direct link is available between the amounts of chemicals and products or activities. From the Nordic SPIN database it is possible to make a relative quantification of products and activities used in industry, and combined with estimates and expert judgement these products and activities are differentiated into sectors. The contribution from households is also based on estimates. If the household contribution is set too low, the emission from industrial sectors will be too high and vice versa. This is due to the fact that the total amount of chemical is constant. A change in distribution of chemicals between industrial sectors and households will, however, affect the total emissions, as different emission factors are applied in industry and households, respectively.

A number of activities are assigned as "other", i.e. activities that can not be related to the comprised source categories. This assignment is based on expert judgement but it is possible that the assigned amount of chemicals may more correctly be included in other sectors.

More detailed information from the industrial sectors is continuously being implemented.

(iv) Rough estimates and assumed emission factors are used for some chemicals. For some chemicals more reliable information has been obtained from the literature and from communication with industrial sectors. In some cases it is more appropriate to define emission factors for sector specific activities rather than for the individual chemicals.

A quantitative measure of the uncertainty has not been assessed. Single values have been used for emission factors and activity distribution ratios etc. A Tier 2 Monte Carlo assessment is currently being implemented in the Danish inventory.

## 5.6 QA/QC and verification

Please refer to the Danish National Inventory Report reported to the UNFCCC (Nielsen et al., 2009).

## 5.7 Recalculations

Improvements and additions are continuously being implemented due to the comprehensiveness and complexity of the use and application of solvents in industries and households. The main improvements in the 2008 reporting include the following:

- An improved and more detailed source allocation method has been implemented, which enables emission calculation on SNAP sub-category level.
- Emission factors (EFs) have been improved for some chemicals.
- EFs have been attributed to all chemicals on SNAP sub-category level.
- $CO_2$ conversion factors have been implemented for all chemicals.

## 5.8 Planned improvements

$N_2O$ emissions from fire extinguishers will be assessed in the coming inventory. In a joint Nordic project in 2010 PAH, PCB, dioxin and mercury use and emissions will be investigated. Furthermore chemicals that are listed as products in Statistics Denmark, e.g. cosmetics, will be included in the inventory.

## 5.9 References

Directive 1999/13/EC of 11 March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations, Brüssel, 1999

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# 6 Agriculture (NFR sector 4)

## 6.1 Overview of the sector

The emission from agricultural activities covers ammonia emission from manure management and agricultural soils, PM emission from animal production and emission from field burning of straw includes ammonia, PM, $NO_x$, CO, NMVOC, $SO_2$, heavy metals, dioxin and PAH.

### 6.1.1 Ammonia

The majority of the Danish ammonia emission, corresponding to 97 %, originates from the agricultural sector. The remaining 3 % originates from traffic and industrial process. Figure 6.1 shows the distribution of sources of $NH_3$ emission from the agricultural sector 2008. The main part of the agricultural emission is related to manure management, corresponding to 82 % and 3% from grassing animals. Emissions from use of synthetic fertiliser and crops contribute with 7 % and 8 %, respectively. Emissions from "Other" as ammonia-treated straw, field burning of agricultural wastes and sewage sludge used as fertiliser amount to less than 1 %.

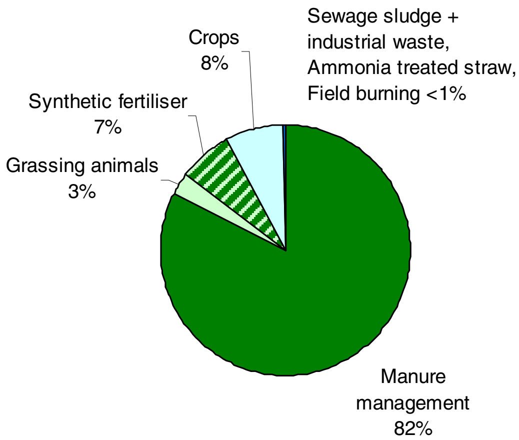


Figure 6.1 Ammonia emissions from the agricultural sector (2008).

From 1985 to 2008, the emission of ammonia from the agricultural sector decreased from 114.21 Gg $NH_3$ to 71.35 Gg $NH_3$, which corresponds to a 38 % reduction (Table 6.1). This is due to the active national environmental policy of the last twenty years. A series of measures have been introduced to prevent loss of nitrogen from agriculture to the aquatic environment. The measures include improved utilisation of nitrogen in livestock manure, requirements with regard to storage and application of livestock manure, increased area with winter green fields to catch nitrogen, a maximum number of animals per hectare and maximum nitrogen application rates to agricultural crops.

The main part of the emission from the agricultural sector is related to livestock production and, hence, the management of manure. The result of the active environmental policy has brought about a decrease in the N-excretion, a decrease of emission pr produced animal and a fall in use of mineral fertilizer, which all has reduced the overall ammonia emission significant.

Table 6.1 Total ammonia emissions from the agricultural sector 1985 to 2008, Gg $NH_3$.

| | | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NFR | | Gg $NH_3$ | | | | | | | | | | | |
| 4. | Agricultural Sector - total | 114.21 | 115.06 | 112.29 | 109.77 | 110.73 | 110.04 | 106.48 | 104.97 | 102.68 | 100.07 | 93.91 | 90.89 |
| 4B | Manure Management | 88.48 | 88.55 | 85.31 | 84.88 | 84.08 | 82.14 | 80.46 | 80.46 | 78.73 | 75.79 | 71.47 | 71.09 |
| 4D | Agricultural Soils - total | 25.69 | 26.47 | 26.93 | 24.85 | 26.58 | 27.82 | 25.95 | 24.42 | 23.84 | 24.18 | 22.33 | 19.70 |
| | Synthetic Fertiliser | 8.48 | 8.04 | 7.83 | 7.83 | 7.80 | 8.68 | 8.33 | 7.81 | 7.34 | 7.64 | 7.27 | 6.16 |
| | Grassing animals | 3.16 | 3.09 | 2.97 | 2.93 | 2.92 | 2.95 | 3.01 | 3.02 | 3.07 | 3.00 | 3.05 | 3.07 |
| | Crops | 5.97 | 5.97 | 5.96 | 5.91 | 5.88 | 5.92 | 5.88 | 5.85 | 5.77 | 5.36 | 5.28 | 5.31 |
| | $NH_3$ treated straw | 6.54 | 8.04 | 8.92 | 7.25 | 9.00 | 10.19 | 8.64 | 7.67 | 7.58 | 8.10 | 6.63 | 5.06 |
| 4F | Field burning of Agricultural Waste | 1.53 | 1.32 | 1.25 | 0.93 | 0.98 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 |
| 4G | Other - Sewage Sludge used as fertiliser | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.07 | 0.07 | 0.09 | 0.11 | 0.10 | 0.11 | 0.10 |
| *Continued* | | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| NFR | | Gg $NH_3$ | | | | | | | | | | | |
| 4. | Agricultural Sector - total | 89.56 | 89.92 | 84.56 | 84.30 | 81.63 | 79.48 | 77.23 | 76.94 | 73.24 | 71.20 | 71.61 | 71.35 |
| 4B | Manure Management | 70.86 | 72.00 | 68.88 | 68.40 | 66.90 | 66.05 | 64.34 | 64.26 | 60.96 | 59.24 | 59.72 | 58.92 |
| 4D | Agricultural Soils - total | 18.61 | 17.84 | 15.59 | 15.81 | 14.65 | 13.34 | 12.82 | 12.63 | 12.23 | 11.91 | 11.84 | 12.38 |
| | Synthetic Fertiliser | 5.59 | 5.63 | 5.23 | 5.07 | 4.66 | 4.15 | 4.06 | 4.31 | 4.27 | 4.33 | 4.48 | 4.86 |
| | Grassing animals | 3.01 | 2.98 | 2.92 | 2.95 | 2.99 | 2.89 | 2.59 | 2.39 | 2.24 | 2.12 | 2.00 | 2.01 |
| | Crops | 5.44 | 5.41 | 5.25 | 5.21 | 5.25 | 5.26 | 5.24 | 5.27 | 5.34 | 5.34 | 5.26 | 5.41 |
| | $NH_3$ treated straw | 4.48 | 3.70 | 2.08 | 2.47 | 1.62 | 0.94 | 0.80 | 0.53 | 0.26 | 0.00 | 0.00 | 0.00 |
| 4F | Field burning of Agricultural Waste | 0.10 | 0.12 | 0.12 | 0.11 | 0.12 | 0.10 | 0.12 | 0.13 | 0.13 | 0.13 | 0.11 | 0.10 |
| 4G | Other - Sewage Sludge used as fertiliser | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.07 | 0.06 | 0.05 | 0.05 | 0.05 | 0.04 |

**Particulate matter**

In NFR, the emission of particulate matter (PM) is registered for the years 2000 to 2008. The emission from the agricultural sector includes the emission of dust from animal housing systems, which include emission from cattle, pigs, poultry, horses, sheep and goats. Furthermore, the emission from field burning of agricultural wastes is calculated.

Present, the Danish inventory do not include emission from plant production, which means activities related to field operations as harvesting and cultivation of the soil.

Given in TSP, emission from the agricultural sector contributes with 27 % of the national PM emission in 2008. The main part of the emission is related to the animal production and field burning contribute less than 1 % to the agricultural emission of PM.

From 2000 to 2008 the PM emission from agricultural activities, given in TSP, has decreased by 12 % mainly due to a fall in the emission from swine (Figure 6.2). The same emission factor is used for all years. The changes in the total emission for each livestock category is mainly reflected the changes in number of animal, but also effected by the distribution of the subcategories and changes in the stable type. The emission from field burning contributes less than 1 % to the agricultural emission of PM.

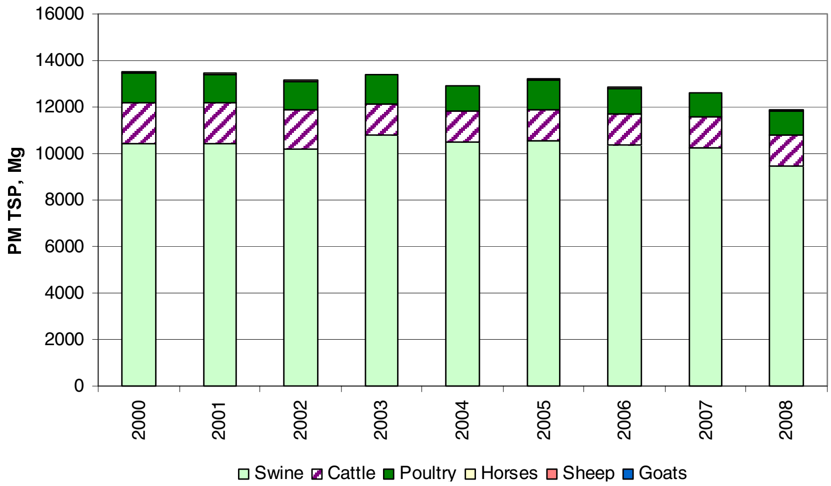


Figure 6.2 Emission of particulate matter (TSP) from the agricultural sector 2000 to 2008.

### 6.1.2 References – sources of information

Data on activity and emissions are collected, evaluated and discussed in cooperation with Statistics Denmark, the Danish Institute of Agricultural Sciences, the Danish Agricultural Advisory Centre, Danish Environmental Protection Agency and the Danish Plant Directorate. It means that both the data and the methods used are evaluated continuously according to latest knowledge and information. Table 6.2 shows the source of data input from the different institutes.

Table 6.2 List of institutes involved in the emission inventory.

| References | Abbreviation | Data / information |
|---|---|---|
| National Environmental Research Institute, University of Aarhus (http://www.dmu.dk) | NERI | -reporting<br>-data collecting |
| Statistics Denmark - Agricultural Statistics (http://www.dst.dk) | DSt | -livestock production<br>-milk yield<br>-slaughtering data<br>-land use<br>-crop production<br>-crop yield |
| Faculty of Agricultural Sciences, University of Aarhus (http://www.agrsci.dk) | FAS | -N-excretion<br>-feeding situation<br>-$NH_3$ emissions factor<br>-PM emissions factor |
| The Danish Agricultural Advisory Centre (http://www.lr.dk) | DAAC | -stable type (until 2004)<br>-grazing situation<br>-manure application time and methods<br>-field burning of agricultural residue |
| Danish Environmental Protection Agency (http://www.mst.dk) | EPA | -sewage sludge used as fertiliser |
| The Danish Plant Directorate (http://www.plantedirektoratet.dk) | PD | -synthetic fertiliser<br>-stable type (from 2005) |

**Methods**

The calculation of the emission is based on the EMEP/EEA Emission Inventory Guidebook.

The emissions from agricultural activities include NFR Table 4B Manure Management, Table 4D Agricultural Soils and Table 4F Field Burning of Agricultural Wastes. In general the field burning of agricultural wastes has been prohibited since 1989. However, burning of straw may only take place in connection with continuously cultivation of seed grass or wet or broken bales of straw.

The emission is calculated as the sum of activities ($a_i$) multiplied by the implied emission factor (IEF) for each activity, *i*.

$$E_{total} = \sum a_i \bullet IEF_i$$

The emissions from the agricultural sector are calculated in a comprehensive agricultural model complex called IAD (Inventory Agriculture Data). This model, as shown in Figure 6.3, is implemented in great detail and it is used to cover emissions of ammonia, particulate matter and greenhouse gases ($N_2O$ and $CH_4$). Thus, there is direct coherence between the ammonia emission and the emission of $N_2O$. A more detailed description of DIEMA is published in Mikkelsen et al. (2006). A new version with updated data and descriptions is planned to be published in 2010.

The National Environmental Research Institute (NERI), which is responsible for the emission inventory, has established data agreements with the institutes and organisations to assure that the necessary data is available for timely completion of the emission inventory. The main part of the emission is related to livestock production and much of the data is based on Danish standards. The Faculty of Agricultural Sciences, University of Aarhus (FAS) delivers Danish standards relating to feeding consumption, manure type in different stable types, nitrogen content in manure, etc. Previously, the standards were updated and published every third or fourth year – the last one is Poulsen et al. from 2001. From year 2001, NERI receives updated data annually directly from FAS in the form of spreadsheets. These standards have been described and published in English in Poulsen & Kristensen (1998).

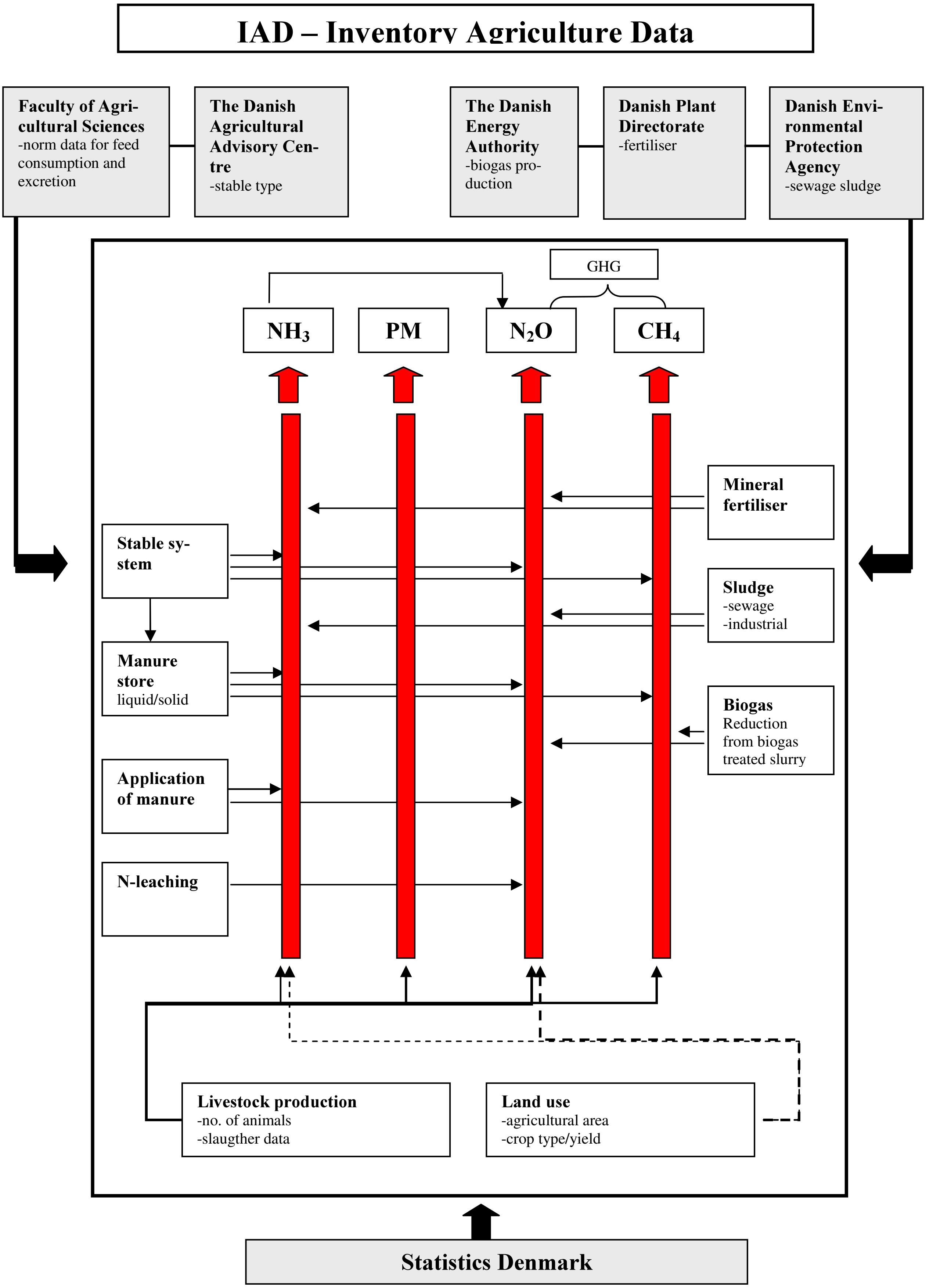


Figure 6.3 IAD – Inventory Agriculture Data.

IAD includes approximately 38 different livestock categories, dependent on livestock category, weight class and age. Each of these subcategories is subdivided according to stable type and manure type, which results in the region of 200 different combinations of subcategories and stable type (Table 6.3). The emission is calculated from each of these subcategories and then aggregated in accordance with the livestock categories given in the NFR. It is important to point out that changes in the emission and the implied emission factor over the years are not only a result of changes in the number of animals, but also depend on changes in the allocation of subcategories, changes in feed consumption, changes in stable type and changed practices with regard to the handling of livestock manure in relation to storage and application.

Table 6.3 Livestock categories and subcategories.

| NFR 4B | Animal categories | Includes | No. of sub-categories in IAD, animal type/stable system |
|---|---|---|---|
| 4B 1a | Dairy Cattle[1] | Dairy Cattle | 12 |
| 4B 1b | Non-dairy Cattle[1] | Calves (<½ yr), heifers, bulls, suckling cattle | 35 |
| 4B 3 | Sheep | including lambs | 1 |
| 4B 4 | Goats | Including kids (meet, dairy and mohair) | 3 |
| 4B 6 | Horses | 200 kg, 400 kg, 600 kg, 800 kg | 4 |
| 4B 8 | Swine | Sows, piglets, slaughtering pigs | 24 |
| 4B 9 | Poultry | Hens, pullet, broilers, turkey, geese, ducks | 21 |
| 4B 13 | Other | Fur farming, deer, Ostrich, pheasant | 9 |

1) For all subcategories, large breed and jersey cattle are distinguished from each other

## 6.2 $NH_3$ emission from Manure Management – NFR 4.B

### 6.2.1 Description

The main part of the ammonia emission 85% is related to manure management. Figure 6.4 shows the emission from manure management (NFR category 4.B) distributed according to the different livestock categories in 2008. The main part of the emission is related to cattle and pig production, corresponding to 80 %.

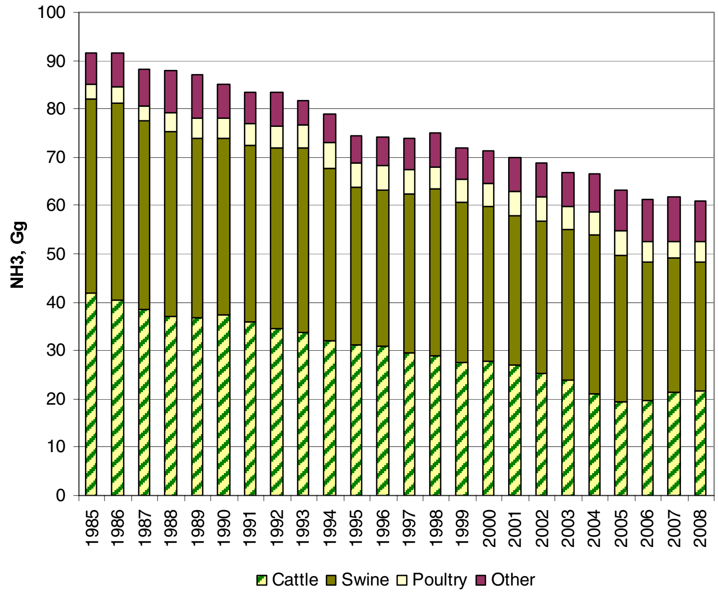


Figure 6.4 Ammonia emission from manure management 1985 to 2008.

### 6.2.2 Methodological issues

**Activity data**

Table 6.4 shows the development in livestock production 1985-2008 based on the Agricultural Statistics (Statistics Denmark). The emission from pigs and poultry is based on slaughter data from the Agricultural Statistics. Only farms larger than 5 hectares are included in the annual census. An approximation of number of horses, goats and sheep on small farms is added to the numbers in the Agricultural Statistics, in agreement with DAAC. The largest difference is found for horses. In the agricultural census, the number of horses is estimated at 60 029 in 2008. The total number of horses in 2008, however, including horses placed at small farms and riding schools, is approximately 190 000. Data on the number of sheep and goats is based on the Central House-animal farm Register (CHR) which is the central register of farms and animal of the Ministry of Food, Agriculture and Fisheries. The number of deer and ostriches is also based on CHR because these are not included in Statistics Denmark. The number of pheasants is based on expert judgement from NERI and pheasant breeding association.

Since 1985, the production of pigs has increased practically. This is contrary to the production of cattle, which has decreased as a result of rising milk yields. Buffalo, camels and llamas, mules and donkeys do not occur in Denmark.

Table 6.4 Livestock production 1985 to 2008, 1000 head - NFR category 4B.

| NFR | Animal category | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4B 1a | Dairy Cattle | 896 | 864 | 811 | 774 | 759 | 753 | 742 | 712 | 714 | 700 | 702 | 701 |
| 4B 1b | Non-dairy cattle | 1 721 | 1 631 | 1 540 | 1 488 | 1 462 | 1 486 | 1 480 | 1 478 | 1 481 | 1 405 | 1 388 | 1 393 |
| 4B 3 | Sheep* | 40 | 52 | 59 | 73 | 83 | 92 | 107 | 102 | 88 | 80 | 81 | 94 |
| 4B 4 | Goats* | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4B 6 | Horses* | 140 | 139 | 138 | 137 | 136 | 135 | 137 | 138 | 140 | 141 | 143 | 144 |
| 4B 8 | Swine | 9 089 | 9 321 | 9 266 | 9 217 | 9 190 | 9 497 | 9 783 | 10 455 | 11 568 | 10 923 | 11 084 | 10 842 |
| 4B 9 | Poultry | 15 219 | 15 220 | 15 540 | 15 524 | 17 194 | 16 249 | 15 933 | 19 041 | 19 898 | 19 852 | 19 619 | 19 888 |
| 4B 13 | Other; | | | | | | | | | | | | |
| 4B 13 | Fur farming | 1 906 | 2 194 | 2 402 | 2 877 | 3 055 | 2 264 | 2 112 | 2 283 | 1 537 | 1 828 | 1 850 | 1 918 |
| 4B 13 | Deer | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 4B 13 | Ostrich | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 4 |
| 4B 13 | Pheasant | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 |

*Continued*

| NFR | Animal category | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4B 1a | Dairy Cattle | 670 | 669 | 640 | 636 | 623 | 610 | 596 | 563 | 564 | 550 | 545 | 558 |
| 4B 1b | Non-dairy cattle | 1 334 | 1 308 | 1 247 | 1 232 | 1 284 | 1 187 | 1 128 | 1 082 | 1 006 | 984 | 1 021 | 1 006 |
| 4B 3 | Sheep* | 96 | 101 | 106 | 112 | 119 | 117 | 121 | 124 | 126 | 128 | 124 | 117 |
| 4B 4 | Goats* | 7 | 8 | 8 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 13 | 14 |
| 4B 6 | Horses* | 146 | 147 | 149 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 |
| 4B 8 | Swine | 11 383 | 12 095 | 11 626 | 11 922 | 12 608 | 12 732 | 12 949 | 13 233 | 13 534 | 13 361 | 13 723 | 12 738 |
| 4B 9 | Poultry | 18 994 | 18 674 | 21 010 | 21 830 | 21 236 | 20 580 | 17 844 | 16 649 | 17 633 | 17 425 | 16 741 | 15 406 |
| 4B 13 | Other; | | | | | | | | | | | | |
| 4B 13 | Fur farming | 2 212 | 2 345 | 2 089 | 2 199 | 2 304 | 2 422 | 2 361 | 2 471 | 2 552 | 2 708 | 2 837 | 2 747 |
| 4B 13 | Deer | 10 | 10 | 10 | 10 | 11 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 4B 13 | Ostrich | 6 | 7 | 8 | 9 | 10 | 7 | 5 | 4 | 4 | 4 | 1 | 0 |
| 4B 13 | Pheasant | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 | 1 063 |

* Includes animals on small farms (less than 5 ha), which are not included in Statistics Denmark figures.

**Implied emission factor**

Table 6.5 shows the implied emission factor for each NFR livestock category from 1990 to 2008. The implied emission factor expresses the average emission of ammonia per animal (from the census) per year. The implied emission factor is changing from year to year depending on a combination of several factors, such as:

- change in the livestock production level or change in the share of different subcategories,
- change in fodder condition and N-excretion,
- change in stable type,
- change in handling of manure in relation to storage and application.

In Annex 2C1, more detailed information about N-excretion and stable type for each livestock category, 1985–2008, used in the Danish emission inventory are given. Furthermore, tables show the Danish standards for emission factors used to calculate the ammonia emission in stables and in relation to storage and application of manure.

For most of the animal categories, the implied emission factor has decreased from 1985 to 2008, which is the result of measures in relation to implementation of the action plans for the aquatic environment and the Ammonia Action Plan. Increasingly strict requirements to improve the utilisation of nitrogen in manure have resulted in reduction of N-excretion, especially for slaughter pigs. Changes in manure management in relation to spreading are another important factor which has reduced the emission. Measures include a requirement for a minimum 9-month manure storage capacity, requirement that manure applied to soil be ploughed down within six hours, a ban on the spreading of manure in winter and, from 1 August 2003, broad spreading is no longer allowed. From 2003 slurry tanks have to be covered with supernatant or safety access cover. From 2006 it is prohibited to treat straw with ammonia.

Table 6.5 Implied emission factor from – manure management 1985 to 2008, kg $NH_3$ pr hd pr yr (NFR category 4B).

| NFR | Animal category | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4b 1a | Dairy cattle | 26.47 | 26.84 | 27.21 | 27.60 | 28.00 | 28.55 | 27.98 | 27.46 | 26.83 | 26.33 | 25.71 | 25.41 |
| 4b 1b | Non-dairy cattle | 6.28 | 6.22 | 6.19 | 6.14 | 6.13 | 6.22 | 6.06 | 5.96 | 5.84 | 5.67 | 5.52 | 5.49 |
| 4B 3 | Sheep | 2.45 | 2.44 | 2.43 | 2.42 | 2.41 | 2.43 | 2.44 | 2.46 | 2.47 | 2.48 | 2.50 | 2.30 |
| 4B 4 | Goats | 2.45 | 2.44 | 2.43 | 2.42 | 2.41 | 2.43 | 2.44 | 2.46 | 2.47 | 2.48 | 2.50 | 2.30 |
| 4B 6 | Horses | 7.79 | 7.75 | 7.70 | 7.66 | 7.62 | 7.44 | 7.27 | 7.10 | 6.93 | 6.75 | 6.58 | 6.57 |
| 4B 8 | Swine | 3.64 | 3.61 | 3.47 | 3.43 | 3.33 | 3.16 | 3.07 | 2.96 | 2.71 | 2.69 | 2.42 | 2.46 |
| 4B 9 | Poultry | 0.17 | 0.18 | 0.18 | 0.20 | 0.20 | 0.22 | 0.22 | 0.19 | 0.20 | 0.22 | 0.21 | 0.20 |
| 4B 13 | Other animals | | | | | | | | | | | | |
| 4B 13 | Fur farming | 2.13 | 2.10 | 2.06 | 2.04 | 2.00 | 1.99 | 1.97 | 1.95 | 1.94 | 1.92 | 1.90 | 1.90 |
| 4B 13 | Deer | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 |
| 4B 13 | Ostrich | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 4B 13 | Pheasant | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.68 | 4.67 | 4.67 | 4.66 |

*Continued*

| NFR | Animal category | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4b 1a | Dairy cattle | 25.30 | 25.03 | 24.53 | 24.61 | 23.61 | 23.20 | 23.28 | 20.98 | 20.57 | 21.19 | 22.23 | 22.12 |
| 4b 1b | Non-dairy cattle | 5.45 | 5.39 | 5.50 | 5.81 | 5.81 | 5.64 | 5.21 | 5.12 | 4.34 | 4.68 | 5.29 | 5.50 |
| 4B 3 | Sheep | 2.09 | 1.89 | 1.70 | 1.93 | 1.93 | 1.94 | 1.85 | 1.85 | 1.85 | 1.85 | 1.76 | 1.76 |
| 4B 4 | Goats | 2.09 | 1.89 | 1.70 | 1.93 | 1.93 | 1.87 | 1.79 | 1.79 | 1.79 | 1.79 | 1.62 | 1.70 |
| 4B 6 | Horses | 6.56 | 6.55 | 6.66 | 6.58 | 6.58 | 6.60 | 6.21 | 6.20 | 6.19 | 6.19 | 5.24 | 5.24 |
| 4B 8 | Swine | 2.39 | 2.35 | 2.35 | 2.22 | 2.03 | 2.03 | 1.97 | 2.04 | 1.84 | 1.76 | 1.67 | 1.73 |
| 4B 9 | Poultry | 0.21 | 0.21 | 0.19 | 0.19 | 0.19 | 0.20 | 0.22 | 0.25 | 0.23 | 0.20 | 0.17 | 0.22 |
| 4B 13 | Other animals | | | | | | | | | | | | |
| 4B 13 | Fur farming | 1.90 | 1.90 | 1.90 | 1.92 | 1.92 | 1.92 | 1.96 | 2.08 | 2.22 | 2.14 | 2.20 | 2.07 |
| 4B 13 | Deer | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 | 1.12 |
| 4B 13 | Ostrich | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 4B 13 | Pheasant | 4.65 | 4.65 | 4.64 | 4.63 | 4.63 | 4.64 | 4.63 | 4.63 | 4.62 | 4.61 | 4.15 | 4.15 |

**Time-series**

The emission of $NH_3$ from manure management is estimated to 58.92 Gg $NH_3$ in 2008 (Table 6.6). From 1985 to 2008, the emission is reduced by 33 %. As mentioned, this development is mainly due to an active environmental policy to reduce nitrogen losses in agricultural production.

This year calculations of ammonia have been adjusted to TAN for the whole period 1985-2008.

The number of cattle has decreased as a result of a growth in milk yield. In 2008, cattle production contributes with 25 % of the total emission from manure management. The pig production contributes with a still increases share of the emission – in 2008, 44 % of the total emission from manure management. The production of slathering pigs has increased by more than 50 % compared with 1985. However, despite this development the emission from pigs is still decreasing. This is due to measures focused on the biological development and improvement in fodder efficiency.

Table 6.6 Emission of $NH_3$ from manure management 1985 to 2008, Gg $NH_3$.

| NFR | Animal category | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4b 1a | Dairy cattle | 28.81 | 28.16 | 26.80 | 25.95 | 25.82 | 26.11 | 25.20 | 23.74 | 23.26 | 22.37 | 21.93 | 21,62 |
| 4b 1b | Non-dairy cattle | 13.12 | 12.32 | 11.57 | 11.10 | 10.87 | 11.22 | 10.89 | 10.70 | 10.51 | 9.68 | 9.31 | 9,28 |
| 4B 3 | Sheep | 0.12 | 0.16 | 0.18 | 0.21 | 0.24 | 0.27 | 0.32 | 0.31 | 0.26 | 0.24 | 0.24 | 0,26 |
| 4B 4 | Goats | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0,02 |
| 4B 6 | Horses | 1.32 | 1.31 | 1.29 | 1.27 | 1.26 | 1.22 | 1.21 | 1.19 | 1.17 | 1.16 | 1.14 | 1,15 |
| 4B 8 | Swine | 40.19 | 40.82 | 39.05 | 38.35 | 37.14 | 36.46 | 36.52 | 37.59 | 38.09 | 35.65 | 32.57 | 32,43 |
| 4B 9 | Poultry | 3.12 | 3.26 | 3.34 | 3.76 | 4.21 | 4.28 | 4.26 | 4.50 | 4.84 | 5.39 | 5.00 | 4,92 |
| 4B 13 | Other: | | | | | | | | | | | | |
| 4B 13 | Fur farming | 4.92 | 5.58 | 6.02 | 7.12 | 7.42 | 5.48 | 5.05 | 5.42 | 3.61 | 4.26 | 4.27 | 4,43 |
| 4B 13 | Deer | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0,01 |
| 4B 13 | Ostrich | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.006 | 0.013 | 0.019 | 0,025 |
| 4B 13 | Pheasant | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0,004 |
| Manure Management - total emission | | 91.65 | 91.64 | 88.28 | 87.81 | 87.01 | 85.09 | 83.47 | 83.47 | 81.80 | 78.80 | 74.52 | 74.16 |

*Continued*

| NFR | Animal category | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4b 1a | Dairy cattle | 20.60 | 20.33 | 19.07 | 18.99 | 17.87 | 17.17 | 16.85 | 14.36 | 14.10 | 14.16 | 14.72 | 14,99 |
| 4b 1b | Non-dairy cattle | 8.82 | 8.57 | 8.33 | 8.69 | 9.05 | 8.13 | 7.14 | 6.73 | 5.30 | 5.59 | 6.56 | 6,72 |
| 4B 3 | Sheep | 0.24 | 0.23 | 0.22 | 0.26 | 0.28 | 0.28 | 0.27 | 0.28 | 0.28 | 0.29 | 0.26 | 0,25 |
| 4B 4 | Goats | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 | 0,03 |
| 4B 6 | Horses | 1.16 | 1.17 | 1.20 | 1.20 | 1.24 | 1.28 | 1.24 | 1.28 | 1.32 | 1.35 | 1.18 | 1,21 |
| 4B 8 | Swine | 33.03 | 34.45 | 33.22 | 32.08 | 31.02 | 31.43 | 31.01 | 32.71 | 30.25 | 28.58 | 27.81 | 26,69 |
| 4B 9 | Poultry | 4.84 | 4.74 | 4.88 | 4.91 | 4.96 | 4.95 | 4.73 | 4.98 | 5.03 | 4.29 | 3.55 | 4,13 |
| 4B 13 | Other: | | | | | | | | | | | | |
| 4B 13 | Fur farming | 5.11 | 5.41 | 4.81 | 5.13 | 5.37 | 5.63 | 5.62 | 6.25 | 6.87 | 7.04 | 7.59 | 6,90 |
| 4B 13 | Deer | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0,01 |
| 4B 13 | Ostrich | 0.031 | 0.038 | 0.044 | 0.050 | 0.056 | 0.037 | 0.027 | 0.023 | 0.021 | 0.020 | 0.003 | 0,002 |
| 4B 13 | Pheasant | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0,004 |
| Manure Management - total emission | | 73.87 | 74.98 | 71.80 | 71.35 | 69.90 | 68.95 | 66.93 | 66.65 | 63.20 | 61.36 | 61.72 | 60.93 |

Figure 6.5 shows the percentage distribution of the $NH_3$ emission in stables, storage, spreading of manure in fields and in deposits to grass. The main part of the reduction in ammonia emission has taken place in connection with the spreading of manure in fields, due to changes in manure application practice. There has been a reduction in emissions in relation to storage as a result of improved covering of slurry tanks. From 1985 to 2008, the emission relating to manure management in stables increased from 39 % to 59 %. In future, the possibilities for ammonia reduction will be likely to be focused on measurements in stables.

It should be mentioned here that the emission from manure deposited by grazing animals is included in the emission from agricultural soils (NFR – 4.D).

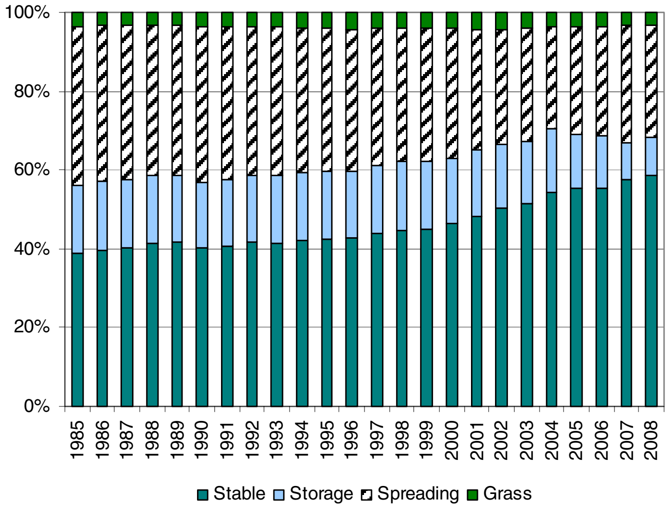


Figure 6.5 The percentage distribution of the $NH_3$ emission in the agricultural production 1985 to 2008.

## 6.3 $NH_3$ emission from agricultural soils – NFR 4.D

### 6.3.1 Description

Ammonia emission from agricultural soils contributes with 14% of the total emission from the agricultural sector. Figure 6.6 shows the different emission sources from agricultural soils (NFR Table 4.D). The majority of the ammonia emission from agricultural soils originates from crops, which in 2008 corresponds to 44 %. Another 40 % is related to use of synthetic fertiliser and the remaining part comes from nitrogen deposited by grazing animals and from ammonia-treated straw used as feed.

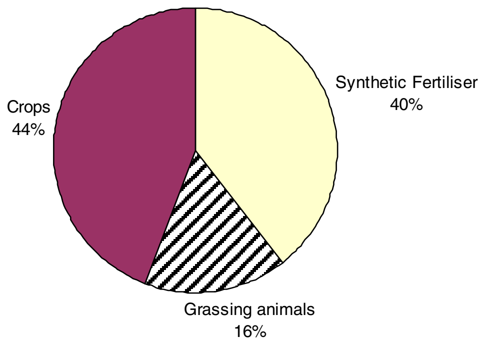


Figure 6.6 Ammonia emissions from agricultural soils 2008.

### 6.3.2 Methodological issues

More detailed description covering the calculation of the different emission sources and information about activity data and emission factors used is given in Annex 2C2.

**Activity data**

At present, farmed area covers about 60 % of the total land area in Denmark. In recent decades, farmed area has decreased, being replaced by forest, semi-natural, road and built-up areas and this development is expected to continue. Table 6.7 shows the activity data used in calculation of the ammonia emission from agricultural soils. Information on farmed area and cultivation of different crop types is collected by Statistics Denmark. The amount of nitrogen used in synthetic fertiliser is based on information from the Danish Plant Directorate. The use of fertiliser has decreased considerably – consumption in 2008 is almost half that in 1985. The increase of fertiliser from 2007 to 2008 can mainly be explained by expectations of rising prices.

Table 6.7 Activity data used to estimate the $NH_3$ emission from agricultural soils 1985 to 2008.

| NFR 4.D | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Activity data | Unit | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
| Cultivated area | 1000 ha | 2 834 | 2 819 | 2 798 | 2 787 | 2 774 | 2 788 | 2 770 | 2 756 | 2 739 | 2 691 | 2 726 | 2 716 |
| N in fertiliser | M kg N | 398 | 382 | 381 | 367 | 377 | 400 | 395 | 370 | 333 | 326 | 316 | 291 |
| N deposit on grass | M kg N | 37 | 36 | 35 | 35 | 34 | 35 | 35 | 35 | 36 | 35 | 36 | 36 |
| $NH_3$ treated straw | M kg N | 10 | 12 | 14 | 11 | 14 | 16 | 13 | 12 | 12 | 12 | 10 | 8 |
| NFR 4.D | | | | | | | | | | | | | |
| Activity data | Unit | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| Cultivated area | 1000 ha | 2 688 | 2 672 | 2 644 | 2 647 | 2 676 | 2 666 | 2 658 | 2 645 | 2 707 | 2 711 | 2 663 | 2 668 |
| N in fertiliser | M kg N | 288 | 283 | 263 | 251 | 234 | 211 | 201 | 207 | 206 | 192 | 195 | 220 |
| N deposit on grass | M kg N | 35 | 35 | 34 | 35 | 35 | 34 | 30 | 28 | 26 | 25 | 24 | 24 |
| $NH_3$ treated straw | M kg N | 7 | 6 | 3 | 4 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |

**Implied emission factor**

The implied emission factors, 1985-2008, in relation to agricultural soils are given in Table 6.8.

The implied emission factors relating to crops are expressed as total emission divided by total area under cultivation, and are decreasing due to the growth in set-a-side area. The implied emission factors relating to use of synthetic fertiliser depend on consumption and type of fertiliser and remain almost the same for all years. The implied emission factors for grazing animals and ammonia used for straw treatment remain unaltered.

Table 6.8 Implied emission factors used to estimate the $NH_3$ emission from agricultural soils.

| NFR 4.D | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Source | Unit | 1985 | 1985 | 1987 | 1988 | 1999 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
| Crops | Kg $NH_3$ pr hectare | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.0 | 1.9 | 2.0 |
| Fertiliser | % of total N | 1.8 | 1.7 | 1.7 | 1.8 | 1.7 | 1.8 | 1.7 | 1.7 | 1.8 | 1.9 | 1.9 | 1.7 |
| N grass | % of total N | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| $NH_3$. straw | % of total $NH_3$-N | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| NFR 4.D | | | | | | | | | | | | | |
| Source | Unit | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| Crops | Kg $NH_3$ pr hectare | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Fertiliser | % of total N | 1.6 | 1.6 | 1.6 | 1.7 | 1.6 | 1.6 | 1.7 | 1.7 | 1.7 | 1.9 | 1.9 | 1.8 |
| N grass | % of total N | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| $NH_3$. straw | % of total $NH_3$-N | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |

### 6.3.3 Time-series

From 1985 to 2008 the ammonia emission from agricultural soils decreased from 25.69 Gg $NH_3$ to 12.38 Gg $NH_3$, which corresponds to a 52 % reduction (Table 6.9). A considerable increase in the use of fertiliser and ammonia used for straw treatment has, in particular, been important for this development.

As mentioned, there has been an active effort in recent decades to reduce nitrogen leaching by means of action plans. This focus on environmental impact in agricultural production has led to an improvement in the utilisation of nitrogen in manure. A consequence of this development is that the use of fertiliser and, in turn, the $NH_3$ emission has been reduced.

Table 6.9 Emission of $NH_3$ from Agricultural Soils from 1985 to 2008, Gg $NH_3$.

| NFR 4.D Agricultural Soils | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Crops | 5.97 | 5.97 | 5.96 | 5.91 | 5.88 | 5.92 | 5.88 | 5.85 | 5.77 | 5.36 | 5.28 | 5.31 |
| Use of fertiliser | 8.48 | 8.04 | 7.83 | 7.83 | 7.80 | 8.68 | 8.33 | 7.81 | 7.34 | 7.64 | 7.27 | 6.16 |
| N deposit on grass | 3.16 | 3.09 | 2.97 | 2.93 | 2.92 | 2.95 | 3.01 | 3.02 | 3.07 | 3.00 | 3.05 | 3.07 |
| $NH_3$ treated straw | 6.54 | 8.04 | 8.92 | 7.25 | 9.00 | 10.19 | 8.64 | 7.67 | 7.58 | 8.10 | 6.63 | 5.06 |
| Emission - total | 25.69 | 26.47 | 26.93 | 24.85 | 26.58 | 27.82 | 25.95 | 24.42 | 23.84 | 24.18 | 22.33 | 19.70 |
| NFR 4.D Agricultural Soils | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| Crops | 5.44 | 5.41 | 5.25 | 5.21 | 5.25 | 5.26 | 5.24 | 5.27 | 5.34 | 5.34 | 5.26 | 5.41 |
| Use of fertiliser | 5.59 | 5.63 | 5.23 | 5.07 | 4.66 | 4.15 | 4.06 | 4.31 | 4.27 | 4.33 | 4.48 | 4.86 |
| N deposit on grass | 3.01 | 2.98 | 2.92 | 2.95 | 2.99 | 2.89 | 2.59 | 2.39 | 2.24 | 2.12 | 2.00 | 2.01 |
| $NH_3$ treated straw | 4.48 | 3.70 | 2.08 | 2.47 | 1.62 | 0.94 | 0.80 | 0.53 | 0.26 | 0.00 | 0.00 | 0.00 |
| Emission - total | 18.61 | 17.84 | 15.59 | 15.81 | 14.65 | 13.34 | 12.82 | 12.63 | 12.23 | 11.91 | 11.84 | 12.38 |

## 6.4 $NH_3$ emission from sewage sludge – NFR 4.G

Around half of the sludge from wastewater treatment is used as fertiliser and applied on agricultural soils. The $NH_3$ emission from sewage sludge is included under the NFR category 4G "Other". The emission from sewage sludge contributes with less than ½ % of the total emission from agricultural emissions.

Information on amount of sludge, N-content and ammonia emission factor is obtained from reports prepared by the Danish Protection Agency. It is assumed that the ammonia emission is 1.9 kg $NH_3$-N pr kg N. The amount of sewage sludge has increased from 1985 until 1995. In the following years to 2008 the amount of sludge used as fertiliser has fallen as a result of increasing request from the industrial sector. The sludge is used in industrial process e.g. in the cement production and production of sandblasting material.

Table 6.10 Emission of $NH_3$ from sewage sludge 1985 to 2008, Gg $NH_3$.

| NFR 4.G Sewage sludge | Unit | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amount of sludge applied on soil | Tonnes of dry matter | 50 000 | 50 000 | 52 380 | 58 200 | 69 840 | 77 883 | 80 181 | 96 174 | 123 382 | 111 155 | 112 235 | 104 010 |
| N-content | Percent | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4,00 | 4.00 | 4.13 | 4.37 |
| N applied on soil | Kg N | 2 000 | 2 000 | 2 095 | 2 328 | 2 794 | 3 115 | 3 207 | 3 847 | 4 935 | 4 446 | 4 635 | 4 545 |
| Emission - total | Gg $NH_3$ | 46 | 46 | 48 | 53 | 64 | 71 | 73 | 88 | 113 | 101 | 106 | 104 |
| NFR 4.G Sewage sludge | Unit | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| Amount of sludge applied on soil | Tonnes of dry matter | 90 701 | 87 209 | 85 733 | 83 727 | 80 877 | 81 623 | 69 661 | 57 700 | 45 738 | 45 427 | 45 623 | 40 000 |
| N-content | Percent | 4.38 | 4.30 | 4.28 | 4.33 | 4.35 | 4.41 | 4.52 | 4.64 | 4.75 | 4.75 | 4.75 | 4.75 |
| N applied on soil | Kg N | 3 973 | 3 750 | 3 669 | 3 625 | 3 518 | 3 600 | 3 151 | 2 675 | 2 173 | 2 158 | 2 167 | 1 900 |
| Emission - total | Gg $NH_3$ | 91 | 86 | 84 | 83 | 80 | 82 | 72 | 61 | 50 | 49 | 49 | 43 |

## 6.5 PM emission from stables – NFR 4.B

This chapter only describes the PM emission related to the animal production. The calculation of PM emission in connection to filed burning of straw is included in chapter 6.6.

### 6.5.1 Description

Investigations have shown that farmers, as well as livestock, are subject to an increased risk of developing lung and respiratory related diseases due to the particulate emissions (Hartung and Seedorf. 1999). This is since the particles are able to carry bacteria, viruses and other organic compounds. Presently, only the emission from 2000 to 2008 is given in NFR.

In 2008 the PM emission from stables, given in TSP, is estimated to 11 855. Of this, 80 % relates to swine production. The emission from cattle and poultry contributes with 11 % and 9 %, respectively and the remainder less than 1 %.

### 6.5.2 Methodological issues

The estimation of PM emission is based on the EMEP-CLRTAP Emission Inventory Guidebook chapter B1010, where the scientific data mainly is based on an investigation of PM emission in North European stables (Takai et al. 1998).

The particle emission includes primary particles in the form of dust from stables. The inventory operates with PM emission from cattle, swine, poultry, horses, and from this year also other poultry, sheep and goats (Table 6.11). Some animals categories are divided into subcategories and for each category it is distinguished between solid and slurry based stable systems.

The PM emission is related to the number of stable places and to the time the animal is housed. The PM emission from grassing animals is considered as negligible.

Table 6.11 Livestock categories used in the PM emission inventory.

| Livestock categories as given in NFR | Subcategories as given in the EMEP-CLRTAP Emission Inventory Guidebook | Danish inventory | Grassing days |
|---|---|---|---|
| Cattle | | | |
| Dairy Cattle | Dairy cattle | Dairy cattle | 18 |
| Non-Dairy Cattle | Calves | Calves < ½ yr | 0 |
| | Beef cattle | Bulls | 0 |
| | | Heifer | 132 |
| | | Suckling cattle | 224 |
| Swine | Sows | Sows (incl piglets until 7 kg) | 0 |
| | Weaners | Weaners (7-30 kg) | 0 |
| | Fattening pigs | Fattening pigs (30-105 kg) | 0 |
| Poultry | Laying hens | Laying hens | 0 |
| | Broilers | Broilers | 0 |
| Horses | Horses | Horses | 183 |
| Sheep | Sheep | Sheep | 265 |
| Goats | Goats | Goats | 265 |

**Activity data**

Livestock production data is based on Statistics Denmark, Agricultural Statistics (www.dst.dk) – Table 6.12.

Table 6.12 Livestock production 2000 – 2008, 1000 head.

| NFR | Animal category | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4B 1a | Dairy Cattle | 636 | 623 | 610 | 596 | 563 | 564 | 550 | 545 | 558 |
| 4B 1b | Non-dairy cattle | 1 232 | 1 284 | 1 187 | 1 128 | 1 082 | 1 006 | 984 | 1 021 | 1 006 |
| 4B 3 | Sheep | 112 | 119 | 117 | 121 | 124 | 126 | 128 | 124 | 117 |
| 4B 4 | Goats | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 13 | 14 |
| 4B 6 | Horses | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 |
| 4B 8 | Swine[1] | 11 922 | 12 608 | 12 732 | 12 949 | 13 233 | 13 534 | 13 361 | 13 723 | 12 738 |
| 4B 9 | Poultry | 21 830 | 21 236 | 20 580 | 17 844 | 16 649 | 17 633 | 17 425 | 16 741 | 15 406 |

[1)] Includes sows. weaners (7-30 kg) and fattening pigs (30-105 kg).

**Emission factor**

Emission factor for TSP, $PM_{10}$ and $PM_{2.5}$ is based on the EMEP/EEA emission inventory guidebook 2009. However, calves and weaners are not included and therefore guidebook 2005 is used. Emission factors for sheep and goats are based on Fontelle et al., 2009. The same emissions factors are used for all years.

In Takai et al. (1998), dust emission from stables is estimated as "inhalable dust". This is defined as particles that can be transported into the body via the respiratory system. Approximately, "inhalable dust" equates to TSP (Hinz. T., 2002). Estimation of TSP is based on the transformation factors for the conversion of inhalable dust into $PM_{10}$ given in inventory guidebook 2005 Table B3 in appendix B.

Table 6.13 Emission factor for particle emission from animal housing system.

| Livestock category | Stable system | Emission factor PM10 kg pr hd pr yr | PM2.5 kg pr hd pr yr | TSP kg pr hd pr yr | Transformation factor PM10 to TSP kg pr hd pr yr |
|---|---|---|---|---|---|
| Cattle: | | | | | |
| Dairy cattle | Solid | 0.36 | 0.23 | 0.29 | 0.46 |
| | Slurry | 0.70 | 0.45 | 0.30 | 0.46 |
| Calves < ½ yr | Solid | 0.16 | 0.10 | 0.29 | 0.46 |
| | Slurry | 0.15 | 0.10 | 0.31 | 0.46 |
| Beef cattle | Solid | 0.24 | 0.16 | 0.31 | 0.46 |
| | Slurry | 0.32 | 0.21 | 0.30 | 0.46 |
| Heifer[1)] | Solid | 0.26 | 0.17 | 0.30 | 0.46 |
| | Slurry | 0.43 | 0.28 | 0.30 | 0.46 |
| Suckling cattle[2)] | Solid | 0.24 | 0.16 | 0.31 | 0.46 |
| | Slurry | 0.32 | 0.21 | 0.30 | 0.46 |
| Swine: | | | | | |
| Sows | Solid | 0.58 | 0.09 | 0.07 | 0.45 |
| | Slurry | 0.45 | 0.07 | 0.07 | 0.45 |
| Weaners | Solid[3)] | 0.18 | 0.03 | 0.07 | 0.45 |
| | Slurry | 0.18 | 0.03 | 0.07 | 0.45 |
| Fattening pigs | Solid | 0.50 | 0.08 | 0.07 | 0.45 |
| | Slurry | 0.42 | 0.07 | 0.07 | 0.45 |
| Poultry: | | | | | |
| Laying hens, cages | Solid | 0.017 | 0.002 | 0.12 | 1.00 |
| Laying hens, pechery | Solid | 0.084 | 0.016 | 0.19 | 1.00 |
| Broilers | Solid | 0.052 | 0.007 | 0.13 | 1.00 |
| Turkeys, ducks and gees | Solid | 0.032 | 0.004 | 0.13 | 1.00 |
| Horses | Solid | 0.18 | 0.12 | 0.31 | 0.46 |
| Sheep | Solid | 0.06 | 0.02 | 0.14 | 0.46 |
| Goats | Solid | 0.06 | 0.02 | 0.14 | 0.46 |

1) Average of “calves” and “dairy cattle”.

2) Assumed the same value as “Beef cattle”.

3) Same as slurry based systems.

### 6.5.3 Time-series

Table 6.14 shows the PM emission, given in TSP, $PM_{10}$ and $PM_{2.5}$ for each animal category in the period 2000 to 2008. It is seen that the main part of the emission originates from swine stables. In the period 2000 to 2008, the total agricultural emission has decreased by 12 % mainly due to a fall in the emission from production of swine. Despite, rice in number of pigs the emission has decreased and this is mainly due to change in stable system to more slurry based systems.

Table 6.14 PM emission from stables 2000 – 2008, Mg $PM_{10}$, $PM_{2.5}$ and TSP.

| | Mg TSP | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| NFR | Animal Category | | | | | | | | | |
| 4B 1a | Dairy | 945 | 914 | 887 | 870 | 833 | 859 | 856 | 836 | 855 |
| 4B 1b | Non-dairy | 847 | 861 | 794 | 501 | 491 | 480 | 485 | 502 | 493 |
| 4B 6 | Horses | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 |
| 4B 8 | Swine | 10 420 | 10 400 | 10 173 | 10 779 | 10 512 | 10 529 | 10 367 | 10 213 | 9 438 |
| 4B 9 | Poultry | 1 265 | 1 246 | 1 237 | 1 232 | 1 063 | 1 278 | 1 082 | 1 038 | 1 027 |
| 4B 3 | Sheep | 4.06 | 4.31 | 4.27 | 4.40 | 4.51 | 4.59 | 4.64 | 4.50 | 4.27 |
| 4B 4 | Goats | 0.31 | 0.34 | 0.34 | 0.37 | 0.39 | 0.42 | 0.44 | 0.46 | 0.51 |
| | TSP total | 13 511 | 13 456 | 13 127 | 13 419 | 12 937 | 13 185 | 12 831 | 12 631 | 11 855 |
| | Mg $PM_{10}$ | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| NFR | Animal Category | | | | | | | | | |
| 4B 1a | Dairy | 435 | 420 | 408 | 400 | 383 | 395 | 394 | 385 | 393 |
| 4B 1b | Non-dairy | 389 | 396 | 365 | 231 | 226 | 221 | 223 | 231 | 227 |
| 4B 6 | Horses | 14 | 14 | 14 | 15 | 15 | 16 | 16 | 17 | 17 |
| 4B 8 | Swine | 4 689 | 4 680 | 4 578 | 4 850 | 4 730 | 4 738 | 4 665 | 4 596 | 4 247 |
| 4B 9 | Poultry | 1 265 | 1 246 | 1 237 | 1 232 | 1 063 | 1 278 | 1 082 | 1 038 | 1 027 |
| 4B 3 | Sheep | 1.87 | 1.98 | 1.96 | 2.02 | 2.08 | 2.11 | 2.13 | 2.07 | 1.96 |
| 4B 4 | Goats | 0.14 | 0.16 | 0.15 | 0.17 | 0.18 | 0.19 | 0.20 | 0.21 | 0.24 |
| | $PM_{10}$ total | 6 794 | 6 759 | 6 605 | 6 730 | 6 420 | 6 650 | 6 383 | 6 268 | 5 913 |
| | Mg $PM_{2.5}$ | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| NFR | Animal Category | | | | | | | | | |
| 4B 1a | Dairy | 279 | 270 | 262 | 257 | 246 | 254 | 253 | 247 | 253 |
| 4B 1b | Non-dairy | 249 | 254 | 234 | 149 | 146 | 142 | 144 | 149 | 146 |
| 4B 6 | Horses | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 11 | 11 |
| 4B 8 | Swine | 765 | 763 | 747 | 791 | 771 | 773 | 761 | 750 | 693 |
| 4B 9 | Poultry | 192 | 188 | 185 | 188 | 164 | 200 | 165 | 159 | 162 |
| 4B 3 | Sheep | 0.55 | 0.58 | 0.58 | 0.60 | 0.61 | 0.62 | 0.63 | 0.61 | 0.58 |
| 4B 4 | Goats | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 | 0.06 | 0.07 |
| | $PM_{2.5}$ total | 1 495 | 1 485 | 1 438 | 1 395 | 1 338 | 1 380 | 1 333 | 1 317 | 1 266 |

## 6.6 Field burning of agricultural wastes – NFR 4F

Field burning of agricultural wastes has in Denmark been prohibited since 1990 and may only take place in connection to production of grass seeds on fields with repeated production and in cases of wet or broken bales of straw. The amount of burnt straw from the grass seed production is estimated as 20 - 15 % of the total amount produced. The amount of burnt bales of or wet straw is estimated as 0.1 % of total amount of straw. Both estimates are based on an expert judgement by the Danish Agricultural Advisory Service. The total amounts are based on data from Statistics Denmark. An EMEP EEA Emission Inventory Guidebook (2009) default value for the emission factors for field burning of agricultural wastes is used.

Emissions of ammonia, $NO_x$, CO, NMVOC, $SO_2$, particulate matter (PM), heavy metals, dioxin and PAH is included under the NFR category 4F. The emission of ammonia and PM from field burning contribute in 2008 with less than 1 % of the agricultural emission. NMVOC from field burning contributes with 13 % of the agricultural emission. The emission of $NO_x$, CO, $SO_2$, heavy metals and dioxin from field burning contribute with less than 1 % of the total national emission, while the emission of PAH contribute with around 2 % of the national emission. From 1989 to 1990 decreases all emissions significantly due to the prohibition, see Annex 2C.3.

## 6.7 NMVOC emissions from agricultural soils – NFR 4D

Around 2 % of the NMVOC emission originates from the agricultural sector, which, in the Danish emission inventory, includes emission from agricultural soils, such as arable land crops and grassland, and field burning of agricultural wastes, see chapter 6.7. Activity data is obtained from Statistics Denmark. The emission factor for agricultural soils is for land with arable crops is 393 g NMVOC pr ha and for grassland, 2120 g NMVOC pr ha (Fenhann & Kilde 1994; Priemé & Christensen 1991).

Table 6.15 NMVOC emission from agricultural soils 1990 – 2008.

| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arable crops, 1000 ha | 2 336 | 2 341 | 2 340 | 2 314 | 2 303 | 2 322 | 2 307 | 2 293 | 2 254 | 2 044 | 2 064 | 2 075 |
| Grassland, 1000 ha | 498 | 478 | 458 | 473 | 472 | 466 | 462 | 463 | 484 | 647 | 446 | 450 |
| NMVOC emission, Gg | 1.97 | 1.93 | 1.89 | 1.91 | 1.90 | 1.90 | 1.89 | 1.88 | 1.91 | 2.18 | 1.76 | 1.77 |
| Contiued | | | | | | | | | | | | |
| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| Arable crops, 1000 ha | 2 138 | 2 125 | 2 064 | 2 043 | 2 060 | 2 065 | 2 062 | 2 079 | 2 086 | 2 083 | 2 050 | 2 107 |
| Grassland, 1000 ha | 403 | 405 | 398 | 413 | 414 | 396 | 390 | 369 | 446 | 460 | 459 | 490 |
| NMVOC emission, Gg | 1.69 | 1.69 | 1.65 | 1.68 | 1.69 | 1.65 | 1.64 | 1.60 | 1.77 | 1.79 | 1.78 | 1.87 |

## 6.8 Uncertainties

Table 6.16 shows the estimated uncertainties for the pollutants.

Uncertainties regarding animal production, such as number of animals, feeding consumption, normative figures ect. are very small. Number of animals is estimated by Statistic Denmark and all cattle, sheep and goats have their own ID-number (ear tags) and, hence, uncertainty with regard to their numbers is almost absent. Statistics Denmark has estimated the uncertainty in the number of pigs to be less than 1 %.

The Danish Normative System for animal excretions is based on data from the Danish Agricultural Advisory Centre (DAAC), which is the central office for all Danish agricultural advisory services. DAAC engages in a great deal of research as well as the collection of efficacy reports from Danish farmers for dairy production, meat production, swine production, etc to optimise productivity in Danish agriculture. In total, feeding plans from 15-18 % of Danish dairy production, 25-30 % of pig production. 80-90 % of poultry production and approximately 100 % of fur production are collected annually. These basic feeding plans are used to develop the standard values of the "Danish Normative System".

The normative figures (Poulsen et al. 2001) are comprised of arithmetic means. Based on feeding plans, the standard deviation in N-excretion rates between farms can be estimated to ±20 % for all animal types (Hanne D. Poulsen. FAS. Pers, comm). However, due to the large number of farms included in the norm figures the arithmetic mean, it can be assumed as a very good estimate with a low uncertainty.

Data for hectares under cultivation is estimated by Statistic Denmark and the uncertainties is based on there calculations. For the most common crops the uncertainties are below 5%.

The combined effect of low uncertainty in actual animal numbers, relatively low uncertainty for feed consumption and excretion rates gives a low uncertainty in the activity data as a whole. The major uncertainty, therefore, relates to the emission factors.

The uncertainties concerning the PM emission factor is at present based on expert judgement. Previously the uncertainties have been considered to be very high. However, guidebook 2009 indicates a lower level of uncertainties and it is planed to study the possibilities to implement these estimates.

The uncertainty for activity data for field burning of agricultural wastes is a combination of the uncertainty for crop production which is low and the uncertainty of the amount of burned straw which is high. The uncertainties for the emission factors are based on EMEP EEA Emission Inventory Guidebook. All uncertainties for field burning are relatively high.

Table 6.16 Estimated uncertainty associated with activities and emission factors for the agricultural sector.

| | Sector | Emission | Activity data % | Emission factor % | Combined uncertainty % | Total uncertainty % |
|---|---|---|---|---|---|---|
| $NO_x$, Gg | 4.F Field burning | 0.10 | 50 | 25 | 56 | 56 |
| CO, Gg | 4.F Field burning | 2.53 | 50 | 100 | 112 | 112 |
| NMVOC, Gg | 4.D Direct soil emission | 1.87 | 1 | 500 | 500 | 437 |
| | 4.F Field burning | 0.27 | 50 | 100 | 112 | |
| $SO_2$, Gg | 4.F Field burning | 0.01 | 50 | 100 | 112 | 112 |
| $NH_3$, Gg | 4.B Manure management | 58.92 | 5 | 20 | 21 | 18 |
| | 4.D Agricultural soils | 12.28 | 2 | 24 | 24 | |
| | 4.F Field burning | 0.10 | 50 | 50 | 71 | |
| | 4.G Other | 0.04 | 20 | 20 | 28 | |
| TSP, Mg | 4.B Manure management | 11 855 | 2 | 500 | 500 | 500 |
| | 4.F Field burning | 0.25 | 50 | 50 | 71 | |
| $PM_{10}$, Mg | 4.B Manure management | 5 913 | 2 | 500 | 500 | 500 |
| | 4.F Field burning | 0.25 | 50 | 50 | 0 | |
| $PM_{2.5}$, Mg | 4.B Manure management | 1 266 | 2 | 500 | 500 | 500 |
| | 4.F Field burning | 0.24 | 50 | 50 | 71 | |
| Pb, Mg | 4.F Field burning | 0.04 | 50 | 50 | 71 | 71 |
| Cd, Mg | 4.F Field burning | 0.00 | 50 | 100 | 112 | 112 |
| Hg, Mg | 4.F Field burning | 0.00 | 50 | 200 | 206 | 206 |
| As, Mg | 4.F Field burning | 0.00 | 50 | 100 | 112 | 112 |
| Cr, Mg | 4.F Field burning | 0.01 | 50 | 200 | 206 | 206 |
| Cu, Mg | 4.F Field burning | 0.00 | 50 | 200 | 206 | 206 |
| Ni, Mg | 4.F Field burning | 0.01 | 50 | 200 | 206 | 206 |
| Se, Mg | 4.F Field burning | 0.00 | 50 | 100 | 112 | 112 |
| Zn, Mg | 4.F Field burning | 0.00 | 50 | 200 | 206 | 206 |
| Dioxin, g I-Teq | 4.F Field burning | 0.03 | 50 | 500 | 502 | 502 |
| Benzo(a)pyrene, Mg | 4.F Field burning | 0.12 | 50 | 500 | 502 | 502 |
| Benzo(b)fluoranthen, Mg | 4.F Field burning | 0.12 | 50 | 500 | 502 | 502 |
| Benzo(k)fluoranthen, Mg | 4.F Field burning | 0.05 | 50 | 500 | 502 | 502 |

## 6.9 Quality assurance and quality control (QA/QC)

A general QA/QC and verification plan for the agricultural sector is still under development, but some measures have been formulated as general lines for the further work. The objectives for the quality planning, as given in the CLRTAP Emission Inventory Guidebook, which is closely related to the IPCC Good Practice Guidance, are to improve the transparency, consistency, comparability, completeness and confidence.

To ensure consistency in the inventory, certain time-series have been prepared for both the activity data, the emission factors and implied emission factors, 1985 - 2008. Considerable variation between years can reveal miscalculations or changes in methods. These variations are checked and errors have been rectified. There have been some problems related to the implementation of the new database system IAD – especially in connection to the data of nitrogen. Now a quality check procedure are provided which include annually check for all activity data, emission factor and implied emission factors.

Activity data and emission factors are collected and discussed in co-operation with specialists and researchers at different institutes and research sections. As a consequence, both data and methods are evaluated continuously according to latest knowledge and information. A more detailed description of quality assurance and quality control is given in the Denmark´s National Inventory Report 2006 - submitted under the United Nations Framework Convention on Climate Change
(http://www2.dmu.dk/Pub/FR724.pdf).

## 6.10 Recalculations

Compared with the previous $NH_3$ and PM emissions inventory (submission 2009), some changes and updates have been made. These changes cause a decrease in the $NH_3$ emission (1985 – 2007) and a decrease in the PM emission (2000 – 2007), see Table 6.17.

The main reason for the decrease in ammonia emission is calculations of ammonia have been adjusted to TAN for the whole period 1985-2008 and this have led to a decrease in the emission from animal manure of 4-8% in the period 1985-2007.

The PM emission mainly decreases because of changes in the emission factor for poultry, the EMEP/EEA (2009) is now used.

Table 6.17 Changes in $NH_3$ emission and PM emission in the agricultural sector compared to NFR reported last year.

| $NH_3$ emission (Gg $NH_3$) | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Previous | 126.87 | 127.74 | 124.20 | 121.43 | 121.69 | 121.36 | 117.13 | 115.31 | 112.62 | 108.28 | 101.29 | 97.20 |
| Updated | 114.21 | 115.06 | 112.29 | 109.77 | 110.73 | 110.04 | 106.48 | 104.97 | 102.68 | 100.07 | 93.91 | 90.89 |
| Difference (pct) | -10.0 | -9.9 | -9.6 | -9.6 | -9.0 | -9.3 | -9.1 | -9.0 | -8.8 | -7.6 | -7.3 | -6.5 |

| $NH_3$ emission (Gg $NH_3$) | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Previous | 96.57 | 97.70 | 92.86 | 92.68 | 91.34 | 88.79 | 80.56 | 80.29 | 75.84 | 73.22 | 72.63 |
| Updated | 89.56 | 89.92 | 84.56 | 84.30 | 81.63 | 79.48 | 77.23 | 76.94 | 73.24 | 71.20 | 71.61 |
| Difference (pct) | -7.3 | -8.0 | -8.9 | -9.0 | -10.6 | -10.5 | -4.1 | -4.2 | -3.4 | -2.8 | -1.4 |

| PM emission (Mg TSP) | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|
| Previous | 15 765 | 15 567 | 15 524 | 14 724 | 14 911 | 15 448 | 15 599 | 14 562 |
| Updated | 13 511 | 13 456 | 13 127 | 13 419 | 12 937 | 13 185 | 12 831 | 12 631 |
| Difference (pct) | -14.3 | -13.6 | -15.4 | -8.9 | -13.2 | -14.7 | -17.7 | -13.3 |

There have been no changes in the methodology.

In the following some further changes are mentioned which has minor influence on the total emissions:

The number of animals have been changed for the categories (years) swine (2000, 2001, 2007), sheep (1994-2007), goats (1990-2007), broilers (2007), heifers (1997) and horses (2007), because of new data or errors. Also for some animals the distribution on liquid and solid manure some changes have been made because of new data.

N ab animal for heifers have been interpolated for the years 2005 and 2006 to remove time-series inconsistency.

New date for sewage sludge for the years 2003-2007 have led to a decrease in emission of ammonia from sewage sludge of 11-40%.

Changes in the distribution of animals on liquid and solid manure have also affected the PM emission. Emissions from sheep, goats and other poultry have been included.

This year the emission from field burning of agricultural wastes has been reconsidered and burning of straw from grass seed production is taken into account. Emission of NH3, $NO_x$, CO, NMVOC, $SO_2$, particulate matter (PM), heavy metals, dioxin and PAH from field burning of agricultural wastes are included in the inventory for the whole period 1985-2008 and recalculations for NH3, $NO_x$, CO, NMVOC, $SO_2$ is made for the years 1985-1989.

## 6.11 Planned improvements

Until now the number of bulls is based on the annually census. Instead, it is planned to use information on slaughtering data received from Statistics Denmark, which better reflects the year production. At the same time the exported animals will be included.

In recent years, there has been focus on reduction of the ammonia emission and especially the possibilities for emission reduction in stables. A number of investigations to estimate the effects from technical measures on the emission have been initiated. However, very few stables have implemented ammonia reduction technologies, although these probably will be an important issue in future. When data is available, it is planned to implement the reduction effect in the emission inventory.

It is planned to include the dust emission from arable farming – i.e. harvesting and field preparation by machines. At the moment there are not resources to implement this, but DK has noticed that ERT strongly encourage making further efforts to include it.

The guidebook 2009 indicates a lower level of uncertainties for PM emission factors for livestock than used by DK in the present inventory. It is planed to study the possibilities to implement the guidebook 2009 estimates.

The QA/QC plan for the agricultural sector is still under development. First step will focus on improvement of the procedure of intern quality check of both data input and output. It is planned to provide a check list of all activity data, emission factor, implied emission factor and other important key parameters. The annual change for each emission source on activity will be checked for significant differences and if necessary explained. Next step includes control of the inventory data calculations. This mean to identify the possibility to compare the calculations made by other institutions or organisations e.g. calculation of total N-excretion made by the Faculty of Agricultural Science. The third step is to consider how to provide a quality assurance procedure for the entire inventory.

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# 7 Waste (NFR sector 6)

The waste sector consists of the four main NFR categories 6A Solid waste disposal on land, 6B Waste-Water handling, 6C Waste incineration and 6D Other waste. Table 7.1 below shows the relevant SNAP codes for the waste sector.

Table 7.1 Link between SNAP codes and NFR sectors.

| SNAP code | SNAP name | NFR code |
|---|---|---|
| 090401 | Managed Waste Disposal on Land | 6A |
| 090402 | Unmanaged Waste Disposal Sites | 6A |
| 090403 | Other | 6A |
| 091001 | Waste water treatment in industry | 6B |
| 091007 | Latrines | 6B |
| 091002 | Waste water treatment in residential/commercial sect. | 6B |
| 090201 | Incineration of domestic or municipal wastes | 6C |
| 090202 | Incineration of industrial wastes (except flaring) | 6C |
| 090204 | Flaring in chemical industries | 6C |
| 090205 | Incineration of sludge from waste water treatment | 6C |
| 090207 | Incineration of hospital wastes | 6C |
| 090208 | Incineration of waste oil | 6C |
| 090901 | Incineration of corpses | 6C |
| 090902 | Incineration of carcasses | 6C |
| 090700 | Open burning of agricultural wastes | 6C |
| 091008 | Other production of fuel (refuse derived fuel) | 6D |
| 091003 | Sludge spreading | 6D |
| 091005 | Compost production | 6D |
| 091006 | Biogas production | 6D |

Incineration of waste in Denmark is done with energy recovery and therefore the emissions are included under the relevant sectors under NFR sector 1A. The documentation for waste incineration is included in chapter 3.2.

The waste sector is presently only a key source for dioxin due to the emissions from accidental fires. It is unsure whether NMVOC from waste disposal and waste-water handling, which is to be included in the inventory, will be key categories in the future.

## 7.1 Solid waste disposal on land

Major emissions from waste disposal are emissions of greenhouse gases. It is assumed that waste disposal also leads to emission of small quantities of NMVOC, CO, $NH_3$ and $NO_x$. PM emissions are emitted from waste handling as well, but no emission factors are available.

For the 2010 submission Denmark has not estimated emissions of air pollutants from solid waste disposal. The draft EMEP/EEA Guidebook contains a default NMVOC emission factor, however due to limited resources it has not been possible to estimate the emissions.

## 7.2 Waste-water handling

According to the EMEP/EEA Guidebook waste-water handling can be a source for emissions of POPs, NMVOC, $NH_3$ and CO. Of these pollutants only NMVOC is thought to be significant.

For the current submission Denmark has not estimated emissions of air pollutants from waste-water handling. The EMEP/EEA Guidebook contains a default NMVOC emission factor for latrines and waste-water handling, however due to limited resources it has not been possible to estimate the emissions.

## 7.3 Waste incineration

Incineration of municipal, industrial and clinical waste take place with energy recovery, therefore the emissions are included in the relevant subsectors under NFR sector 1A. For documentation please refer to chapter 3.2. Flaring off-shore and in refineries are included under NFR sector 1B2c, for documentation please refer to chapter 3.4. No flaring in chemical industry occurs in Denmark.

### 7.3.1 Cremation

*Human cremation*

The incineration of human bodies is a common practice that is performed on an increasing part of the yearly deceased. All Danish incineration facilities use optimised and controlled combustions, with temperatures reaching 800-850 °C, secondary combustion chambers, controlled combustion air flow and regulations for coffin materials.

However the emissions of especially Hg caused by cremations can still contribute to a considerable part of the total national emissions. In addition to the most frequently discussed emissions of Hg and PCDD/Fs (dioxins and furans), are the emissions of compounds like $SO_X$, $NO_X$, VOC, CO, other heavy metals (As, Cd, Cr, Co, Ni, Pb, Se, Zn) and particulate matter.

Crematoria are usually located within cities, close to residential areas and normally, their stacks are relatively low. Therefore environmental and human exposure is likely to occur as a result of emissions from cremation facilities.

*Animal cremation*

The burning of animal carcasses in animal crematoria follows much the same procedure as human cremation. Animal cremation facilities use similar two chambered furnaces and controlled combustion. However animals are burned in special designed plastic (PE) bags rather than coffins.

Emission from animal cremation is also similar to that of human cremation, with the exception of heavy metals.

Animal cremations are performed in two ways, individually where the owner often pays for receiving the ashes in an urn or collectively which is most often the case with animal carcasses that are left at the veterinarian.

**Methodology**

*Human cremation*

There are 31 crematoria in Denmark, some with multiple furnaces, 21 facilities are run by the church and 10 by the local authorities (DKL, 2009)(KM, 2006).

During the 1990es all Danish crematoria were rebuilt to meet new standards. This included installation of secondary combustion chambers and in most cases, replacement of old primary incineration chambers (Schleicher et al., 2001). All Danish cremation facilities are therefore performing controlled incinerations with a good burn-out of the gases, and a low production of pollutants. But only a very few crematoria are equipped with flue gas cleaning (bag filters with activated carbon).

Following the development of new technology, the emission limits for crematoria are lowered again in 1/2011. These new standard terms were originally expected from 1/2009 but have been postponed two years for existing crematoria. Table 7.2 shows a comparison of the emission limits from 2/1993 and the new standard limits.

Table 7.2 Emission limit values mg pr normal $m^3$ at 11 % $O_2$ (Schleicher & Gram, 2008).

| Component | Report 2/1993 | Standard terms (1/2011) |
|---|---|---|
| | Emission limit value mg/normal $m^3$ at 11 % $O_2$ | |
| Total dust | 80 | 10 |
| CO | 50 | 50 |
| $CO_2$ | 500 | 500 |
| Hg | No demands | 0.1 |
| Other demands: | | |
| Stack height | 3 m above rooftop | 3 m above rooftop |
| Temperature in stack | Minimum 150 °C | Minimum 110 °C |
| Flue gas flow in stack | 8 – 20 m/s | No demands |
| Temperature in after burner | 850 °C | 800 °C |
| Residence time in after burner | 2 seconds | 2 seconds |
| Odour | The crematory must not cause noticeable odour in the surroundings | The crematory must not cause odour nuisance outside the crematory perimeter, that is significant according to the supervisory authority |

The use of air pollution control devices, and activated carbon, for the removal of Hg is expected to reduce the flue gas concentration of dioxins, PAH's and odour. Existing knowledge on the reduction efficiencies justifies that no emission limits are necessary (Schleicher & Gram, 2008).

*Animal cremation*

Open burning of animal carcasses is illegal in Denmark and is not occurring, and small-scale incinerators are not known to be used at Danish farms. Livestock that is diseased or in other ways unfit for consumption is disposed of through rendering plants, incineration of livestock carcasses is illegal and these carcasses are therefore commonly used in the production of fat and soap at Daka Bio-industries.

The only animal carcasses that are approved for cremation in Denmark are deceased pets and animals used for experimental purposes, where the burning must take place at a specialised animal crematorium. There are four animal crematoria in Denmark but one of these is situated at the AVV waste incineration site. The special designed cremation furnaces are at this location connected to the flue gas cleaning equipment of the waste incineration plant and the emission from the cremations are included in the yearly inventory from AVV and consequently included under waste incineration in this report. Therefore only three animal crematoria are discussed in this section.

Animal by-products are considered waste, and emission from animal crematoria must therefore comply with the EU requirements for waste incineration. The EU directive (2000/76/EF) on waste incineration has been transferred in to Danish law (Statutory order nr.162[13]).

The incineration of animal carcasses is, as the incineration of human corpses, performed in special furnaces. All furnaces at Danish pet crematoria have primary incineration chambers with temperatures around 850 ºC and secondary combustion chambers with temperatures around 1100 ºC. The fuel used at the Danish facilities is natural gas.

Emissions from pet cremations are calculated for $SO_2$, $NO_X$, NMVOC, $CH_4$, CO, $CO_2$, $N_2O$, $NH_3$, particles, heavy metals (As, Cd, Cr, Cu, Ni, Pb, Se, Zn), HCBs, dioxins/furans, PAHs and PCBs. For the compounds $SO_2$, $NO_X$, $CH_4$, CO, $CO_2$, $N_2O$, As, Se, HCB and PCB emission are estimated by using the same emission factors as for human cremation.

#### Activity data

*Human cremation*

Table 7.3 shows the development in total number of nationally deceased persons, number of cremations and in the fraction of cremated corpses from the total number of deceased. Data for the total number of nationally deceased persons is collected from (Danmarks Statistik 2009). The data describing the number of cremations and the cremation fraction in the period 1990-2008 is gathered from the Association of Danish Crematoria (DKL 2009). By assuming that the development of the cremation fraction is constant back to the year 1980, the fraction from 1980-1989 can be calculated from the trend of the development of 1990-2008. An estimation of the number of yearly cremations from 1980-1989 is then found by multiplying the calculated cremation fraction with the number of nationally deceased persons.

[13] Bekendtgørelse nr. 162 of 11 March 2003 on waste incineration plants.

Table 7.3 Activity data (DKL 2009).

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| Nationally deceased | 55 939 | 56 359 | 55 368 | 57 156 | 57 109 | 58 378 | 58 100 | 58 136 | 58 984 | 59 397 |
| Cremations | 35 226 | 35 745 | 35 367 | 36 768 | 36 996 | 38 082 | 38 164 | 38 450 | 39 278 | 39 822 |
| Cremation fraction, % | 63.0 | 63.4 | 63.9 | 64.3 | 64.8 | 65.2 | 65.7 | 66.1 | 66.6 | 67.0 |
| *Continued* | | | | | | | | | | |
| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Nationally deceased | 60 926 | 59 581 | 60 821 | 62 809 | 61 099 | 63 127 | 61 043 | 59 898 | 58 453 | 59 179 |
| Cremations | 40 991 | 40 666 | 41 455 | 43 194 | 42 762 | 43 847 | 43 262 | 42 891 | 41 660 | 42 299 |
| Cremation fraction, % | 67.3 | 68.3 | 68.2 | 68.8 | 70.0 | 69.5 | 70.8 | 71.6 | 69.1 | 74.4 |
| *Continued* | | | | | | | | | | |
| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| Nationally deceased | 57 998 | 58 355 | 58 610 | 57 574 | 55 806 | 54 962 | 55 477 | 55 604 | 54 591 | |
| Cremations | 41 651 | 41 707 | 42 539 | 41 997 | 41 555 | 40 758 | 41 233 | 41 766 | 41 788 | |
| Cremation fraction, % | 71.8 | 71.5 | 72.6 | 72.9 | 74.5 | 74.2 | 74.3 | 75.1 | 76.6 | |

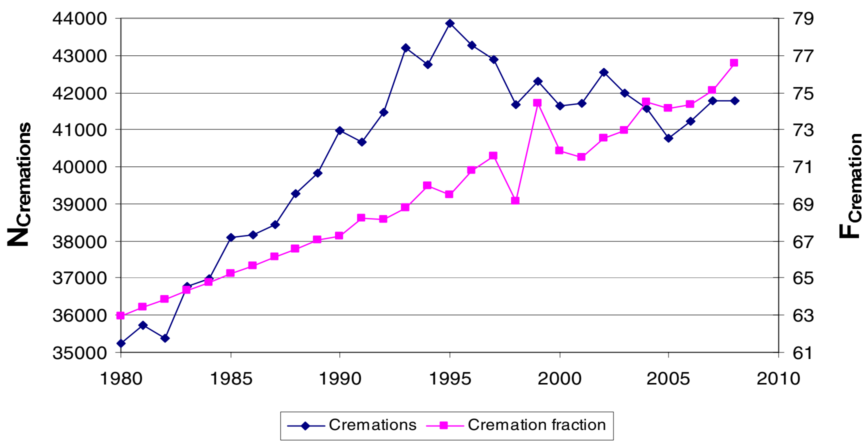


Figure 7.1 Illustration of the development in cremations (DKL 2009), where the number of cremations, $N_{cremations}$, is shown at the left Y-axis. The cremation percentage, $F_{cremations}$, shows the percent of cremation deceased of the total deceased from the year 1990 to 2008. Data for 1980-1989 are estimated values.

Even though the total number of yearly cremations is fluctuating, the cremation percentage has been increasing since 1990, and is likely to continue to increase.

*Animal cremation*

Activity data for the incineration of animal carcasses are gathered directly from the pet crematoria. There is no national statistics available on the activity of animal crematoria. The precision of activity data therefore depends on the information provided by the crematoria.

The following Table 7.4 lists the four Danish crematoria, their foundation year and provides each crematorium with an id letter.

Table 7.4 Animal crematoria I Denmark.

| Id | Name of crematorium | Founded in |
|---|---|---|
| A | Dansk Dyrekremering ApS | May 2006 |
| B | Ada's Kæledyrskrematorium ApS | Unknown, existed in more than 25 years, assumed 1980 |
| C | Kæledyrskrematoriet | 2006 |
| D | Kæledyrskrematoriet v. Modtagestation Vendsyssel I/S | - |

Crematoria D is situated at the AVV waste incineration site and the emission from this site is, as previously mentioned, included in the yearly inventory from AVV and consequently included under waste incineration in this report. From here on only crematoria A-C are considered.

Table 7.5 lists the activity data for crematoria A, B, C and the total national cremated amount for the years 1980-2008.

Table 7.5 Activity data, (direct contact with all Danish crematoria).

| Year | Amount cremated at crematorium A, Mg | Amount cremated at crematorium B, Mg | Amount cremated at crematorium C, Mg | Amount cremated nationally, Mg |
|---|---|---|---|---|
| 1980 | - | 50 | - | 50 |
| 1981 | - | 60 | - | 60 |
| 1982 | - | 70 | - | 70 |
| 1983 | - | 80 | - | 80 |
| 1984 | - | 90 | - | 90 |
| 1985 | - | 100 | - | 100 |
| 1986 | - | 110 | - | 110 |
| 1987 | - | 120 | - | 120 |
| 1988 | - | 130 | - | 130 |
| 1989 | - | 140 | - | 140 |
| 1990 | - | 150 | - | 150 |
| 1991 | - | 160 | - | 160 |
| 1992 | - | 170 | - | 170 |
| 1993 | - | 180 | - | 180 |
| 1994 | - | 190 | - | 190 |
| 1995 | - | 200 | - | 200 |
| 1996 | - | 210 | - | 210 |
| 1997 | - | 220 | - | 220 |
| 1998 | - | 235 | - | 235 |
| 1999 | - | 368 | - | 368 |
| 2000 | - | 443 | - | 443 |
| 2001 | - | 452 | - | 452 |
| 2002 | - | 451 | - | 451 |
| 2003 | - | 462 | - | 462 |
| 2004 | - | 571 | - | 571 |
| 2005 | - | 762 | - | 762 |
| 2006 | 300 | 798 | 18 | 1 116 |
| 2007 | 450 | 802 | 32 | 1 284 |
| 2008 | 450 | 848 | 40 | 1 338 |

Crematorium A delivered activity data for 2008 as the interval 400-500 Mg, the exact value is assumed to be the average of this interval and the rate is assumed to be constant back to the year 2006. The activity data for Crematoria A in 2006 is rated according to the founding of the site in May of this year.

Crematorium B delivered exact yearly activity data for the years 1998-2008. They were not certain about the founding year but have existed for more than 25 years. It is assumed that crematorium B was founded in January 1980. These activity data are shown as the thick line in Figure 7.2 and added a trendline and the equation of the trendline.

It is not possible to extrapolate data back to 1980 because the activity, due to the steep trendline, in this case would become negative from 1993 and back in time.

Statistic data describing the national consumption for pets including food and equipment for pets was evaluated as surrogate data. These statistic data show an increase of consumption of 6 % from 1998 to 2000, in the same period the national amount of cremated animal carcasses increased with 89 % and no correlation seems to be present. Since there are no other available data on the subject of pets, it is concluded that there are no surrogate data available. The activity data for the period of 1980-1997 are estimated by en expert judgement. The estimated data are shown in Table 7.5 and the following Figure 7.2.

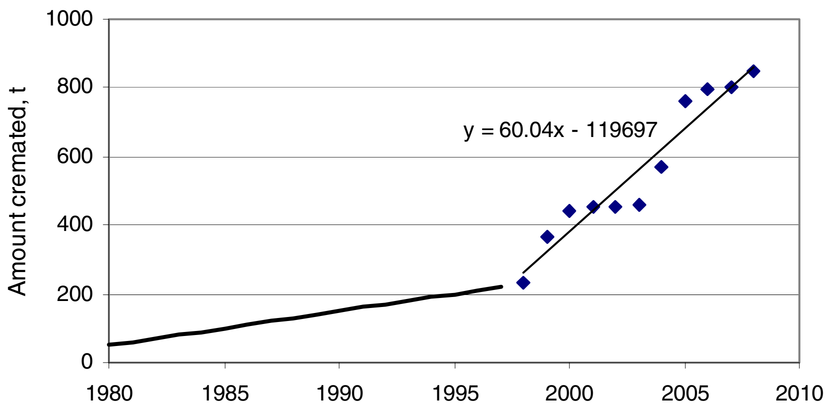


Figure 7.2 shows the amount of cremated carcasses in Mg at crematorium B which is the oldest and largest crematorium in Denmark. Data from 1998-2008 are delivered by the crematorium and is considered to be exact, these data are marked as points. Date from 1980-1997 are estimated and are shown as the thick line in the figure.

**Emission factors**

*Human cremation*

For crematoria, emissions are calculated by multiplying the total number of cremations by the emission factors. Since there are no measurements available of the yearly emission from Danish crematoria, the estimation of emissions is based on emission factors from literature. The estimation is based on the measurements performed in countries that are comparable with Denmark. By comparable is meant countries that use similar incineration processes, similar cremation techniques including support fuel and have a similar composition of sources to lifetime exposure, lifetimes and coffins.

Table 7.6 lists the emission factors and their respective references.

Table 7.6 Emission factors for human cremation with references.

| Pollutant name | Unit | Emission factor* | Reference |
|---|---|---|---|
| $SO_X$ | g/body | 54.4 | US-EPA |
| $NO_X$ | g/body | 308.5 | US-EPA |
| NMVOC | g/body | 13.0 | CANA, 1993 |
| $CH_4$ | g/body | 11.8 | Aasestad |
| CO | g/body | 10.8 | Schleicher et al., 2001 |
| $CO_2$ | kg/body | 50.1 | Fontelle et al. |
| $N_2O$ | g/body | 14.7 | Aasestad |
| $NH_3$ | | NA | |
| TSP | g/body | 43.5 | WEBFIRE |
| $PM_{10}$ | g/body | 39.2 | WEBFIRE |
| $PM_{2.5}$ | g/body | 39.2 | WEBFIRE |
| As | µg/body | 10.98 | US-EPA |
| Cd | µg/body | 3.11 | US-EPA |
| Cr | µg/body | 8.44 | US-EPA |
| Cu | µg/body | 7.71 | US-EPA |
| Hg | g/body | 1.12 | Kriegbaum et al. |
| Ni | µg/body | 10.8 | US-EPA |
| Pb | µg/body | 18.6 | US-EPA |
| Se | g/body | 0.0223 | WEBFIRE |
| Zn | g/body | 0.181 | WEBFIRE |
| HCB | µg/body | 151.6 | Eisaku TODA |
| PCDD/F | µg I-TEQ/body** | 0.950 | Henriksen et al. |
| Flouranthene | µg/body | 0.0590 | US-EPA |
| Benzo(b)flouranthene | µg/body | 8.14 | WEBFIRE |
| Benzo(k)flouranthene | µg/body | 7.27 | WEBFIRE |
| Benzo(a)pyrene | µg/body | 0.0103 | US-EPA |
| Benzo(g,h,i)perylene | µg/body | 14.9 | WEBFIRE |
| Indeno(1,2,3-c-d)pyrene | µg/body | 7.88 | WEBFIRE |
| PCB | µg/body | 413.5 | Eisaku TODA |

*NA = not available.

** I-TEQ: International Toxicity Equivalents.

Danish measurements of dioxin emissions from three furnaces in two different crematoria in 2001 showed concentration ranges of 0.2 – 0.7 ng I-TEQ pr $m^3$ (n.t.10 % $O_2$) and emission factor in the range of 180 - 930 ng I-TEQ pr cremation. The calculated average emission factor is 350 ng I-TEQ pr cremation, and the average concentration is 0.3 ng I-TEQ pr $m^3$ (n.t.10 %$O_2$). The measurements are assumed representative for all Danish crematory furnaces (Schleicher & Gram, 2008).

A Danish substance flow analysis from 2003 estimated the dioxin emission factor from crematoria to be in the range of 6-70 mg I-TEQ pr year (90 % confidence level), with an average value of 950 ng I-TEQ pr cremation (Henriksen et al., 2006). The estimate from Henriksen et al., 2006 is the based on the latest dated measurements and is the one chosen for this inventory.

It has not been possible to find data for ammonia. Ammonia might appear in lesser amounts, but will most likely be converted to $NO_X$ at the high incineration temperatures.

For the compounds $CH_4$, $CO_2$, $N_2O$, Se, PCB, HCB, benzo(b)- and (k)-flouranthene, benzo(g,h,i)perylene and indeno(1,2,3-c-d)pyrene, it has not been possible to find any additional data to validate the emission factors. Only in the case of PCB, Thomsen et al.,2009 provides an emission factor for PCB of 0.4 mg pr tonnes and assuming a body mass of 70 kg this gives an emission factor of 28 µg pr body. The Japanese reference (Eisaku TODA, 2006) may be overestimated due to differences in sources to the total exposure in Japan and in Denmark and due to a higher technological development and use of air pollution devices. Still, the Japanese emission factor was selected in the inventory of this year as this data source represents newest knowledge and refers to real measurements.

For the compounds As, Cd, Cr, Cu, Ni, benzo(a)pyrene and flouranthene, the emission factors from US EPA 1996 were compared with data found in the database provided by US EPA (WEBFIRE, 1992). The two data sources present emission factors that differ significantly for these compounds. Since no other data is available, the most resent estimated emission factor is chosen.

In addition to the two US data sources (WEBFIRE and US-EPA, 1996), emission factors for Pb and Zn were found in a scientific paper by Santarsiero et al.,2005 and, for Pb, also in a Swiss report (Heldstab et al., 2008). These data corresponds well with the emission factors of the WEBFIRE database, which are therefore applied for Pb and Zn.

Since emission factors are country specific, Danish estimated data is selected whenever available. Ten data sources were found providing emission factors for CO, Hg and PCDD/F and amongst these were data from the Danish EPA and the National Environmental Research Institute (NERI). The selected Danish emission factors were verified by comparability to values provided by the US database WEBFIRE and the Swiss report by Heldstab et al., 2008.

Five data sources to information and estimates of emission factors for $SO_2$, $NO_x$ and NMVOC showed very similar values. Since none of these data sources are based on Danish estimates, the most common (US-EPA, 1996) and (CANA, 1993) referenced by the EMEP/Corinair Guidebook 2007 are selected.

There are also several data sources to the emission factor of TSP. The WEBFIRE database provides the one referred to in most of the scientific literature, and was therefore selected for this inventory. The particulate matter fractions of $PM_{10}$ and $PM_{2.5}$ are both calculated from TSP, as it is assumed that $PM_{10}$ and $PM_{2.5}$ are 90 % of the total TSP (Fontelle et al., 2008).

*Animal cremation*

Concerning the burning of animal carcasses in animal crematoria there is not much literature to be found. NAEI, 2007 provides emission factors with the unit kt, but since no explanation is provided as to that amount this emission factor is valid for, the database is not of any use as a source.

The Guidebook, 2009 is the only available source to emission factors for NMVOC, $NH_3$, TSP, $PM_{10}$, $PM_{2.5}$ and PCDD/F. It does also provide an emission factor for PAHs but does not specify on the single compounds. Neither does the emission factor provided by Chen et al., 2003, but this source divides the compounds into three categories according to weight and is generally more detailed. Chen et al., 2003 is therefore chosen to supply the PAH emission factor. The following Table 7.7 lists the three PAH categories given by Chen et al., 2003

Table 7.7 PAH groups, Chen et al. (2003).

| Molecular weight | Description | Compounds | Value, mg pr. t |
|---|---|---|---|
| Low | 2- and 3-ringed PAHs | Naphthalene, Acenaphthylene, Acenaphthene, Fluorine, Phenanthrene, Anthracene | 2 435 |
| Middle | 4-ringed PAHs | Fluoranthene*, Pyrene, Benzo(a)anthracene, Chrysene | 234 |
| High | 5-, 6- and 7-ringed PAHs | Cyclopenta(c,d)pyrene, Benzo(b)fluoranthene*, Benzo(k)fluoranthene*, Benzo(e )yrene, Benzo(a)pyrene*, Perylene, Benzo(ghi)perylene*, Indeno(1,2,3,-c,d)pyrene*, Dibenzo(a,h)anthrance, Benzo(b)chrycene, Coronene | 198 |
| Total | | | 2 867 |

* Compounds which are normally provided with emission factors (P11-16).

Chen et al., 2004 is the only available source to emission factors for the heavy metals Cd, Cr, Cu, Ni, Pb and Zn.

The emission factors of the remaining compounds $SO_2$, $NO_X$, $CH_4$, CO, $CO_2$, $N_2O$, As, Se, HCB and PCB are collected from the section on human cremation, and it is assumed that humans and animals are similar in composition for this purpose.

There is a good compliance between the emission factors for animal and human incineration for PCDD/F and a relatively good compliance for NMVOC, TSP, $PM_{10}$ and $PM_{2.5}$. Emission factors for PAHs are not comparable because Chen et al., 2003 does not supply data for the individual PAHs, and the three categories low, middle and high molecular weight contains far more compounds than the 6 standard PAHs (P11-16) which are accessible for human cremations.

The emission factors given by Chen et al., 2004 for heavy metals are at least a factor 100 larger than those accepted for human cremations with the exception of that of Zn which is much higher for the incineration of corpses.

No data was available for the emission of Hg in animal cremations. The emission factor accepted for human incineration is not accepted in the case of Hg, because the Hg emission from human cremations primarily stems from tooth fillings.

Table 7.8 states the best available emission factors for animal cremations.

Table 7.8 Emission factors for animal cremation with references.

| Pollutant | Unit | Emission factor | Source |
|---|---|---|---|
| $SO_2$ | g/Mg | 837* | US-EPA |
| $NO_X$ | g/Mg | 4 746* | US-EPA |
| NMVOC | g/Mg | 2 000 | Guidebook, 2009 |
| $CH_4$ | g/Mg | 182* | Aasestad |
| CO | g/Mg | 166* | Schleicher et al., 2001 |
| $CO_2$ | kg/Mg | 770* | Fontelle et al. |
| $N_2O$ | g/Mg | 226* | Aasestad |
| $NH_3$ | g/Mg | 1 900 | Guidebook, 2009 |
| TSP | g/Mg | 2 180 | Guidebook, 2009 |
| $PM_{10}$ | g/Mg | 1 530 | Guidebook, 2009 |
| $PM_{2.5}$ | g/Mg | 1 310 | Guidebook, 2009 |
| As | mg/Mg | 0.17* | US-EPA |
| Cd | mg/Mg | 10 | Chen et al., 2004 |
| Cr | mg/Mg | 70 | Chen et al., 2004 |
| Cu | mg/Mg | 20 | Chen et al., 2004 |
| Hg | - | NAV | - |
| Ni | mg/Mg | 60 | Chen et al., 2004 |
| Pb | mg/Mg | 180 | Chen et al., 2004 |
| Se | mg/Mg | 343* | WEBFIRE |
| Zn | mg/Mg | 190 | Chen et al., 2004 |
| HCB | mg/Mg | 2.34* | Eisaku TODA |
| PCDD/F | ng I-TEQ/Mg | 10 000 | Guidebook, 2009 |
| LM-PAHs | mg/Mg | 2 435 | Chen et al., 2003 |
| MM-PAHs | mg/Mg | 234 | Chen et al., 2003 |
| HM-PAHs | mg/Mg | 198 | Chen et al., 2003 |
| PAHs | mg/Mg | 2 867 | Chen et al., 2003 |
| PCB | mg/Mg | 6.37* | Eisaku TODA |

* Emission factors from human cremations.

**Emissions**

Table 7.9a, b and c shows the total national emissions from the years 1980-2008. The dioxin emission is given in I-TEQ; i.e. International Toxicity Equivalents which is a weighted addition of congener toxicity with reference to 2,3,7,8-TCDD (Seveso-dioxin).

Table 7.9a Total national emissions from incineration of corpses – 1980 to 1989.

| Pollutant name | Unit | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $SO_X$ | Mg | 1.92 | 1.95 | 1.93 | 2.00 | 2.01 | 2.07 | 2.08 | 2.09 | 2.14 | 2.17 |
| $NO_X$ | Mg | 10.87 | 11.03 | 10.91 | 11.34 | 11.41 | 11.75 | 11.77 | 11.86 | 12.12 | 12.29 |
| NMVOC | Mg | 0.458 | 0.465 | 0.460 | 0.478 | 0.481 | 0.495 | 0.496 | 0.500 | 0.511 | 0.518 |
| $CH_4$ | Mg | 0.414 | 0.420 | 0.416 | 0.432 | 0.435 | 0.448 | 0.449 | 0.452 | 0.462 | 0.468 |
| CO | Mg | 0.379 | 0.385 | 0.381 | 0.396 | 0.398 | 0.410 | 0.411 | 0.414 | 0.423 | 0.429 |
| $CO_2$ | Gg | 1.76 | 1.79 | 1.77 | 1.84 | 1.85 | 1.91 | 1.91 | 1.92 | 1.97 | 1.99 |
| $N_2O$ | Mg | 0.518 | 0.525 | 0.520 | 0.540 | 0.544 | 0.560 | 0.561 | 0.565 | 0.577 | 0.585 |
| TSP | Mg | 1.53 | 1.56 | 1.54 | 1.60 | 1.61 | 1.66 | 1.66 | 1.67 | 1.71 | 1.73 |
| $PM_{10}$ | Mg | 1.38 | 1.40 | 1.38 | 1.44 | 1.45 | 1.49 | 1.49 | 1.51 | 1.54 | 1.56 |
| $PM_{2.5}$ | Mg | 1.38 | 1.40 | 1.38 | 1.44 | 1.45 | 1.49 | 1.49 | 1.51 | 1.54 | 1.56 |
| As | g | 0.387 | 0.392 | 0.388 | 0.404 | 0.406 | 0.418 | 0.419 | 0.422 | 0.431 | 0.437 |
| Cd | g | 0.109 | 0.111 | 0.110 | 0.114 | 0.115 | 0.118 | 0.119 | 0.119 | 0.122 | 0.124 |
| Cr | g | 0.297 | 0.302 | 0.298 | 0.310 | 0.312 | 0.321 | 0.322 | 0.324 | 0.331 | 0.336 |
| Cu | g | 0.272 | 0.276 | 0.273 | 0.284 | 0.285 | 0.294 | 0.294 | 0.296 | 0.303 | 0.307 |
| Hg | kg | 39.4 | 40.0 | 39.6 | 41.1 | 41.4 | 42.6 | 42.7 | 43.0 | 44.0 | 44.6 |
| Ni | g | 0.379 | 0.384 | 0.380 | 0.395 | 0.398 | 0.409 | 0.410 | 0.413 | 0.422 | 0.428 |
| Pb | g | 0.655 | 0.665 | 0.658 | 0.684 | 0.688 | 0.708 | 0.710 | 0.715 | 0.731 | 0.741 |
| Se | g | 786 | 798 | 789 | 821 | 826 | 850 | 852 | 858 | 877 | 889 |
| Zn | kg | 6.36 | 6.46 | 6.39 | 6.64 | 6.68 | 6.88 | 6.90 | 6.95 | 7.10 | 7.20 |
| HCB | g | 5.34 | 5.42 | 5.36 | 5.57 | 5.61 | 5.77 | 5.78 | 5.83 | 5.95 | 6.04 |
| PCDD/F | mg I-TEQ | 33.5 | 34.0 | 33.6 | 34.9 | 35.1 | 36.2 | 36.3 | 36.5 | 37.3 | 37.8 |
| Flouranthene | mg | 2.08 | 2.11 | 2.09 | 2.17 | 2.18 | 2.25 | 2.25 | 2.27 | 2.32 | 2.35 |
| Benzo(b)flouranthene | mg | 287 | 291 | 288 | 299 | 301 | 310 | 311 | 313 | 320 | 324 |
| Benzo(k)flouranthene | mg | 256 | 260 | 257 | 267 | 269 | 277 | 277 | 279 | 285 | 289 |
| Benzo(a)pyrene | mg | 0.364 | 0.370 | 0.366 | 0.380 | 0.383 | 0.394 | 0.395 | 0.398 | 0.406 | 0.412 |
| Benzo(g,h,i)perylene | mg | 525 | 532 | 527 | 548 | 551 | 567 | 568 | 573 | 585 | 593 |
| Indeno(1,2,3-c-d)pyrene | mg | 278 | 282 | 279 | 290 | 292 | 300 | 301 | 303 | 310 | 314 |
| PCB | g | 14.6 | 14.8 | 14.6 | 15.2 | 15.3 | 15.7 | 15.8 | 15.9 | 16.2 | 16.5 |

Table 7.9b Total national emissions from incineration of corpses – 1990 to 1999.

| Pollutant name | Unit | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $SO_X$ | Mg | 2.23 | 2.21 | 2.26 | 2.35 | 2.33 | 2.39 | 2.35 | 2.33 | 2.27 | 2.30 |
| $NO_X$ | Mg | 12.65 | 12.55 | 12.79 | 13.33 | 13.19 | 13.53 | 13.35 | 13.23 | 12.85 | 13.05 |
| NMVOC | Mg | 0.533 | 0.529 | 0.539 | 0.562 | 0.556 | 0.570 | 0.562 | 0.558 | 0.542 | 0.550 |
| $CH_4$ | Mg | 0.482 | 0.478 | 0.488 | 0.508 | 0.503 | 0.516 | 0.509 | 0.504 | 0.490 | 0.497 |
| CO | Mg | 0.441 | 0.438 | 0.446 | 0.465 | 0.461 | 0.472 | 0.466 | 0.462 | 0.449 | 0.456 |
| $CO_2$ | Gg | 2.05 | 2.04 | 2.07 | 2.16 | 2.14 | 2.19 | 2.17 | 2.15 | 2.09 | 2.12 |
| $N_2O$ | Mg | 0.603 | 0.598 | 0.609 | 0.635 | 0.629 | 0.645 | 0.636 | 0.630 | 0.612 | 0.622 |
| TSP | Mg | 1.78 | 1.77 | 1.80 | 1.88 | 1.86 | 1.91 | 1.88 | 1.87 | 1.81 | 1.84 |
| $PM_{10}$ | Mg | 1.61 | 1.59 | 1.62 | 1.69 | 1.67 | 1.72 | 1.69 | 1.68 | 1.63 | 1.66 |
| $PM_{2.5}$ | Mg | 1.61 | 1.59 | 1.62 | 1.69 | 1.67 | 1.72 | 1.69 | 1.68 | 1.63 | 1.66 |
| As | g | 0.450 | 0.446 | 0.455 | 0.474 | 0.469 | 0.481 | 0.475 | 0.471 | 0.457 | 0.464 |
| Cd | g | 0.127 | 0.126 | 0.129 | 0.134 | 0.133 | 0.136 | 0.134 | 0.133 | 0.129 | 0.131 |
| Cr | g | 0.346 | 0.343 | 0.350 | 0.364 | 0.361 | 0.370 | 0.365 | 0.362 | 0.351 | 0.357 |
| Cu | g | 0.316 | 0.314 | 0.320 | 0.333 | 0.330 | 0.338 | 0.334 | 0.331 | 0.321 | 0.326 |
| Hg | kg | 45.9 | 45.5 | 46.4 | 48.3 | 47.9 | 49.1 | 48.4 | 48.0 | 46.6 | 47.3 |
| Ni | g | 0.441 | 0.437 | 0.446 | 0.464 | 0.460 | 0.471 | 0.465 | 0.461 | 0.448 | 0.455 |
| Pb | g | 0.762 | 0.756 | 0.771 | 0.803 | 0.795 | 0.816 | 0.805 | 0.798 | 0.775 | 0.787 |
| Se | g | 915 | 908 | 925 | 964 | 954 | 979 | 965 | 957 | 930 | 944 |
| Zn | kg | 7.41 | 7.35 | 7.49 | 7.80 | 7.73 | 7.92 | 7.82 | 7.75 | 7.53 | 7.64 |
| HCB | g | 6.21 | 6.16 | 6.28 | 6.55 | 6.48 | 6.65 | 6.56 | 6.50 | 6.31 | 6.41 |
| PCDD/F | mg I-TEQ | 38.9 | 38.6 | 39.4 | 41.0 | 40.6 | 41.7 | 41.1 | 40.7 | 39.6 | 40.2 |
| Flouranthene | mg | 2.42 | 2.40 | 2.44 | 2.55 | 2.52 | 2.59 | 2.55 | 2.53 | 2.46 | 2.49 |
| Benzo(b)flouranthene | mg | 334 | 331 | 337 | 352 | 348 | 357 | 352 | 349 | 339 | 344 |
| Benzo(k)flouranthene | mg | 298 | 296 | 301 | 314 | 311 | 319 | 314 | 312 | 303 | 307 |
| Benzo(a)pyrene | mg | 0.424 | 0.420 | 0.429 | 0.447 | 0.442 | 0.453 | 0.447 | 0.443 | 0.431 | 0.437 |
| Benzo(g,h,i)perylene | mg | 611 | 606 | 617 | 643 | 637 | 653 | 644 | 639 | 621 | 630 |
| Indeno(1,2,3-c-d)pyrene | mg | 323 | 321 | 327 | 340 | 337 | 346 | 341 | 338 | 328 | 333 |
| PCB | g | 17.0 | 16.8 | 17.1 | 17.9 | 17.7 | 18.1 | 17.9 | 17.7 | 17.2 | 17.5 |

Table 7.9c Total national emissions from incineration of corpses – 2000 to 2008.

| Pollutant name | Unit | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SO_X$ | Mg | 2.27 | 2.27 | 2.32 | 2.29 | 2.26 | 2.22 | 2.24 | 2.27 | 2.27 |
| $NO_X$ | Mg | 12.85 | 12.87 | 13.12 | 12.96 | 12.82 | 12.57 | 12.72 | 12.88 | 12.89 |
| NMVOC | Mg | 0.541 | 0.542 | 0.553 | 0.546 | 0.540 | 0.530 | 0.536 | 0.543 | 0.543 |
| $CH_4$ | Mg | 0.490 | 0.490 | 0.500 | 0.494 | 0.489 | 0.479 | 0.485 | 0.491 | 0.491 |
| CO | Mg | 0.449 | 0.449 | 0.458 | 0.452 | 0.448 | 0.439 | 0.444 | 0.450 | 0.450 |
| $CO_2$ | Gg | 2.08 | 2.09 | 2.13 | 2.10 | 2.08 | 2.04 | 2.06 | 2.09 | 2.09 |
| $N_2O$ | Mg | 0.612 | 0.613 | 0.625 | 0.617 | 0.611 | 0.599 | 0.606 | 0.614 | 0.614 |
| TSP | Mg | 1.81 | 1.81 | 1.85 | 1.83 | 1.81 | 1.77 | 1.79 | 1.82 | 1.82 |
| $PM_{10}$ | Mg | 1.63 | 1.63 | 1.67 | 1.64 | 1.63 | 1.60 | 1.61 | 1.64 | 1.64 |
| $PM_{2.5}$ | Mg | 1.63 | 1.63 | 1.67 | 1.64 | 1.63 | 1.60 | 1.61 | 1.64 | 1.64 |
| As | g | 0.457 | 0.458 | 0.467 | 0.461 | 0.456 | 0.447 | 0.453 | 0.458 | 0.459 |
| Cd | g | 0.129 | 0.130 | 0.132 | 0.130 | 0.129 | 0.127 | 0.128 | 0.130 | 0.130 |
| Cr | g | 0.351 | 0.352 | 0.359 | 0.354 | 0.351 | 0.344 | 0.348 | 0.352 | 0.353 |
| Cu | g | 0.321 | 0.322 | 0.328 | 0.324 | 0.320 | 0.314 | 0.318 | 0.322 | 0.322 |
| Hg | kg | 46.6 | 46.7 | 47.6 | 47.0 | 46.5 | 45.6 | 46.1 | 46.7 | 46.8 |
| Ni | g | 0.448 | 0.448 | 0.457 | 0.451 | 0.447 | 0.438 | 0.443 | 0.449 | 0.449 |
| Pb | g | 0.775 | 0.776 | 0.791 | 0.781 | 0.773 | 0.758 | 0.767 | 0.777 | 0.777 |
| Se | g | 930 | 931 | 949 | 937 | 927 | 910 | 920 | 932 | 933 |
| Zn | kg | 7.53 | 7.54 | 7.69 | 7.59 | 7.51 | 7.36 | 7.45 | 7.55 | 7.55 |
| HCB | g | 6.31 | 6.32 | 6.45 | 6.37 | 6.30 | 6.18 | 6.25 | 6.33 | 6.33 |
| PCDD/F | mg I-TEQ | 39.6 | 39.6 | 40.4 | 39.9 | 39.5 | 38.7 | 39.2 | 39.7 | 39.7 |
| Flouranthene | mg | 2.46 | 2.46 | 2.51 | 2.48 | 2.45 | 2.40 | 2.43 | 2.46 | 2.46 |
| Benzo(b)flouranthene | mg | 339 | 339 | 346 | 342 | 338 | 332 | 336 | 340 | 340 |
| Benzo(k)flouranthene | mg | 303 | 303 | 309 | 305 | 302 | 296 | 300 | 304 | 304 |
| Benzo(a)pyrene | mg | 0.431 | 0.431 | 0.440 | 0.434 | 0.430 | 0.421 | 0.426 | 0.432 | 0.432 |
| Benzo(g,h,i)perylene | mg | 620 | 621 | 634 | 626 | 619 | 607 | 614 | 622 | 622 |
| Indeno(1,2,3-c-d)pyrene | mg | 328 | 329 | 335 | 331 | 328 | 321 | 325 | 329 | 329 |
| PCB | g | 17.2 | 17.2 | 17.6 | 17.4 | 17.2 | 16.9 | 17.1 | 17.3 | 17.3 |

The emission of $CO_2$ much exceeds the sum of all other emissions. With an averages body weight of 65 kg and an emission factor of 50 kg pr body, $CO_2$ delivers 99 wt% of the total emitted off gas. This massive amount of $CO_2$ is possibly contributed to by a support fuel.

*Animal cremation*

For the burning of animal carcasses, emissions are calculated by multiplying the amount of incinerated animals by the emission factors.

National emissions are shown in the following Table 7.10a, b, c.

Table 7.10a Total national emissions from incineration of carcasses – 1980 to 1989.

| Pollutant name | unit | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $SO_2$ | Mg | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.08 | 0.09 | 0.10 | 0.11 | 0.12 |
| $NO_X$ | Mg | 0.24 | 0.28 | 0.33 | 0.38 | 0.43 | 0.47 | 0.52 | 0.57 | 0.62 | 0.66 |
| NMVOC | Mg | 0.10 | 0.12 | 0.14 | 0.16 | 0.18 | 0.20 | 0.22 | 0.24 | 0.26 | 0.28 |
| $CH_4$ | Mg | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 |
| CO | Mg | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| $CO_2$ | Gg | 0.04 | 0.05 | 0.05 | 0.06 | 0.07 | 0.08 | 0.08 | 0.09 | 0.10 | 0.11 |
| $N_2O$ | Mg | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 |
| $NH_3$ | Mg | 0.10 | 0.11 | 0.13 | 0.15 | 0.17 | 0.19 | 0.21 | 0.23 | 0.25 | 0.27 |
| TSP | Mg | 0.11 | 0.13 | 0.15 | 0.17 | 0.20 | 0.22 | 0.24 | 0.26 | 0.28 | 0.31 |
| $PM_{10}$ | Mg | 0.08 | 0.09 | 0.11 | 0.12 | 0.14 | 0.15 | 0.17 | 0.18 | 0.20 | 0.21 |
| $PM_{2.5}$ | Mg | 0.07 | 0.08 | 0.09 | 0.10 | 0.12 | 0.13 | 0.14 | 0.16 | 0.17 | 0.18 |
| As | mg | 8.45 | 10.14 | 11.82 | 13.51 | 15.20 | 16.89 | 18.58 | 20.27 | 21.96 | 23.65 |
| Cd | g | 0.50 | 0.60 | 0.70 | 0.80 | 0.90 | 1.00 | 1.10 | 1.20 | 1.30 | 1.40 |
| Cr | g | 3.50 | 4.20 | 4.90 | 5.60 | 6.30 | 7.00 | 7.70 | 8.40 | 9.10 | 9.80 |
| Cu | g | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.20 | 2.40 | 2.60 | 2.80 |
| Ni | g | 3.00 | 3.60 | 4.20 | 4.80 | 5.40 | 6.00 | 6.60 | 7.20 | 7.80 | 8.40 |
| Pb | g | 9.00 | 10.80 | 12.60 | 14.40 | 16.20 | 18.00 | 19.80 | 21.60 | 23.40 | 25.20 |
| Se | g | 17.17 | 20.60 | 24.04 | 27.47 | 30.90 | 34.34 | 37.77 | 41.21 | 44.64 | 48.07 |
| Zn | g | 9.50 | 11.40 | 13.30 | 15.20 | 17.10 | 19.00 | 20.90 | 22.80 | 24.70 | 26.60 |
| HCB | g | 0.12 | 0.14 | 0.16 | 0.19 | 0.21 | 0.23 | 0.26 | 0.28 | 0.30 | 0.33 |
| PCDD/F | mg | 0.50 | 0.60 | 0.70 | 0.80 | 0.90 | 1.00 | 1.10 | 1.20 | 1.30 | 1.40 |
| LM-PAHs | g | 121.75 | 146.10 | 170.45 | 194.80 | 219.15 | 243.50 | 267.85 | 292.20 | 316.55 | 340.90 |
| MM-PAHs | g | 11.70 | 14.04 | 16.38 | 18.72 | 21.06 | 23.40 | 25.74 | 28.08 | 30.42 | 32.76 |
| HM-PAHs | g | 9.90 | 11.88 | 13.86 | 15.84 | 17.82 | 19.80 | 21.78 | 23.76 | 25.74 | 27.72 |
| PAHs | g | 143.35 | 172.02 | 200.69 | 229.36 | 258.03 | 286.70 | 315.37 | 344.04 | 372.71 | 401.38 |
| PCB | g | 0.32 | 0.38 | 0.45 | 0.51 | 0.57 | 0.64 | 0.70 | 0.76 | 0.83 | 0.89 |

Table 7.10b Total national emissions from incineration of carcasses – 1990 t0 1999.

| | unit | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $SO_2$ | Mg | 0.13 | 0.13 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 | 0.18 | 0.20 | 0.31 |
| $NO_X$ | Mg | 0.71 | 0.76 | 0.81 | 0.85 | 0.90 | 0.95 | 1.00 | 1.04 | 1.11 | 1.75 |
| NMVOC | Mg | 0.30 | 0.32 | 0.34 | 0.36 | 0.38 | 0.40 | 0.42 | 0.44 | 0.47 | 0.74 |
| $CH_4$ | Mg | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 | 0.07 |
| CO | Mg | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 | 0.06 |
| $CO_2$ | Gg | 0.12 | 0.12 | 0.13 | 0.14 | 0.15 | 0.15 | 0.16 | 0.17 | 0.18 | 0.28 |
| $N_2O$ | Mg | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 | 0.08 |
| $NH_3$ | Mg | 0.29 | 0.30 | 0.32 | 0.34 | 0.36 | 0.38 | 0.40 | 0.42 | 0.45 | 0.70 |
| TSP | Mg | 0.33 | 0.35 | 0.37 | 0.39 | 0.41 | 0.44 | 0.46 | 0.48 | 0.51 | 0.80 |
| $PM_{10}$ | Mg | 0.23 | 0.24 | 0.26 | 0.28 | 0.29 | 0.31 | 0.32 | 0.34 | 0.36 | 0.56 |
| $PM_{2.5}$ | Mg | 0.20 | 0.21 | 0.22 | 0.24 | 0.25 | 0.26 | 0.28 | 0.29 | 0.31 | 0.48 |
| As | mg | 25.34 | 27.03 | 28.72 | 30.41 | 32.10 | 33.78 | 35.47 | 37.16 | 39.64 | 62.22 |
| Cd | g | 1.50 | 1.60 | 1.70 | 1.80 | 1.90 | 2.00 | 2.10 | 2.20 | 2.35 | 3.68 |
| Cr | g | 10.50 | 11.20 | 11.90 | 12.60 | 13.30 | 14.00 | 14.70 | 15.40 | 16.43 | 25.78 |
| Cu | g | 3.00 | 3.20 | 3.40 | 3.60 | 3.80 | 4.00 | 4.20 | 4.40 | 4.69 | 7.37 |
| Ni | g | 9.00 | 9.60 | 10.20 | 10.80 | 11.40 | 12.00 | 12.60 | 13.20 | 14.08 | 22.10 |
| Pb | g | 27.00 | 28.80 | 30.60 | 32.40 | 34.20 | 36.00 | 37.80 | 39.60 | 42.24 | 66.30 |
| Se | g | 51.51 | 54.94 | 58.38 | 61.81 | 65.24 | 68.68 | 72.11 | 75.54 | 80.58 | 126.47 |
| Zn | g | 28.50 | 30.40 | 32.30 | 34.20 | 36.10 | 38.00 | 39.90 | 41.80 | 44.59 | 69.98 |
| HCB | g | 0.35 | 0.37 | 0.40 | 0.42 | 0.44 | 0.47 | 0.49 | 0.51 | 0.55 | 0.86 |
| PCDD/F | mg | 1.50 | 1.60 | 1.70 | 1.80 | 1.90 | 2.00 | 2.10 | 2.20 | 2.35 | 3.68 |
| LM-PAHs | g | 365.25 | 389.60 | 413.95 | 438.30 | 462.65 | 487.00 | 511.35 | 535.70 | 571.39 | 896.83 |
| MM-PAHs | g | 35.10 | 37.44 | 39.78 | 42.12 | 44.46 | 46.80 | 49.14 | 51.48 | 54.91 | 86.18 |
| HM-PAHs | g | 29.70 | 31.68 | 33.66 | 35.64 | 37.62 | 39.60 | 41.58 | 43.56 | 46.46 | 72.92 |
| PAHs | g | 430.05 | 458.72 | 487.39 | 516.06 | 544.73 | 573.40 | 602.07 | 630.74 | 672.76 | 1 055.93 |
| PCB | g | 0.96 | 1.02 | 1.08 | 1.15 | 1.21 | 1.27 | 1.34 | 1.40 | 1.49 | 2.35 |

Table 7.10c Total national emissions from incineration of carcasses – 2000 to 2008.

| | unit | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SO_2$ | Mg | 0.37 | 0.38 | 0.38 | 0.39 | 0.48 | 0.64 | 0.93 | 1.07 | 1.12 |
| $NO_X$ | Mg | 2.10 | 2.15 | 2.14 | 2.19 | 2.71 | 3.62 | 5.30 | 6.10 | 6.35 |
| NMVOC | Mg | 0.89 | 0.90 | 0.90 | 0.92 | 1.14 | 1.52 | 2.23 | 2.57 | 2.68 |
| $CH_4$ | Mg | 0.08 | 0.08 | 0.08 | 0.08 | 0.10 | 0.14 | 0.20 | 0.23 | 0.24 |
| CO | Mg | 0.07 | 0.08 | 0.07 | 0.08 | 0.09 | 0.13 | 0.19 | 0.21 | 0.22 |
| $CO_2$ | Gg | 0.34 | 0.35 | 0.35 | 0.36 | 0.44 | 0.59 | 0.86 | 0.99 | 1.03 |
| $N_2O$ | Mg | 0.10 | 0.10 | 0.10 | 0.10 | 0.13 | 0.17 | 0.25 | 0.29 | 0.30 |
| $NH_3$ | Mg | 0.84 | 0.86 | 0.86 | 0.88 | 1.09 | 1.45 | 2.12 | 2.44 | 2.54 |
| TSP | Mg | 0.97 | 0.99 | 0.98 | 1.01 | 1.25 | 1.66 | 2.43 | 2.80 | 2.92 |
| $PM_{10}$ | Mg | 0.68 | 0.69 | 0.69 | 0.71 | 0.87 | 1.17 | 1.71 | 1.96 | 2.05 |
| $PM_{2.5}$ | Mg | 0.58 | 0.59 | 0.59 | 0.60 | 0.75 | 1.00 | 1.46 | 1.68 | 1.75 |
| As | mg | 74.90 | 76.40 | 76.22 | 77.98 | 96.48 | 128.78 | 188.58 | 216.93 | 226.07 |
| Cd | g | 4.43 | 4.52 | 4.51 | 4.62 | 5.71 | 7.62 | 11.16 | 12.84 | 13.38 |
| Cr | g | 31.04 | 31.66 | 31.59 | 32.31 | 39.98 | 53.36 | 78.14 | 89.89 | 93.68 |
| Cu | g | 8.87 | 9.05 | 9.02 | 9.23 | 11.42 | 15.25 | 22.33 | 25.68 | 26.77 |
| Ni | g | 26.61 | 27.14 | 27.07 | 27.70 | 34.27 | 45.74 | 66.98 | 77.05 | 80.30 |
| Pb | g | 79.82 | 81.41 | 81.22 | 83.09 | 102.80 | 137.22 | 200.94 | 231.16 | 240.89 |
| Se | g | 152.26 | 155.31 | 154.94 | 158.51 | 196.11 | 261.78 | 383.34 | 440.98 | 459.55 |
| Zn | g | 84.25 | 85.94 | 85.73 | 87.71 | 108.51 | 144.85 | 212.11 | 244.00 | 254.28 |
| HCB | g | 1.04 | 1.06 | 1.06 | 1.08 | 1.34 | 1.78 | 2.61 | 3.00 | 3.13 |
| PCDD/F | mg | 4.43 | 4.52 | 4.51 | 4.62 | 5.71 | 7.62 | 11.16 | 12.84 | 13.38 |
| LM-PAHs | g | 1 079.73 | 1 101.36 | 1 098.72 | 1 124.03 | 1 390.67 | 1 856.31 | 2 718.32 | 3 127.06 | 3 258.75 |
| MM-PAHs | g | 103.76 | 105.84 | 105.59 | 108.02 | 133.64 | 178.39 | 261.23 | 300.51 | 313.16 |
| HM-PAHs | g | 87.80 | 89.56 | 89.34 | 91.40 | 113.08 | 150.94 | 221.04 | 254.27 | 264.98 |
| PAHs | g | 1 271.28 | 1 296.76 | 1 293.64 | 1 323.45 | 1 637.40 | 2 185.65 | 3 200.59 | 3 681.84 | 3 836.89 |
| PCB | g | 2.82 | 2.88 | 2.87 | 2.94 | 3.64 | 4.86 | 7.11 | 8.18 | 8.52 |

**Uncertainties and time-series consistency**

*Human cremation*

The uncertainty of the number of cremations is miniscule, however for the purpose of the calculation it has been set to 1 %. The uncertainties on the emission factors used in this inventory, and at the present level of available information, are shown in Table 7.11

Table 7.11 Estimated uncertainties on activity data and emission factors.

| Pollutant | Activity data, % | Emission factor, % |
|---|---|---|
| $SO_2$ | 1 | 100 |
| $NO_x$ | 1 | 150 |
| NMVOC | 1 | 50 |
| $CH_4$ | 1 | 300 |
| CO | 1 | 150 |
| $CO_2$ | 1 | 150 |
| $N_2O$ | 1 | 1000 |
| TSP | 1 | 1000 |
| $PM_{10}$ | 1 | 1000 |
| $PM_{2.5}$ | 1 | 1000 |
| As | 1 | 1000 |
| Cd | 1 | 1000 |
| Cr | 1 | 1000 |
| Cu | 1 | 1000 |
| Hg | 1 | 1000 |
| Ni | 1 | 1000 |
| Pb | 1 | 1000 |
| Se | 1 | 1000 |
| Zn | 1 | 1000 |
| HCB | 1 | 1000 |
| PCDD/F | 1 | 1000 |
| Flouranthene | 1 | 1000 |
| Benzo(b)flouranthene | 1 | 1000 |
| Benzo(k)flouranthene | 1 | 1000 |
| Benzo(a)pyrene | 1 | 1000 |
| Benzo(g,h,i)perylene | 1 | 1000 |
| Indeno(1,2,3-c,d)pyrene | 1 | 1000 |
| PCB | 1 | 1000 |

*Animal cremation*

The uncertainty of the activity data for animal cremations is minimal for the most recent years but is increasing back in time.

Emission factor uncertainties are set at 500 for all three sources, Chen et al., 2003; Chen et al., 2004 and Guidebook, 2009.

The uncertainties for the emission factors used in this inventory, and at the present level of available information, are shown in Table 7.12.

Table 7.12 Estimated uncertainties on activity data and emission factors.

| Pollutant | Activity data, % | Emission factor, % |
|---|---|---|
| $SO_2$ | 50 | 100* |
| $NO_X$ | 50 | 150* |
| NMVOC | 50 | 500 |
| $CH_4$ | 50 | 300* |
| CO | 50 | 150* |
| $CO_2$ | 50 | 150* |
| $N_2O$ | 50 | 1 000* |
| $NH_3$ | 50 | 500 |
| TSP | 50 | 500 |
| $PM_{10}$ | 50 | 500 |
| $PM_{2.5}$ | 50 | 500 |
| As | 50 | 1 000* |
| Cd | 50 | 500 |
| Cr | 50 | 500 |
| Cu | 50 | 500 |
| Hg | 50 | - |
| Ni | 50 | 500 |
| Pb | 50 | 500 |
| Se | 50 | 1 000* |
| Zn | 50 | 500 |
| HCB | 50 | 1 000* |
| PCDD/F | 50 | 500 |
| LM-PAHs | 50 | 500 |
| MM-PAHs | 50 | 500 |
| HM-PAHs | 50 | 500 |
| PAHs | 50 | 500 |
| PCB | 50 | 1 000* |

*Uncertainties for emission factors for human cremations.

**Source-specific QA/QC and verification**

The specific QA/QC activities for this sector are under development.

**Source-specific recalculations**

None

**Source-specific planned improvements**

None

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## 7.4 Other waste

This category is a catch all for the waste sector. Emissions in this category could stem from sludge spreading, compost production, biogas production and accidental fires.

### 7.4.1 Sludge spreading

Sludge from waste water treatment plants is only spread out in the open with the purpose of fertilising crop fields. Emissions that derive from this activity are covered in Chapter 6.

### 7.4.2 Compost production

This section covers the aerobic biological treatment of solid wastes called composting. Pollutants that escape from this treatment are methane ($CH_4$), nitrous oxide ($N_2O$), ammonia ($NH_3$), carbon oxide ($CO_2$) and carbon monoxide (CO).

**Methodology**

Emissions from composting have been calculated according to a country specific method

In Denmark, composting of solid biological waste includes

- composting of garden and park waste (GPW),
- organic waste from households,
- organic waste from other sources,
- sludge and,
- home composting of garden and vegetable food waste.

In 2001, 123 composting facilities treated only garden and park waste (type 2 facilities), nine facilities treated organic waste mixed with GPW or other organic waste (type 1 facilities) and 10 facilities treated GPW mixed with sludge and/or "other organic waste" (type 3 facilities). 92 % of these facilities consisted entirely of windrow composting which is a low technology composting method with natural access to air. It is assumed that all facilities can be considered as using windrow composting.

Composting is performed with low technology in Denmark this means that temperature, moisture and aeration is not consistently controlled or regulated. Temperature is measured but not controlled, moisture is regulated by watering the windrows in respect to weather conditions and aeration is assisted by turning the windrows.

During composting a large fraction of the degradable organic carbon (DOC) in the waste material is converted into $CO_2$. Even though the windrows are regularly turned to support aeration, anaerobic sections are inevitable and will cause a small emission of $CH_4$. In the same manner, aerobic biological digestion of N leads to an emission of $NO_X$, while the anaerobic decomposition leads to the emission of $NH_3$. (Guidelines, 2006)

### Activity data

All Danish waste treatment plants are obligated to statutory registration and reporting of all wastes entering and leaving the plants. All waste streams are weighed, categorised with a waste type and a type of treatment and registered to the ISAG waste information system. (Affaldsstatistik, 2006)

Figure 7.3 illustrates the nationally composted amount of waste divided in the five categories mentioned earlier.

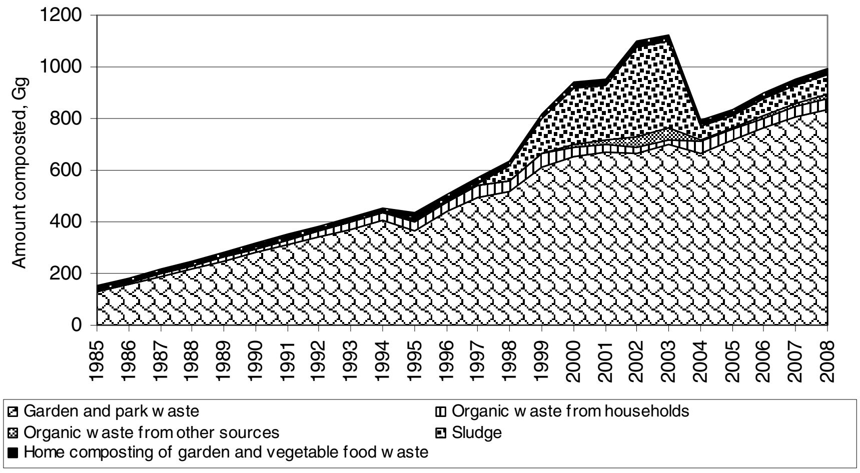


Figure 7.3 National amount of composted waste, these data are also shown in Table 7.14.

Activity data for the years 1995-2006 stems from ISAG data for the categories: organic waste from households, organic waste from other sources and sludge. Activities for 2007-2008 are calculated by using the development trend from earlier years.

None of the developments in composting of organic waste from other sources or composting of sludge demonstrate a convincing trend that can be used for estimation of activity data for previous years. Since there is no surrogate data available for the years 1985-1994, activity data for these years and categories can not be estimated and is marked "not available".

The amounts of organic waste from households composted in the years 1985-1994 are estimated by multiplying the number of facilities treating this type of waste with the average amount composted pr facility in the years 1995-2001 (2.6-3.8 Gg pr facility pr year). The following Table 7.13 shows the number of composting sites divided in the three types described in "Methodology".

Table 7.13 Number of composting facilities in the years 1985-2001.

| Facility type | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|
| Type 1 | 2 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Type 2 | 6 | 10 | 14 | 18 | 22 | 38 | 54 | 70 | 86 | 102 |
| Type 3 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 3 | 4 |
| Total | 8 | 12 | 17 | 21 | 26 | 44 | 62 | 79 | 97 | 115 |

*Continued*

| Facility type | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|
| Type 1 | 13 | 14 | 13 | 14 | 13 | 11 | 9 |
| Type 2 | 113 | 108 | 99 | 102 | 111 | 115 | 123 |
| Type 3 | 9 | 9 | 11 | 10 | 10 | 7 | 10 |
| Total | 136 | 133 | 126 | 130 | 139 | 138 | 149 |

Type 1 waste treatment sites normally includes biogas producing facilities, but these are not included in Table 7.13.

Petersen (2001) and Petersen og Hansen (2003) provides 1997-2001 activity data for the composting of garden and park waste. Activity data for GPW for the years 1985-1996 and 2002-2008 are estimated from the surrogate data gathered from the waste statistic reports, Affaldsstatistik, 2006 (and earlier years). The waste statistics provides the development in composting and wood chipping of GPW for 1995-2006, and by looking at the trend of this development the surrogate data is estimated for the remaining years 1985-1994 and 2007-2008.

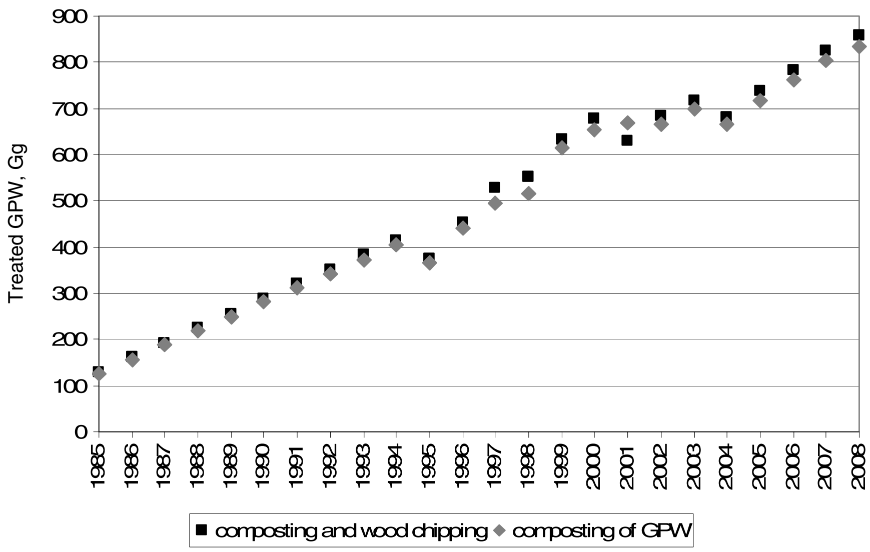


Figure 7.4 Composted amount of GPW.

The last waste category involved in composting is home composting of garden waste and vegetable waste. The activity data for this category is known from Petersen og Kielland (2003) to be 21.4 Gg in 2001. It is assumed that the following estimates made by Petersen og Kielland are valid for all years 1985-2008.

- 28 % of all residential buildings with private gardens (including weekend cabins) are actively contributing to home composting
- 14 % of all multi-dwelling houses are actively contributing to home composting
- 50 kg waste pr year will in average be composted at every contributing residential building

- 10 kg waste pr year will in average be composted at every contributing multi-dwelling house

The total number of occupied residential buildings, weekend cabins and multi-dwelling houses are found at the Statistics Denmark website. The calculated activity data for home composting of garden and vegetable waste are shown in Table 7.14

Table 7.14 Activity data composting, Gg.

| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|
| Composting of garden and park waste | 127 | 157 | 188 | 219 | 250 | 281 | 311 | 342 | 373 | 404 |
| Composting of organic waste from households | 5.2 | 7.1 | 9.1 | 11.0 | 12.9 | 16.2 | 19.4 | 22.6 | 25.9 | 29.1 |
| Composting of organic waste from other sources | NAV | NAV | NAV | NAV | NAV | NAV | NAV | NAV | NAV | NAV |
| Composting of sludge | NAV | NAV | NAV | NAV | NAV | NAV | NAV | NAV | NAV | NAV |
| Home composting of garden and vegetable food waste | 18.7 | 19.1 | 19.3 | 19.6 | 19.8 | 20.0 | 20.2 | 20.3 | 20.5 | 20.6 |

Continued

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|
| Composting of garden and park waste | 366 | 440 | 496 | 517 | 614 | 653 | 669 | 667 | 698 | 665 |
| Composting of organic waste from households | 34 | 36 | 46 | 42 | 48 | 38 | 34 | 18 | 18 | 47 |
| Composting of organic waste from other sources | 6 | 2 | 1 | 1 | 1 | 9 | 18 | 45 | 48 | 6 |
| Composting of sludge | 7 | 6 | 7 | 57 | 134 | 218 | 211 | 348 | 336 | 53 |
| Home composting of garden and vegetable food waste | 20.7 | 20.8 | 20.9 | 21.0 | 21.2 | 21.3 | 21.4 | 21.5 | 21.6 | 21.8 |

Continued

| | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|
| Composting of garden and park waste | 718 | 762 | 804 | 835 |
| Composting of organic waste from households | 38 | 36 | 40 | 40 |
| Composting of organic waste from other sources | 7 | 12 | 14 | 17 |
| Composting of sludge | 50 | 67 | 71 | 78 |
| Home composting of garden and vegetable food waste | 22.0 | 22.2 | 22.3 | 22.4 |

NAV = Not available

**Emission factors**

The emission from composting strongly depends on both the composition of the treated waste and on process conditions such as aeration, mechanical agitation, moisture control and temperature pattern. (Amlinger et al., 2008)

The emission factors stated in Table 7.15 are considered the best available for the calculation of Danish national emissions from composting.

Table 7.15 Composting emission factors.

| | Composting of garden and park waste (GPW) | Composting of organic waste | Composting of sludge | Home composting of garden and vegetable food waste |
|---|---|---|---|---|
| Unit | Kg pr Mg | Kg pr Mg | Kg pr Mg | Kg pr Mg |
| $CH_4$ | 4.2 | 0.268 | 0.041 | 5.625 |
| CO | 0.563 | NAV | NAV | 0.075 |
| $CO_2$ | NO | NO | 17.5 | NO |
| $N_2O$ | 0.12 | 0.072 | 0.216 | 0.105 |
| $NH_3$ | 0.66 | 0.190 | 0.022 | 0.630 |
| Source | Boldrin et al. | Amlinger et al. | Amlinger et al. | Boldrin et al. |

Emission factors for composting of GPW waste and for home composting of garden and vegetable food waste are derived from Boldrin et al., 2009. No other sources were found that describe the emission from home composting.

Two other sources provide emission factors for composting of GPW; Amlinger et al., 2008 and Hellebrand, 1998. All three sources give very similar data. Boldrin et al., 2009 is the chosen source since this is a Danish report based on experiments from Danish waste and composting methods.

Emissions from Boldrin et al., 2009 are given in percentage of total degraded carbon or nitrogen respectively. The factors shown in Table 7.15 are calculated by assuming 37.5 % DOC in dry matter, 2 % N in dry matter and 50 % moisture in the waste.

The $CO_2$ produced and emitted during composting is short-cycled C and is therefore normally regarded as global warming neutral. (Boldrin et al.)

Emission factors for composting of organic municipal waste and sludge are given by Amlinger et al., 2008. Pagans et al., 2006 delivers similar emissions for $NH_3$ from these waste categories but do not consider any other pollutants. Amlinger et al. is chosen as the most recent and thorough source to these data.

Since the origin of the sludge is not fully clarified, the $CO_2$ emission is therefore not assumed to be carbon neutral for composting of sludge.

Most other reviewed sources do not divide waste into categories of GPW, municipal waste, sludge etc.

**Emissions**

Table 7.16a, b and c shows the total national emissions from composting for the years 1985-2008.

Table 7.16a National emissions from composting – 1985 to 1994.

| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg |
| $CH_4$ | 638.2 | 770.1 | 901.5 | 1032.7 | 1163.6 | 1295.1 | 1426.5 | 1557.4 | 1688.5 | 1819.3 |
| CO | 72.6 | 89.9 | 107.3 | 124.6 | 142.0 | 159.3 | 176.6 | 194.0 | 211.3 | 228.6 |
| $CO_2$ | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| $N_2O$ | 17.5 | 21.4 | 25.3 | 29.1 | 33.0 | 36.9 | 40.9 | 44.8 | 48.8 | 52.7 |
| $NH_3$ | 96.9 | 118.1 | 139.2 | 160.3 | 181.4 | 202.8 | 224.3 | 245.7 | 267.2 | 288.6 |

Table 7.16b National emissions from composting – 1995 to 2004.

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg |
| $CH_4$ | 1666.2 | 1977.3 | 2213.7 | 2303.5 | 2717.7 | 2882.6 | 2951.1 | 2955.5 | 3083.4 | 2930.0 |
| CO | 207.6 | 249.3 | 280.6 | 292.4 | 347.1 | 368.7 | 377.7 | 377.1 | 394.1 | 375.4 |
| $CO_2$ | 122.5 | 105.0 | 122.5 | 997.5 | 2345.0 | 3815.0 | 3692.5 | 6090.0 | 5880.0 | 927.5 |
| $N_2O$ | 50.5 | 59.0 | 66.6 | 79.6 | 108.3 | 130.9 | 131.7 | 161.9 | 163.1 | 97.2 |
| $NH_3$ | 267.6 | 315.9 | 355.4 | 369.2 | 437.1 | 463.7 | 475.7 | 481.5 | 502.2 | 470.1 |

Table 7.16c National emissions from composting – 2005 to 2008.

| | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|
| Unit | Mg | Mg | Mg | Mg |
| $CH_4$ | 3153.9 | 3340.7 | 3520.3 | 3651.5 |
| CO | 405.6 | 430.3 | 454.0 | 471.3 |
| $CO_2$ | 875.0 | 1172.5 | 1242.5 | 1365.0 |
| $N_2O$ | 102.5 | 111.6 | 118.0 | 123.5 |
| $NH_3$ | 503.0 | 533.4 | 563.5 | 585.0 |

**Uncertainties and time-series consistency**

The following Table 7.17 lists the uncertainties for composting activity data and emission factors.

Table 7.17 Uncertainties composting.

| Pollutant | Activity data, % | Emission factor, % |
|---|---|---|
| $CH_4$ | 50 | 100 |
| CO | 50 | 100 |
| $CO_2$ | 50 | 100 |
| $N_2O$ | 50 | 100 |
| $NH_3$ | 50 | 100 |

**Source-specific QA/QC and verification**

The specific QA/QC activities for this sector are under development.

**Source-specific recalculations**

None.

**Source-specific planned improvements**

None.

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### 7.4.3 Biogas production

In Denmark biogas production from waste is divided in three categories,

- biogas production from organic waste with the purpose of energy production, included in Chapter 3, Energy.
- biogas production from manure, included in Chapter 6, Agriculture.
- and biogas production from sludge from waste water treatment, this activity has not been added this years inventory but is under investigation.

Biogas production in this section only covers fugitive emissions from biological waste, sludge and manure, storage and pre-treatment prior to the actual production. However, emissions on these activities are considered negligible.

### 7.4.4 Accidental fires

Accidental fires cover fires in vehicles, buildings and landfill fires.

#### Methodology

*Building fires*

Emissions from building fires are calculated by multiplying the number of building fires with selected emission factors. Four types of buildings are separated with different emission factors: detached houses, undetached houses, apartment buildings and industrial buildings.

Emissions from building fires are calculated for particles, heavy metals (As, Cd, Cu, Cr, Hg, Ni, Pb Zn, Se), dioxins/furans, NMVOC, $CH_4$, HCN, HCl, $NO_X$, $SO_2$, $N_2O$, CO, $CO_2$, PAH, HCB, PCB and $NH_3$.

Activity data for building fires are classified in three categories: large, medium and small. The emission factors comply for full scale building fires and the activity data is therefore recalculated as a full scale equivalent where it is assumed that a medium and a small fire leads to 50 % and 5 % of a large fire respectively, and that a large fire is a full scale fire.

*Vehicle fires*

Emissions from vehicle fires are calculated by multiplying the number of vehicle fires with selected emission factors. Emission factors are only available for different vehicle types, whereas it is assumed that all the different vehicle types leads to similar emissions. The activity data is recalculated as an yearly combusted mass by multiplying the number of different vehicles fires with the Danish registered average weight of the given vehicle type.

Emissions from vehicle fires are calculated for particles, heavy metals (As, Cd, Co, Cu, Cr, Hg, Mn, Ni, Pb, Zn, Se), dioxins/furans, NMVOC, $CH_4$, HCN, HCl, NO, $NO_X$, $SO_2$, $N_2O$, CO, $CO_2$, PAH, HCB, PCB and $NH_3$.

*Landfill fires*

Landfill fires have not been calculated for this year's inventory, this category is under development.

**Activity data**

In January 2005 it became mandatory for the local authority to register every rescue assignment in the *online data registration- and reporting system* called ODIN, ODIN in developed and run by the Danish Emergency Management Agency (DEMA). As a result of this, some activity data from 2005 and forth can not be directly compared with older data. For example, some specific rescue assignments were not registered prior to the year 2005, and a compilation of data might therefore give the impression of a certain development, even though it is not actually the case. (DEMA, 2007)

Table 7.18 states the occurrence of fires in general, building fires and vehicle fires registered at DEMA. The occurrence of building fires prior to 1989 are estimated as an average of the years 1989-2008.

Table 7.18 Occurrence of building and vehicle fires.

| Year | All fires | Building fires | Vehicle fires |
|---|---|---|---|
| 1980 | - | 7 158 | 1 782 |
| 1981 | - | 7 158 | 1 796 |
| 1982 | - | 7 158 | 1 810 |
| 1983 | - | 7 158 | 1 824 |
| 1984 | - | 7 158 | 1 838 |
| 1985 | - | 7 158 | 1 835 |
| 1986 | - | 7 158 | 1 875 |
| 1987 | - | 7 158 | 1 897 |
| 1988 | - | 7 158 | 1 896 |
| 1989 | 18 784 | 7 548 | 1 894 |
| 1990 | 17 025 | 6 841 | 1 881 |
| 1991 | 17 589 | 7 068 | 1 883 |
| 1992 | 19 124 | 7 685 | 1 892 |
| 1993 | 16 803 | 6 752 | 1 898 |
| 1994 | 16 918 | 6 798 | 1 908 |
| 1995 | 19 543 | 7 853 | 1 999 |
| 1996 | 19 756 | 7 939 | 2 074 |
| 1997 | 18 236 | 7 328 | 2 139 |
| 1998 | 16 320 | 6 558 | 2 196 |
| 1999 | 17 538 | 7 048 | 2 248 |
| 2000 | 17 174 | 6 901 | 2 281 |
| 2001 | 16 894 | 6 789 | 2 311 |
| 2002 | 16 362 | 6 575 | 2 341 |
| 2003 | 18 443 | 7 411 | 2 353 |
| 2004 | 15 927 | 6 400 | 2 389 |
| 2005 | 16 551 | 6 651 | 2 461 |
| 2006 | 16 965 | 7 221 | 2 546 |
| 2007 | 18 519 | 7 855 | 2 392 |
| 2008 | 20 915 | 7 938 | 2 954 |

*Building fires*

Activity data for accidental building fires is given by The Danish Emergency Management Agency (DEMA). Fires are categorised to three extents, large, medium and small. A large fire is in this context defined as a fire that involves the use of two or more fire hoses for fire extinguishing and is assumed to typically involve a complete house, one or more apartments, or at least part of an industrial complex. A medium size fire is in this context defined as a fire involving the use of only 1 fire hose for fire-fighting and will typically involve a part of a single room in an apartment or house. And a small size fire is in this context defined as a fire that was extinguished before the arrival of the fire service, extinguished by small tools or a chimney fire.

The total number of registered fires is known for the years 1989-2008. For the years 2006-2008 the total number of registered building fires are known, and by assuming that the share of building fires in respect to the total number of registered fires, can be considered as constant for every year back to 1989, the total number of building fires can be calculated for the years 1989-2005.

Furthermore the building fires that occurred in the years 2006-2008 are subcategorising into industrial building, detached house, undetached house and apartment building fires. And by once again assuming that the average of these shares are representative for the years 1989-2005, the building fires from the earlier years are also subdivided into these four building types.

Table 7.19 states the registered activity data for building fires for the years 2006-2008, divided in both size and building type. The calculated averages describes the average share of building fires from 2006-2008 of a certain type and size, in relation to all fires (building and non-building) of the same size and during the same three years period.

Table 7.19 Registered occurrence of building fires.

| Year | Size | Industry | Detached | Undetached | Apartment | All building fires |
|---|---|---|---|---|---|---|
| | large | 214 | 945 | 236 | 117 | 1 512 |
| | medium | 243 | 950 | 346 | 624 | 2 163 |
| | small | 242 | 1 449 | 585 | 977 | 3 253 |
| 2006 | all | 699 | 3 344 | 1 167 | 1 718 | 6 928 |
| | large | 268 | 988 | 239 | 152 | 1 647 |
| | medium | 324 | 1 021 | 391 | 720 | 2 456 |
| | small | 369 | 1 432 | 717 | 932 | 3 450 |
| 2007 | all | 961 | 3 441 | 1 347 | 1 804 | 7 553 |
| | large | 244 | 1 153 | 206 | 145 | 1 748 |
| | medium | 216 | 1 153 | 306 | 796 | 2 471 |
| | small | 107 | 1 567 | 694 | 1 013 | 3 381 |
| 2008 | all | 567 | 3 873 | 1 206 | 1 954 | 7 600 |
| | large | 32.61 | 28.95 | 18.31 | 7.56 | 21.57 |
| | medium | 35.17 | 29.31 | 28.04 | 39.08 | 31.93 |
| Average, % | small | 32.23 | 41.73 | 53.66 | 53.36 | 46.50 |

As mentioned above, it is assumed that the average percentages provided by the years 2006-2008 are compliable for the years 1989-2005. Hereby, similar activity data can be estimated back to 1989. Activity data from 1980-1988 are estimated based on the trend provided by the years 1989-2008.

It is furthermore assumed that a medium size fire has a damage rate of 50 % compared to a large (full scale) fire and that a small size fire leads to the emission of 5 % of a large fire. From these damage rates, a full scale equivalent can be calculated from the earlier calculated activity data, results are shown in the following Table 7.20.

Table 7.20 Full scale equivalent activity data for accidental building fires from the years 1980-2008 (DEMA).

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| Industry | 343 | 344 | 344 | 344 | 345 | 345 | 345 | 346 | 346 | 367 |
| Detached | 1 443 | 1 445 | 1 447 | 1 449 | 1 451 | 1 453 | 1 455 | 1 457 | 1 459 | 1 553 |
| Undetached | 392 | 392 | 393 | 393 | 393 | 393 | 394 | 394 | 394 | 417 |
| Apartment | 482 | 483 | 484 | 484 | 485 | 486 | 486 | 487 | 488 | 519 |
| Continued | | | | | | | | | | |
| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Industry | 333 | 344 | 374 | 329 | 331 | 382 | 386 | 357 | 319 | 343 |
| Detached | 1 407 | 1 454 | 1 581 | 1 389 | 1 398 | 1 615 | 1 633 | 1 507 | 1 349 | 1 450 |
| Undetached | 378 | 390 | 424 | 373 | 375 | 434 | 438 | 405 | 362 | 389 |
| Apartment | 471 | 486 | 529 | 465 | 468 | 540 | 546 | 504 | 451 | 485 |
| Continued | | | | | | | | | | |
| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| Industry | 336 | 330 | 320 | 361 | 312 | 324 | 348 | 448 | 357 | |
| Detached | 1 420 | 1 396 | 1 352 | 1 524 | 1 317 | 1 368 | 1 492 | 1 570 | 1 808 | |
| Undetached | 381 | 375 | 363 | 409 | 353 | 367 | 438 | 470 | 394 | |
| Apartment | 475 | 467 | 452 | 510 | 440 | 458 | 478 | 559 | 594 | |

The amount of detailed activity data is still limited due to the few years of reported data in the ODIN system, during the next years more data will become available providing a better basis for extrapolating back in time.

*Vehicle fires*

Activity data for accidental vehicle fires is, like accidental building fires, given by The Danish Emergency Management Agency (DEMA). The activity data is categorised in cars (lighter than 3500 kg), buses, trucks, vans, motor homes, mobile homes, motorcycles/mopeds and tankers. These are gathered in five categories; passenger cars, buses, light duty vehicles (vans, motor homes, mobile homes), heavy duty vehicles (trucks and tankers) and motorcycles/mopeds.

The total number of registered vehicles is known for all years 1985-2008 (Statistics Denmark), but the number of vehicle fires is only known for the years 2007 and 2008. By assuming that the share of vehicle fires in relation to the total number of registered vehicles of the respective categories can be counted as constant, the number of vehicle fires is estimated for the years 1985-2006. The numbers of vehicle from 1980 to 1984 are extrapolated based on the years 1985 to 1989, where a clear trend has been visible this trend has been extrapolated (e.g. passenger cars), otherwise the average value of 1985 to 1989 has been used (e.g. buses). Table 7.21 states the total number of national registered vehicles, the number of vehicle fires and the average share of burned vehicles from 1980-2008.

Table 7.21 Different types of nationally registered vehicles and yearly numbers of vehicle fires.

| | Passenger cars | | | Buses | | | Light duty vehicles | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Registered nationally | Share, % | Fires | Registered nationally | Share, % | Fires | Registered nationally | Share, % | Fires |
| 1980 | 1 474 932 | 0.084 | 1 236 | 8 070 | 0.650 | 52 | 107 186 | 0.044 | 48 |
| 1981 | 1 496 673 | 0.084 | 1 254 | 8 070 | 0.650 | 52 | 117 632 | 0.044 | 52 |
| 1982 | 1 518 414 | 0.084 | 1 272 | 8 070 | 0.650 | 52 | 128 077 | 0.044 | 57 |
| 1983 | 1 540 155 | 0.084 | 1 290 | 8 070 | 0.650 | 52 | 138 523 | 0.044 | 62 |
| 1984 | 1 561 895 | 0.084 | 1 309 | 8 070 | 0.650 | 52 | 148 968 | 0.044 | 66 |
| 1985 | 1 564 275 | 0.084 | 1 311 | 8 010 | 0.650 | 52 | 154 480 | 0.044 | 69 |
| 1986 | 1 617 658 | 0.084 | 1 355 | 8 105 | 0.650 | 52 | 172 058 | 0.044 | 77 |
| 1987 | 1 644 883 | 0.084 | 1 378 | 8 110 | 0.650 | 52 | 185 678 | 0.044 | 83 |
| 1988 | 1 653 954 | 0.084 | 1 386 | 8 093 | 0.650 | 52 | 193 143 | 0.044 | 86 |
| 1989 | 1 654 830 | 0.084 | 1 386 | 8 031 | 0.650 | 52 | 196 165 | 0.044 | 87 |
| 1990 | 1 645 414 | 0.084 | 1 379 | 8 080 | 0.650 | 53 | 197 876 | 0.044 | 88 |
| 1991 | 1 649 127 | 0.084 | 1 382 | 7 429 | 0.650 | 48 | 201 996 | 0.044 | 90 |
| 1992 | 1 660 339 | 0.084 | 1 391 | 7 529 | 0.650 | 49 | 206 502 | 0.044 | 92 |
| 1993 | 1 663 933 | 0.084 | 1 394 | 7 576 | 0.650 | 49 | 212 616 | 0.044 | 95 |
| 1994 | 1 668 102 | 0.084 | 1 398 | 7 680 | 0.650 | 50 | 220 911 | 0.044 | 98 |
| 1995 | 1 732 058 | 0.084 | 1 451 | 9 813 | 0.650 | 64 | 228 385 | 0.044 | 102 |
| 1996 | 1 792 012 | 0.084 | 1 501 | 9 882 | 0.650 | 64 | 233 914 | 0.044 | 104 |
| 1997 | 1 840 218 | 0.084 | 1 542 | 9 861 | 0.650 | 64 | 240 255 | 0.044 | 107 |
| 1998 | 1 876 585 | 0.084 | 1 572 | 9 915 | 0.650 | 64 | 248 965 | 0.044 | 111 |
| 1999 | 1 907 657 | 0.084 | 1 598 | 9 840 | 0.650 | 64 | 259 157 | 0.044 | 115 |
| 2000 | 1 917 274 | 0.084 | 1 606 | 9 820 | 0.650 | 64 | 272 122 | 0.044 | 121 |
| 2001 | 1 932 931 | 0.084 | 1 619 | 9 695 | 0.650 | 63 | 282 847 | 0.044 | 126 |
| 2002 | 1 946 172 | 0.084 | 1 630 | 9 637 | 0.650 | 63 | 295 436 | 0.044 | 131 |
| 2003 | 1 949 909 | 0.084 | 1 634 | 9 636 | 0.650 | 63 | 309 601 | 0.044 | 138 |
| 2004 | 1 968 412 | 0.084 | 1 649 | 9 511 | 0.650 | 62 | 336 025 | 0.044 | 150 |
| 2005 | 2 013 240 | 0.084 | 1 687 | 9 543 | 0.650 | 62 | 372 630 | 0.044 | 166 |
| 2006 | 2 064 681 | 0.084 | 1 730 | 9 519 | 0.650 | 62 | 414 389 | 0.044 | 184 |
| 2007 | 2 151 636 | 0.077 | 1 658 | 9 410 | 0.584 | 55 | 402 410 | 0.038 | 151 |
| 2008 | 2 200 000 | 0.091 | 1 991 | 9 500 | 0.716 | 68 | 410 000 | 0.051 | 211 |

Table 7.21 Different types of nationally registered vehicles and yearly numbers of vehicle fires. Continued.

| | Heavy duty vehicles | | | Motorcycles/mopeds | | |
|---|---|---|---|---|---|---|
| Year | Registered nationally | Share, % | Fires | Registered nationally | Share, % | Fires |
| 1980 | 41 246 | 0.311 | 128 | 220 273 | 0.144 | 318 |
| 1981 | 41 246 | 0.311 | 128 | 214 104 | 0.144 | 309 |
| 1982 | 41 246 | 0.311 | 128 | 207 934 | 0.144 | 300 |
| 1983 | 41 246 | 0.311 | 128 | 201 764 | 0.144 | 291 |
| 1984 | 41 246 | 0.311 | 128 | 195 594 | 0.144 | 282 |
| 1985 | 40 373 | 0.311 | 125 | 192 395 | 0.144 | 278 |
| 1986 | 41 935 | 0.311 | 130 | 180 868 | 0.144 | 261 |
| 1987 | 42 047 | 0.311 | 131 | 175 456 | 0.144 | 253 |
| 1988 | 41 069 | 0.311 | 128 | 169 450 | 0.144 | 245 |
| 1989 | 40 804 | 0.311 | 127 | 167 255 | 0.144 | 241 |
| 1990 | 40 123 | 0.311 | 125 | 164 111 | 0.144 | 237 |
| 1991 | 40 958 | 0.311 | 127 | 163 362 | 0.144 | 236 |
| 1992 | 41 872 | 0.311 | 130 | 159 024 | 0.144 | 230 |
| 1993 | 43 111 | 0.311 | 134 | 156 405 | 0.144 | 226 |
| 1994 | 44 794 | 0.311 | 139 | 154 376 | 0.144 | 223 |
| 1995 | 46 309 | 0.311 | 144 | 165 313 | 0.144 | 239 |
| 1996 | 47 430 | 0.311 | 147 | 178 096 | 0.144 | 257 |
| 1997 | 47 802 | 0.311 | 149 | 192 364 | 0.144 | 278 |
| 1998 | 48 827 | 0.311 | 152 | 205 654 | 0.144 | 297 |
| 1999 | 49 245 | 0.311 | 153 | 220 064 | 0.144 | 318 |
| 2000 | 49 185 | 0.311 | 153 | 233 695 | 0.144 | 337 |
| 2001 | 48 811 | 0.311 | 152 | 243 390 | 0.144 | 351 |
| 2002 | 48 148 | 0.311 | 150 | 253 731 | 0.144 | 366 |
| 2003 | 47 703 | 0.311 | 148 | 256 779 | 0.144 | 371 |
| 2004 | 47 480 | 0.311 | 148 | 263 815 | 0.144 | 381 |
| 2005 | 48 312 | 0.311 | 150 | 274 264 | 0.144 | 396 |
| 2006 | 49 683 | 0.311 | 154 | 287 672 | 0.144 | 415 |
| 2007 | 50 760 | 0.268 | 136 | 302 914 | 0.129 | 392 |
| 2008 | 51 500 | 0.353 | 182 | 315 000 | 0.159 | 502 |

The average weight of a passenger car, bus, light commercial vehicle and truck are known for every year back to 1993 (Statistics Denmark). The corresponding weights from 1980 to 1992 and the average weight of a unit from the category "motorcycles/mopeds" are estimated by an expert judgment. The total amount of vehicle involved in fires can then be calculated from the number of vehicle fires and the average weights of the different vehicle types. It is assumed that only 70 % of the total vehicle mass involved in a fire actually burns, see Table 7.22.

Table 7.22 Average vehicle mass involved in fires.

| Year | Passenger car fires | Average weight, kg | Bus fires | Average weight, kg | Light duty vehicle fires | Average weight, kg |
|---|---|---|---|---|---|---|
| 1980 | 1 236 | 850 | 52 | 10 000 | 48 | 2 000 |
| 1981 | 1 254 | 850 | 52 | 10 000 | 52 | 2 000 |
| 1982 | 1 272 | 850 | 52 | 10 000 | 57 | 2 000 |
| 1983 | 1 290 | 850 | 52 | 10 000 | 62 | 2 000 |
| 1984 | 1 309 | 850 | 52 | 10 000 | 66 | 2 000 |
| 1985 | 1 311 | 850 | 52 | 10 000 | 69 | 2 000 |
| 1986 | 1 355 | 850 | 53 | 10 000 | 77 | 2 000 |
| 1987 | 1 378 | 850 | 53 | 10 000 | 83 | 2 000 |
| 1988 | 1 386 | 850 | 53 | 10 000 | 86 | 2 000 |
| 1989 | 1 386 | 850 | 52 | 10 000 | 87 | 2 000 |
| 1990 | 1 379 | 850 | 53 | 10 000 | 88 | 2 000 |
| 1991 | 1 382 | 850 | 48 | 10 000 | 90 | 2 000 |
| 1992 | 1 391 | 850 | 49 | 10 000 | 92 | 2 000 |
| 1993 | 1 394 | 901 | 49 | 10 068 | 95 | 2 297 |
| 1994 | 1 398 | 908 | 50 | 10 512 | 98 | 2 382 |
| 1995 | 1 451 | 923 | 64 | 10 807 | 102 | 2 492 |
| 1996 | 1 501 | 935 | 64 | 10 899 | 104 | 2 638 |
| 1997 | 1 542 | 948 | 64 | 10 950 | 107 | 2 746 |
| 1998 | 1 572 | 964 | 64 | 10 960 | 111 | 2 848 |
| 1999 | 1 598 | 982 | 64 | 11 140 | 115 | 2 964 |
| 2000 | 1 606 | 999 | 64 | 11 195 | 121 | 3 103 |
| 2001 | 1 619 | 1 012 | 63 | 11 312 | 126 | 3 238 |
| 2002 | 1 630 | 1 024 | 63 | 11 387 | 131 | 3 333 |
| 2003 | 1 634 | 1 039 | 63 | 11 479 | 138 | 3 442 |
| 2004 | 1 649 | 1 052 | 62 | 11 572 | 150 | 3 561 |
| 2005 | 1 687 | 1 068 | 62 | 11 560 | 166 | 3 793 |
| 2006 | 1 730 | 1 086 | 62 | 11 684 | 184 | 4 120 |
| 2007 | 1 658 | 1 105 | 55 | 11 753 | 151 | 4 505 |
| 2008 | 1 991 | 1 122 | 68 | 11 700 | 211 | 4 710 |

Table 7.22 Average vehicle mass involved in fires. Continued

| Year | Heavy duty vehicle fires | Average weight, kg | Motorcycle/ moped fires | Average weight, kg | Total vehicle mass involved in fires, Mg | Total vehicle mass burnt, Mg |
|---|---|---|---|---|---|---|
| 1980 | 128 | 15 000 | 318 | 80 | 3 618 | 2 532 |
| 1981 | 128 | 15 000 | 309 | 80 | 3 642 | 2 549 |
| 1982 | 128 | 15 000 | 300 | 80 | 3 666 | 2 566 |
| 1983 | 128 | 15 000 | 291 | 80 | 3 690 | 2 583 |
| 1984 | 128 | 15 000 | 282 | 80 | 3 714 | 2 600 |
| 1985 | 125 | 15 000 | 278 | 80 | 3 676 | 2 573 |
| 1986 | 130 | 15 000 | 261 | 80 | 3 807 | 2 665 |
| 1987 | 131 | 15 000 | 253 | 80 | 3 843 | 2 690 |
| 1988 | 128 | 15 000 | 245 | 80 | 3 809 | 2 666 |
| 1989 | 127 | 15 000 | 241 | 80 | 3 796 | 2 657 |
| 1990 | 125 | 15 000 | 237 | 80 | 3 762 | 2 633 |
| 1991 | 127 | 15 000 | 236 | 80 | 3 765 | 2 635 |
| 1992 | 130 | 15 000 | 230 | 80 | 3 825 | 2 678 |
| 1993 | 134 | 14 921 | 226 | 85 | 3 987 | 2 791 |
| 1994 | 139 | 14 863 | 223 | 86 | 4 116 | 2 881 |
| 1995 | 144 | 14 991 | 239 | 85 | 4 460 | 3 122 |
| 1996 | 147 | 15 119 | 257 | 86 | 4 628 | 3 240 |
| 1997 | 149 | 15 178 | 278 | 87 | 4 736 | 3 315 |
| 1998 | 152 | 15 302 | 297 | 90 | 4 885 | 3 420 |
| 1999 | 153 | 15 408 | 318 | 91 | 5 010 | 3 507 |
| 2000 | 153 | 15 394 | 337 | 93 | 5 078 | 3 555 |
| 2001 | 152 | 15 061 | 351 | 94 | 5 076 | 3 553 |
| 2002 | 150 | 14 654 | 366 | 94 | 5 048 | 3 534 |
| 2003 | 148 | 14 188 | 371 | 95 | 5 028 | 3 520 |
| 2004 | 148 | 13 756 | 381 | 96 | 5 049 | 3 534 |
| 2005 | 150 | 13 412 | 396 | 98 | 5 200 | 3 640 |
| 2006 | 154 | 13 334 | 415 | 100 | 5 461 | 3 823 |
| 2007 | 136 | 13 427 | 392 | 102 | 5 024 | 3 517 |
| 2008 | 182 | 13 407 | 502 | 104 | 6 516 | 4 561 |

**Emission factors**

*Building fires*

For building fires, emissions are calculated by multiplying the number of full scale equivalent fires by the emission factors. The estimation of emissions is based on emission factors from literature. The estimation is based on the measurements and estimations performed in countries that are comparable with Denmark. By comparable is meant countries that have similar building traditions, in relation to the material used in building structure and interior.

In the process of selecting the best reliable emission factors for the calculation of the emissions from Danish accidental building fires, a range of different sources have been studied. Unfortunately it is difficult to do an interrelated comparison of the different sources because they all establish emission factors on different assumptions and many of these assumptions are not fully accounted for. Table 7.23 lists the emission factors that were chosen as the best reliable and their respective references.

Table 7.23 Emission factors building fires.

| Emission | Unit | Detached houses | Undetached houses | Apartment buildings | Industrial buildings | Source |
|---|---|---|---|---|---|---|
| $SO_X$ | kg pr fire | 258.5 | 213.6 | 123.6 | 802.9 | Blomqvist et al., 2002 |
| $NO_X$ | kg pr fire | 19.3 | 15.9 | 8.0 | 45.0 | NAEI, 2007 |
| NMVOC | kg pr fire | 96.5 | 79.5 | 40.2 | 225.0 | NAEI, 2007 |
| $CH_4$ | kg pr fire | 41.8 | 34.5 | 17.4 | 97.5 | NAEI, 2007 |
| CO | kg pr fire | 270.1 | 222.7 | 112.5 | 630.0 | NAEI, 2007 |
| $CO_2$ - total | ton pr fire | 31.2 | 25.8 | 14.9 | 80.0 | Blomqvist et al., 2002 |
| $CO_2$ - biomasse | ton pr fire | 25.8 | 21.3 | 12.3 | 67.6 | Blomqvist et al., 2002 |
| $CO_2$ - non-bio | ton pr fire | 5.44 | 4.49 | 2.60 | 12.34 | Blomqvist et al., 2002 |
| $N_2O$ | - | NAV | NAV | NAV | NAV | - |
| $NH_3$ | - | NA | NA | NA | NA | - |
| TSP | g pr fire | 143.8 | 61.6 | 43.8 | 27.2 | EEA, 2009 |
| $PM_{10}$ | g pr fire | 143.8 | 61.6 | 43.8 | 27.2 | EEA, 2009 |
| $PM_{2.5}$ | g pr fire | 143.8 | 61.6 | 43.8 | 27.2 | EEA, 2009 |
| As | mg pr fire | 1.35 | 0.58 | 0.41 | 0.25 | EEA, 2009 |
| Cd | mg pr fire | 0.85 | 0.36 | 0.26 | 0.16 | EEA, 2009 |
| Cr | mg pr fire | 1.29 | 0.55 | 0.39 | 0.24 | EEA, 2009 |
| Cu | mg pr fire | 2.99 | 1.28 | 0.91 | 0.57 | EEA, 2009 |
| Hg | mg pr fire | 0.85 | 0.36 | 0.26 | 0.16 | EEA, 2009 |
| Ni | - | NAV | NAV | NAV | NAV | - |
| Pb | mg pr fire | 0.42 | 0.18 | 0.13 | 0.08 | EEA, 2009 |
| Se | - | NAV | NAV | NAV | NAV | - |
| Zn | - | NAV | NAV | NAV | NAV | - |
| HCB | - | NAV | NAV | NAV | NAV | - |
| PCDD/F | mg pr fire | 3.05 | 2.52 | 1.27 | 7.13 | Hansen, 2000 |
| Benzo[b]-fluoranthene | g pr fire | 12.22 | 10.07 | 5.09 | 28.50 | NAEI, 2007 |
| Benzo[k]-fluoranthene | g pr fire | 4.31 | 3.55 | 1.79 | 10.05 | NAEI, 2007 |
| Benzo[a]-pyrene | g pr fire | 7.72 | 6.36 | 3.21 | 18.00 | NAEI, 2007 |
| Benzo[g,h,i]-perylene | g pr fire | 8.36 | 6.89 | 3.48 | 19.50 | NAEI (2007) |
| Indeno[1,2,3-cd]pyrene | g pr fire | 8.36 | 6.89 | 3.48 | 19.50 | NAEI, 2007 |
| PAH | g pr fire | 273.2 | 225.2 | 113.8 | 637.2 | NAEI, 2007 |
| PCB | - | NAV | NAV | NAV | NAV | - |
| HCN | kg pr fire | 103.5 | 85.3 | 43.1 | 241.5 | EIIP, 2001 |
| HCl | kg pr fire | 44.1 | 36.3 | 18.4 | 102.8 | EIIP, 2001 |

NAV = not available, NA = not applicable.

Emission factors from the EMEP/EEA Guidebook (EEA, 2009) have not been altered as they were already specified for the four building types; detached houses, undetached houses, apartment buildings and industrial buildings.

A number of assumptions and factors that are non-accounted for were used to reach the emission factors in Claire, 1999. The article only considers one building type of 1300 square feet, and the emission factors were therefore altered into matching the four building types stated in tables 7.19, 7.20 and 7.23. This alternation was performed simply by adjusting the average floor space for each of the four building types respectively, whereas factors like loss rate and pounds of combustible contents per square foot are not altered.

The average floor space in Danish buildings is stated in Table 7.24. The data is collected from (Statistics Denmark) and takes into account possible multiple building floors but not attics and basements. The average floor space in industrial buildings, schools etc. is estimated to 500 square meters for all years.

Table 7.24 Average floor space in building types.

| Year | Detached | Undetached | Apartment |
|---|---|---|---|
| 1980 | 154 | 130 | 74 |
| 1981 | 154 | 130 | 74 |
| 1982 | 154 | 130 | 74 |
| 1983 | 154 | 130 | 74 |
| 1984 | 154 | 130 | 75 |
| 1985 | 154 | 130 | 75 |
| 1986 | 155 | 129 | 75 |
| 1987 | 156 | 129 | 75 |
| 1988 | 156 | 129 | 75 |
| 1989 | 156 | 129 | 75 |
| 1990 | 156 | 129 | 75 |
| 1991 | 156 | 128 | 75 |
| 1992 | 155 | 128 | 75 |
| 1993 | 155 | 128 | 75 |
| 1994 | 155 | 128 | 75 |
| 1995 | 155 | 129 | 75 |
| 1996 | 155 | 129 | 75 |
| 1997 | 155 | 129 | 75 |
| 1998 | 155 | 130 | 75 |
| 1999 | 155 | 130 | 75 |
| 2000 | 156 | 131 | 75 |
| 2001 | 160 | 131 | 75 |
| 2002 | 161 | 131 | 75 |
| 2003 | 162 | 131 | 75 |
| 2004 | 163 | 132 | 75 |
| 2005 | 162 | 131 | 76 |
| 2006 | 163 | 132 | 76 |
| 2007 | 160 | 132 | 76 |
| 2008 | 161 | 133 | 77 |

Statistics Denmark, BOL51 and BOL 511.

The Swedish source (Persson et al., 1998) gives emission factors for HCN, HCl, $NO_X$, CO and $CO_2$ expressed as kg pr Mg of object burned and divided in three different objects; house, apartment and schools of average Swedish sizes. The data is based on the distribution of combustible material in the interior of the different building types, and does not take into account the combustible material in the structure itself. These emission factors are recalculated using Danish data for average building sizes, resulting in the subdivision of building types in detached, undetached, apartment and industrial buildings.

(Persson et al., 1998) sets a rate of weight loss at 12.4 %, but does not specify any further on different building types. It seems quite unrealistic that the same rate of weight loss applies for houses and industrial buildings, resulting in the conclusion that there is most likely an overestimation on the emission factors for industrial buildings.

In 2002 a report on the further development of this data (Blomqvist et al., 2002) was published, this report added data for the amount of combustible material in the building structure. The emission factors from this source is calculated by combining the estimated amount of combustible material in the building structure itself, with the amount of combustible material estimated in (Persson et al., 1998) to be in the interior of the different building types. Again, Danish data for the average floor space in different building types is used to divided the emission factors into the four categories; detached houses, undetached houses, apartment buildings and industrial buildings.

The emission factors from both (Persson et al., 1998) and (Blomqvist et al., 2002) are probably overestimated due to building traditions, because wood is use to a further extent in Sweden and Norway contra Denmark.

The last three sources that were considered are all presented in mass emission per mass burned. For the calculation of these emission factors to a unit that is comparable with those of the emission factors from the other sources, the building masses are estimated using the same methodology as Hansen, 2000 and stated in Table 7.25 for 2008.

Table 7.25 Building mass pr building type.

| | Unit | Detached house | Undetached house | Apartment building | Industry building |
|---|---|---|---|---|---|
| Average floor area* | $m^2$ | 161 | 133 | 77 | 500 |
| Building mass pr floor area | $kg/m^2$ | 40 | 40 | 35 | 30 |
| Total building mass | Mg/fire | 6.4 | 5.3 | 2.7 | 15.0 |

* 2008 numbers

EIIP, 2001 gathers emission factors from the Californian EPA and the U.S. EPA, NAEI, 2007 represents the UK National Atmospheric Emissions Inventory and the UNEP toolkit.

Emission factors for particulate matter are available from the EMEP/EEA Guidebook (hereafter the Guidebook), EIIP, 2001, Claire, 1999 and NAEI, 2007, giving four emission factors that vary from 0.14-51.4 kg PM per full scale fire of a detached house. The best reliable source in this case is believed to be the Guidebook which states both the $PM_{10}$ and the $PM_{2.5}$ to be equal to the TSP. There is however the quite questionable relationship between the different building types that is claimed by the Guidebook. Comparing with the average floor areas shown in Table 7.24 and 7.25, it seems illogical that a fire in a detached house will cause more than twice the emission of a fire in an undetached house. That a full scale fire in an apartment building is expected to cause less than a third of the emission of that in a detached house, and that a large fire in an industrial building should cause less than a firth of the emission from a detached house, even keeping in mind an expected difference in the composition of the interior.

The Guidebook is the only found source of emission factors for the heavy metals arsenic, cadmium, cobber, chrome, lead and mercury, no emission factors were found for Ni, Se and Zn.

For the emission factor of dioxins and furans there are three sources. Hansen, 2000 and UNEP toolkit provides data that are very similar with 50-1000 and 400 µg pr Mg respectively. In addition the Guidebook gives an emission factor of 0.0014 mg pr fire. Hansen, 2000 is chosen as the best reliable source with an average of 475 µg pr Mg, translating to 3.05 mg pr fire for full scale detached house fires.

NAEI, 2007 is the only source that provides data for PAHs, and that gives emission factors for VOCs divided into NMVOC and $CH_4$. The total PAH emission factor sums the emissions of: benzo(b)flouranthene, benzo(k)flouranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, acenapthene, acenapthylene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthracene, chrysene, dibenz[ah]anthracene and benzo[ghi]perylene.

Being that (Persson et al., 1998) and (Blomqvist et al., 2002) are the only sources to $SO_X$ and $CO_2$ emission factors, (Blomqvist et al., 2002) is the best available source as this provides a more recent and more detailed method. The share of $CO_2$ emission that stems from the burning of wood is calculated from the estimated wood contents in an average house. (Blomqvist et al., 2002) specifies that an average house of 120 square meters has a structure that consists of 9000 kg wood and an interior that consists of 2780 kg wood. With a $CO_2$ yield factor of 1.63 kg pr kg wood and a Danish average floor area of 161 square meters, the $CO_2$ emission from the burning of wood in a full scale detached house fire is 25.76 Mg pr fire.

Emission factors for HCN and HCl are provided by several sources (EIIP, 2001, Persson et al., 1998 and Blomqvist et al., 2002). The three sources do however not comply very well to each other since EIIP, 2001 is much higher for the compound HCN and quite lower for HCl.

$NO_X$ and CO are described by the same three sources but also by Claire, 1999 and NAEI, 2007. In the case of both compounds there is a good compliance between the emission factors provided by EIIP, 2001, Claire, 1999 and NAEI, 2007. And in both cases the more recent factors of NAEI, 2007 are selected.

No data was available for $N_2O$, HCB and PCB. $NH_3$ is assumed not to be emitted.

*Vehicle fires*

In the process of selecting the best reliable emission factors for the calculation of the emissions from Danish vehicle fires, a range of different sources have been studied. Unfortunately it is difficult to do an interrelated comparison of the different sources because they all establish emission factors on different assumptions and many of these assumptions are not fully accounted for. Table 7.26 lists the accessible emission factors and their respective references.

Table 7.26 Emission factors vehicle fires.

| | unit | Emission factor | Source |
|---|---|---|---|
| $SO_2$ | kg pr Mg | 5 | Lönnermark et al., 2004 |
| $NO_X$ | kg pr Mg | 2 | Lemieux et al., 2004 |
| NMVOC | kg pr Mg | 8.5 | Lönnermark et al., 2004 |
| $CH_4$ | kg pr Mg | 5 | NAEI, 2007 |
| CO | kg pr Mg | 63 | Lönnermark et al., 2004 |
| $CO_2$, fossil | kg pr Mg | 2 400 | Lönnermark et al., 2004 |
| $N_2O$ | - | NAV | - |
| $NH_3$ | - | NA | - |
| TSP | kg pr Mg | 2.05 | EEA, 2009 |
| $PM_{10}$ | kg pr Mg | 2.05 | EEA, 2009 |
| $PM_{2.5}$ | kg pr Mg | 2.05 | EEA, 2009 |
| As | g pr Mg | 0.26 | Lönnermark et al., 2004 |
| Cd | g pr Mg | 1.7 | Lönnermark et al., 2004 |
| Cr | g pr Mg | 3.8 | Lönnermark et al., 2004 |
| Cu | g pr Mg | 27 | Lönnermark et al., 2004 |
| Hg | - | NAV | - |
| Ni | g pr Mg | 2.8 | Lönnermark et al., 2004 |
| Pb | g pr Mg | 820 | Lönnermark et al., 2004 |
| Se | - | NAV | - |
| Zn | g pr Mg | 3 200 | Lönnermark et al., 2004 |
| Co | g pr Mg | 0.32 | Lönnermark et al., 2004 |
| Mn | g pr Mg | 5.7 | Lönnermark et al., 2004 |
| HCB | - | NAV | - |
| PCDD/F | mg I-TEQ/Mg | 0.0428 | Hansen, 2000 |
| Benzo[b]fluoranthene | g pr Mg | 32.3 | Lemieux et al., 2004 |
| Benzo[k]fluoranthene | g pr Mg | | Lemieux et al., 2004 |
| Benzo[a]pyrene | g pr Mg | 14.7 | Lemieux et al., 2004 |
| Benzo[g,h,i]perylene | g pr Mg | 6.3 | Lemieux et al., 2004 |
| Indeno[1,2,3-cd]pyrene | g pr Mg | 23.3 | Lemieux et al., 2004 |
| PAH | g pr Mg | 1 638.80 | Lemieux et al., 2004 |
| PCB | - | NAV | - |
| HCN | kg pr Mg | 1.6 | Lönnermark et al., 2004 |
| HCl | kg pr Mg | 13 | Lönnermark et al., 2004 |

NAV = not available, NA = not applicable.

Being that NAEI, 2007 has no references as to where they have collected data, this source of emission factors can not be counted as an additional indication in the cases where it shows a direct compliance with other sources. This leaves only the emission factors of NMVOC and PAHs. In the case of PAHs the experimentally obtained emission factors of Lemieux et al., 2004 is considered to be the best available, also Lemieux et al., 2004 includes a 16$^{th}$ PAH: naphthylene, in addition to benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, acenapthene, acenapthylene, fluorine, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthracene, chrysene, dibenz[ah]anthracene and benzo[ghi]perylene.

In the case of NMVOC the best available source to an emission factor is considered to be Lönnermark et al., 2004, comparing with available VOC emission factors it does however seem that Lönnermark et al., 2004 is possibly underestimating this emission.

PCDD/F has the best documented emission factor as eight sources were found for this group of compounds. The Guidebook gives an emission factor that is a factor 1000 lower than the other sources and Lönnermark et al., 2004 and Lemieux et al., 2004 give factors that are a factor 1000 and 100,000 higher than the major of the sources respectively. There is a very good compliance between the remaining five sources; Hansen, 2000, UNEP toolkit, 2005, NAEI, 2007, Blomqvist et al., 2002 and Schleicher et al, 2004. Hansen, 2000 is chosen as the source for the calculation of the PCDD/F emission from vehicle fires.

Lönnermark et al., 2004 is the only available source to emission factors for heavy metals (As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Zn, Hg, Se). Emission factors from this source were derived by both small-scale and full-scale tests.

There are three sources to particle matter emission factors: the EMEP/EEA Guidebook, Lönnermark et al., 2004 and Lemieux et al., 2004. The two latter give the quite similar data of 38 and 50 kg pr Mg combusted vehicle respectively. The emission factor supplied by the Guidebook is given in kg pr fire and is therefore divided by the average weight of a passenger car in 2008, to give a factor that is better comparable; the resulting emission factor is of 2.0 kg pr Mg.

Persson et al. (1998) and Lönnermark et al., 2004 are the only available sources to $CO_2$, HCN, HCl and $SO_2$ emission factors for vehicle fires. Since Lönnermark et al., 2004 is the more resent source and establishes its emission factors on experimental data, this is chosen as the best reliable source.

Persson et al. (1998) and Lemieux et al., 2004 delivers very similar emission factors for $NO_X$, the more resent Lemieux et al., 2004 is chosen as the most reliable.

Emission factors for CO are available from the same two sources and from Lönnermark et al., 2004, in this case Lönnermark et al., 2004 and Lemieux et al., 2004 delivers the same factor. Lönnermark et al., 2004 is chosen as the best available source since it is based on experimental data.

No data was available for Hg, Se, $N_2O$, HCB and PCB. $NH_3$ is assumed not to be emitted.

#### Emissions

The dioxin emission is given in I-TEQ; i.e. International Toxicity Equivalents, which is a weighted addition of congener toxicity with reference to 2,3,7,8-TCDD (Seveso-dioxin).

*Building fires*

Table 7.27a, b and c shows the total national emissions from building fires from the years 1980-2008.

Table 7.27a National emissions from building fires – 1980 to 1989.

| | unit | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $SO_X$ | Mg | 805.78 | 805.78 | 805.78 | 805.78 | 805.78 | 805.78 | 805.78 | 805.78 | 805.78 | 849.71 |
| $NO_X$ | Mg | 54.33 | 54.33 | 54.33 | 54.33 | 54.33 | 54.33 | 54.33 | 54.33 | 54.33 | 57.30 |
| NMVOC | Mg | 271.67 | 271.67 | 271.67 | 271.67 | 271.67 | 271.67 | 271.67 | 271.67 | 271.67 | 286.48 |
| $CH_4$ | Mg | 117.72 | 117.72 | 117.72 | 117.72 | 117.72 | 117.72 | 117.72 | 117.72 | 117.72 | 124.14 |
| CO | Mg | 760.66 | 760.66 | 760.66 | 760.66 | 760.66 | 760.66 | 760.66 | 760.66 | 760.66 | 802.13 |
| $CO_2$ - total | Gg | 91.35 | 91.35 | 91.35 | 91.35 | 91.35 | 91.35 | 91.35 | 91.35 | 91.35 | 96.33 |
| $CO_2$ - biomasse | Gg | 75.98 | 75.98 | 75.98 | 75.98 | 75.98 | 75.98 | 75.98 | 75.98 | 75.98 | 80.13 |
| $CO_2$ - non-bio | Gg | 15.37 | 15.37 | 15.37 | 15.37 | 15.37 | 15.37 | 15.37 | 15.37 | 15.37 | 16.20 |
| TSP | kg | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 281.74 |
| $PM_{10}$ | kg | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 281.74 |
| $PM_{2.5}$ | kg | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 267.17 | 281.74 |
| As | g | 2.51 | 2.51 | 2.51 | 2.51 | 2.51 | 2.51 | 2.51 | 2.51 | 2.51 | 2.64 |
| Cd | g | 1.58 | 1.58 | 1.58 | 1.58 | 1.58 | 1.58 | 1.58 | 1.58 | 1.58 | 1.66 |
| Cr | g | 2.39 | 2.39 | 2.39 | 2.39 | 2.39 | 2.39 | 2.39 | 2.39 | 2.39 | 2.52 |
| Cu | g | 5.56 | 5.56 | 5.56 | 5.56 | 5.56 | 5.56 | 5.56 | 5.56 | 5.56 | 5.86 |
| Hg | g | 1.58 | 1.58 | 1.58 | 1.58 | 1.58 | 1.58 | 1.58 | 1.58 | 1.58 | 1.66 |
| Pb | g | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 | 0.82 |
| PCDD/F | g I-TEQ | 8.60 | 8.60 | 8.60 | 8.60 | 8.60 | 8.60 | 8.60 | 8.60 | 8.60 | 9.07 |
| Benzo[b]fluoranthene | Mg | 34.41 | 34.41 | 34.41 | 34.41 | 34.41 | 34.41 | 34.41 | 34.41 | 34.41 | 36.29 |
| Benzo[k]fluoranthene | Mg | 12.13 | 12.13 | 12.13 | 12.13 | 12.13 | 12.13 | 12.13 | 12.13 | 12.13 | 12.80 |
| Benzo[a]pyrene | Mg | 21.73 | 21.73 | 21.73 | 21.73 | 21.73 | 21.73 | 21.73 | 21.73 | 21.73 | 22.92 |
| Benzo[g,h,i]perylene | Mg | 23.54 | 23.54 | 23.54 | 23.54 | 23.54 | 23.54 | 23.54 | 23.54 | 23.54 | 24.83 |
| Indeno[1,2,3-cd]pyrene | Mg | 23.54 | 23.54 | 23.54 | 23.54 | 23.54 | 23.54 | 23.54 | 23.54 | 23.54 | 24.83 |
| PAH | Mg | 769.36 | 769.36 | 769.36 | 769.36 | 769.36 | 769.36 | 769.36 | 769.36 | 769.36 | 811.30 |
| HCN | Mg | 291.55 | 291.55 | 291.55 | 291.55 | 291.55 | 291.55 | 291.55 | 291.55 | 291.55 | 307.45 |
| HCl | Mg | 124.13 | 124.13 | 124.13 | 124.13 | 124.13 | 124.13 | 124.13 | 124.13 | 124.13 | 130.90 |

Table 7.27b National emissions from building fires – 1990 to 1999.

| | unit | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $SO_X$ | Mg | 770.14 | 795.66 | 865.09 | 760.10 | 765.30 | 884.05 | 893.68 | 824.92 | 738.25 | 793.35 |
| $NO_X$ | Mg | 51.93 | 53.65 | 58.33 | 51.25 | 51.60 | 59.61 | 60.26 | 55.62 | 49.78 | 53.49 |
| NMVOC | Mg | 259.65 | 268.25 | 291.66 | 256.26 | 258.02 | 298.05 | 301.30 | 278.12 | 248.90 | 267.47 |
| $CH_4$ | Mg | 112.51 | 116.24 | 126.39 | 111.05 | 111.81 | 129.16 | 130.56 | 120.52 | 107.86 | 115.91 |
| CO | Mg | 727.02 | 751.10 | 816.65 | 717.54 | 722.45 | 834.54 | 843.64 | 778.73 | 696.91 | 748.92 |
| $CO_2$ - total | Gg | 87.31 | 90.20 | 98.07 | 86.17 | 86.76 | 100.22 | 101.31 | 93.52 | 83.69 | 89.94 |
| $CO_2$ - biomasse | Gg | 72.62 | 75.03 | 81.58 | 71.68 | 72.17 | 83.36 | 84.27 | 77.79 | 69.62 | 74.81 |
| $CO_2$ - non-bio | Gg | 14.69 | 15.17 | 16.50 | 14.49 | 14.59 | 16.86 | 17.04 | 15.73 | 14.08 | 15.13 |
| TSP | kg | 255.35 | 263.81 | 286.84 | 252.02 | 253.75 | 293.12 | 296.32 | 273.52 | 244.78 | 263.05 |
| $PM_{10}$ | kg | 255.35 | 263.81 | 286.84 | 252.02 | 253.75 | 293.12 | 296.32 | 273.52 | 244.78 | 263.05 |
| $PM_{2.5}$ | kg | 255.35 | 263.81 | 286.84 | 252.02 | 253.75 | 293.12 | 296.32 | 273.52 | 244.78 | 263.05 |
| As | g | 2.40 | 2.47 | 2.69 | 2.36 | 2.38 | 2.75 | 2.78 | 2.57 | 2.30 | 2.47 |
| Cd | g | 1.51 | 1.56 | 1.69 | 1.49 | 1.50 | 1.73 | 1.75 | 1.62 | 1.45 | 1.55 |
| Cr | g | 2.29 | 2.36 | 2.57 | 2.26 | 2.27 | 2.62 | 2.65 | 2.45 | 2.19 | 2.36 |
| Cu | g | 5.31 | 5.49 | 5.96 | 5.24 | 5.28 | 6.09 | 6.16 | 5.69 | 5.09 | 5.47 |
| Hg | g | 1.51 | 1.56 | 1.69 | 1.49 | 1.50 | 1.73 | 1.75 | 1.62 | 1.45 | 1.55 |
| Pb | g | 0.75 | 0.77 | 0.84 | 0.74 | 0.74 | 0.86 | 0.87 | 0.80 | 0.72 | 0.77 |
| PCDD/F | g I-TEQ | 8.22 | 8.49 | 9.24 | 8.12 | 8.17 | 9.44 | 9.54 | 8.81 | 7.88 | 8.47 |
| Benzo[b]fluoranthene | Mg | 32.89 | 33.98 | 36.94 | 32.46 | 32.68 | 37.75 | 38.16 | 35.23 | 31.53 | 33.88 |
| Benzo[k]fluoranthene | Mg | 11.60 | 11.98 | 13.03 | 11.45 | 11.52 | 13.31 | 13.46 | 12.42 | 11.12 | 11.95 |
| Benzo[a]pyrene | Mg | 20.77 | 21.46 | 23.33 | 20.50 | 20.64 | 23.84 | 24.10 | 22.25 | 19.91 | 21.40 |
| Benzo[g,h,i]perylene | Mg | 22.50 | 23.25 | 25.28 | 22.21 | 22.36 | 25.83 | 26.11 | 24.10 | 21.57 | 23.18 |
| Indeno[1,2,3-cd]pyrene | Mg | 22.50 | 23.25 | 25.28 | 22.21 | 22.36 | 25.83 | 26.11 | 24.10 | 21.57 | 23.18 |
| PAH | Mg | 735.33 | 759.69 | 825.98 | 725.74 | 730.71 | 844.08 | 853.28 | 787.63 | 704.88 | 757.48 |
| HCN | Mg | 278.66 | 287.89 | 313.01 | 275.02 | 276.90 | 319.87 | 323.36 | 298.48 | 267.12 | 287.05 |
| HCl | Mg | 118.64 | 122.57 | 133.27 | 117.09 | 117.89 | 136.19 | 137.67 | 127.08 | 113.73 | 122.21 |

Table 7.27c National emissions from building fires – 2000 to 2008.

| | unit | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SO_X$ | Mg | 776.88 | 764.22 | 740.15 | 834.29 | 720.47 | 748.70 | 817.63 | 935.53 | 911.81 |
| $NO_X$ | Mg | 52.38 | 51.53 | 49.91 | 56.26 | 48.58 | 50.48 | 55.25 | 62.44 | 61.99 |
| NMVOC | Mg | 261.92 | 257.65 | 249.54 | 281.28 | 242.90 | 252.42 | 276.23 | 312.21 | 309.96 |
| $CH_4$ | Mg | 113.50 | 111.65 | 108.13 | 121.89 | 105.26 | 109.38 | 119.70 | 135.29 | 134.32 |
| CO | Mg | 733.38 | 721.42 | 698.71 | 787.57 | 680.13 | 706.78 | 773.44 | 874.19 | 867.89 |
| $CO_2$ - total | Gg | 88.07 | 86.64 | 83.91 | 94.58 | 81.68 | 84.88 | 92.79 | 105.32 | 103.99 |
| $CO_2$ - biomasse | Gg | 73.26 | 72.06 | 69.80 | 78.67 | 67.94 | 70.60 | 77.18 | 87.68 | 86.44 |
| $CO_2$ - non-bio | Gg | 14.81 | 14.57 | 14.11 | 15.91 | 13.74 | 14.28 | 15.62 | 17.64 | 17.55 |
| TSP | kg | 257.59 | 253.39 | 245.41 | 276.62 | 238.89 | 248.25 | 272.04 | 291.46 | 319.99 |
| $PM_{10}$ | kg | 257.59 | 253.39 | 245.41 | 276.62 | 238.89 | 248.25 | 272.04 | 291.46 | 319.99 |
| $PM_{2.5}$ | kg | 257.59 | 253.39 | 245.41 | 276.62 | 238.89 | 248.25 | 272.04 | 291.46 | 319.99 |
| As | g | 2.42 | 2.38 | 2.30 | 2.59 | 2.24 | 2.33 | 2.55 | 2.73 | 3.00 |
| Cd | g | 1.52 | 1.50 | 1.45 | 1.63 | 1.41 | 1.47 | 1.61 | 1.72 | 1.89 |
| Cr | g | 2.31 | 2.27 | 2.20 | 2.48 | 2.14 | 2.22 | 2.44 | 2.61 | 2.87 |
| Cu | g | 5.36 | 5.27 | 5.10 | 5.75 | 4.97 | 5.16 | 5.66 | 6.06 | 6.65 |
| Hg | g | 1.52 | 1.50 | 1.45 | 1.63 | 1.41 | 1.47 | 1.61 | 1.72 | 1.89 |
| Pb | g | 0.75 | 0.74 | 0.72 | 0.81 | 0.70 | 0.73 | 0.80 | 0.85 | 0.94 |
| PCDD/F | g I-TEQ | 8.29 | 8.16 | 7.90 | 8.91 | 7.69 | 7.99 | 8.75 | 9.89 | 9.82 |
| Benzo[b]fluoranthene | Mg | 33.18 | 32.64 | 31.61 | 35.63 | 30.77 | 31.97 | 34.99 | 39.55 | 39.26 |
| Benzo[k]fluoranthene | Mg | 11.70 | 11.51 | 11.15 | 12.56 | 10.85 | 11.27 | 12.34 | 13.95 | 13.84 |
| Benzo[a]pyrene | Mg | 20.95 | 20.61 | 19.96 | 22.50 | 19.43 | 20.19 | 22.10 | 24.98 | 24.80 |
| Benzo[g,h,i]perylene | Mg | 22.70 | 22.33 | 21.63 | 24.38 | 21.05 | 21.88 | 23.94 | 27.06 | 26.86 |
| Indeno[1,2,3-cd]pyrene | Mg | 22.70 | 22.33 | 21.63 | 24.38 | 21.05 | 21.88 | 23.94 | 27.06 | 26.86 |
| PAH | Mg | 741.76 | 729.67 | 706.69 | 796.57 | 687.90 | 714.85 | 782.28 | 884.18 | 877.81 |
| HCN | Mg | 281.09 | 276.51 | 267.80 | 301.86 | 260.68 | 270.90 | 296.45 | 335.06 | 332.65 |
| HCl | Mg | 119.68 | 117.73 | 114.02 | 128.52 | 110.99 | 115.34 | 126.21 | 142.65 | 141.63 |

*Vehicle fires*

Table 7.28a, b and c shows the total national emissions from vehicle fires from the years 1980-2008.

Table 7.28a National emissions from vehicle fires – 1980 to 1989.

| | unit | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $SO_2$ | Mg | 12.66 | 12.75 | 12.83 | 12.92 | 13.00 | 12.87 | 13.32 | 13.45 | 13.33 | 13.29 |
| $NO_X$ | Mg | 5.06 | 5.10 | 5.13 | 5.17 | 5.20 | 5.15 | 5.33 | 5.38 | 5.33 | 5.31 |
| NMVOC | Mg | 21.53 | 21.67 | 21.81 | 21.96 | 22.10 | 21.87 | 22.65 | 22.87 | 22.66 | 22.59 |
| $CH_4$ | Mg | 12.66 | 12.75 | 12.83 | 12.92 | 13.00 | 12.87 | 13.32 | 13.45 | 13.33 | 13.29 |
| CO | Mg | 159.55 | 160.61 | 161.67 | 162.73 | 163.79 | 162.10 | 167.89 | 169.50 | 167.99 | 167.40 |
| $CO_2$, fossil | Gg | 6.08 | 6.12 | 6.16 | 6.20 | 6.24 | 6.18 | 6.40 | 6.46 | 6.40 | 6.38 |
| TSP | Mg | 5.19 | 5.22 | 5.26 | 5.29 | 5.33 | 5.27 | 5.46 | 5.51 | 5.46 | 5.45 |
| $PM_{10}$ | Mg | 5.19 | 5.22 | 5.26 | 5.29 | 5.33 | 5.27 | 5.46 | 5.51 | 5.46 | 5.45 |
| $PM_{2.5}$ | Mg | 5.19 | 5.22 | 5.26 | 5.29 | 5.33 | 5.27 | 5.46 | 5.51 | 5.46 | 5.45 |
| As | kg | 0.66 | 0.66 | 0.67 | 0.67 | 0.68 | 0.67 | 0.69 | 0.70 | 0.69 | 0.69 |
| Cd | kg | 4.31 | 4.33 | 4.36 | 4.39 | 4.42 | 4.37 | 4.53 | 4.57 | 4.53 | 4.52 |
| Cr | kg | 9.62 | 9.69 | 9.75 | 9.82 | 9.88 | 9.78 | 10.13 | 10.22 | 10.13 | 10.10 |
| Cu | kg | 68.38 | 68.83 | 69.29 | 69.74 | 70.20 | 69.47 | 71.95 | 72.64 | 71.99 | 71.74 |
| Ni | kg | 7.09 | 7.14 | 7.19 | 7.23 | 7.28 | 7.20 | 7.46 | 7.53 | 7.47 | 7.44 |
| Pb | kg | 2 076.63 | 2 090.44 | 2 104.26 | 2 118.07 | 2 131.88 | 2 109.89 | 2 185.25 | 2 206.16 | 2 186.48 | 2 178.84 |
| Zn | kg | 8 103.92 | 8 157.83 | 8 211.73 | 8 265.64 | 8 319.54 | 8 233.70 | 8 527.79 | 8 609.39 | 8 532.62 | 8 502.79 |
| Co | kg | 0.81 | 0.82 | 0.82 | 0.83 | 0.83 | 0.82 | 0.85 | 0.86 | 0.85 | 0.85 |
| Mn | kg | 14.44 | 14.53 | 14.63 | 14.72 | 14.82 | 14.67 | 15.19 | 15.34 | 15.20 | 15.15 |
| PCDD/F | g I-TEQ | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.12 | 0.11 | 0.11 |
| *Naphthylene* | kg | 2 236.94 | 2 251.82 | 2 266.69 | 2 281.57 | 2 296.45 | 2 272.76 | 2 353.94 | 2 376.46 | 2 355.27 | 2 347.03 |
| Benzo[b+k]-fluoranthene | kg | 81.80 | 82.34 | 82.89 | 83.43 | 83.98 | 83.11 | 86.08 | 86.90 | 86.13 | 85.83 |
| Benzo[a]-pyrene | kg | 37.23 | 37.48 | 37.72 | 37.97 | 38.22 | 37.82 | 39.17 | 39.55 | 39.20 | 39.06 |
| Benzo[g,h,i]-perylene | kg | 15.95 | 16.06 | 16.17 | 16.27 | 16.38 | 16.21 | 16.79 | 16.95 | 16.80 | 16.74 |
| Indeno[1,2,3-cd]pyrene | kg | 59.01 | 59.40 | 59.79 | 60.18 | 60.58 | 59.95 | 62.09 | 62.69 | 62.13 | 61.91 |
| PAH | Mg | 4.15 | 4.18 | 4.21 | 4.23 | 4.26 | 4.22 | 4.37 | 4.41 | 4.37 | 4.35 |
| HCN | Mg | 4.05 | 4.08 | 4.11 | 4.13 | 4.16 | 4.12 | 4.26 | 4.30 | 4.27 | 4.25 |
| HCl | Mg | 32.92 | 33.14 | 33.36 | 33.58 | 33.80 | 33.45 | 34.64 | 34.98 | 34.66 | 34.54 |

Table 7.28b National emissions from vehicle fires – 1990 to 1999.

| | unit | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $SO_2$ | Mg | 13.17 | 13.18 | 13.39 | 13.95 | 14.41 | 15.61 | 16.20 | 16.58 | 17.10 | 17.54 |
| $NO_X$ | Mg | 5.27 | 5.27 | 5.36 | 5.58 | 5.76 | 6.24 | 6.48 | 6.63 | 6.84 | 7.01 |
| NMVOC | Mg | 22.38 | 22.40 | 22.76 | 23.72 | 24.49 | 26.53 | 27.54 | 28.18 | 29.07 | 29.81 |
| $CH_4$ | Mg | 13.17 | 13.18 | 13.39 | 13.95 | 14.41 | 15.61 | 16.20 | 16.58 | 17.10 | 17.54 |
| CO | Mg | 165.89 | 166.02 | 168.69 | 175.81 | 181.51 | 196.67 | 204.10 | 208.85 | 215.45 | 220.95 |
| $CO_2$, fossil | Gg | 6.32 | 6.32 | 6.43 | 6.70 | 6.91 | 7.49 | 7.78 | 7.96 | 8.21 | 8.42 |
| TSP | Mg | 5.40 | 5.40 | 5.49 | 5.72 | 5.90 | 6.40 | 6.64 | 6.79 | 7.01 | 7.19 |
| $PM_{10}$ | Mg | 5.40 | 5.40 | 5.49 | 5.72 | 5.90 | 6.40 | 6.64 | 6.79 | 7.01 | 7.19 |
| $PM_{2.5}$ | Mg | 5.40 | 5.40 | 5.49 | 5.72 | 5.90 | 6.40 | 6.64 | 6.79 | 7.01 | 7.19 |
| As | kg | 0.68 | 0.69 | 0.70 | 0.73 | 0.75 | 0.81 | 0.84 | 0.86 | 0.89 | 0.91 |
| Cd | kg | 4.48 | 4.48 | 4.55 | 4.74 | 4.90 | 5.31 | 5.51 | 5.64 | 5.81 | 5.96 |
| Cr | kg | 10.01 | 10.01 | 10.17 | 10.60 | 10.95 | 11.86 | 12.31 | 12.60 | 13.00 | 13.33 |
| Cu | kg | 71.10 | 71.15 | 72.30 | 75.35 | 77.79 | 84.29 | 87.47 | 89.51 | 92.34 | 94.69 |
| Ni | kg | 7.37 | 7.38 | 7.50 | 7.81 | 8.07 | 8.74 | 9.07 | 9.28 | 9.58 | 9.82 |
| Pb | kg | 2 159.26 | 2 160.88 | 2 195.65 | 2 288.36 | 2 362.53 | 2 559.82 | 2 656.51 | 2 718.40 | 2 804.27 | 2 875.82 |
| Zn | kg | 8 426.39 | 8 432.72 | 8 568.40 | 8 930.18 | 9 219.64 | 9 989.54 | 10 366.86 | 10 608.38 | 10 943.49 | 11 222.72 |
| Co | kg | 0.84 | 0.84 | 0.86 | 0.89 | 0.92 | 1.00 | 1.04 | 1.06 | 1.09 | 1.12 |
| Mn | kg | 15.01 | 15.02 | 15.26 | 15.91 | 16.42 | 17.79 | 18.47 | 18.90 | 19.49 | 19.99 |
| PCDD/F | g I-TEQ | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 | 0.15 |
| *Naphthylene* | Mg | 2 325.95 | 2 327.69 | 2 365.15 | 2 465.01 | 2 544.91 | 2 757.43 | 2 861.58 | 2 928.24 | 3 020.74 | 3 097.82 |
| Benzo[b+k]-fluoranthene | kg | 85.05 | 85.12 | 86.49 | 90.14 | 93.06 | 100.83 | 104.64 | 107.08 | 110.46 | 113.28 |
| Benzo[a]-pyrene | kg | 38.71 | 38.74 | 39.36 | 41.02 | 42.35 | 45.89 | 47.62 | 48.73 | 50.27 | 51.55 |
| Benzo[g,h,i]-perylene | kg | 16.59 | 16.60 | 16.87 | 17.58 | 18.15 | 19.67 | 20.41 | 20.89 | 21.54 | 22.09 |
| Indeno[1,2,3-cd]pyrene | kg | 61.35 | 61.40 | 62.39 | 65.02 | 67.13 | 72.74 | 75.48 | 77.24 | 79.68 | 81.72 |
| PAH | Mg | 4.32 | 4.32 | 4.39 | 4.57 | 4.72 | 5.12 | 5.31 | 5.43 | 5.60 | 5.75 |
| HCN | Mg | 4.21 | 4.22 | 4.28 | 4.47 | 4.61 | 4.99 | 5.18 | 5.30 | 5.47 | 5.61 |
| HCl | Mg | 34.23 | 34.26 | 34.81 | 36.28 | 37.45 | 40.58 | 42.12 | 43.10 | 44.46 | 45.59 |

Table 7.28c National emissions from vehicle fires – 2000 to 2008.

| | unit | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SO_2$ | Mg | 17.77 | 17.77 | 17.67 | 17.60 | 17.67 | 18.20 | 19.11 | 17.58 | 22.81 |
| $NO_X$ | Mg | 7.11 | 7.11 | 7.07 | 7.04 | 7.07 | 7.28 | 7.65 | 7.03 | 9.12 |
| NMVOC | Mg | 30.21 | 30.20 | 30.03 | 29.92 | 30.04 | 30.94 | 32.49 | 29.89 | 38.77 |
| $CH_4$ | Mg | 17.77 | 17.77 | 17.67 | 17.60 | 17.67 | 18.20 | 19.11 | 17.58 | 22.81 |
| CO | Mg | 223.94 | 223.86 | 222.61 | 221.73 | 222.66 | 229.33 | 240.84 | 221.56 | 287.35 |
| $CO_2$, fossil | Gg | 8.53 | 8.53 | 8.48 | 8.45 | 8.48 | 8.74 | 9.17 | 8.44 | 10.95 |
| TSP | Mg | 7.29 | 7.28 | 7.24 | 7.21 | 7.24 | 7.46 | 7.83 | 7.21 | 9.35 |
| $PM_{10}$ | Mg | 7.29 | 7.28 | 7.24 | 7.21 | 7.24 | 7.46 | 7.83 | 7.21 | 9.35 |
| $PM_{2.5}$ | Mg | 7.29 | 7.28 | 7.24 | 7.21 | 7.24 | 7.46 | 7.83 | 7.21 | 9.35 |
| As | kg | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.95 | 0.99 | 0.91 | 1.19 |
| Cd | kg | 6.04 | 6.04 | 6.01 | 5.98 | 6.01 | 6.19 | 6.50 | 5.98 | 7.75 |
| Cr | kg | 13.51 | 13.50 | 13.43 | 13.37 | 13.43 | 13.83 | 14.53 | 13.36 | 17.33 |
| Cu | kg | 95.97 | 95.94 | 95.41 | 95.03 | 95.42 | 98.28 | 103.22 | 94.95 | 123.15 |
| Ni | kg | 9.95 | 9.95 | 9.89 | 9.85 | 9.90 | 10.19 | 10.70 | 9.85 | 12.77 |
| Pb | kg | 2 914.73 | 2 913.70 | 2 897.49 | 2 886.04 | 2 898.07 | 2 984.89 | 3 134.68 | 2 883.82 | 3 740.14 |
| Zn | kg | 11 374.55 | 11 370.53 | 11 307.27 | 11 262.60 | 11 309.54 | 11 648.35 | 12 232.90 | 11 253.92 | 14 595.68 |
| Co | kg | 1.14 | 1.14 | 1.13 | 1.13 | 1.13 | 1.16 | 1.22 | 1.13 | 1.46 |
| Mn | kg | 20.26 | 20.25 | 20.14 | 20.06 | 20.15 | 20.75 | 21.79 | 20.05 | 26.00 |
| PCDD/F | g I-TEQ | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.16 | 0.16 | 0.15 | 0.20 |
| *Naphthylene* | Mg | 3 139.73 | 3 138.62 | 3 121.16 | 3 108.83 | 3 121.79 | 3 215.31 | 3 376.66 | 3 106.43 | 4 028.86 |
| Benzo[b+k]-fluoranthene | kg | 114.81 | 114.77 | 114.13 | 113.68 | 114.16 | 117.58 | 123.48 | 113.59 | 147.33 |
| Benzo[a]-pyrene | kg | 52.25 | 52.23 | 51.94 | 51.74 | 51.95 | 53.51 | 56.19 | 51.70 | 67.05 |
| Benzo[g,h,i]-perylene | kg | 22.39 | 22.39 | 22.26 | 22.17 | 22.27 | 22.93 | 24.08 | 22.16 | 28.74 |
| Indeno[1,2,3-cd]pyrene | kg | 82.82 | 82.79 | 82.33 | 82.01 | 82.35 | 84.81 | 89.07 | 81.94 | 106.27 |
| PAH | Mg | 5.83 | 5.82 | 5.79 | 5.77 | 5.79 | 5.97 | 6.26 | 5.76 | 7.47 |
| HCN | Mg | 5.69 | 5.69 | 5.65 | 5.63 | 5.65 | 5.82 | 6.12 | 5.63 | 7.30 |
| HCl | Mg | 46.21 | 46.19 | 45.94 | 45.75 | 45.95 | 47.32 | 49.70 | 45.72 | 59.29 |

**Uncertainties and time-series consistency**

The uncertainty of the total number of accidental fires is miniscule, but the division into building and transportation types might lead to a small uncertainty, primarily caused by the category "other". The uncertainty for both building and vehicle activity data is therefore set to 10 %. The uncertainty is lowest for recent years. The uncertainties on the emission factors used in this inventory, and at the present level of available information, are shown in Table 7.29.

Table 7.29 Uncertainties Accidental fires.

| Pollutant | Activity data, % | Building fires, % | Vehicle fires, % |
|---|---|---|---|
| $SO_2$ | 10 | 500 | 500 |
| $NO_X$ | 10 | 700 | 500 |
| NMVOC | 10 | 700 | 500 |
| $CH_4$ | 10 | 700 | 700 |
| CO | 10 | 700 | 500 |
| $CO_2$, fossil | 10 | 500 | 500 |
| $N_2O$ | 10 | - | - |
| $NH_3$ | 10 | - | - |
| TSP | 10 | 700 | 700 |
| $PM_{10}$ | 10 | 700 | 700 |
| $PM_{2.5}$ | 10 | 700 | 700 |
| As | 10 | 700 | 500 |
| Cd | 10 | 700 | 500 |
| Cr | 10 | 700 | 500 |
| Cu | 10 | 700 | 500 |
| Hg | 10 | 700 | - |
| Ni | 10 | - | 500 |
| Pb | 10 | 700 | 500 |
| Se | 10 | - | - |
| Zn | 10 | - | 500 |
| Co | 10 | - | 500 |
| Mn | 10 | - | 500 |
| HCB | 10 | - | - |
| PCDD/F | 10 | 100 | 100 |
| Benzo[b]fluoranthene | 10 | 700 | 500 |
| Benzo[k]fluoranthene | 10 | 700 | 500 |
| Benzo[a]pyrene | 10 | 700 | 500 |
| Benzo[g,h,i]perylene | 10 | 700 | 500 |
| Indeno[1,2,3-cd]pyrene | 10 | 700 | 500 |
| PAH | 10 | 700 | 500 |
| PCB | 10 | - | - |
| HCN | 10 | 700 | 500 |
| HCl | 10 | 700 | 500 |

#### Source-specific QA/QC and verification

The specific QA/QC activities for this sector are under development.

#### Source-specific recalculations

The 2009 submission inventory only contained briefly estimated national emissions for accidental- and landfill fires for dioxins/furans. While this years inventory contains detailed calculations for all available pollutants from accidental building- and vehicle fires.

#### Source-specific planned improvements

An estimation of national emissions from landfill fires will be added to this section.

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### 7.4.5 Other combustion

Other combustion sources include open burning of yard waste, wild fires, tobacco smoking, barbeques and fire works.

In Denmark, the open burning of private yard waste is under different restrictions according to the respective municipality. These restrictions involve what can be burned but also the quantity, how, when and where or in some cases a complete banning. There is no registration of private waste burning and the activity data on this subject are very difficult to estimate. People are generally appealed to compost their yard waste or to dispose of it through one of the many waste disposal/recycling sites.

The occurrence of bonfires at midsummer night and in general are likewise not registered, therefore it has not been possible to obtain activity data.

Due to the cold and wet climate conditions in Denmark wild fires very seldom occurs. Controlled burnings are completely prohibited and the occasional wild fires are of such a small scale that this activity is assumed negligible.

The use of tobacco, barbeques and fire works is under investigation.

#### Source-specific planned improvements

Activity data will be estimated for yard waste burning and a literature study on emission factors carried out. National emissions estimates from tobacco smoking, barbeques and fire work are also under development.

# 8 Reporting spatially distributed emissions on grid

## 8.1 Background for reporting

Geographically distributed emissions, has been reported in 2007 to the UNECE LRTAP Convention for the years 1990, 1995, 2000 and 2005. Emission data are disaggregated to the standard EMEP grid with a resolution of 50km x 50km. Mandatory reporting are following 14 air pollutants: $SO_x$, $NO_x$, $NH_3$, NMVOC, CO, TSP, $PM_{10}$, $PM_{2.5}$, Pb, Cd, Hg, DIOX, PAH and HCB. The reporting includes gridded data for sector totals as well as totals for all sectors together. Guidelines for reporting air emissions on grid are given in UN (2003). Gridded emission data are used in integrated European air pollution models, e.g. RAINS/GAINS and EMEP's chemical transport models. Table 8.1 lists the categories (sectors) used for reporting emission data on grid based on the Danish inventories.

Table 8.1 Categories used for reporting gridded emission data according to the guidelines from United Nations.

| Categories for Gridding | | UN categories used for DK reporting |
|---|---|---|
| 01 | Combustion in Power Plants and Industry | √ |
| 02a | Transport above 1000m | √ |
| 02b | Transport below 1000m | √ |
| 03 | Commercial Residential and Other Stationary Combustion | √ |
| 04 | Fugitive Emissions from Fuels | √ |
| 05 | Industrial Processes | √ |
| 06 | Solvents and other product use | √ |
| 07 | Agriculture | √ |
| 08 | Waste | √ |
| 09 | Other | - |
| | Natural | - |

The gridded emission data from the 2007 reporting are available at the EIONET homepage. Further, the methodology is described in a Danish langued report by Jensen et al. (2008).

## 8.2 Methods and data for disaggregation of emission data

In the present work geographic data was used as proxies positioning the activity, which causes the emission. As an example we used a geographic data set for land cover of forest for distributing emissions from forest machinery.

Based on the theme of forest land cover, fractions of forest in each grid cell were calculated, and the total emission from forest machinery was distributed in harmony with the fractions of forest in each grid cell. A similar methodology was used for distributing emissions from other categories.

An explanation of the applied methodology in greater detail is available in Jensen et al. (2008). A wide range of different geographic data sets has been applied in the mapping procedure. The most essential data are listed in Table 8.2.

Table 8.2 List of different geographic data used in the mapping exercise.

| Data owner | Data set | Contents |
|---|---|---|
| The National Survey and Cadastre | Topographic map | Geo-referenced basic map layers on administrative units, Land cover, territorial borders, coastline and infrastructure. |
| National Agency for Enterprise and Construction | Central Dwelling and Building Register (Danish abbreviation BBR) | Geo-referenced information on dwellings and buildings |
| The Directorate for Food, Fisheries and Agri Business | The Central Husbandry Register (CHR) | Geo-referenced information on stock of livestock at farm level |
| The Directorate for Food, Fisheries and Agri Business | The General Agricultural Register (GLR) | Geo-referenced information on agricultural fields |
| National Environmental Research Institute | Large Point Sources (LPS) | Geo-referenced information on power plants and large industrial plants |
| Danish Forest and Nature Agency | Military training terrain | Geo-referenced information on military training terrains |

The disaggregation was as far as possible done at the SNAP level within the different reporting categories listed in Table 7.1. The disaggregation at the highly detailed SNAP level was later aggregated to the reporting categories (sector totals), and these were again further aggregated to national totals for all sectors. It is worth to mention that the composition of the predefined reporting categories for gridded emission data are not fully compatible with the categories used in the NFR-schemes for annual reporting of emission data[14] to UNECE.

## 8.3 Maps with geographical distributed emission data

It is not possible in this section to present all maps for all reporting years and sectors. Therefore, we choose to show national totals for selected air pollutants from the latest reporting year (2005). The selected air pollutants are: Ammonia ($NH_3$), sulphur dioxide ($SO_2$), nitrogen dioxide ($NO_2$) and small particulate matter ($PM_{2.5}$). Figure 8.1 shows the geographical distributed emissions for these air pollutants. Even from the national distributed totals, spatial patterns from the major sectors are recognisable.

[14] The annual reporting of emission data to UNECE includes all air pollutants except greenhouse gases.

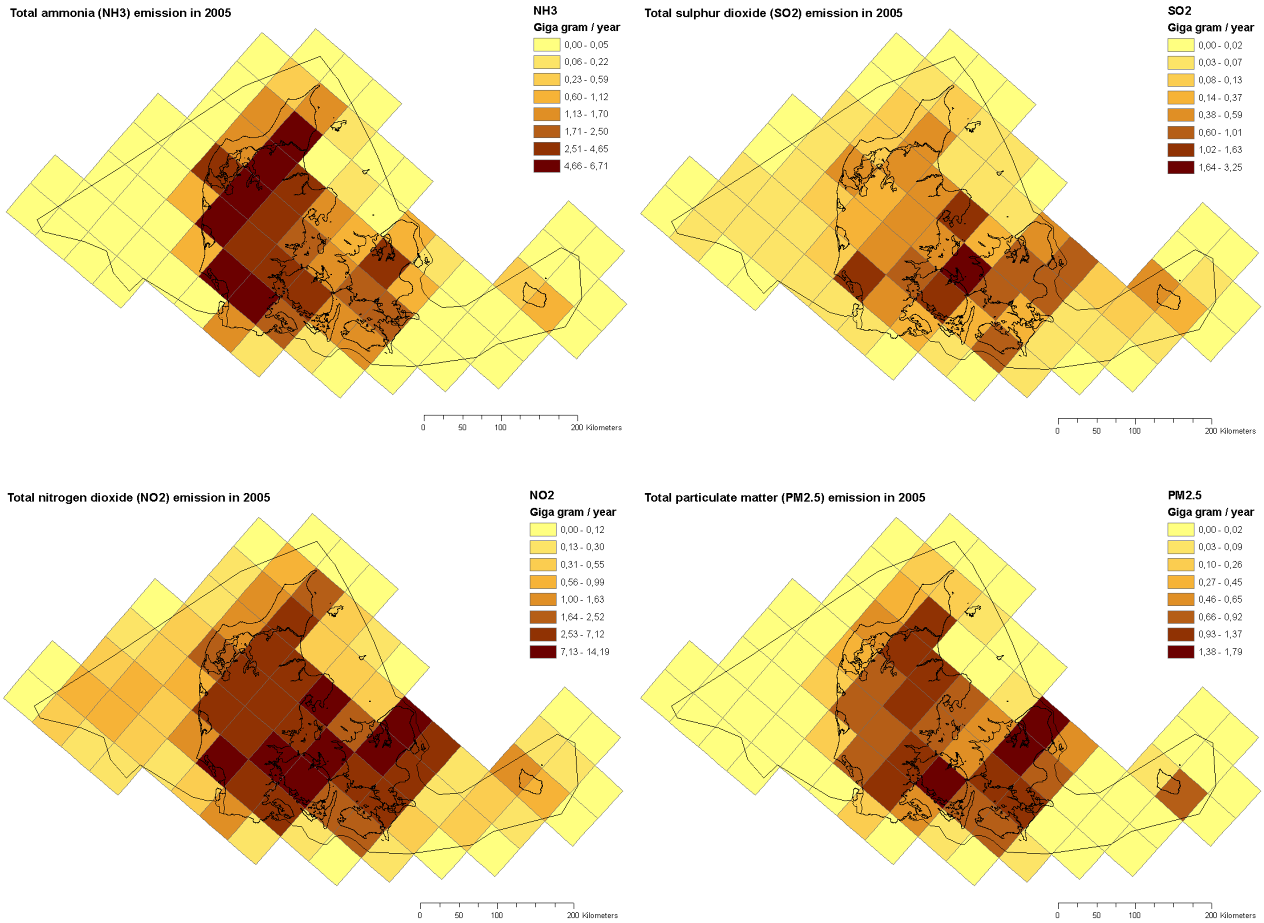


Figure 8.1 Geographical distribution of national emissions of $NH_3$, $SO_2$, $NO_2$ and $PM_{2.5}$ in 2005.

The agricultural sector is the major contributor to the national total $NH_3$ emission. Emission of $NH_3$ is mainly related to livestock farming and especially to the handling of manure from the animals. Emissions of $NH_3$ are therefore related to storage and spreading of manure as well as emissions from stables (Mikkelsen et al., 2006). The geographical pattern of the $NH_3$ emission is in good agreement with the localisation and concentration of the Danish livestock farming in the northern and western part of Jutland.

The geographical distribution of $SO_2$ reflects mainly the localisation of large power plants in Denmark, because these are the overall sources of $SO_2$ emissions. During the 4 reporting years, this pattern has become weaker, due to the implementation of techniques for reduction of sulphur in the outlet smoke from the power plants. Even though the $SO_2$ emission has decreased dramatically it still produces a distinct pattern reflecting the localisation of large power plants in Denmark.

For $NO_2$ the pattern is not that distinct as for $SO_2$, because it reflects a combination of emission contributions from both power plants and industry, commercial and residential plants and as well transport – mainly road transport. This means that the geographic pattern to a certain point reflects the localisation of infrastructure, dwellings and power plants and industry in Denmark.

The distribution of $PM_{2.5}$ is mainly related to road transport and emissions from residential wood use. Therefore the emissions of $PM_{2.5}$ follow the localisation of the Danish road network and the large residential areas with single family houses.

As already mentioned the total $SO_2$ emission for Denmark has decreased significantly since 1990. The total emission of $SO_2$ in 2005 corresponds to approx. 12 percent of the total $SO_2$ emission in 1990. The spatially distributed pattern of $SO_2$ in 1990 is illustrated in Figure 8.2. For making comparisons between the two reporting years – see also Figure 8.1.

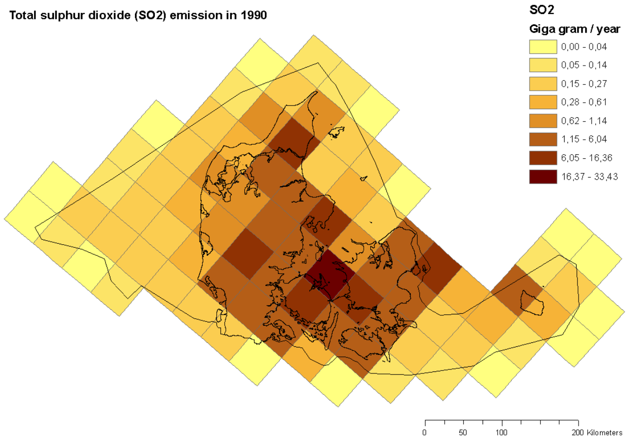


Figure 8.2 Spatial pattern of the total annual $SO_2$ emission in Denmark in 1990.

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# 9 Recalculations and Improvements

In general, considerable work is being carried out to improve the inventories. Investigations and research carried out in Denmark and abroad produce new results and findings which are given consideration and, to the extent which is possible, are included as the basis for emission estimates and as data in the inventory databases. Furthermore, the updates of the EMEP/CORINAIR guidebook (Now the EMEP/EEA Guidebook), and the work of the Task Force on Emission Inventories and its expert panels are followed closely in order to be able to incorporate the best scientific information as the basis for the inventories. The further important references in this regard are the IPCC guidelines and IPCC good practice guidance.

The implementation of new results in inventories is made in a way so that improvements, as far as possible, better reflect Danish conditions and circumstances. This is in accordance with good practice. Furthermore, efforts are made to involve as many experts as possible in the reasoning, justification and feasibility of implementation of improvements.

In improving the inventories, care is taken to consider implementation of improvements for the whole time-series of inventories to make it consistent. Such efforts lead to recalculation of previously submitted inventories. This submission includes recalculated inventories for the whole time-series. The reasoning for the recalculations performed is to be found in the sectoral chapters of this report. The text below focuses on improvements and recalculations, in general, and further serves as an overview and summary of the relevant text in the sectoral chapters.

## 9.1 Energy

Improvements and updates of the Danish energy statistics are made regularly by the producer of the statistics, the Danish Energy Agency. In close cooperation with the DEA, these improvements and updates are reflected in the emission inventory for the energy sector. The Danish energy statistics have, for the most part, been aggregated to the SNAP categorisation. This, however, does not include energy statistics for fuel consumption data for specific industries.

The inventories are still being improved through work to increase the number of large point sources, e.g. power plants, included in the databases as individual point sources. Such an inclusion makes it possible to use plant-specific data for emissions, etc, available e.g. in annual environmental reports from the plants in question.

### 9.1.1 Stationary Combustion

Improvements and recalculations since the 2009 emission inventory submission include:

- The national energy statistics has been updated for the years 1980-2008. This has only resulted in small differences.
- Improved emission factors for decentralised CHP plants referring to a Danish emission measurement program have been implemented.
- A time-series have been estimated for the HCB emission factor for MSW incineration.
- The NMVOC emission factors that are not country specific now all refer to the EMEP/EEA Guidebook. The emission factors for the key-sources are country specific and are not affected by this recalculation.
- Improved emission factors for residential wood combustion have been estimated for NMVOC, TSP, $PM_{10}$, $PM_{2.5}$ and PCDD/F. The update in emission factors refer to a study funded by the Danish EPA.
- $NH_3$ emissions from residential plants have been estimated for the first time. The emission factors for coal, brown coal, coke and wood refer to the EMEP/EEA Guidebook.

### 9.1.2 Mobile sources

#### Road transport

The total mileage per vehicle category from 2005-2008 have been updated based on the traffic index development (derived from traffic counts on selected roads) from the Danish Road Directorate. In addition new data prepared by DTU Transport for the Danish Infrastructure Commission has given information of the total mileage driven by foreign trucks on Danish roads. This mileage contribution has been added to the total mileage for Danish trucks on Danish roads, for trucks > 16 tonnes of gross vehicle weight. The data from DTU Transport was estimated for 2005, and by using appropriate assumptions the mileage have been backcasted to 1985 and forecasted to 2008.

For passenger cars the new division of total mileage into gasoline and diesel made by the Danish Road Directorate is regarded as very broad. Hence in the subsequent model calculations, the fuel and emission results for diesel passenger cars are adjusted with the overall sales/calculated fuel ratio, being applied to the estimates for the other diesel vehicle categories as well. This is a change compared to previous year’s inventory submissions for which the diesel passenger car results remain unadjusted.

For heavy duty vehicles an error for the NMVOC emission factors for Euro 0-III trucks and buses has been corrected giving somewhat smaller emission factors.

For mopeds and motorcycles, updated first registration year information for 2005+ and 2000+, respectively, has caused some changes in the fleet/technology mix and the resulting emissions.

The minimum and maximum percentage difference and year of numeric maximum differences (min %, max %, year of max %) for the different emission components are: Particulates (-2.5 %, -9.1 %, 2007), $NO_x$ (0.5 %, 5 %, 2007), $SO_2$ (0 %, - 0.1 %, 2007), NMVOC (0.1 %, -0.9 %, 2005), CO (-0.1 %, -1.8 %, 2007) and $NH_3$ (0 %, 0.8 %, 2003).

#### National sea transport

No changes have been made.

#### Fishery

No changes have been made.

#### Military

Emission factors derived from the new road transport simulations have caused some emission changes from 1985-2007. The minimum and maximum emission differences (min %, max %) for the different emission components are: Particulates (-3 %, -9 %), $NO_x$ (0 %, 3 %), NMVOC (0 %, -5 %), CO (0 %, -2 %) and $NH_3$ (0 %, -1 %).

#### Residential

The number of riders has been updated for 2007. Thus, the emission increases are 1 % for NMVOC and particulates, 2 % for $SO_2$, $NO_x$, $CH_4$ and $CO_2$, and 3 % for CO, $N_2O$ and $NH_3$.

#### Industrial non road machinery

The number of wheel type excavators has been updated for 2007. The fuel consumption and emission increases are insignificant.

#### Agricultural non road machinery

The number of machine pool tractors, harvesters and self-propelled vehicles has been updated for 2007. The fuel consumption and emission increases are less than 1 %.

#### Railways

No changes have been made.

#### Aviation

En error for 2007 has been corrected. Erroneously, the flights between Denmark and Greenland/Faroe Islands were treated as international flights. As a result of this correction the fuel consumption and emissions change substantially. The fuel consumption increases by 51%, whereas particulates, $NO_x$, NMVOC and CO emissions increase by 34 %, 39 %, 7 % and 4 %, respectively.

Very small emission changes between 0 % and 2 % occur for the years 2001-2006, due to inclusion of new representative aircraft types.

### 9.1.3 Fugitive emissions

#### Coal import

The amounts of imported coal used for calculation of fugitive emissions from storage of solid fuels (SNAP 050103) have been updated according to the Energy Statistics for 2008 for the years 1980-2002.

#### Gasoline sales

The amounts of gasoline sales used for calculation of fugitive emissions from service stations (SNAP 050503) have been updated according to the Energy Statistics for 2008 for the years 1983-2007.

#### Service stations

The emission factors for NMVOC from service stations have been updated for both reloading of tankers and refuelling of vehicles for the years 2000-2008.

#### Data storage improvements for 1B2a2

This year the data storage Level 2 has been improved for 1B2a2 (SNAP 050201 – Land-based activities and SNAP 050202 – offshore activities). Data at SNAP-level have been split into two sources for each snap category; "Oil loading and transport", and "Pipelines" for land-based activities (SNAP 050201) and Extraction of oil and natural gas" and "Oil loading and transport" for offshore activities. Thereby the implied emission factors now refer to the sources separately instead of referring to a mix of sources. Emissions from the four sources are calculated on basis of the same activity data; Mg crude oil produced. . This does not change the emissions but only the activity data and the implied emission factors in the NFR tables.

#### Town gas

Emissions from distribution of town gas have been included in the emission inventory for the years 1985-2008. The input data are sparse as more of the distribution companies have been closed down. Only in the cities of Copenhagen and Aalborg town gas is still being distributed. Another two distribution companies are included in the inventory. Those were closed in 2004 and 2006, respectively. To complete the time-series interpolation and extrapolation has been used on basis of the available data. The uncertainties are expected to be large both regarding the distribution for years without data, the distribution loss and the gas composition.

#### Offshore flaring

The amounts of offshore flaring for the time-series have been reviewed and some changes have been carried out. As the calorific values and gas composition is not known for years before 2006 the emission calculations are changed so that they are now based on the flared amounts given in Nm3 instead of GJ as used in earlier emission inventories. The emission factors are still based on the EMEP/EEA guidebook, but contrary to earlier years the emission factors are not converted according to the gas quality data for Danish natural gas, which has been the best obtainable conversion factor. For $SO_2$, particulate matter, dioxin and PAHs the TIER 1 emission factors from the EMEP/EEA guidebook (2009) are used as is the case for natural gas combustion in CHP plants. As those factors are given per energy units they have to be converted to emissions per volume gas. This conversion is based on the average calorific value of the gas flared offshore in 2006-2008 which again is based on data from the ETS reports.

#### Flaring in storage and treatment plants

The same emission factors are adopted for flaring in storage and treatment plants as for offshore flaring for the components $SO_2$, $NO_x$, CO, particulate matter, dioxin and PAHs. The emissions of NMVOC are given by the plants in the environmental reports.

#### Flaring in refineries

The emission factors for flaring in refineries have been updated. The emission factors for NMVOC are based on new information from one of the refineries on the fuel gas composition. The same emission factors are adopted for the second Danish refinery. Emission factors from the EMEP/EEA guidebook (2009) are used to calculate emissions of $NO_x$ and CO. For $SO_2$, particulate matter, dioxin and PAHs the TIER 1 emission factors from the EMEP/EEA guidebook (2009) are used as is the case for natural gas combustion in CHP plants.

## 9.2 Industrial processes

For sector 2D2 Food and Drink, emissions of NMVOC from production of bread, sugar, ethanol, spirits, margarine, cooking fats, processing of meat and fish and coffe roasting have been included for the first time. The esimtates cover the period 1990-2008.

## 9.3 Solvents

Improvements and additions are continuously being implemented due to the comprehensiveness and complexity of the use and application of solvents in industries and households. The main improvements in the 2010 reporting include the following:

- An improved and more detailed source allocation method has been implemented, which enables emission calculation on SNAP sub-category level.
- Emission factors (EFs) have been improved for some chemicals.
- EFs have been attributed to all chemicals on SNAP sub-category level.

## 9.4 Agriculture

Compared with the previous $NH_3$ and PM emissions inventory (submission 2009), some changes and updates have been made. These changes cause a decrease in the $NH_3$ emission (1985 – 2007) and a decrease in the PM emission (2000 – 2007), see Table 9.1.

The main reason for the decrease in ammonia emission is calculations of ammonia have been adjusted to TAN for the whole period 1985-2008 and this have led to a decrease in the emission from animal manure of 4-8% in the period 1985-2007.

The PM emission mainly decreases because of changes in the emission factor for poultry, the EMEP/EEA (2009) is now used.

Table 9.1 Changes in $NH_3$ emission (1985 to 2997) and PM emission (2000 to 2007) in the agricultural sector compared to NFR reported last year.

| $NH_3$ emission (Gg $NH_3$) | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|
| Previous | 126.87 | 127.74 | 124.20 | 121.43 | 121.69 | 121.36 | 117.13 | 115.31 | 112.62 | 108.28 |
| Updated | 114.21 | 115.06 | 112.29 | 109.77 | 110.73 | 110.04 | 106.48 | 104.97 | 102.68 | 100.07 |
| Difference (%) | -10.0 | -9.9 | -9.6 | -9.6 | -9.0 | -9.3 | -9.1 | -9.0 | -8.8 | -7.6 |
| $NH_3$ emission (Gg $NH_3$) | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
| Previous | 101.29 | 97.20 | 96.57 | 97.70 | 92.86 | 92.68 | 91.34 | 88.79 | 80.56 | 80.29 |
| Updated | 93.91 | 90.89 | 89.56 | 89.92 | 84.56 | 84.30 | 81.63 | 79.48 | 77.23 | 76.94 |
| Difference (%) | -7.3 | -6.5 | -7.3 | -8.0 | -8.9 | -9.0 | -10.6 | -10.5 | -4.1 | -4.2 |
| $NH_3$ emission (Gg $NH_3$) | 2005 | 2006 | 2007 | | | | | | | |
| Previous | 75.84 | 73.22 | 72.63 | | | | | | | |
| Updated | 73.24 | 71.20 | 71.61 | | | | | | | |
| Difference (%) | -3.4 | -2.8 | -1.4 | | | | | | | |
| PM emission (Mg TSP) | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | | |
| Previous | 15 765 | 15 567 | 15 524 | 14 724 | 14 911 | 15 448 | 15 599 | 14 562 | | |
| Updated | 13 511 | 13 456 | 13 127 | 13 419 | 12 937 | 13 185 | 12 831 | 12 631 | | |
| Difference (pct) | -14.3 | -13.6 | -15.4 | -8.9 | -13.2 | -14.7 | -17.7 | -13.3 | | |

There have been no changes in the methodology.

In the following some further changes are mentioned which has minor influence on the total emissions:

The number of animals have been changed for the categories (years) swine (2000, 2001, 2007), sheep (1994-2007), goats (1990-2007), broilers (2007), heifers (1997) and horses (2007), because of new data or errors. Also for some animals the distribution on liquid and solid manure some changes have been made because of new data.

N ab animal for heifers have been interpolated for the years 2005 and 2006 to remove time-series inconsistency.

New date for sewage sludge for the years 2003-2007 have led to a decrease in emission of ammonia from sewage sludge of 11-40%.

Changes in the distribution of animals on liquid and solid manure have also affected the PM emission. Emissions from sheep, goats and other poultry have been included.

This year the emission from field burning of agricultural wastes has been reconsidered and burning of straw from grass seed production is taken into account. Emission of $NH_3$, $NO_x$, CO, NMVOC, $SO_2$, particulate matter (PM), heavy metals, dioxin and PAH from field burning of agricultural wastes are included in the inventory for the whole period 1985-2008 and recalculations for $NH_3$, $NO_x$, CO, NMVOC, $SO_2$ is made for the years 1985-1989.

## 9.5 Waste

The inventory submission for 2010 includes for the first time emissions from incineration of carcasses. Also emissions of other pollutants than PCDD/F from accidental fires have been estimated for the first time. This affects emission estimates of all relevant pollutants from the base years of the protocols to 2008.

# 10 Completeness

The Danish emissions inventory due 15 February 2010 includes all sources identified by the EMEP/EEA guidebook except the following:

### 10.1.1 General comment

For the 2010 submission Denmark did not use the new reporting template. The new template and Guidebook contains several new subsectors that will have to be estimated. Unfortunately resources are not available to improve the emission inventory by estimating the new source categories. At this time there is no timeline for fully implementing the new reporting guidelines and the EMEP/EEA Guidebook.

### 10.1.2 Industrial processes

- Mineral products (NFR 2A): The inventory will be improved regarding completion of pollutants included. The methodology used for some of the pollutants from glass production is inconsistent and will be improved.
- Metal production (NFR 2C): For secondary aluminium and zinc production, potential emissions of heavy metals will be investigated.

# Annex 1

The complete NFR tables for Denmark can be found on Eionets Central Data Repository:
http://cdr.eionet.europa.eu/dk/Air_Emission_Inventories/Submission_EMEP_UNECE

# Annex 2A

## Annex 2A-1 IPCC/SNAP source correspondence list

Table 2A-1.1 Correspondence list for IPCC source categories 1A1, 1A2 and 1A4 and SNAP (EEA 2007).

| SNAP_id | SNAP_name | IPCC source |
|---|---|---|
| 01 | Combustion in energy and transformation industries | |
| 010100 | Public power | 1A1a |
| 010101 | Combustion plants >= 300 MW (boilers) | 1A1a |
| 010102 | Combustion plants >= 50 and < 300 MW (boilers) | 1A1a |
| 010103 | Combustion plants < 50 MW (boilers) | 1A1a |
| 010104 | Gas turbines | 1A1a |
| 010105 | Stationary engines | 1A1a |
| 010200 | District heating plants | 1A1a |
| 010201 | Combustion plants >= 300 MW (boilers) | 1A1a |
| 010202 | Combustion plants >= 50 and < 300 MW (boilers) | 1A1a |
| 010203 | Combustion plants < 50 MW (boilers) | 1A1a |
| 010204 | Gas turbines | 1A1a |
| 010205 | Stationary engines | 1A1a |
| 010300 | Petroleum refining plants | 1A1b |
| 010301 | Combustion plants >= 300 MW (boilers) | 1A1b |
| 010302 | Combustion plants >= 50 and < 300 MW (boilers) | 1A1b |
| 010303 | Combustion plants < 50 MW (boilers) | 1A1b |
| 010304 | Gas turbines | 1A1b |
| 010305 | Stationary engines | 1A1b |
| 010306 | Process furnaces | 1A1b |
| 010400 | Solid fuel transformation plants | 1A1c |
| 010401 | Combustion plants >= 300 MW (boilers) | 1A1c |
| 010402 | Combustion plants >= 50 and < 300 MW (boilers) | 1A1c |
| 010403 | Combustion plants < 50 MW (boilers) | 1A1c |
| 010404 | Gas turbines | 1A1c |
| 010405 | Stationary engines | 1A1c |
| 010406 | Coke oven furnaces | 1A1c |
| 010407 | Other (coal gasification, liquefaction, ...) | 1A1c |
| 010500 | Coal mining, oil/gas extraction, pipeline compressors | |
| 010501 | Combustion plants >= 300 MW (boilers) | 1A1c |
| 010502 | Combustion plants >= 50 and < 300 MW (boilers) | 1A1c |
| 010503 | Combustion plants < 50 MW (boilers) | 1A1c |
| 010504 | Gas turbines | 1A1c |
| 010505 | Stationary engines | 1A1c |
| 02 | Non-industrial combustion plants | |
| 020100 | Commercial and institutional plants (t) | 1A4a |
| 020101 | Combustion plants >= 300 MW (boilers) | 1A4a |
| 020102 | Combustion plants >= 50 and < 300 MW (boilers) | 1A4a |
| 020103 | Combustion plants < 50 MW (boilers) | 1A4a |
| 020104 | Stationary gas turbines | 1A4a |
| 020105 | Stationary engines | 1A4a |
| 020106 | Other stationary equipments (n) | 1A4a |
| 020200 | Residential plants | 1A4b |
| 020201 | Combustion plants >= 50 MW (boilers) | 1A4b |
| 020202 | Combustion plants < 50 MW (boilers) | 1A4b |
| 020203 | Gas turbines | 1A4b |
| 020204 | Stationary engines | 1A4b |
| 020205 [2)] | Other equipments (stoves, fireplaces, cooking,...) [2)] | 1A4b |
| 020300 | Plants in agriculture, forestry and aquaculture | 1A4c |
| 020301 | Combustion plants >= 50 MW (boilers) | 1A4c |
| 020302 | Combustion plants < 50 MW (boilers) | 1A4c |
| 020303 | Stationary gas turbines | 1A4c |
| 020304 | Stationary engines | 1A4c |
| 020305 | Other stationary equipments (n) | 1A4c |
| 03 | Combustion in manufacturing industry | |
| 030100 | Comb. in boilers, gas turbines and stationary | 1A2 |
| 030101 | Combustion plants >= 300 MW (boilers) | 1A2 |
| 030102 | Combustion plants >= 50 and < 300 MW (boilers) | 1A2 |
| 030103 | Combustion plants < 50 MW (boilers) | 1A2 |
| 030104 | Gas turbines | 1A2 |
| 030105 | Stationary engines | 1A2 |
| 030106 | Other stationary equipments (n) | 1A2 |
| 030200 | Process furnaces without contact | |
| 030203 | Blast furnace cowpers | 1A2a |
| 030204 | Plaster furnaces | 1A2f |
| 030205 | Other furnaces | 1A2f |
| 0303 | Processes with contact | |
| 030301 | Sinter and pelletizing plants | 1A2a |
| 030302 | Reheating furnaces steel and iron | 1A2a |
| 030303 | Gray iron foundries | 1A2a |

| SNAP_id | SNAP_name | IPCC source |
|---|---|---|
| *Continued* | | |
| 030304 | Primary lead production | 1A2b |
| 030305 | Primary zinc production | 1A2b |
| 030306 | Primary copper production | 1A2b |
| 030307 | Secondary lead production | 1A2b |
| 030308 | Secondary zinc production | 1A2b |
| 030309 | Secondary copper production | 1A2b |
| 030310 | Secondary aluminium production | 1A2b |
| 030311 | Cement (f) | 1A2f |
| 030312 | Lime (includ. iron and steel and paper pulp industr.)(f) | 1A2f |
| 030313 | Asphalt concrete plants | 1A2f |
| 030314 | Flat glass (f) | 1A2f |
| 030315 | Container glass (f) | 1A2f |
| 030316 | Glass wool (except binding) (f) | 1A2f |
| 030317 | Other glass (f) | 1A2f |
| 030318 | Mineral wool (except binding) | 1A2f |
| 030319 | Bricks and tiles | 1A2f |
| 030320 | Fine ceramic materials | 1A2f |
| 030321 | Paper-mill industry (drying processes) | 1A2d |
| 030322 | Alumina production | 1A2b |
| 030323 | Magnesium production (dolomite treatment) | 1A2b |
| 030324 | Nickel production (thermal process) | 1A2b |
| 030325 | Enamel production | 1A2f |
| 030326 | Other | 1A2f |
| 08 1) | Other mobile sources and machinery | |
| 0804 1) | Maritime activities | |
| 080403 1) | National fishing | 1A4c |
| 0806 1) | Agriculture | 1A4c |
| 0807 1) | Forestry | 1A4c |
| 0808 1) | Industry | 1A2f |
| 0809 1) | Household and gardening | 1A4b |

[1)] Not stationary combustion. Included in a NFR sector that also includes stationary combustion plants

[2)] Stoves, fireplaces and cooking is included in the sector 0202 or 020202 in the Danish inventory. It is not possible based on the Danish energy statistics to split the residential fuel consumption between stoves/fireplaces/cooking and residential boilers.

## Annex 2A-2 Fuel rate

Table 2A-2.1 Fuel consumption rate of stationary combustion plants 2008, PJ.

| fuel_type | fuel_gr_abbr | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BIOMASS | BIO PROD GAS | | | | | | | | | | |
| | BIOGAS | 0.184 | 0.194 | 0.204 | 0.206 | 0.206 | 0.294 | 0.345 | 0.342 | 0.354 | 0.636 |
| | FISH & RAPE OIL | | | | | | | | 1.972 | 1.860 | 1.302 |
| | SEWAGE SLUDGE | | | | | | | | | | |
| | STRAW | 4.840 | 6.647 | 7.420 | 8.319 | 8.319 | 9.892 | 10.274 | 10.831 | 11.258 | 11.659 |
| | WOOD | 11.331 | 13.997 | 14.976 | 14.999 | 14.999 | 15.008 | 17.025 | 17.968 | 17.629 | 17.595 |
| WASTE | MUNICIP. WASTES | 10.639 | 11.259 | 11.883 | 12.573 | 12.573 | 13.834 | 14.366 | 14.349 | 14.465 | 15.125 |
| GAS | NATURAL GAS | 5.041 | 5.501 | 5.664 | 6.280 | 6.280 | 30.403 | 48.497 | 62.192 | 67.423 | 71.715 |
| LIQUID | GAS OIL | 147.198 | 121.179 | 107.794 | 99.565 | 99.565 | 109.918 | 102.702 | 101.129 | 83.420 | 71.248 |
| | KEROSENE | 3.925 | 3.571 | 3.610 | 3.554 | 3.554 | 4.611 | 3.886 | 3.005 | 1.947 | 1.765 |
| | LPG | 6.381 | 5.591 | 5.602 | 5.639 | 5.639 | 5.026 | 4.869 | 4.382 | 3.570 | 2.938 |
| | NAPHTA | | | | | | | 0.102 | | | |
| | ORIMULSION | | | | | | | | | | |
| | PETROLEUM COKE | 1.143 | 2.626 | 6.101 | 7.230 | 7.230 | 8.627 | 9.747 | 8.198 | 5.901 | 4.550 |
| | REFINERY GAS | 11.029 | 11.672 | 10.581 | 11.858 | 11.858 | 11.520 | 13.168 | 13.253 | 13.619 | 14.632 |
| | RESIDUAL OIL | 177.766 | 138.192 | 117.466 | 96.629 | 95.487 | 84.784 | 74.195 | 55.385 | 44.543 | 38.303 |
| SOLID | BROWN COAL BRI. | 0.384 | 0.497 | 0.817 | 0.705 | 0.705 | 0.813 | 0.459 | 0.347 | 0.197 | 0.129 |
| | COAL | 245.685 | 195.560 | 238.415 | 232.978 | 232.978 | 301.615 | 305.999 | 300.366 | 280.932 | 231.283 |
| | COKE OVEN COKE | 3.540 | 2.815 | 2.948 | 2.540 | 2.540 | 1.960 | 1.587 | 1.522 | 1.255 | 1.030 |
| **Total** | | **629.086** | **519.300** | **533.480** | **503.075** | **501.934** | **598.306** | **607.221** | **595.240** | **548.371** | **483.911** |

*Continued*

| fuel_type | fuel_gr_abbr | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BIOMASS | BIO PROD GAS | | | | | | | | | | |
| | BIOGAS | 0.752 | 0.910 | 0.899 | 1.077 | 1.279 | 1.754 | 1.985 | 2.390 | 2.635 | 2.613 |
| | FISH & RAPE OIL | 0.744 | 0.744 | 0.744 | 0.800 | 0.245 | 0.251 | 0.060 | 0.014 | 0.014 | 0.027 |
| | SEWAGE SLUDGE | | | | | | | | | | |
| | STRAW | 12.481 | 13.306 | 13.880 | 13.366 | 12.662 | 13.053 | 13.546 | 13.912 | 13.904 | 13.668 |
| | WOOD | 18.247 | 20.042 | 21.031 | 22.220 | 21.940 | 21.845 | 23.389 | 23.459 | 22.938 | 24.403 |
| WASTE | MUNICIP. WASTES | 15.499 | 16.744 | 17.797 | 19.410 | 20.312 | 22.906 | 24.952 | 26.770 | 26.591 | 29.138 |
| GAS | NATURAL GAS | 76.092 | 86.107 | 90.467 | 102.475 | 114.586 | 132.699 | 156.277 | 164.489 | 178.707 | 187.877 |
| LIQUID | GAS OIL | 61.449 | 64.998 | 56.102 | 62.025 | 53.930 | 53.698 | 58.019 | 51.071 | 48.425 | 47.555 |
| | KEROSENE | 5.086 | 0.943 | 0.784 | 0.771 | 0.650 | 0.581 | 0.540 | 0.437 | 0.417 | 0.256 |
| | LPG | 2.596 | 2.549 | 2.315 | 2.371 | 2.398 | 2.638 | 2.870 | 2.363 | 2.413 | 2.177 |
| | NAPHTA | | | | | | | | | | |
| | ORIMULSION | | | | | | 19.913 | 36.767 | 40.488 | 32.580 | 34.191 |
| | PETROLEUM COKE | 4.460 | 4.404 | 4.814 | 6.179 | 4.309 | 4.850 | 6.381 | 6.523 | 5.798 | 7.284 |
| | REFINERY GAS | 14.169 | 14.537 | 14.865 | 15.405 | 16.360 | 20.838 | 21.476 | 16.945 | 15.225 | 15.724 |
| | RESIDUAL OIL | 32.118 | 38.252 | 38.505 | 32.823 | 46.229 | 33.009 | 37.766 | 26.580 | 29.985 | 23.696 |
| SOLID | BROWN COAL BRI. | 0.116 | 0.167 | 0.095 | 0.128 | 0.092 | 0.075 | 0.056 | 0.054 | 0.048 | 0.038 |
| | COAL | 253.444 | 344.300 | 286.838 | 300.799 | 323.397 | 270.346 | 371.908 | 276.277 | 234.285 | 196.472 |
| | COKE OVEN COKE | 1.276 | 1.450 | 1.181 | 1.155 | 1.226 | 1.273 | 1.226 | 1.253 | 1.346 | 1.423 |
| **Total** | | **498.529** | **609.453** | **550.318** | **581.004** | **619.616** | **599.728** | **757.218** | **653.026** | **615.310** | **586.540** |

*Continued*

| fuel_type | fuel_gr_abbr | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| BIOMASS | BIO PROD GAS | | | | | | | | | 0.087 |
| | BIOGAS | 2.871 | 3.020 | 3.332 | 3.545 | 3.452 | 4.030 | 4.094 | 4.012 | 3.928 |
| | FISH & RAPE OIL | 0.049 | 0.191 | 0.127 | 0.259 | 0.650 | 0.732 | 0.970 | 0.845 | 1.917 |
| | SEWAGE SLUDGE | 0.040 | 0.375 | 0.065 | 0.055 | 0.058 | 0.058 | | | |
| | STRAW | 12.220 | 13.698 | 15.651 | 16.719 | 17.939 | 18.483 | 18.625 | 18.331 | 15.363 |
| | WOOD | 27.522 | 30.867 | 31.630 | 39.002 | 43.649 | 49.797 | 51.476 | 59.936 | 62.584 |
| WASTE | MUNICIP. WASTES | 30.352 | 32.325 | 35.057 | 36.494 | 37.229 | 37.417 | 39.610 | 39.494 | 40.939 |
| GAS | NATURAL GAS | 186.122 | 193.827 | 193.609 | 196.322 | 194.678 | 187.701 | 191.122 | 170.875 | 172.002 |
| LIQUID | GAS OIL | 41.260 | 43.668 | 38.674 | 38.955 | 35.919 | 31.852 | 26.774 | 21.681 | 20.871 |
| | KEROSENE | 0.170 | 0.287 | 0.256 | 0.338 | 0.215 | 0.280 | 0.221 | 0.119 | 0.119 |
| | LPG | 1.885 | 1.610 | 1.477 | 1.554 | 1.669 | 1.671 | 1.720 | 1.388 | 1.477 |
| | NAPHTA | | | | | | | | | |
| | ORIMULSION | 34.148 | 30.244 | 23.846 | 1.921 | 0.019 | | | | |
| | PETROLEUM COKE | 7.292 | 8.313 | 8.282 | 8.717 | 9.381 | 9.341 | 9.720 | 10.415 | 8.174 |
| | REFINERY GAS | 15.556 | 15.755 | 15.197 | 16.555 | 15.891 | 15.347 | 16.116 | 15.916 | 14.782 |
| | RESIDUAL OIL | 18.836 | 21.091 | 26.161 | 28.431 | 24.500 | 21.940 | 26.094 | 21.186 | 17.389 |
| SOLID | BROWN COAL BRI. | 0.026 | 0.033 | 0.019 | 0.003 | | | | | |
| | COAL | 164.708 | 174.309 | 174.654 | 238.978 | 182.497 | 154.008 | 231.966 | 194.146 | 170.753 |
| | COKE OVEN COKE | 1.187 | 1.110 | 1.068 | 0.995 | 1.143 | 0.980 | 1.011 | 1.122 | 1.037 |
| **Total** | | **544.243** | **570.722** | **569.105** | **628.843** | **568.886** | **533.637** | **619.518** | **559.465** | **531.422** |

Table 2A-2.2 Detailed fuel consumption data for stationary combustion plants, PJ. 1980 – 2008.

| fuel_type | fuel_gr_abbr | NFR | nfr_name | snap_id | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BIOMASS | BIOGAS | 1A1 | Electricity and heat production | 010100 | 0.054 | 0.054 | 0.054 | 0.056 | 0.056 | 0.094 | 0.100 | 0.097 | 0.115 | 0.164 |
| | | | | 010200 | | | | | | 0.010 | 0.040 | 0.040 | 0.034 | 0.030 |
| | | 1A2 | Industry | 030100 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.024 | 0.024 | 0.024 | 0.033 | 0.281 |
| | | 1A4 | Commercial/ Institutional | 020100 | 0.123 | 0.133 | 0.143 | 0.143 | 0.143 | 0.166 | 0.181 | 0.181 | 0.172 | 0.161 |
| | FISH & RAPE OIL | 1A1 | Electricity and heat production | 010200 | | | | | | | | 1.972 | 1.860 | 1.302 |
| | STRAW | 1A1 | Electricity and heat production | 010100 | | | | | | 0.073 | 0.087 | 0.058 | | 0.058 |
| | | | | 010200 | 0.290 | 0.290 | 0.304 | 0.551 | 0.551 | 1.436 | 1.740 | 2.262 | 2.683 | 3.074 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 1.820 | 2.543 | 2.846 | 3.107 | 3.107 | 3.353 | 3.379 | 3.404 | 3.430 | 3.411 |
| | | | Residential | 020200 | 2.730 | 3.814 | 4.270 | 4.661 | 4.661 | 5.030 | 5.068 | 5.106 | 5.145 | 5.116 |
| | WOOD | 1A1 | Electricity and heat production | 010200 | | | | | | | 1.290 | 1.702 | 2.031 | 2.762 |
| | | 1A2 | Industry | 030100 | 3.710 | 4.251 | 4.424 | 4.781 | 4.781 | 5.280 | 5.555 | 5.480 | 5.580 | 5.695 |
| | | 1A4 | Agriculture/ Forestry | 020300 | | | | | | 0.102 | 0.094 | 0.071 | 0.071 | 0.087 |
| | | | Commercial/ Institutional | 020100 | | | | | | | 0.165 | 0.165 | 0.165 | 0.164 |
| | | | Residential | 020200 | 7.621 | 9.746 | 10.552 | 10.218 | 10.218 | 9.626 | 9.922 | 10.550 | 9.783 | 8.887 |
| WASTE | MUNICIP. WASTES | 1A1 | Electricity and heat production | 010100 | | | | | | | | | 0.194 | 0.263 |
| | | | | 010200 | 9.983 | 10.569 | 11.137 | 11.788 | 11.788 | 12.988 | 13.491 | 13.491 | 13.411 | 13.970 |
| | | 1A2 | Industry | 030100 | 0.055 | 0.054 | 0.075 | 0.075 | 0.075 | 0.064 | 0.063 | 0.046 | 0.046 | 0.037 |
| | | 1A4 | Commercial/ Institutional | 020100 | 0.601 | 0.636 | 0.671 | 0.710 | 0.710 | 0.782 | 0.812 | 0.812 | 0.814 | 0.855 |
| GAS | NATURAL GAS | 1A1 | Electricity and heat production | 010100 | | | | | | 3.176 | 5.562 | 3.510 | 5.959 | 6.510 |
| | | | | 010200 | | | | 0.296 | 0.296 | 6.082 | 12.317 | 15.041 | 13.816 | 11.291 |
| | | | Other energy industries | 010504 | 0.017 | 0.814 | 1.266 | 1.572 | 1.572 | 4.151 | 5.210 | 7.391 | 8.805 | 9.131 |
| | | 1A2 | Industry | 030100 | 0.414 | 0.430 | 0.391 | 0.352 | 0.352 | 5.035 | 8.977 | 14.820 | 17.190 | 21.887 |
| | | | | 030106 | | | | | | 0.150 | 0.002 | 0.344 | 0.268 | 0.224 |
| | | 1A4 | Agriculture/ Forestry | 020300 | | | | | | 0.248 | 0.952 | 1.305 | 1.498 | 1.895 |
| | | | Commercial/ Institutional | 020100 | 0.369 | 0.341 | 0.319 | 0.341 | 0.341 | 3.287 | 3.667 | 5.022 | 5.339 | 5.256 |
| | | | Residential | 020200 | 4.242 | 3.917 | 3.688 | 3.719 | 3.719 | 8.273 | 11.810 | 14.759 | 14.548 | 15.519 |
| LIQUID | GAS OIL | 1A1 | Electricity and heat production | 010100 | 0.249 | 0.345 | 0.297 | 0.382 | 0.382 | 0.117 | 0.231 | 0.416 | 0.400 | 0.317 |
| | | | | 010200 | 0.287 | 0.295 | 0.389 | 0.330 | 0.330 | 0.886 | 0.732 | 0.739 | 0.707 | 2.952 |
| | | | Petroleum refining | 010306 | | | | | | | 0.004 | 0.001 | | |
| | | 1A2 | Industry | 030100 | 6.107 | 2.874 | 1.070 | 0.780 | 0.780 | 3.572 | 2.875 | 2.196 | 0.860 | 0.882 |
| | | | | 030106 | | | | | | | 0.002 | 0.002 | 0.001 | 0.006 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 2.612 | 1.533 | 0.671 | 0.510 | 0.510 | 1.864 | 1.537 | 1.252 | 0.534 | 0.628 |
| | | | Commercial/ Institutional | 020100 | 24.694 | 21.726 | 18.299 | 17.880 | 17.880 | 18.638 | 17.961 | 18.062 | 13.819 | 12.177 |
| | | | Residential | 020200 | 113.249 | 94.406 | 87.068 | 79.682 | 79.682 | 84.841 | 79.360 | 78.460 | 67.098 | 54.285 |
| | KEROSENE | 1A2 | Industry | 030100 | 0.167 | 0.184 | 0.166 | 0.179 | 0.179 | 0.436 | 0.270 | 0.190 | 0.103 | 0.061 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 0.269 | 0.335 | 0.418 | 0.314 | 0.314 | 0.247 | 0.175 | 0.150 | 0.066 | 0.032 |
| | | | Commercial/ Institutional | 020100 | 1.145 | 1.009 | 0.997 | 0.978 | 0.978 | 1.441 | 0.988 | 0.686 | 0.593 | 0.464 |
| | | | Residential | 020200 | 2.344 | 2.043 | 2.029 | 2.084 | 2.084 | 2.488 | 2.454 | 1.978 | 1.185 | 1.207 |
| | LPG | 1A1 | Electricity and heat production | 010200 | 0.002 | 0.002 | 0.153 | 0.141 | 0.141 | 0.063 | 0.023 | 0.012 | 0.010 | 0.010 |
| | | 1A2 | Industry | 030100 | 3.657 | 2.962 | 2.723 | 2.775 | 2.775 | 1.973 | 1.987 | 2.122 | 1.943 | 1.694 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 0.616 | 0.586 | 0.454 | 0.399 | 0.399 | 0.056 | 0.052 | 0.242 | 0.209 | 0.274 |
| | | | Commercial/ Institutional | 020100 | 0.942 | 0.854 | 0.935 | 0.903 | 0.903 | 1.160 | 1.007 | 0.214 | 0.167 | 0.120 |
| | | | Residential | 020200 | 1.163 | 1.186 | 1.336 | 1.421 | 1.421 | 1.774 | 1.800 | 1.791 | 1.241 | 0.840 |
| | NAPHTA | 1A1 | Electricity and heat production | 010100 | | | | | | | 0.102 | | | |
| | PETROLEUM COKE | 1A1 | Electricity and heat production | 010200 | | | | | | | | 0.165 | 0.063 | |
| | | 1A2 | Industry | 030100 | 1.143 | 2.626 | 5.661 | 6.989 | 6.989 | 0.420 | 1.502 | 0.451 | 0.050 | |
| | | | | 030311 | | | | | | 6.765 | 6.819 | 5.458 | 3.921 | 3.820 |
| | | 1A4 | Agriculture/ Forestry | 020300 | | | | 0.007 | 0.007 | 0.438 | 0.692 | 0.716 | 0.703 | |

| fuel_type | fuel_gr_abbr | NFR | nfr_name | snap_id | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Commercial/ Institutional | 020100 | | | 0.104 | 0.055 | 0.055 | 0.176 | 0.036 | 0.296 | 0.273 | 0.055 |
| | | | Residential | 020200 | | | 0.335 | 0.178 | 0.178 | 0.827 | 0.699 | 1.112 | 0.890 | 0.675 |
| | REFINERY GAS | 1A1 | Petroleum refining | 010300 | | | | | | | 0.068 | 0.137 | 0.205 | 0.332 |
| | | | | 010306 | 10.926 | 11.562 | 10.468 | 11.729 | 11.729 | 11.390 | 12.959 | 12.953 | 13.225 | 14.092 |
| | | 1A2 | Industry | 030100 | 0.103 | 0.110 | 0.112 | 0.129 | 0.129 | 0.130 | 0.141 | 0.163 | 0.189 | 0.208 |
| | RESIDUAL OIL | 1A1 | Electricity and heat production | 010100 | 47.677 | 24.956 | 18.017 | 8.518 | 8.518 | 13.348 | 14.292 | 10.464 | 12.960 | 10.783 |
| | | | | 010200 | 48.997 | 43.678 | 40.823 | 34.724 | 34.724 | 25.102 | 15.665 | 11.530 | 5.426 | 3.035 |
| | | | Petroleum refining | 010306 | 3.301 | 3.592 | 2.527 | 2.502 | 2.502 | 2.825 | 2.740 | 2.180 | 1.606 | 1.653 |
| | | 1A2 | Industry | 030100 | 50.678 | 40.700 | 35.663 | 33.704 | 32.562 | 29.888 | 29.390 | 21.334 | 17.170 | 16.599 |
| | | | | 030311 | | | | | | 0.376 | 1.330 | 2.123 | 2.652 | 2.627 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 9.784 | 10.122 | 5.213 | 5.350 | 5.350 | 2.547 | 2.625 | 2.244 | 1.693 | 1.704 |
| | | | Commercial/ Institutional | 020100 | 12.482 | 10.469 | 10.334 | 8.304 | 8.304 | 7.737 | 5.611 | 4.214 | 2.574 | 1.535 |
| | | | Residential | 020200 | 4.847 | 4.676 | 4.888 | 3.527 | 3.527 | 2.961 | 2.542 | 1.297 | 0.461 | 0.367 |
| SOLID | BROWN COAL BRI. | 1A2 | Industry | 030100 | 0.002 | 0.018 | 0.008 | 0.029 | 0.029 | 0.077 | 0.042 | 0.037 | 0.005 | |
| | | 1A4 | Agriculture/ Forestry | 020300 | | | | 0.011 | 0.011 | 0.132 | 0.140 | 0.063 | 0.042 | 0.035 |
| | | | Commercial/ Institutional | 020100 | | | | | | | | | 0.001 | 0.000 |
| | | | Residential | 020200 | 0.382 | 0.479 | 0.809 | 0.665 | 0.665 | 0.604 | 0.276 | 0.247 | 0.149 | 0.093 |
| | COAL | 1A1 | Electricity and heat production | 010100 | 226.186 | 177.693 | 221.810 | 216.542 | 216.542 | 271.286 | 276.468 | 272.137 | 253.755 | 206.802 |
| | | | | 010200 | 0.102 | 1.704 | 2.583 | 5.222 | 5.222 | 12.092 | 11.344 | 9.343 | 8.486 | 6.800 |
| | | 1A2 | Industry | 030100 | 17.652 | 13.259 | 11.442 | 8.012 | 8.012 | 9.837 | 8.966 | 10.254 | 10.360 | 9.109 |
| | | | | 030106 | 0.368 | 0.412 | 0.457 | 0.374 | 0.374 | | | | | |
| | | | | 030311 | | | | | | 2.758 | 3.790 | 4.158 | 4.186 | 5.477 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 0.261 | 1.008 | 1.196 | 1.837 | 1.837 | 4.640 | 4.520 | 4.132 | 3.674 | 2.645 |
| | | | Commercial/ Institutional | 020100 | | | | | | | 0.010 | 0.034 | 0.170 | 0.015 |
| | | | Residential | 020200 | 1.116 | 1.484 | 0.927 | 0.991 | 0.991 | 1.002 | 0.900 | 0.307 | 0.302 | 0.436 |
| | COKE OVEN COKE | 1A2 | Industry | 030100 | 2.470 | 1.530 | 1.344 | 1.493 | 1.493 | 1.307 | 1.121 | 1.089 | 1.056 | 0.907 |
| | | 1A4 | Residential | 020200 | 1.069 | 1.286 | 1.604 | 1.047 | 1.047 | 0.653 | 0.466 | 0.433 | 0.199 | 0.123 |
| **Grand Total** | | | | | **629.086** | **519.300** | **533.480** | **503.075** | **501.934** | **598.306** | **607.221** | **595.240** | **548.371** | **483.911** |

| fuel_type | fuel_gr_abbr | NFR | nfr_name | snap_id | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BIOMASS | BIOGAS | 1A1 | Electricity and heat production | 010100 | 0.141 | 0.219 | 0.029 | 0.042 | | | | | | |
| | | | | 010101 | | | | | 0.017 | 0.000 | 0.024 | 0.020 | | |
| | | | | 010102 | | | | | 0.010 | | 0.094 | 0.041 | 0.050 | 0.030 |
| | | | | 010103 | | | | | 0.054 | 0.118 | 0.079 | 0.111 | 0.087 | 0.104 |
| | | | | 010104 | | | 0.079 | 0.089 | 0.200 | 0.169 | 0.007 | | | |
| | | | | 010105 | 0.095 | 0.175 | 0.251 | 0.406 | 0.415 | 0.599 | 0.826 | 1.230 | 1.549 | 1.500 |
| | | | | 010200 | 0.030 | 0.030 | 0.053 | 0.053 | | | | | | |
| | | | | 010203 | | | | | 0.046 | 0.044 | 0.054 | 0.034 | 0.031 | 0.025 |
| | | | | 010205 | | | | | 0.041 | | | | | |
| | | | Other energy industries | 010505 | 0.007 | 0.007 | 0.007 | 0.007 | 0.006 | 0.052 | 0.060 | 0.057 | 0.031 | 0.029 |
| | | 1A2 | Industry | 030100 | | | | | 0.013 | 0.126 | 0.096 | 0.117 | 0.074 | 0.033 |
| | | | | 030102 | | | | | 0.007 | 0.016 | 0.016 | 0.019 | 0.016 | 0.016 |
| | | | | 030104 | | | | | | 0.001 | 0.001 | 0.001 | | |
| | | | | 030105 | | | | | | | | | 0.000 | 0.000 |
| | | 1A4 | Agriculture/ Forestry | 020300 | | | | | 0.003 | 0.004 | 0.132 | 0.026 | 0.035 | 0.030 |
| | | | | 020304 | 0.010 | 0.010 | 0.010 | 0.010 | 0.007 | 0.016 | 0.017 | 0.018 | 0.026 | 0.041 |
| | | | Commercial/ Institutional | 020100 | 0.199 | 0.179 | 0.084 | 0.064 | 0.113 | 0.170 | 0.173 | 0.272 | 0.225 | 0.293 |
| | | | | 020103 | | | | | | | 0.014 | 0.039 | 0.071 | 0.074 |

| fuel_type | fuel_gr_abbr | NFR | nfr_name | snap_id | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 020104 | | | | | | 0.027 | | | | |
| | | | | 020105 | 0.270 | 0.290 | 0.387 | 0.406 | 0.349 | 0.411 | 0.390 | 0.405 | 0.439 | 0.437 |
| | FISH & RAPE OIL | 1A1 | Electricity and heat production | 010103 | | | | | 0.034 | 0.024 | 0.022 | 0.000 | 0.005 | 0.007 |
| | | | | 010200 | 0.744 | 0.744 | 0.744 | 0.800 | | | | | | |
| | | | | 010203 | | | | | 0.212 | 0.227 | 0.039 | 0.014 | 0.008 | 0.020 |
| | STRAW | 1A1 | Electricity and heat production | 010100 | 0.479 | 0.985 | 1.487 | 1.643 | | | | | | |
| | | | | 010101 | | | | | 0.100 | 0.082 | 0.610 | 0.740 | 1.014 | 1.340 |
| | | | | 010102 | | | | | 0.622 | 1.287 | 1.704 | 1.845 | 1.752 | 1.819 |
| | | | | 010103 | | | | | 1.127 | 1.297 | 1.362 | 1.174 | 1.181 | 1.058 |
| | | | | 010200 | 3.524 | 3.843 | 3.915 | 3.806 | | | | | | |
| | | | | 010201 | | | | | 0.022 | | | | | |
| | | | | 010202 | | | | | 0.057 | 0.180 | 0.114 | 0.096 | 0.136 | 0.142 |
| | | | | 010203 | | | | | 3.378 | 3.409 | 3.700 | 3.564 | 3.526 | 3.565 |
| | | 1A2 | Industry | 030100 | | | | | | | | | 0.000 | 0.000 |
| | | | | 030103 | | | | | | 0.003 | | | | |
| | | 1A4 | Agriculture/ Forestry | 020300 | 3.391 | 3.391 | 3.391 | 3.167 | 2.942 | 2.718 | 2.422 | 2.595 | 2.515 | 2.295 |
| | | | | 020302 | | | | | | | | 0.006 | 0.006 | 0.006 |
| | | | Residential | 020200 | 5.087 | 5.087 | 5.087 | 4.750 | 4.414 | 4.077 | 3.633 | 3.892 | 3.773 | 3.443 |
| | WOOD | 1A1 | Electricity and heat production | 010100 | | | 0.172 | 0.515 | | | | | | |
| | | | | 010101 | | | | | 0.043 | | | | 0.264 | |
| | | | | 010102 | | | | | 1.053 | 0.865 | 0.862 | 1.001 | 1.372 | 2.377 |
| | | | | 010103 | | | | | 0.624 | 0.672 | 0.578 | 0.645 | 0.575 | 0.732 |
| | | | | 010104 | | | | | 0.079 | 0.004 | | | | |
| | | | | 010105 | | | | | | | | | | 0.002 |
| | | | | 010200 | 3.217 | 3.648 | 4.096 | 3.751 | | | | | | |
| | | | | 010201 | | | | | 0.009 | | | | | |
| | | | | 010202 | | | | | 0.000 | 0.044 | 0.165 | 0.191 | 0.207 | 0.194 |
| | | | | 010203 | | | | | 3.338 | 3.491 | 3.857 | 3.795 | 3.972 | 3.928 |
| | | 1A2 | Industry | 030100 | 5.784 | 5.690 | 5.751 | 5.822 | 4.465 | 4.254 | 4.098 | 4.166 | 4.274 | 4.250 |
| | | | | 030102 | | | | | | | | | 0.002 | 0.001 |
| | | | | 030103 | | | | | 0.481 | 0.413 | 0.624 | 0.524 | 0.412 | 0.414 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 0.087 | 0.087 | 0.087 | 0.068 | 0.068 | 0.068 | 0.087 | 0.097 | 0.230 | 0.231 |
| | | | | 020304 | | | | | | | | | 0.001 | 0.014 |
| | | | Commercial/ Institutional | 020100 | 0.204 | 0.204 | 0.204 | 0.204 | 0.216 | 0.273 | 0.449 | 0.471 | 0.493 | 0.642 |
| | | | | 020105 | | | | | | | | | 0.002 | 0.002 |
| | | | Residential | 020200 | 8.954 | 10.412 | 10.720 | 11.860 | 11.564 | 11.761 | 12.669 | 12.569 | 11.134 | 11.615 |
| WASTE | MUNICIP. WASTES | 1A1 | Electricity and heat production | 010100 | 0.990 | 3.563 | 5.578 | 8.433 | | | | | | |
| | | | | 010101 | | | | | | | | | 1.288 | 1.278 |
| | | | | 010102 | | | | | 5.110 | 6.527 | 7.153 | 10.832 | 11.715 | 16.938 |
| | | | | 010103 | | | | | 2.910 | 3.755 | 5.003 | 3.074 | 1.957 | 4.039 |
| | | | | 010104 | | | | | 1.665 | 2.028 | 3.192 | 3.025 | 2.806 | 2.453 |
| | | | | 010200 | 13.567 | 12.142 | 11.111 | 9.839 | | | | | | |
| | | | | 010201 | | | | | 0.007 | | | | | |
| | | | | 010202 | | | | | 3.472 | 3.703 | 4.646 | 4.649 | 4.618 | |
| | | | | 010203 | | | | | 5.909 | 5.559 | 3.699 | 3.978 | 3.458 | 2.915 |
| | | 1A2 | Industry | 030100 | 0.028 | 0.028 | 0.037 | 0.039 | 0.026 | 0.029 | 0.028 | 0.024 | 0.029 | 0.035 |
| | | 1A4 | Commercial/ Institutional | 020100 | 0.914 | 1.011 | 1.071 | 1.099 | 1.182 | 1.275 | 1.222 | 1.180 | 0.710 | 1.473 |
| | | | | 020103 | | | | | 0.031 | 0.031 | 0.010 | 0.008 | 0.010 | 0.007 |
| GAS | NATURAL GAS | 1A1 | Electricity and heat production | 010100 | | | | | | | | 0.006 | 0.021 | 0.017 |
| | | | | 010101 | 4.005 | 4.395 | 3.279 | 4.422 | 8.438 | 10.454 | 12.217 | 14.600 | 20.809 | 21.308 |

| fuel_type | fuel_gr_abbr | NFR | nfr_name | snap_id | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 010102 | | | | | 0.295 | 0.300 | 1.346 | 5.620 | 5.987 | 2.416 |
| | | | | 010103 | | | | | 2.487 | 1.775 | 1.558 | 1.138 | 0.959 | 0.717 |
| | | | | 010104 | 1.859 | 2.397 | 4.806 | 7.327 | 7.777 | 8.548 | 14.500 | 12.220 | 13.003 | 21.614 |
| | | | | 010105 | 0.678 | 1.291 | 2.199 | 4.169 | 8.358 | 16.420 | 22.162 | 24.109 | 26.701 | 26.834 |
| | | | | 010200 | 11.033 | 13.655 | 12.350 | 11.420 | | | | | | |
| | | | | 010202 | | | | | 1.072 | 1.017 | 0.844 | 0.661 | 0.539 | 0.282 |
| | | | | 010203 | | | | | 6.160 | 5.525 | 3.803 | 2.420 | 1.989 | 1.874 |
| | | | | 010205 | | | | | 0.132 | 0.339 | 0.377 | 0.230 | 0.236 | 0.226 |
| | | | Other energy industries | 010502 | | | | | | 0.399 | 0.391 | 0.417 | 0.413 | 0.409 |
| | | | | 010504 | 9.482 | 9.703 | 11.119 | 11.235 | 12.268 | 12.506 | 14.850 | 19.455 | 21.637 | 23.562 |
| | | | | 010505 | 0.002 | 0.004 | 0.004 | 0.004 | 0.003 | 0.004 | 0.008 | 0.005 | 0.015 | 0.014 |
| | | 1A2 | Industry | 030100 | 22.280 | 23.781 | 23.888 | 25.535 | 29.248 | 30.318 | 29.252 | 29.423 | 29.114 | 31.167 |
| | | | | 030102 | | | | | 0.863 | 2.662 | 2.465 | 2.972 | 2.962 | 3.100 |
| | | | | 030103 | | | | | 0.300 | 0.064 | 0.147 | 0.170 | 0.132 | 0.127 |
| | | | | 030104 | 0.506 | 0.609 | 0.664 | 0.730 | 0.761 | 0.910 | 2.563 | 3.366 | 5.106 | 6.501 |
| | | | | 030105 | 0.000 | 0.000 | 0.000 | 0.000 | 0.011 | 0.173 | 0.873 | 0.960 | 1.157 | 1.160 |
| | | | | 030106 | 0.136 | 0.024 | 0.038 | 0.070 | 0.053 | 0.024 | 0.015 | 0.005 | 0.032 | 0.039 |
| | | | | 030315 | | | | | | | | 0.924 | 0.903 | 1.005 |
| | | | | 030318 | | | | | | 0.625 | 0.590 | 0.621 | 0.671 | 0.687 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 2.222 | 2.680 | 2.385 | 2.463 | 2.485 | 2.560 | 2.666 | 2.645 | 2.476 | 2.242 |
| | | | | 020303 | | | | | | | 0.006 | 0.026 | 0.066 | 0.077 |
| | | | | 020304 | 0.104 | 0.104 | 0.136 | 0.161 | 0.282 | 0.961 | 1.796 | 2.620 | 3.354 | 3.379 |
| | | | Commercial/ Institutional | 020100 | 6.376 | 6.934 | 7.382 | 8.909 | 7.343 | 8.437 | 11.247 | 9.107 | 8.662 | 7.525 |
| | | | | 020103 | | | | | 0.002 | | | 0.002 | 0.049 | 0.011 |
| | | | | 020104 | | | | | 0.012 | 0.026 | 0.031 | 0.026 | 0.023 | 0.031 |
| | | | | 020105 | 0.046 | 0.089 | 0.278 | 0.350 | 0.474 | 0.609 | 0.681 | 0.866 | 0.959 | 0.986 |
| | | | Residential | 020200 | 17.362 | 20.433 | 21.440 | 24.904 | 24.737 | 26.947 | 30.412 | 28.362 | 29.138 | 28.982 |
| | | | | 020202 | | | | | | | 0.026 | 0.025 | 0.018 | 0.031 |
| | | | | 020204 | | 0.008 | 0.499 | 0.776 | 1.023 | 1.095 | 1.448 | 1.488 | 1.576 | 1.554 |
| LIQUID | GAS OIL | 1A1 | Electricity and heat production | 010100 | 0.239 | 0.416 | 0.641 | 0.245 | | | | | | |
| | | | | 010101 | | | | | 0.012 | 0.051 | 0.042 | 0.195 | 0.109 | 0.258 |
| | | | | 010102 | | | | | 0.043 | 0.030 | 0.153 | 0.114 | 0.082 | 0.159 |
| | | | | 010103 | | | | | 0.059 | 0.040 | 0.078 | 0.042 | 0.044 | 0.061 |
| | | | | 010104 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.076 | 0.081 | 0.054 | 0.147 | 0.060 |
| | | | | 010105 | 0.017 | 0.033 | 0.035 | 0.035 | 0.116 | 0.137 | 0.099 | 0.100 | 0.134 | 0.108 |
| | | | | 010200 | 1.941 | 0.813 | 0.744 | 0.947 | | | | | | |
| | | | | 010201 | | | | | 0.027 | 0.007 | | | | |
| | | | | 010202 | | | | | 0.174 | 0.361 | 0.800 | 0.515 | 0.418 | 0.258 |
| | | | | 010203 | | | | | 0.844 | 0.444 | 0.555 | 0.510 | 0.652 | 0.296 |
| | | | | 010205 | | | | | 0.001 | | | | | 0.001 |
| | | | Petroleum refining | 010306 | | 0.040 | 0.044 | 0.029 | 0.049 | 0.033 | 0.022 | 0.087 | | |
| | | 1A2 | Industry | 030100 | 0.538 | 1.370 | 1.431 | 0.952 | 0.813 | 1.460 | 2.252 | 1.895 | 1.799 | 2.478 |
| | | | | 030102 | | | | | | 0.003 | | | 0.000 | 0.001 |
| | | | | 030103 | | | | | 0.002 | 0.001 | 0.011 | 0.001 | 0.002 | 0.000 |
| | | | | 030104 | | | | | | | | 0.000 | 0.000 | 0.007 |
| | | | | 030105 | | | 0.001 | 0.002 | 0.002 | | | | | |
| | | | | 030106 | 0.006 | 0.007 | 0.009 | 0.003 | 0.009 | 0.007 | 0.007 | 0.008 | 0.016 | 0.070 |
| | | | | 030315 | | | | | | | | 0.001 | 0.001 | 0.005 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 0.406 | 1.014 | 1.176 | 0.794 | 0.708 | 1.182 | 1.940 | 1.799 | 1.675 | 2.297 |
| | | | | 020302 | | | | | | | | 0.000 | | |
| | | | | 020304 | | | | | | | 0.004 | 0.002 | | |

| fuel_type | fuel_gr_abbr | NFR | nfr_name | snap_id | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Commercial/ Institutional | 020100 | 11.795 | 10.623 | 9.062 | 9.007 | 7.157 | 6.556 | 6.620 | 6.093 | 5.442 | 5.781 |
| | | | | 020102 | | | | | 0.191 | | 0.000 | | 0.000 | |
| | | | | 020103 | | | | | 0.000 | | 0.058 | 0.058 | 0.054 | 0.039 |
| | | | | 020105 | | | 0.001 | 0.001 | 0.001 | 0.020 | 0.002 | 0.000 | 0.000 | 0.000 |
| | | | Residential | 020200 | 46.463 | 50.638 | 42.914 | 49.967 | 43.679 | 43.288 | 45.296 | 39.595 | 37.850 | 35.675 |
| | KEROSENE | 1A2 | Industry | 030100 | 0.070 | 0.046 | 0.038 | 0.035 | 0.030 | 0.024 | 0.031 | 0.028 | 0.016 | 0.009 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 0.043 | 0.028 | 0.026 | 0.026 | 0.027 | 0.021 | 0.023 | 0.025 | 0.021 | 0.011 |
| | | | Commercial/ Institutional | 020100 | 0.569 | 0.210 | 0.207 | 0.189 | 0.155 | 0.124 | 0.103 | 0.096 | 0.128 | 0.117 |
| | | | Residential | 020200 | 4.405 | 0.660 | 0.512 | 0.521 | 0.438 | 0.411 | 0.383 | 0.287 | 0.252 | 0.119 |
| | LPG | 1A1 | Electricity and heat production | 010100 | | 0.001 | 0.001 | 0.003 | | | | | | |
| | | | | 010103 | | | | | | 0.001 | | | | |
| | | | | 010200 | 0.009 | 0.013 | 0.010 | | | | | | | |
| | | | | 010203 | | | | | 0.003 | | | | | 0.000 |
| | | | Petroleum refining | 010306 | | | 0.005 | | 0.008 | 0.015 | 0.021 | 0.018 | | |
| | | 1A2 | Industry | 030100 | 1.576 | 1.689 | 1.589 | 1.451 | 1.558 | 1.738 | 1.920 | 1.597 | 1.624 | 1.355 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 0.259 | 0.247 | 0.192 | 0.122 | 0.116 | 0.125 | 0.137 | 0.109 | 0.126 | 0.087 |
| | | | Commercial/ Institutional | 020100 | 0.083 | 0.077 | 0.077 | 0.122 | 0.125 | 0.131 | 0.138 | 0.128 | 0.116 | 0.110 |
| | | | | 020103 | | | | | | | | | 0.000 | |
| | | | | 020105 | | | | | | | | | 0.001 | 0.001 |
| | | | Residential | 020200 | 0.670 | 0.522 | 0.442 | 0.673 | 0.589 | 0.628 | 0.653 | 0.510 | 0.546 | 0.624 |
| | ORIMULSION | 1A1 | Electricity and heat production | 010101 | | | | | | 19.913 | 36.767 | 40.488 | 32.580 | 34.191 |
| | PETROLEUM COKE | 1A1 | Electricity and heat production | 010100 | | | | 1.239 | | | | | | |
| | | 1A2 | Industry | 030100 | 0.300 | | 0.056 | 0.123 | | 0.098 | 0.110 | 0.034 | 0.026 | 0.039 |
| | | | | 030311 | 2.499 | 2.991 | 3.234 | 3.231 | 3.469 | 3.707 | 4.966 | 5.230 | 4.775 | 6.399 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 0.837 | 0.611 | 0.473 | 0.500 | | 0.240 | 0.286 | 0.323 | 0.201 | 0.089 |
| | | | Commercial/ Institutional | 020100 | 0.062 | 0.104 | 0.090 | 0.096 | 0.092 | 0.070 | 0.091 | 0.098 | 0.071 | 0.050 |
| | | | Residential | 020200 | 0.761 | 0.697 | 0.961 | 0.990 | 0.748 | 0.734 | 0.929 | 0.839 | 0.726 | 0.706 |
| | REFINERY GAS | 1A1 | Electricity and heat production | 010101 | | | | | | | 0.035 | 0.040 | | |
| | | | Petroleum refining | 010300 | 0.458 | 0.926 | 1.526 | 0.016 | | | | | | |
| | | | | 010304 | | | | 2.067 | 2.355 | 2.290 | 5.070 | 4.082 | 2.996 | 4.173 |
| | | | | 010306 | 13.520 | 13.486 | 13.237 | 13.214 | 14.005 | 18.548 | 16.337 | 12.771 | 12.203 | 11.551 |
| | | 1A2 | Industry | 030100 | 0.191 | 0.125 | 0.102 | 0.108 | | | 0.035 | 0.053 | 0.027 | |
| | RESIDUAL OIL | 1A1 | Electricity and heat production | 010100 | 0.775 | 0.364 | 1.742 | 0.741 | | | | | | |
| | | | | 010101 | 7.172 | 10.053 | 8.691 | 8.420 | 22.142 | 11.174 | 16.072 | 7.736 | 11.557 | 7.214 |
| | | | | 010102 | 0.042 | 0.017 | 0.027 | 0.024 | 0.180 | 0.254 | 0.443 | 0.421 | 0.510 | 0.763 |
| | | | | 010103 | | | | | 0.252 | 0.173 | 0.201 | 0.159 | 0.116 | 0.102 |
| | | | | 010104 | | | | | 0.320 | 0.347 | 0.237 | 0.302 | 0.355 | 0.118 |
| | | | | 010105 | 0.009 | 0.009 | 0.009 | 0.009 | 0.012 | 0.004 | 0.005 | 0.002 | 0.006 | 0.004 |
| | | | | 010200 | 2.006 | 2.236 | 1.141 | 0.879 | | | | | | |
| | | | | 010202 | | | | | 0.134 | 0.173 | 0.171 | 0.141 | 0.102 | 0.136 |
| | | | | 010203 | | | | | 0.859 | 0.939 | 1.201 | 0.875 | 0.779 | 0.962 |
| | | | Petroleum refining | 010306 | 1.309 | 2.038 | 3.569 | 3.490 | 3.337 | 2.334 | 2.244 | 1.622 | 1.106 | 1.090 |
| | | 1A2 | Industry | 030100 | 16.531 | 19.002 | 18.557 | 14.527 | 12.588 | 10.217 | 10.610 | 9.223 | 9.121 | 8.683 |
| | | | | 030102 | | | | | 0.742 | 0.911 | 0.789 | 0.790 | 0.663 | 0.696 |
| | | | | 030103 | | | | | 0.200 | 0.207 | 0.166 | 0.123 | 0.122 | 0.136 |
| | | | | 030104 | | | | | | | | 0.054 | | |
| | | | | 030311 | 1.763 | 2.153 | 2.367 | 2.397 | 2.619 | 2.840 | 1.771 | 1.864 | 2.539 | 0.886 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 1.224 | 1.296 | 1.634 | 1.687 | 1.942 | 2.617 | 3.071 | 2.492 | 2.563 | 2.396 |
| | | | | 020302 | | | | | | | | | 0.009 | 0.001 |
| | | | | 020304 | | | | | | | | | 0.009 | 0.011 |

| fuel_type | fuel_gr_abbr | NFR | nfr_name | snap_id | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Commercial/ Institutional | 020100 | 1.070 | 0.865 | 0.601 | 0.517 | 0.719 | 0.677 | 0.718 | 0.729 | 0.384 | 0.450 |
| | | | | 020103 | | | | | 0.088 | 0.078 | | | | |
| | | | Residential | 020200 | 0.217 | 0.219 | 0.168 | 0.130 | 0.095 | 0.063 | 0.066 | 0.046 | 0.043 | 0.050 |
| SOLID | BROWN COAL BRI. | 1A2 | Industry | 030100 | 0.004 | 0.007 | 0.004 | 0.018 | 0.003 | 0.002 | 0.001 | 0.001 | | |
| | | 1A4 | Agriculture/ Forestry | 020300 | 0.060 | 0.092 | 0.052 | 0.022 | 0.012 | 0.010 | 0.007 | 0.004 | 0.004 | |
| | | | Commercial/ Institutional | 020100 | 0.001 | 0.002 | | 0.008 | 0.001 | 0.001 | 0.000 | 0.000 | | |
| | | | Residential | 020200 | 0.051 | 0.067 | 0.039 | 0.080 | 0.076 | 0.062 | 0.047 | 0.049 | 0.044 | 0.038 |
| | COAL | 1A1 | Electricity and heat production | 010100 | 8.523 | 12.892 | 10.176 | 8.221 | | | | | | |
| | | | | 010101 | 219.781 | 303.105 | 252.745 | 269.459 | 295.430 | 244.510 | 347.252 | 252.648 | 211.429 | 176.641 |
| | | | | 010102 | 2.119 | 2.654 | 2.250 | 2.269 | 8.605 | 8.381 | 9.033 | 8.671 | 9.023 | 8.238 |
| | | | | 010103 | | | | | 0.837 | 0.526 | 0.149 | 0.039 | 0.024 | 0.034 |
| | | | | 010104 | | | | | 0.272 | 0.270 | 0.301 | 0.074 | | |
| | | | | 010105 | | | | | 0.020 | | | | | |
| | | | | 010200 | 6.017 | 6.635 | 5.173 | 3.581 | | | | | | |
| | | | | 010201 | | | | | 0.153 | 0.020 | | | | |
| | | | | 010202 | | | | | 1.112 | 0.790 | 0.200 | 0.065 | 0.018 | 0.000 |
| | | | | 010203 | | | | | 0.378 | 0.317 | 0.228 | 0.049 | 0.048 | 0.007 |
| | | 1A2 | Industry | 030100 | 8.850 | 8.977 | 6.751 | 7.699 | 5.867 | 4.833 | 4.461 | 4.494 | 4.676 | 3.715 |
| | | | | 030102 | | | | | 0.615 | 1.051 | 1.450 | 1.467 | 1.406 | 1.412 |
| | | | | 030103 | | | | | 0.190 | 0.183 | 0.193 | 0.192 | | |
| | | | | 030311 | 5.019 | 6.049 | 6.577 | 6.602 | 6.914 | 7.225 | 7.068 | 7.209 | 6.628 | 5.638 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 2.458 | 2.854 | 2.204 | 2.106 | 2.295 | 1.798 | 1.446 | 1.239 | 0.904 | 0.708 |
| | | | Commercial/ Institutional | 020100 | 0.088 | 0.009 | 0.096 | 0.076 | 0.090 | 0.066 | 0.041 | 0.043 | 0.002 | |
| | | | Residential | 020200 | 0.589 | 1.125 | 0.866 | 0.786 | 0.619 | 0.377 | 0.086 | 0.086 | 0.127 | 0.079 |
| | COKE OVEN COKE | 1A2 | Industry | 030100 | 1.169 | 1.351 | 1.078 | 1.073 | 1.163 | 0.287 | 0.304 | 0.295 | 0.319 | 0.381 |
| | | | | 030318 | | | | | | 0.937 | 0.886 | 0.931 | 1.007 | 1.030 |
| | | 1A4 | Residential | 020200 | 0.107 | 0.099 | 0.103 | 0.081 | 0.063 | 0.049 | 0.037 | 0.027 | 0.020 | 0.011 |
| **Grand Total** | | | | | **498.529** | **609.453** | **550.318** | **581.004** | **619.616** | **599.728** | **757.218** | **653.026** | **615.310** | **586.540** |

| fuel_type | fuel_gr_abbr | NFR | nfr_name | snap_id | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BIOMASS | BIO PROD GAS | 1A1 | Electricity and heat production | 010105 | | | | | | | | | 0.085 |
| | | 1A2 | Industry | 030105 | | | | | | | | | 0.000 |
| | | 1A4 | Commercial/ Institutional | 020105 | | | | | | | | | 0.001 |
| | BIOGAS | 1A1 | Electricity and heat production | 010102 | 0.026 | 0.023 | 0.020 | 0.022 | 0.017 | 0.017 | 0.017 | 0.016 | 0.012 |
| | | | | 010103 | 0.135 | 0.124 | 0.090 | 0.097 | 0.078 | 0.070 | 0.105 | 0.109 | 0.111 |
| | | | | 010105 | 1.549 | 1.589 | 1.686 | 1.705 | 1.435 | 1.536 | 1.287 | 1.418 | 1.496 |
| | | | | 010203 | 0.022 | 0.011 | 0.013 | 0.017 | 0.023 | 0.041 | 0.017 | 0.018 | 0.041 |
| | | | | 010205 | | | | | 0.036 | 0.110 | 0.155 | 0.149 | 0.014 |
| | | | Other energy industries | 010505 | 0.033 | 0.029 | 0.031 | 0.032 | 0.061 | 0.100 | 0.116 | 0.098 | |
| | | 1A2 | Industry | 030100 | 0.033 | 0.028 | 0.038 | 0.034 | 0.046 | 0.143 | 0.137 | 0.145 | 0.074 |
| | | | | 030102 | 0.016 | 0.059 | 0.072 | 0.096 | 0.113 | 0.048 | 0.052 | 0.035 | 0.101 |
| | | | | 030103 | | | | | | | | | 0.011 |
| | | | | 030105 | 0.001 | 0.024 | 0.018 | 0.014 | 0.017 | | 0.104 | 0.073 | 0.209 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 0.076 | 0.080 | 0.096 | 0.135 | 0.169 | 0.084 | 0.296 | 0.325 | 0.710 |
| | | | | 020304 | 0.077 | 0.109 | 0.239 | 0.456 | 0.411 | 0.509 | 0.591 | 0.447 | 0.155 |
| | | | Commercial/ Institutional | 020100 | 0.311 | 0.355 | 0.425 | 0.322 | 0.426 | 0.474 | 0.578 | 0.658 | 0.464 |
| | | | | 020103 | 0.087 | 0.085 | 0.074 | 0.085 | 0.101 | 0.355 | 0.138 | 0.102 | 0.114 |

| fuel_type | fuel_gr_abbr | NFR | nfr_name | snap_id | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 020105 | 0.507 | 0.504 | 0.528 | 0.531 | 0.517 | 0.544 | 0.501 | 0.421 | 0.417 |
| | FISH & RAPE OIL | 1A1 | Electricity and heat production | 010101 | | | | | | | | 0.025 | 0.012 |
| | | | | 010102 | | | | | 0.001 | 0.002 | | 0.040 | 0.547 |
| | | | | 010103 | | | | 0.002 | 0.055 | 0.152 | 0.254 | 0.277 | 0.332 |
| | | | | 010105 | | | | | 0.002 | | | | |
| | | | | 010202 | | | | 0.019 | 0.005 | 0.021 | 0.024 | 0.033 | 0.090 |
| | | | | 010203 | 0.049 | 0.191 | 0.126 | 0.238 | 0.589 | 0.557 | 0.692 | 0.469 | 0.624 |
| | | 1A2 | Industry | 030100 | | | | | | 0.000 | 0.000 | | |
| | | | | 030105 | | | 0.000 | 0.000 | | 0.000 | 0.000 | 0.000 | 0.001 |
| | | 1A4 | Agriculture/ Forestry | 020304 | 0.000 | 0.001 | 0.000 | | | | | | |
| | | | Commercial/ Institutional | 020105 | | | | | | | | 0.001 | |
| | | | Residential | 020200 | | | | | | | | | 0.312 |
| | SEWAGE SLUDGE | 1A2 | Industry | 030311 | 0.040 | 0.375 | 0.065 | 0.055 | 0.058 | 0.058 | | | |
| | STRAW | 1A1 | Electricity and heat production | 010101 | 1.120 | 1.588 | 2.643 | 3.192 | 4.366 | 4.088 | 4.422 | 4.474 | 3.187 |
| | | | | 010102 | 1.827 | 1.746 | 1.641 | 1.712 | 1.815 | 1.765 | 1.489 | 1.448 | 1.456 |
| | | | | 010103 | 0.640 | 1.905 | 1.754 | 1.928 | 1.336 | 1.394 | 1.358 | 1.259 | 1.676 |
| | | | | 010104 | | 0.102 | 1.216 | 1.707 | 2.477 | 3.118 | 3.175 | 3.099 | 0.815 |
| | | | | 010202 | 0.151 | 0.098 | | | 0.095 | 0.096 | 0.082 | 0.088 | 0.090 |
| | | | | 010203 | 3.291 | 3.418 | 3.556 | 3.339 | 3.007 | 3.180 | 3.258 | 3.122 | 3.298 |
| | | 1A2 | Industry | 030105 | 0.000 | 0.000 | | | | | | | |
| | | 1A4 | Agriculture/ Forestry | 020300 | 2.074 | 1.934 | 1.934 | 1.934 | 1.934 | 1.934 | 1.937 | 1.934 | 1.937 |
| | | | | 020302 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | | 0.006 | |
| | | | Residential | 020200 | 3.112 | 2.901 | 2.901 | 2.901 | 2.901 | 2.901 | 2.905 | 2.901 | 2.905 |
| | WOOD | 1A1 | Electricity and heat production | 010101 | | 0.001 | 0.066 | 0.305 | 0.231 | 1.247 | 0.695 | 0.622 | 0.532 |
| | | | | 010102 | 2.275 | 2.187 | 3.176 | 5.855 | 5.627 | 5.966 | 6.355 | 6.086 | 5.773 |
| | | | | 010103 | 0.670 | 0.747 | 0.780 | 0.446 | 1.062 | 1.079 | 1.129 | 0.897 | 0.462 |
| | | | | 010104 | | | 0.120 | 1.657 | 4.488 | 4.479 | 2.609 | 3.758 | 5.947 |
| | | | | 010105 | 0.053 | 0.060 | 0.062 | 0.000 | | | | | |
| | | | | 010202 | 0.180 | 0.250 | 0.164 | 0.196 | 0.620 | 0.417 | 0.600 | 0.581 | 0.566 |
| | | | | 010203 | 3.882 | 4.298 | 4.651 | 5.066 | 4.798 | 5.018 | 5.312 | 5.395 | 6.337 |
| | | 1A2 | Industry | 030100 | 4.450 | 4.596 | 3.313 | 3.534 | 3.426 | 3.763 | 3.784 | 4.179 | 5.117 |
| | | | | 030102 | 0.001 | 0.001 | | | | | 0.009 | 1.063 | 1.184 |
| | | | | 030103 | 0.440 | 0.431 | 0.411 | 0.295 | 0.342 | 0.527 | 0.521 | 0.147 | |
| | | 1A4 | Agriculture/ Forestry | 020300 | 0.170 | 0.147 | 0.147 | 0.112 | 0.098 | 0.087 | 0.087 | 0.087 | 0.077 |
| | | | | 020304 | 0.000 | 0.000 | | | | | | | |
| | | | Commercial/ Institutional | 020100 | 0.776 | 0.665 | 0.672 | 0.681 | 0.681 | 0.816 | 0.952 | 1.012 | 1.067 |
| | | | | 020105 | | 0.000 | 0.001 | | 0.000 | 0.000 | 0.000 | 0.001 | |
| | | | Residential | 020200 | 14.625 | 17.484 | 18.067 | 20.855 | 22.274 | 26.400 | 29.424 | 36.108 | 35.523 |
| WASTE | MUNICIP. WASTES | 1A1 | Electricity and heat production | 010101 | 1.231 | 2.809 | 3.502 | 0.143 | | | | | 0.028 |
| | | | | 010102 | 18.306 | 17.902 | 19.003 | 22.524 | 24.720 | 24.848 | 25.935 | 26.444 | 27.599 |
| | | | | 010103 | 8.361 | 8.343 | 8.321 | 7.848 | 7.885 | 8.133 | 8.310 | 8.503 | 8.456 |
| | | | | 010104 | 0.417 | | | 0.625 | | | 0.067 | | |
| | | | | 010105 | | | | | | | 0.740 | | |
| | | | | 010203 | 1.396 | 2.195 | 2.430 | 2.570 | 2.507 | 2.093 | 2.133 | 2.854 | 2.796 |
| | | 1A2 | Industry | 030102 | | | | 0.005 | 0.004 | 0.004 | 0.004 | | 0.042 |
| | | | | 030311 | 0.505 | 1.062 | 1.788 | 1.406 | 1.927 | 1.932 | 1.512 | 1.644 | 1.956 |
| | | 1A4 | Commercial/ Institutional | 020100 | 0.122 | | | 1.296 | 0.110 | 0.234 | 0.726 | | |
| | | | | 020103 | 0.014 | 0.013 | 0.013 | 0.075 | 0.076 | 0.173 | 0.183 | 0.049 | 0.062 |
| GAS | NATURAL GAS | 1A1 | Electricity and heat production | 010100 | 0.015 | 0.011 | 0.000 | 0.001 | 0.002 | | 0.006 | 0.027 | |
| | | | | 010101 | 23.542 | 20.515 | 19.247 | 20.165 | 19.287 | 18.925 | 20.813 | 13.887 | 13.915 |

| fuel_type | fuel_gr_abbr | NFR | nfr_name | snap_id | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 010102 | 1.590 | 4.250 | 2.893 | 1.877 | 1.582 | 2.007 | 1.080 | 1.469 | 4.175 |
| | | | | 010103 | 0.684 | 0.734 | 0.657 | 1.058 | 0.837 | 1.651 | 2.238 | 3.196 | 2.444 |
| | | | | 010104 | 22.974 | 25.003 | 30.031 | 29.928 | 30.713 | 25.116 | 31.959 | 25.441 | 26.725 |
| | | | | 010105 | 25.640 | 27.865 | 27.702 | 27.012 | 26.392 | 23.502 | 20.419 | 16.284 | 14.578 |
| | | | | 010202 | 0.218 | 0.287 | 0.291 | 0.278 | 0.428 | 0.320 | 0.123 | 0.251 | 0.437 |
| | | | | 010203 | 1.427 | 1.768 | 1.482 | 1.850 | 1.612 | 2.256 | 2.136 | 2.141 | 2.656 |
| | | | | 010205 | 0.203 | 0.228 | 0.207 | 0.172 | 0.474 | 0.552 | 0.853 | 0.302 | 0.137 |
| | | | Other energy industries | 010502 | 0.341 | 0.353 | 0.379 | 0.323 | 0.361 | 0.325 | 0.379 | 0.348 | 0.354 |
| | | | | 010504 | 25.016 | 24.413 | 26.180 | 26.247 | 27.067 | 27.791 | 28.342 | 28.131 | 27.972 |
| | | | | 010505 | 0.014 | 0.012 | 0.011 | 0.012 | 0.012 | 0.009 | 0.008 | 0.005 | 0.002 |
| | | 1A2 | Industry | 030100 | 28.608 | 30.958 | 29.348 | 28.370 | 26.869 | 27.737 | 27.625 | 29.222 | 29.104 |
| | | | | 030102 | 2.690 | 2.869 | 1.190 | 2.274 | 2.296 | 2.200 | 2.293 | 1.573 | 1.498 |
| | | | | 030103 | 0.116 | 0.118 | 0.015 | 0.119 | 0.124 | 0.190 | 0.131 | 0.172 | 0.478 |
| | | | | 030104 | 6.756 | 6.139 | 6.724 | 6.526 | 6.633 | 5.965 | 4.711 | 4.396 | 3.735 |
| | | | | 030105 | 1.556 | 1.642 | 1.545 | 1.544 | 1.570 | 1.256 | 0.952 | 0.465 | 0.485 |
| | | | | 030106 | 0.051 | 0.054 | 0.026 | 0.017 | 0.022 | 0.002 | 0.003 | | |
| | | | | 030315 | 1.101 | 1.089 | 1.016 | 0.946 | 0.911 | 0.874 | 0.827 | 0.834 | 0.869 |
| | | | | 030318 | 0.629 | 0.589 | 0.524 | 0.552 | 0.607 | 0.557 | 0.557 | 0.631 | 0.568 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 2.384 | 2.687 | 2.543 | 2.320 | 2.258 | 2.248 | 2.008 | 1.897 | 2.021 |
| | | | | 020303 | 0.062 | 0.060 | 0.064 | 0.054 | 0.054 | 0.058 | 0.042 | 0.029 | 0.027 |
| | | | | 020304 | 3.109 | 2.935 | 3.116 | 2.856 | 2.864 | 2.494 | 1.811 | 1.166 | 1.091 |
| | | | Commercial/ Institutional | 020100 | 7.234 | 7.323 | 7.624 | 9.215 | 9.200 | 9.745 | 10.728 | 10.221 | 9.983 |
| | | | | 020103 | 0.043 | 0.067 | 0.165 | 0.011 | 0.050 | 0.036 | 0.025 | 0.017 | 0.038 |
| | | | | 020104 | 0.023 | 0.031 | 0.043 | 0.034 | 0.022 | 0.013 | 0.040 | 0.024 | |
| | | | | 020105 | 1.033 | 1.045 | 1.080 | 1.023 | 1.033 | 0.862 | 0.946 | 0.832 | 0.801 |
| | | | Residential | 020200 | 27.569 | 29.262 | 28.082 | 30.023 | 29.858 | 29.524 | 28.542 | 26.640 | 26.609 |
| | | | | 020202 | 0.055 | 0.069 | 0.030 | 0.063 | 0.064 | 0.018 | 0.026 | 0.021 | 0.086 |
| | | | | 020204 | 1.439 | 1.450 | 1.392 | 1.451 | 1.476 | 1.467 | 1.499 | 1.254 | 1.212 |
| LIQUID | GAS OIL | 1A1 | Electricity and heat production | 010101 | 0.136 | 0.123 | 0.092 | 0.957 | 0.220 | 0.186 | 0.476 | 0.563 | 0.939 |
| | | | | 010102 | 0.279 | 0.367 | 0.279 | 0.115 | 0.139 | 0.116 | 0.094 | 0.136 | 0.091 |
| | | | | 010103 | | 0.034 | 0.037 | 0.017 | 0.015 | 0.022 | 0.051 | 0.004 | 0.008 |
| | | | | 010104 | 0.103 | 0.040 | 0.075 | 0.079 | 0.081 | 0.126 | 0.081 | 0.097 | 0.118 |
| | | | | 010105 | 0.069 | 0.085 | 0.066 | 0.064 | 0.107 | 0.073 | 0.060 | 0.046 | 0.014 |
| | | | | 010201 | | | | | 0.093 | 0.053 | 0.021 | 0.025 | 0.060 |
| | | | | 010202 | 0.694 | 0.830 | 0.167 | 0.256 | 0.419 | 0.178 | 0.164 | 0.304 | 0.257 |
| | | | | 010203 | 0.233 | 0.355 | 0.307 | 1.126 | 0.493 | 0.367 | 0.301 | 0.246 | 0.516 |
| | | | | 010204 | | | | | | 0.008 | 0.006 | 0.008 | |
| | | | | 010205 | | | | | 0.005 | 0.001 | 0.001 | 0.001 | 0.001 |
| | | | Other energy industries | 010505 | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| | | | Petroleum refining | 010306 | | | | 0.003 | 0.009 | 0.002 | 0.010 | 0.008 | 0.004 |
| | | 1A2 | Industry | 030100 | 2.184 | 3.011 | 2.369 | 2.666 | 2.551 | 1.694 | 0.652 | 0.002 | 0.001 |
| | | | | 030102 | 0.003 | 0.005 | 0.000 | 0.004 | 0.003 | 0.003 | 0.013 | 0.011 | 0.018 |
| | | | | 030103 | 0.082 | 0.000 | 0.000 | | | | 0.000 | | 0.000 |
| | | | | 030104 | 0.000 | | 0.001 | | | 0.002 | 0.000 | 0.000 | 0.000 |
| | | | | 030105 | 0.000 | 0.001 | | | | | | | 0.018 |
| | | | | 030106 | 0.008 | 0.010 | 0.007 | 0.007 | 0.009 | 0.009 | 0.007 | | |
| | | | | 030315 | 0.002 | 0.002 | 0.001 | 0.001 | 0.004 | 0.007 | 0.001 | 0.000 | 0.000 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 2.156 | 2.567 | 2.193 | 2.309 | 2.050 | 1.335 | 0.579 | | |
| | | | | 020304 | 0.005 | 0.003 | 0.005 | 0.006 | | 0.002 | 0.000 | 0.004 | |
| | | | Commercial/ Institutional | 020100 | 4.958 | 4.685 | 4.031 | 4.289 | 4.411 | 3.755 | 3.029 | 1.653 | 1.919 |

| fuel_type | fuel_gr_abbr | NFR | nfr_name | snap_id | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 020103 | 0.071 | 0.044 | 0.044 | 0.030 | 0.019 | 0.048 | 0.032 | 0.016 | 0.033 |
| | | | | 020105 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.001 | 0.001 | 0.008 |
| | | | Residential | 020200 | 30.276 | 31.506 | 28.998 | 27.027 | 25.291 | 23.863 | 21.197 | 18.554 | 16.857 |
| | | | | 020204 | | | | | | | | | 0.010 |
| | KEROSENE | 1A2 | Industry | 030100 | 0.008 | 0.026 | 0.065 | 0.048 | 0.020 | 0.013 | 0.019 | 0.014 | 0.016 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 0.008 | 0.023 | 0.011 | 0.011 | 0.007 | 0.008 | 0.007 | 0.004 | 0.004 |
| | | | Commercial/ Institutional | 020100 | 0.063 | 0.080 | 0.070 | 0.074 | 0.077 | 0.101 | 0.059 | 0.015 | 0.011 |
| | | | Residential | 020200 | 0.091 | 0.159 | 0.110 | 0.205 | 0.111 | 0.158 | 0.136 | 0.086 | 0.088 |
| | LPG | 1A1 | Electricity and heat production | 010101 | | | | | | | 0.000 | | 0.000 |
| | | | | 010102 | | | | | | | | | 0.000 |
| | | | | 010203 | 0.000 | | | | | 0.000 | | | 0.000 |
| | | 1A2 | Industry | 030100 | 1.019 | 0.761 | 0.678 | 0.730 | 0.749 | 0.740 | 0.775 | 0.493 | 0.404 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 0.093 | 0.080 | 0.055 | 0.058 | 0.053 | 0.046 | 0.046 | 0.027 | 0.022 |
| | | | Commercial/ Institutional | 020100 | 0.122 | 0.119 | 0.137 | 0.170 | 0.215 | 0.218 | 0.211 | 0.199 | 0.268 |
| | | | | 020105 | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | | | Residential | 020200 | 0.651 | 0.649 | 0.608 | 0.596 | 0.651 | 0.667 | 0.689 | 0.669 | 0.782 |
| | ORIMULSION | 1A1 | Electricity and heat production | 010101 | 34.148 | 30.244 | 23.846 | 1.921 | 0.019 | | | | |
| | PETROLEUM COKE | 1A1 | Electricity and heat production | 010102 | | | | | 0.007 | 0.002 | | | |
| | | 1A2 | Industry | 030100 | 0.285 | 0.128 | 0.224 | 0.230 | 0.181 | 0.163 | 0.163 | | |
| | | | | 030311 | 6.475 | 7.657 | 7.543 | 7.714 | 8.188 | 7.796 | 8.284 | 9.109 | 6.835 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 0.006 | 0.003 | 0.000 | 0.001 | | | | | |
| | | | Commercial/ Institutional | 020100 | 0.012 | 0.012 | 0.005 | 0.009 | | 0.065 | 0.009 | 0.014 | 0.025 |
| | | | Residential | 020200 | 0.513 | 0.513 | 0.509 | 0.762 | 1.005 | 1.315 | 1.264 | 1.292 | 1.314 |
| | REFINERY GAS | 1A1 | Petroleum refining | 010304 | 3.908 | 3.979 | 3.855 | 3.804 | 3.797 | 3.219 | 3.018 | 3.142 | 2.551 |
| | | | | 010306 | 11.649 | 11.777 | 11.342 | 12.750 | 12.094 | 12.128 | 13.098 | 12.774 | 12.231 |
| | RESIDUAL OIL | 1A1 | Electricity and heat production | 010101 | 4.046 | 5.951 | 5.018 | 7.329 | 5.578 | 5.461 | 4.346 | 5.502 | 3.268 |
| | | | | 010102 | 0.513 | 0.254 | 0.279 | 0.334 | 0.596 | 0.591 | 0.884 | 0.810 | 0.642 |
| | | | | 010103 | 0.109 | 0.117 | 0.120 | 0.106 | 0.017 | | | | 0.108 |
| | | | | 010104 | 0.117 | 1.768 | 6.695 | 9.359 | 7.484 | 6.336 | 8.397 | 4.501 | 4.469 |
| | | | | 010105 | 0.017 | 0.001 | 0.001 | 0.006 | 0.002 | | | | |
| | | | | 010202 | 0.059 | 0.087 | 0.123 | 0.084 | 0.034 | 0.027 | 0.030 | 0.056 | 0.040 |
| | | | | 010203 | 0.617 | 0.611 | 0.548 | 0.323 | 0.187 | 0.260 | 0.102 | 0.085 | 0.065 |
| | | | Petroleum refining | 010306 | 1.323 | 1.443 | 1.363 | 0.907 | 1.072 | 0.691 | 0.619 | 0.822 | 0.907 |
| | | 1A2 | Industry | 030100 | 8.157 | 7.629 | 8.617 | 6.610 | 6.144 | 5.041 | 7.764 | 6.017 | 2.993 |
| | | | | 030102 | 0.714 | 0.792 | 0.809 | 1.645 | 1.690 | 1.898 | 1.606 | 1.417 | 2.902 |
| | | | | 030103 | 0.140 | 0.090 | | | | | | | 0.337 |
| | | | | 030105 | | 0.000 | 0.000 | 0.001 | 0.000 | 0.005 | 0.000 | | 0.001 |
| | | | | 030311 | 0.859 | 0.502 | 0.592 | 0.587 | 0.817 | 0.694 | 0.979 | 1.056 | 0.512 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 1.779 | 1.640 | 1.365 | 0.911 | 0.720 | 0.759 | 0.904 | 0.640 | 0.636 |
| | | | | 020302 | 0.003 | 0.002 | 0.002 | 0.006 | 0.005 | 0.007 | 0.017 | 0.032 | 0.031 |
| | | | | 020304 | 0.004 | 0.005 | 0.003 | 0.003 | | | | | |
| | | | Commercial/ Institutional | 020100 | 0.343 | 0.173 | 0.478 | 0.171 | 0.108 | 0.121 | 0.252 | 0.234 | 0.465 |
| | | | Residential | 020200 | 0.036 | 0.027 | 0.149 | 0.047 | 0.044 | 0.049 | 0.195 | 0.013 | 0.013 |
| SOLID | BROWN COAL BRI. | 1A4 | Residential | 020200 | 0.026 | 0.033 | 0.019 | 0.003 | | | | | |
| | COAL | 1A1 | Electricity and heat production | 010101 | 146.911 | 158.990 | 161.608 | 225.397 | 167.931 | 140.019 | 218.347 | 180.898 | 159.452 |
| | | | | 010102 | 6.225 | 4.971 | 4.685 | 4.578 | 4.512 | 4.048 | 3.289 | 3.050 | 2.813 |
| | | | | 010103 | 0.035 | 0.024 | 0.015 | 0.034 | 0.024 | | | | 0.095 |
| | | | | 010202 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.004 | | 0.019 | |
| | | | | 010203 | 0.004 | 0.000 | | | | 0.000 | | | |
| | | 1A2 | Industry | 030100 | 3.667 | 3.554 | 2.127 | 2.826 | 3.338 | 2.724 | 2.527 | 2.716 | 1.517 |

| fuel_type | fuel_gr_abbr | NFR | nfr_name | snap_id | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 030102 | 1.063 | 0.997 | 0.998 | 1.570 | 1.499 | 1.499 | 1.431 | 1.372 | 1.468 |
| | | | | 030311 | 5.708 | 4.523 | 4.349 | 3.369 | 3.754 | 3.917 | 4.365 | 4.030 | 3.544 |
| | | 1A4 | Agriculture/ Forestry | 020300 | 1.079 | 1.234 | 0.856 | 1.203 | 1.437 | 1.787 | 2.004 | 2.053 | 1.858 |
| | | | | 020304 | | | | | | 0.003 | | | |
| | | | Commercial/ Institutional | 020100 | | | | | 0.001 | | | | |
| | | | Residential | 020200 | 0.014 | 0.013 | 0.015 | 0.000 | 0.000 | 0.008 | 0.004 | 0.007 | 0.005 |
| | COKE OVEN COKE | 1A2 | Industry | 030100 | 0.238 | 0.223 | 0.279 | 0.276 | 0.302 | 0.241 | 0.246 | 0.206 | 0.148 |
| | | | | 030102 | | | | | | | | 0.037 | 0.107 |
| | | | | 030318 | 0.944 | 0.883 | 0.786 | 0.693 | 0.814 | 0.739 | 0.765 | 0.877 | 0.782 |
| | | 1A4 | Residential | 020200 | 0.005 | 0.003 | 0.003 | 0.026 | 0.027 | 0.000 | 0.000 | 0.002 | 0.001 |
| **Grand Total** | | | | | **544.243** | **570.722** | **569.105** | **628.843** | **568.886** | **533.637** | **619.518** | **559.465** | **531.422** |

## Annex 2A-3 Lower Calorific Value (LCV) of fuels

(see table next page)

Table 56 Time-series for calorific values of fuels (DEA 2009b).

| | | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Crude Oil, Average | GJ pr tonne | 42.40 | 42.40 | 42.40 | 42.70 | 42.70 | 42.70 | 42.70 | 43.00 | 43.00 | 43.00 |
| Crude Oil, Golf | GJ pr tonne | 41.80 | 41.80 | 41.80 | 41.80 | 41.80 | 41.80 | 41.80 | 41.80 | 41.80 | 41.80 |
| Crude Oil, North Sea | GJ pr tonne | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 43.00 | 43.00 | 43.00 |
| Refinery Feedstocks | GJ pr tonne | 41.60 | 41.60 | 41.60 | 41.60 | 41.60 | 41.60 | 41.60 | 42.70 | 42.70 | 42.70 |
| Refinery Gas | GJ pr tonne | 52.00 | 52.00 | 52.00 | 52.00 | 52.00 | 52.00 | 52.00 | 52.00 | 52.00 | 52.00 |
| LPG | GJ pr tonne | 46.00 | 46.00 | 46.00 | 46.00 | 46.00 | 46.00 | 46.00 | 46.00 | 46.00 | 46.00 |
| Naphtha (LVN) | GJ pr tonne | 44.50 | 44.50 | 44.50 | 44.50 | 44.50 | 44.50 | 44.50 | 44.50 | 44.50 | 44.50 |
| Motor Gasoline | GJ pr tonne | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 |
| Aviation Gasoline | GJ pr tonne | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 |
| JP4 | GJ pr tonne | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 |
| Other Kerosene | GJ pr tonne | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 |
| JP1 | GJ pr tonne | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 |
| Gas/Diesel Oil | GJ pr tonne | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 |
| Fuel Oil | GJ pr tonne | 40.40 | 40.40 | 40.40 | 40.40 | 40.40 | 40.40 | 40.70 | 40.65 | 40.65 | 40.65 |
| Orimulsion | GJ pr tonne | 27.60 | 27.60 | 27.60 | 27.60 | 27.60 | 28.13 | 28.02 | 27.72 | 27.84 | 27.58 |
| Petroleum Coke | GJ pr tonne | 31.40 | 31.40 | 31.40 | 31.40 | 31.40 | 31.40 | 31.40 | 31.40 | 31.40 | 31.40 |
| Waste Oil | GJ pr tonne | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 |
| White Spirit | GJ pr tonne | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 |
| Bitumen | GJ pr tonne | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 |
| Lubricants | GJ pr tonne | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 |
| Natural Gas | GJ pr 1000 $Nm^3$ | 39.00 | 39.00 | 39.00 | 39.30 | 39.30 | 39.30 | 39.30 | 39.60 | 39.90 | 40.00 |
| Town Gas | GJ pr 1000 $m^3$ | | | | | | | 17.00 | 17.00 | 17.00 | 17.00 |
| Electricity Plant Coal | GJ pr tonne | 25.30 | 25.40 | 25.80 | 25.20 | 24.50 | 24.50 | 24.70 | 24.96 | 25.00 | 25.00 |
| Other Hard Coal | GJ pr tonne | 26.10 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 |
| Coke | GJ pr tonne | 31.80 | 29.30 | 29.30 | 29.30 | 29.30 | 29.30 | 29.30 | 29.30 | 29.30 | 29.30 |
| Brown Coal Briquettes | GJ pr tonne | 18.30 | 18.30 | 18.30 | 18.30 | 18.30 | 18.30 | 18.30 | 18.30 | 18.30 | 18.30 |
| Straw | GJ pr tonne | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 |
| Wood Chips | GJ pr Cubic metre | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 |
| Wood Chips | GJ pr $m^3$ | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 |
| Firewood, Hardwood | GJ pr $m^3$ | 10.40 | 10.40 | 10.40 | 10.40 | 10.40 | 10.40 | 10.40 | 10.40 | 10.40 | 10.40 |
| Firewood, Conifer | GJ pr tonne | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 |
| Wood Pellets | GJ pr tonne | 17.50 | 17.50 | 17.50 | 17.50 | 17.50 | 17.50 | 17.50 | 17.50 | 17.50 | 17.50 |
| Wood Waste | GJ pr Cubic metre | 14.70 | 14.70 | 14.70 | 14.70 | 14.70 | 14.70 | 14.70 | 14.70 | 14.70 | 14.70 |
| Wood Waste | GJ pr 1000 $m^3$ | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 |
| Biogas | GJ pr tonne | | | | | | | | 23.00 | 23.00 | 23.00 |
| Wastes | GJ pr tonne | 8.20 | 8.20 | 9.00 | 9.40 | 9.40 | 10.00 | 10.50 | 10.50 | 10.50 | 10.50 |
| Bioethanol | GJ pr tonne | 26.70 | 26.70 | 26.70 | 26.70 | 26.70 | 26.70 | 26.70 | 26.70 | 26.70 | 26.70 |
| Liquid Biofuels | GJ pr tonne | 37.60 | 37.60 | 37.60 | 37.60 | 37.60 | 37.60 | 37.60 | 37.60 | 37.60 | 37.60 |
| Fish Oil | GJ pr tonne | 37.20 | 37.20 | 37.20 | 37.20 | 37.20 | 37.20 | 37.20 | 37.20 | 37.20 | 37.20 |

| *Continued* | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| Crude Oil, Average | GJ pr tonne | 43.00 | 43.00 | 43.00 | 43.00 | 43.00 | 43.00 | 43.00 | 43.00 | 43.00 |
| Crude Oil, Golf | GJ pr tonne | 41.80 | 41.80 | 41.80 | 41.80 | 41.80 | 41.80 | 41.80 | 41.80 | 41.80 |
| Crude Oil, North Sea | GJ pr tonne | 43.00 | 43.00 | 43.00 | 43.00 | 43.00 | 43.00 | 43.00 | 43.00 | 43.00 |
| Refinery Feedstocks | GJ pr tonne | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 |
| Refinery Gas | GJ pr tonne | 52.00 | 52.00 | 52.00 | 52.00 | 52.00 | 52.00 | 52.00 | 52.00 | 52.00 |
| LPG | GJ pr tonne | 46.00 | 46.00 | 46.00 | 46.00 | 46.00 | 46.00 | 46.00 | 46.00 | 46.00 |
| Naphtha (LVN) | GJ pr tonne | 44.50 | 44.50 | 44.50 | 44.50 | 44.50 | 44.50 | 44.50 | 44.50 | 44.50 |
| Motor Gasoline | GJ pr tonne | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 |
| Aviation Gasoline | GJ pr tonne | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 |
| JP4 | GJ pr tonne | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 | 43.80 |
| Other Kerosene | GJ pr tonne | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 |
| JP1 | GJ pr tonne | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 |
| Gas/Diesel Oil | GJ pr tonne | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 | 42.70 |
| Fuel Oil | GJ pr tonne | 40.65 | 40.65 | 40.65 | 40.65 | 40.65 | 40.65 | 40.65 | 40.65 | 40.65 |
| Orimulsion | GJ pr tonne | 27.62 | 27.64 | 27.71 | 27.65 | 27.65 | 27.65 | 27.65 | 27.65 | 27.65 |
| Petroleum Coke | GJ pr tonne | 31.40 | 31.40 | 31.40 | 31.40 | 31.40 | 31.40 | 31.40 | 31.40 | 31.40 |
| Waste Oil | GJ pr tonne | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 |
| White Spirit | GJ pr tonne | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 | 43.50 |
| Bitumen | GJ pr tonne | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 |
| Lubricants | GJ pr tonne | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 | 41.90 |
| Natural Gas | GJ pr 1000 $Nm^3$ | 40.15 | 39.99 | 40.06 | 39.94 | 39.77 | 39.67 | 39.54 | 39.59 | 39.48 |
| Town Gas | GJ pr 1000 $m^3$ | 17.01 | 16.88 | 17.39 | 16.88 | 17.58 | 17.51 | 17.20 | 17.14 | 17.14 |
| Electricity Plant Coal | GJ pr tonne | 24.80 | 24.90 | 25.15 | 24.73 | 24.60 | 24.40 | 24.80 | 24.40 | 24.30 |
| Other Hard Coal | GJ pr tonne | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 | 26.50 |
| Coke | GJ pr tonne | 29.30 | 29.30 | 29.30 | 29.30 | 29.30 | 29.30 | 29.30 | 29.30 | 29.30 |
| Brown Coal Briquettes | GJ pr tonne | 18.30 | 18.30 | 18.30 | 18.30 | 18.30 | 18.30 | 18.30 | 18.30 | 18.30 |
| Straw | GJ pr tonne | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 |
| Wood Chips | GJ pr Cubic metre | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 |
| Wood Chips | GJ pr $m^3$ | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 |
| Firewood, Hardwood | GJ pr $m^3$ | 10.40 | 10.40 | 10.40 | 10.40 | 10.40 | 10.40 | 10.40 | 10.40 | 10.40 |
| Firewood, Conifer | GJ pr tonne | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 |
| Wood Pellets | GJ pr tonne | 17.50 | 17.50 | 17.50 | 17.50 | 17.50 | 17.50 | 17.50 | 17.50 | 17.50 |
| Wood Waste | GJ pr Cubic metre | 14.70 | 14.70 | 14.70 | 14.70 | 14.70 | 14.70 | 14.70 | 14.70 | 14.70 |
| Wood Waste | GJ pr 1000 $m^3$ | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 |
| Biogas | GJ pr tonne | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 |
| Wastes | GJ pr tonne | 10.50 | 10.50 | 10.50 | 10.50 | 10.50 | 10.50 | 10.50 | 10.50 | 10.50 |
| Bioethanol | GJ pr tonne | 26.70 | 26.70 | 26.70 | 26.70 | 26.70 | 26.70 | 26.70 | 26.70 | 26.70 |
| Liquid Biofuels | GJ pr tonne | 37.60 | 37.60 | 37.60 | 37.60 | 37.60 | 37.60 | 37.60 | 37.60 | 37.60 |
| Fish Oil | GJ pr tonne | 37.20 | 37.20 | 37.20 | 37.20 | 37.20 | 37.20 | 37.20 | 37.20 | 37.20 |

Table 2A-3.2 Fuel category correspondence list, DEA, NERI and Climate Convention reportings (IPCC).

| Danish Energy Agency | NERI Emission database | IPCC fuel category |
|---|---|---|
| Other Hard Coal | Coal | Solid |
| Coke | Coke oven coke | Solid |
| Electricity Plant Coal | Coal | Solid |
| Brown Coal Briquettes | Brown coal briq. | Solid |
| Orimulsion | Orimulsion | Liquid |
| Petroleum Coke | Petroleum coke | Liquid |
| Fuel Oil | Residual oil | Liquid |
| Waste Oil | Residual oil | Liquid |
| Gas/Diesel Oil | Gas oil | Liquid |
| Other Kerosene | Kerosene | Liquid |
| LPG | LPG | Liquid |
| Refinery Gas | Refinery gas | Liquid |
| Town Gas | Natural gas | Gas |
| Natural Gas | Natural gas | Gas |
| Straw | Straw | Biomass |
| Wood Waste | Wood and simil. | Biomass |
| Wood Pellets | Wood and simil. | Biomass |
| Wood Chips | Wood and simil. | Biomass |
| Firewood, Hardwood & Conifer | Wood and simil. | Biomass |
| Waste Combustion | Municip. wastes | Biomass / Other fuel |
| Fish Oil | Fish & Rape oil | Biomass |
| Biogas | Biogas | Biomass |
| Biogas, other | Biogas | Biomass |
| Biogas, landfill | Biogas | Biomass |
| Biogas, sewage sludge | Biogas | Biomass |
| (Wood applied in gas engines) | Biomass producer gas | Biomass |

# Annex 2A-4 Emission factors

Table 2A-4.1 $SO_2$, $NO_x$, NMVOC and CO emission factors and references 2008.

| | | | | | $SO_2$ | | $NO_x$ | | NMVOC | | CO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fuel type** | **Fuel** | **NFR** | **NFR_name** | **snap** | **g/GJ** | Ref. | **g/GJ** | Ref. | **g/GJ** | Ref. | **g/GJ** | Ref. |
| BIO-MASS | WOOD | 1A1a | Electricity and heat production | 010102 | 1.9 | 12 | 81 | 12 | 5.1 | 12 | 90 | 12 |
| | | | | 010103 | 1.9 | 12 | 81 | 12 | 5.1 | 12 | 90 | 12 |
| | | | | 010104 | 1.9 | 12 | 81 | 12 | 5.1 | 12 | 90 | 12 |
| | | | | 010202 | 25 | 22, 21 | 90 | 22, 21, 4 | 7.3 | 13 | 240 | 4 |
| | | | | 010203 | 25 | 22, 21 | 90 | 22, 21, 4 | 7.3 | 13 | 240 | 4 |
| | | 1A2 | Industry | 030100 | 25 | 22, 21 | 90 | 22, 21, 4 | 10 | 13 | 240 | 4 |
| | | | | 030102 | 25 | 22, 21 | 90 | 22, 21, 4 | 10 | 13 | 240 | 4 |
| | | 1A4a | Commercial/ Institutional | 020100 | 25 | 22, 21 | 90 | 22, 21, 4 | 146 | 13 | 240 | 4 |
| | | 1A4b i | Residential | 020200 | 25 | 22, 21 | 120 | 22 | 476 | 39 | 3353 | 39 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 25 | 22, 21 | 90 | 22, 21, 4 | 146 | 13 | 240 | 4 |
| | STRAW | 1A1a | Electricity and heat production | 010101 | 49 | 12 | 125 | 12 | 0.78 | 12 | 67 | 12 |
| | | | | 010102 | 49 | 12 | 125 | 12 | 0.78 | 12 | 67 | 12 |
| | | | | 010103 | 49 | 12 | 125 | 12 | 0.78 | 12 | 67 | 12 |
| | | | | 010104 | 49 | 12 | 125 | 12 | 0.78 | 12 | 67 | 12 |
| | | | | 010202 | 130 | 5 | 90 | 4, 28 | 7.3 | 13 | 325 | 4, 5 |
| | | | | 010203 | 130 | 5 | 90 | 4, 28 | 7.3 | 13 | 325 | 4, 5 |
| | | 1A4b i | Residential | 020200 | 130 | 5 | 90 | 4, 28 | 400 | 13 | 4000 | 1, 6, 7 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 130 | 5 | 90 | 4, 28 | 146 | 13 | 4000 | 1, 6, 7 |
| | FISH & RAPE OIL | 1A1a | Electricity and heat production | 010101 | 1 | 37 | 220 | 38 | 0.8 | 13 | 15 | 15 |
| | | | | 010102 | 1 | 37 | 220 | 38 | 0.8 | 13 | 15 | 15 |
| | | | | 010103 | 1 | 37 | 220 | 38 | 0.8 | 13 | 15 | 15 |
| | | | | 010202 | 1 | 37 | 65 | 15 | 0.8 | 13 | 15 | 15 |
| | | | | 010203 | 1 | 37 | 65 | 15 | 0.8 | 13 | 15 | 15 |
| | | 1A2 | Industry | 030105 | 1 | 37 | 700 | 15 | 37 | 13 | 100 | 15 |
| | | 1A4b i | Residential | 020200 | 1 | 37 | 700 | 15 | 100 | 15 | 100 | 15 |
| | BIOGAS | 1A1a | Electricity and heat production | 010102 | 25 | 26 | 28 | 4 | 2 | 16 | 36 | 4 |
| | | | | 010103 | 25 | 26 | 28 | 4 | 2 | 16 | 36 | 4 |
| | | | | 010105 | 19.2 | 31 | 202 | 12 | 10 | 12 | 310 | 12 |
| | | | | 010203 | 25 | 26 | 28 | 4 | 2 | 16 | 36 | 4 |
| | | | | 010205 | 19.2 | 31 | 202 | 12 | 10 | 12 | 310 | 12 |
| | | 1A2 | Industry | 030100 | 25 | 26 | 28 | 4 | 2 | 16 | 36 | 4 |
| | | | | 030102 | 25 | 26 | 59 | 4 | 2 | 16 | 36 | 4 |
| | | | | 030103 | 25 | 26 | 59 | 4 | (4)[15] | 16 | 36 | 4 |
| | | | | 030105 | 19.2 | 31 | 202 | 12 | 10 | 12 | 310 | 12 |
| | | 1A4a | Commercial/ Institutional | 020100 | 25 | 26 | 28 | 4 | 2 | 16 | 36 | 4 |
| | | | | 020103 | 25 | 26 | 28 | 4 | 2 | 16 | 36 | 4 |
| | | | | 020105 | 19.2 | 31 | 202 | 12 | 10 | 12 | 310 | 12 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 25 | 26 | 28 | 4 | 2 | 16 | 36 | 4 |
| | | | | 020304 | 19.2 | 31 | 202 | 12 | 10 | 12 | 310 | 12 |
| | BIO PROD GAS | 1A1a | Electricity and heat production | 010105 | 1.9 | 12 | 173 | 12 | 2 | 12 | 586 | 12 |
| | | 1A2 | Industry | 030105 | 1.9 | 12 | 173 | 12 | 2 | 12 | 586 | 12 |
| | | 1A4a | Commercial/ Institutional | 020105 | 1.9 | 12 | 173 | 12 | 2 | 12 | 586 | 12 |
| WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | 8.3 | 12 | 102 | 12 | 0.56 | 12 | 3.9 | 12 |
| | | | | 010103 | 8.3 | 12 | 102 | 12 | 0.56 | 12 | 3.9 | 12 |
| | | | | 010203 | 15 | 34 | 164 | 9 | 2 | 13 | 10 | 9 |
| | | 1A2 | Industry | 030102 | 15 | 34 | 164 | 9 | 2 | 13 | 10 | 9 |
| | | 1A4a | Commercial/ Institutional | 020103 | 15 | 34 | 164 | 9 | 2 | 13 | 10 | 9 |
| GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010101 | 0.3 | 17 | 97 | 9 | 2 | 14 | 15 | 3 |
| | | | | 010102 | 0.3 | 17 | 97 | 9 | 2 | 14 | 15 | 3 |
| | | | | 010103 | 0.3 | 17 | 42 | 9 | 2 | 14 | 28 | 4 |
| | | | | 010104 | 0.3 | 17 | 48 | 12 | 1.6 | 12 | 4.8 | 12 |
| | | | | 010105 | 0.3 | 17 | 135 | 12 | 92 | 12 | 58 | 12 |
| | | | | 010202 | 0.3 | 17 | 42 | 36 | 2 | 14 | 28 | 4 |
| | | | | 010203 | 0.3 | 17 | 42 | 36 | 2 | 14 | 28 | 4 |
| | | | | 010205 | 0.3 | 17 | 135 | 12 | 92 | 12 | 58 | 12 |
| | | 1A1c | Other energy industries | 010504 | 0.3 | 17 | 250 | 1, 8, 32 | 1.4 | 31 | 6.2 | 31 |
| | | | | 010505 | 0.3 | 17 | 135 | 12 | 92 | 12 | 58 | 12 |
| | | 1A2 | Industry | 030100 | 0.3 | 17 | 42 | 36 | 2 | 14 | 28 | 4 |
| | | | | 030103 | 0.3 | 17 | 42 | 36 | 2 | 14 | 28 | 4 |
| | | | | 030104 | 0.3 | 17 | 48 | 12 | 1.6 | 12 | 4.8 | 12 |
| | | | | 030105 | 0.3 | 17 | 135 | 12 | 92 | 12 | 58 | 12 |
| | | 1A4a | Commercial/ Institutional | 020100 | 0.3 | 17 | 30 | 1,4,11 | 2 | 14 | 28 | 4 |
| | | | | 020103 | 0.3 | 17 | 30 | 1,4,11 | 2 | 14 | 28 | 4 |
| | | | | 020105 | 0.3 | 17 | 135 | 12 | 92 | 12 | 58 | 12 |
| | | 1A4b i | Residential | 020200 | 0.3 | 17 | 30 | 1,4,11 | 4 | 11 | 20 | 11 |
| | | | | 020202 | 0.3 | 17 | 30 | 1,4,11 | 4 | 11 | 20 | 11 |
| | | | | 020204 | 0.3 | 17 | 135 | 12 | 92 | 12 | 58 | 12 |

[15] Error. Should have been 2 g pr GJ.

| Fuel type | Fuel | NFR | NFR_name | snap | $SO_2$ g/GJ | Ref. | $NO_x$ g/GJ | Ref. | NMVOC g/GJ | Ref. | CO g/GJ | Ref. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1A4c i | Agriculture/ Forestry | 020300 | 0.3 | 17 | 30 | 1,4,11 | 2 | 14 | 28 | 4 |
| | | | | 020303 | 0.3 | 17 | 48 | 12 | 1.6 | 12 | 4.8 | 12 |
| | | | | 020304 | 0.3 | 17 | 135 | 12 | 92 | 12 | 58 | 12 |
| LIQUID | PETROLEUM COKE | 1A4a | Commercial/ Institutional | 020100 | 605 | 20 | 50 | 1 | 88.8 | 13 | 1000 | 1 |
| | | 1A4b i | Residential | 020200 | 605 | 20 | 50 | 1 | 484 | 13 | 1000 | 1 |
| | RESIDUAL OIL | 1A1a | Electricity and heat production | 010101 | 82 | 18 | 1717 | 18 | 2.3 | 13 | 15 | 3 |
| | | | | 010102 | 82 | 18 | 1717 | 18 | 0.8 | 12 | 2.8 | 12 |
| | | | | 010103 | 82 | 18 | 1717 | 18 | 0.8 | 12 | 2.8 | 12 |
| | | | | 010104 | 82 | 18 | 1717 | 18 | 2.3 | 13 | 15 | 3 |
| | | | | 010202 | 344 | 25,10,24 | 142 | 4 | 2.3 | 13 | 30 | 1 |
| | | | | 010203 | 344 | 25,10,24 | 142 | 4 | 2.3 | 13 | 30 | 1 |
| | | 1A1b | Petroleum refining | 010306 | 537 | 33 | 142 | 4 | 2.3 | 13 | 30 | 1 |
| | | 1A2 | Industry | 030100 | 344 | 25,10,24 | 130 | 28 | 10 | 13 | 30 | 1 |
| | | | | 030102 | 344 | 25,10,24 | 136 | 12 | 0.8 | 12 | 2.8 | 12 |
| | | | | 030103 | 344 | 25,10,24 | 136 | 12 | 0.8 | 12 | 2.8 | 12 |
| | | | | 030105 | 344 | 25,10,24 | 130 | 28 | 10 | 13 | 100 | 1 |
| | | 1A4a | Commercial/ Institutional | 020100 | 344 | 25,10,24 | 142 | 4 | 5 | 13 | 30 | 1 |
| | | 1A4b i | Residential | 020200 | 344 | 25,10,24 | 142 | 4 | 15 | 13 | 30 | 1 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 344 | 25,10,24 | 142 | 4 | 5 | 13 | 30 | 1 |
| | | | | 020302 | 344 | 25,10,24 | 142 | 4 | 5 | 13 | 30 | 1 |
| | GAS OIL | 1A1a | Electricity and heat production | 010101 | 23 | 27 | 249 | 18 | 0.8 | 13 | 15 | 3 |
| | | | | 010102 | 23 | 27 | 249 | 18 | 0.8 | 13 | 15 | 3 |
| | | | | 010103 | 23 | 27 | 65 | 28 | 0.8 | 13 | 15 | 3 |
| | | | | 010104 | 23 | 27 | 350 | 9 | 0.2 | 13 | 15 | 3 |
| | | | | 010105 | 23 | 27 | 942 | 12 | 37 | 13 | 130 | 12 |
| | | | | 010201 | 23 | 27 | 65 | 28 | 0.8 | 13 | 30 | 1 |
| | | | | 010202 | 23 | 27 | 65 | 28 | 0.8 | 13 | 30 | 1 |
| | | | | 010203 | 23 | 27 | 65 | 28 | 0.8 | 13 | 30 | 1 |
| | | | | 010205 | 23 | 27 | 942 | 12 | 37 | 13 | 130 | 12 |
| | | 1A1b | Petroleum refining | 010306 | 23 | 27 | 65 | 28 | 0.8 | 13 | 30 | 1 |
| | | 1A2 | Industry | 030100 | 23 | 27 | 65 | 28 | 10 | 13 | 30 | 1 |
| | | | | 030102 | 23 | 27 | 65 | 28 | 5 | 13 | 30 | 1 |
| | | | | 030103 | 23 | 27 | 65 | 28 | 10 | 13 | 30 | 1 |
| | | | | 030104 | 23 | 27 | 350 | 9 | 0.2 | 13 | 15 | 3 |
| | | | | 030105 | 23 | 27 | 942 | 12 | 37 | 13 | 130 | 12 |
| | | 1A4a | Commercial/ Institutional | 020100 | 23 | 27 | 52 | 4 | 5 | 13 | 30 | 1 |
| | | | | 020103 | 23 | 27 | 52 | 4 | 5 | 13 | 30 | 1 |
| | | | | 020105 | 23 | 27 | 942 | 12 | 37 | 13 | 130 | 12 |
| | | 1A4b i | Residential | 020200 | 23 | 27 | 52 | 4 | 15 | 13 | 43 | 1 |
| | | | | 020204 | 23 | 27 | 942 | 12 | 37 | 13 | 130 | 12 |
| | KEROSENE | 1A2 | Industry | 030100 | 5 | 30 | 50 | 1 | 10 | 13 | 20 | 1 |
| | | 1A4a | Commercial/ Institutional | 020100 | 5 | 30 | 50 | 1 | 5 | 13 | 20 | 1 |
| | | 1A4b i | Residential | 020200 | 5 | 30 | 50 | 1 | 15 | 13 | 20 | 1 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 5 | 30 | 50 | 1 | 5 | 13 | 20 | 1 |
| | LPG | 1A1a | Electricity and heat production | 010102 | 0.13 | 23 | 96 | 32 | 0.8 | 13 | 25 | 1 |
| | | | | 010203 | 0.13 | 23 | 96 | 32 | 0.8 | 13 | 25 | 1 |
| | | 1A2 | Industry | 030100 | 0.13 | 23 | 96 | 32 | 5 | 13 | 25 | 1 |
| | | 1A4a | Commercial/ Institutional | 020100 | 0.13 | 23 | 71 | 32 | 5 | 13 | 25 | 1 |
| | | | | 020105 | 0.13 | 23 | 71 | 32 | 5 | 13 | 25 | 1 |
| | | 1A4b i | Residential | 020200 | 0.13 | 23 | 47 | 32 | 10 | 13 | 25 | 1 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 0.13 | 23 | 71 | 32 | 5 | 13 | 25 | 1 |
| | REFINERY GAS | 1A1b | Petroleum refining | 010304 | 1 | 2 | 170 | 9 | 1.4 | 35 | 6.2 | 35 |
| | | | | 010306 | 1 | 2 | 80 | 40 | 1.4 | 35 | 6.2 | 35 |
| SOLID | COAL | 1A1a | Electricity and heat production | 010101 | 26 | 18 | 59 | 18 | 1.2 | 13 | 10 | 3 |
| | | | | 010102 | 26 | 18 | 59 | 18 | 1.2 | 13 | 10 | 3 |
| | | | | 010103 | 26 | 18 | 59 | 18 | 1.2 | 13 | 10 | 3 |
| | | 1A2 | Industry | 030100 | 574 | 19 | 95 | 4 | 10 | 13 | 10 | 3 |
| | | 1A4b i | Residential | 020200 | 574 | 19 | 95 | 4 | 484 | 13 | 2000 | 32 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 574 | 19 | 95 | 4 | 88.8 | 13 | 931 | 13 |
| | COKE OVEN COKE | 1A2 | Industry | 030100 | 574 | 19 | 95 | 4 | 10 | 13 | 10 | 29 |
| | | 1A4b i | Residential | 020200 | 574 | 19 | 95 | 4 | 484 | 13 | 2000 | 29 |


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40. NERI calculation based on plant specific data.

Table 2A-4.2a $SO_2$, $NO_x$, NMVOC and CO emission factors time-series, g pr GJ for the years 1990 to 1999.

| pol_abbr | fuel_type | fuel_gr_abbr | nfr_id_EA | nfr_name | snap_id | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $SO_2$ | LIQUID | GAS OIL | 1A1a | Electricity and heat production | 010101 | | | | | 94 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010102 | | | | | 94 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010103 | | | | | 94 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010104 | 94 | 94 | 94 | 94 | 94 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010105 | 94 | 94 | 94 | 94 | 94 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010201 | | | | | 94 | 23 | | | | |
| | | | | | 010202 | | | | | 94 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010203 | | | | | 94 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010205 | | | | | 94 | | | | | 23 |
| | | | 1A1b | Petroleum refining | 010306 | | 94 | 94 | 94 | 94 | 23 | 23 | 23 | | |
| | | | 1A2 | Industry | 030100 | 94 | 94 | 94 | 94 | 94 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 030103 | | | | | 94 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 030105 | | | 94 | 94 | 94 | | | | | |
| | | | | | 030106 | 94 | 94 | 94 | 94 | 94 | 23 | 23 | 23 | 23 | 23 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 94 | 94 | 94 | 94 | 94 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 020102 | | | | | 94 | | 23 | | 23 | |
| | | | | | 020103 | | | | | 94 | | 23 | 23 | 23 | 23 |
| | | | | | 020105 | | | 94 | 94 | 94 | 23 | 23 | 23 | 23 | 23 |
| | | | 1A4b i | Residential | 020200 | 94 | 94 | 94 | 94 | 94 | 23 | 23 | 23 | 23 | 23 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 94 | 94 | 94 | 94 | 94 | 23 | 23 | 23 | 23 | 23 |
| | | ORIMULSION | 1A1a | Electricity and heat production | 010101 | | | | | | | 147 | 149 | | |
| | | PETROLEUM COKE | 1A2 | Industry | 030100 | 787 | | 787 | 787 | | 787 | 787 | 787 | 787 | 787 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 787 | 787 | 787 | 787 | 787 | 787 | 787 | 787 | 787 | 787 |
| | | | 1A4b i | Residential | 020200 | 787 | 787 | 787 | 787 | 787 | 787 | 787 | 787 | 787 | 787 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 787 | 787 | 787 | 787 | | 787 | 787 | 787 | 787 | 787 |
| | | REFINERY GAS | 1A1b | Petroleum refining | 010306 | 190 | 190 | 190 | 190 | | | | | | |
| | | RESIDUAL OIL | 1A1a | Electricity and heat production | 010100 | 446 | 470 | 490 | 475 | | | | | | |
| | | | | | 010101 | | | | | | 351 | 408 | 344 | 369 | 369 |
| | | | | | 010102 | 446 | 470 | 490 | 475 | 1564 | 351 | 408 | 344 | 369 | 369 |
| | | | | | 010103 | | | | | 1564 | 351 | 408 | 344 | 369 | 369 |
| | | | | | 010104 | | | | | 1564 | 351 | 408 | 344 | 369 | 369 |
| | | | | | 010105 | 446 | 470 | 490 | 475 | 1564 | 351 | 408 | 344 | 369 | 369 |
| | | | | | 010202 | | | | | 495 | 495 | 495 | 344 | 344 | 344 |
| | | | | | 010203 | | | | | 495 | 495 | 495 | 344 | 344 | 344 |
| | | | 1A1b | Petroleum refining | 010306 | 643 | 38 | 222 | 389 | | | | 537 | 537 | 537 |
| | | | 1A2 | Industry | 030100 | 495 | 495 | 495 | 495 | 495 | 495 | 495 | 344 | 344 | 344 |
| | | | | | 030102 | | | | | 495 | 495 | 495 | 344 | 344 | 344 |
| | | | | | 030103 | | | | | 495 | 495 | 495 | 344 | 344 | 344 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 495 | 495 | 495 | 495 | 495 | 495 | 495 | 344 | 344 | 344 |
| | | | 1A4b i | Residential | 020200 | 495 | 495 | 495 | 495 | 495 | 495 | 495 | 344 | 344 | 344 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 495 | 495 | 495 | 495 | 495 | 495 | 495 | 344 | 344 | 344 |
| | SOLID | COAL | 1A1a | Electricity and heat production | 010100 | 506 | 571 | 454 | 386 | | | | | | |
| | | | | | 010101 | 506 | 571 | 454 | 386 | 343 | 312 | 420 | 215 | 263 | 193 |
| | | | | | 010102 | 506 | 571 | 454 | 386 | 343 | 312 | 420 | 215 | 263 | 193 |
| | | | | | 010103 | | | | | 343 | 312 | 420 | 215 | 263 | 193 |

| | | | | | | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 010104 | | | | | 343 | 312 | 420 | 215 | | |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | 138 | 116 | 95 | 73 | | | | | | |
| | | | | | 010102 | | | | | 52 | 30 | | | 26 | 25 |
| | | | | | 010103 | | | | | 52 | 30 | 29 | 28 | 26 | 25 |
| | | | | | 010104 | | | | | 52 | 30 | 29 | 28 | 26 | 25 |
| | | | | | 010200 | 138 | 131 | 124 | 117 | | | | | | |
| | | | | | 010202 | | | | | 110 | 103 | | | | |
| | | | | | 010203 | | | | | 110 | 103 | 95 | 88 | 81 | 74 |
| | | | 1A2 | Industry | 030100 | 138 | 131 | 124 | 117 | 110 | 103 | 95 | 88 | 81 | 74 |
| | | | | | 030102 | | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 138 | 131 | 124 | 117 | 110 | 103 | 95 | 88 | 81 | 74 |
| | | | | | 020103 | | | | | 110 | 103 | 95 | 88 | 81 | 74 |
| $NO_x$ | BIOMASS | BIOGAS | 1A1a | Electricity and heat production | 010105 | 711 | 696 | 681 | 665 | 650 | 635 | 616 | 597 | 578 | 559 |
| | | | | | 010205 | | | | | 650 | | | | | |
| | | | 1A1c | Other energy industries | 010505 | 711 | 696 | 681 | 665 | 650 | 635 | 616 | 597 | 578 | 559 |
| | | | 1A2 | Industry | 030105 | | | | | | | | | 578 | 559 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 711 | 696 | 681 | 665 | 650 | 635 | 616 | 597 | 578 | 559 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 711 | 696 | 681 | 665 | 650 | 635 | 616 | 597 | 578 | 559 |
| | | FISH & RAPE OIL | 1A1a | Electricity and heat production | 010200 | 100 | 95 | 90 | 85 | | | | | | |
| | | | | | 010203 | | | | | 80 | 75 | 70 | 65 | 65 | 65 |
| | | WOOD | 1A1a | Electricity and heat production | 010202 | | | | | 130 | 130 | 130 | 130 | 130 | 90 |
| | | | | | 010203 | | | | | 130 | 130 | 130 | 130 | 130 | 90 |
| | | | 1A2 | Industry | 030100 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 90 |
| | | | | | 030102 | | | | | | | | | 130 | 90 |
| | | | | | 030103 | | | | | 130 | 130 | 130 | 130 | 130 | 90 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 90 |
| | | | | | 020105 | | | | | | | | | 130 | 90 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 90 |
| | | | | | 020304 | | | | | | | | | 130 | 90 |
| | GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010100 | | | | | | | | 115 | 115 | 115 |
| | | | | | 010101 | | | | | 115 | | | 115 | | |
| | | | | | 010102 | | | | | 115 | 115 | | | 115 | 115 |
| | | | | | 010104 | 161 | 157 | 153 | 149 | 145 | 141 | 138 | 134 | 131 | 127 |
| | | | | | 010105 | 276 | 241 | 235 | 214 | 199 | 194 | 193 | 170 | 167 | 167 |
| | | | | | 010205 | | | | | 199 | 194 | 193 | 170 | 167 | 167 |
| | | | 1A1c | Other energy industries | 010505 | 276 | 241 | 235 | 214 | 199 | 194 | 193 | 170 | 167 | 167 |
| | | | 1A2 | Industry | 030104 | 161 | | | | 145 | 141 | 138 | 134 | 131 | 127 |
| | | | | | 030105 | 276 | 241 | 235 | 214 | 199 | 194 | 193 | 170 | 167 | 167 |
| | | | 1A4a | Commercial/ Institutional | 020104 | | | | | 145 | 141 | 138 | 134 | 131 | 127 |
| | | | | | 020105 | 276 | 241 | 235 | 214 | 199 | 194 | 193 | 170 | 167 | 167 |
| | | | 1A4b i | Residential | 020204 | | 241 | 235 | 214 | 199 | 194 | 193 | 170 | 167 | 167 |
| | | | 1A4c i | Agriculture/ Forestry | 020303 | | | | | | | 138 | 134 | 131 | 127 |
| | | | | | 020304 | 276 | 241 | 235 | 214 | 199 | 194 | 193 | 170 | 167 | 167 |
| | LIQUID | GAS OIL | 1A1a | Electricity and heat production | 010103 | | | | | 80 | 75 | 65 | 65 | 65 | 65 |
| | | | | | 010105 | 1450 | 1399 | 1348 | 1298 | 1247 | 1196 | 1145 | 1094 | 1044 | 993 |
| | | | | | 010200 | 100 | 95 | 90 | 85 | | | | | | |
| | | | | | 010201 | | | | | 80 | 75 | | | | |
| | | | | | 010202 | | | | | 80 | 75 | 70 | 65 | 65 | 65 |

| | | | | | | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 010203 | | | | | 80 | 75 | 70 | 65 | 65 | 65 |
| | | | | | 010205 | | | | | 1247 | | | | | 993 |
| | | | 1A1b | Petroleum refining | 010306 | | 95 | 90 | 85 | 80 | 75 | 70 | 65 | | |
| | | | 1A2 | Industry | 030100 | 100 | 95 | 90 | 85 | 80 | 75 | 70 | 65 | 65 | 65 |
| | | | | | 030102 | | | | | | 75 | | | 65 | 65 |
| | | | | | 030103 | | | | | 80 | 75 | 70 | 65 | 65 | 65 |
| | | | | | 030105 | | | 1348 | 1298 | 1247 | | | | | |
| | | | | | 030106 | 100 | 95 | 90 | 85 | 80 | 75 | 70 | 65 | 65 | 65 |
| | | | 1A4a | Commercial/ Institutional | 020105 | | | 1348 | 1298 | 1247 | 1196 | 1145 | 1094 | 1044 | 993 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | | | | | | | 1145 | 1094 | | |
| | | ORIMULSION | 1A1a | Electricity and heat production | 010101 | | | | | | | 139 | 138 | | |
| | | PETROLEUM COKE | 1A2 | Industry | 030100 | 200 | | 200 | 200 | | 200 | 200 | 200 | 200 | 200 |
| | | REFINERY GAS | 1A1b | Petroleum refining | 010306 | 100 | 100 | 100 | 100 | | | | | | |
| | | RESIDUAL OIL | 1A1a | Electricity and heat production | 010100 | 342 | 384 | 294 | 289 | | | | | | |
| | | | | | 010101 | | | | | | 239 | 250 | 200 | 177 | 152 |
| | | | | | 010102 | 342 | 384 | 294 | 289 | 267 | 239 | 250 | 200 | 177 | 152 |
| | | | | | 010103 | | | | | 267 | 239 | 250 | 200 | 177 | 152 |
| | | | | | 010104 | | | | | 267 | 239 | 250 | 200 | 177 | 152 |
| | | | | | 010105 | 342 | 384 | 294 | 289 | 267 | 239 | 250 | 200 | 177 | 152 |
| | SOLID | BROWN COAL BRI. | 1A4b i | Residential | 020200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| | | COAL | 1A1a | Electricity and heat production | 010100 | 342 | 384 | 294 | 289 | | | | | | |
| | | | | | 010101 | 342 | 384 | 294 | 289 | 267 | 239 | 250 | 200 | 177 | 152 |
| | | | | | 010102 | 342 | 384 | 294 | 289 | 267 | 239 | 250 | 200 | 177 | 152 |
| | | | | | 010103 | | | | | 267 | 239 | 250 | 200 | 177 | 152 |
| | | | | | 010104 | | | | | 267 | 239 | 250 | 200 | | |
| | | | | | 010202 | | | | | 200 | 200 | 200 | 200 | 200 | 200 |
| | | | | | 010203 | | | | | 200 | 200 | 200 | 200 | 200 | 200 |
| | | | 1A2 | Industry | 030100 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | |
| | | | 1A4b i | Residential | 020200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| | | COKE OVEN COKE | 1A2 | Industry | 030100 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| | | | 1A4b i | Residential | 020200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | | | | | 134 | 134 | | | 134 | 129 |
| | | | | | 010103 | | | | | 134 | 134 | 134 | 134 | 134 | 129 |
| | | | | | 010104 | | | | | 134 | 134 | 134 | 134 | 134 | 129 |
| NMVOC | BIOMASS | BIOGAS | 1A1a | Electricity and heat production | 010105 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | | | | | 010205 | | | | | 14 | | | | | |
| | | | 1A1c | Other energy industries | 010505 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | | | 1A2 | Industry | 030105 | | | | | | | | | 14 | 14 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | | STRAW | 1A2 | Industry | 030100 | | | | | | | | | 37 | 24 |
| | | | 1A4b i | Residential | 020200 | 925 | 872.5 | 820 | 767 | 715 | 663 | 610 | 558 | 505 | 453 |
| | | WOOD | 1A2 | Industry | 030100 | 146 | 132 | 119 | 105 | 92 | 78 | 64 | 51 | 37 | 24 |
| | | | | | 030103 | | | | | 92 | 78 | 64 | 51 | 37 | 24 |
| | | | 1A4b i | Residential | 020200 | 650 | 650 | 650 | 650 | 650 | 650 | 650 | 650 | 650 | 650 |

| | | | | | | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010104 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| | | | | | 010105 | 60 | 69 | 81 | 127 | 140 | 142 | 138 | 124 | 122 | 122 |
| | | | | | 010205 | | | | | 140 | 142 | 138 | 124 | 122 | 122 |
| | | | 1A1c | Other energy industries | 010505 | 60 | 69 | 81 | 127 | 140 | 142 | 138 | 124 | 122 | 122 |
| | | | 1A2 | Industry | 030104 | 1.4 | | | | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| | | | | | 030105 | 60 | 69 | 81 | 127 | 140 | 142 | 138 | 124 | 122 | 122 |
| | | | 1A4a | Commercial/ Institutional | 020104 | | | | | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| | | | | | 020105 | 60 | 69 | 81 | 127 | 140 | 142 | 138 | 124 | 122 | 122 |
| | | | 1A4b i | Residential | 020204 | | 69 | 81 | 127 | 140 | 142 | 138 | 124 | 122 | 122 |
| | | | 1A4c i | Agriculture/ Forestry | 020303 | | | | | | | 1.4 | 1.4 | 1.4 | 1.4 |
| | | | | | 020304 | 60 | 69 | 81 | 127 | 140 | 142 | 138 | 124 | 122 | 122 |
| | LIQUID | REFINERY GAS | 1A1b | Petroleum refining | 010306 | 4 | 4 | 4 | 4 | | | | | | |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | | | | | 0.98 | 0.98 | | | 0.98 | 0.98 |
| | | | | | 010103 | | | | | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| | | | | | 010104 | | | | | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| CO | BIOMASS | BIOGAS | 1A1a | Electricity and heat production | 010105 | 230 | 234 | 239 | 243 | 248 | 252 | 256 | 260 | 265 | 269 |
| | | | | | 010205 | | | | | 248 | | | | | |
| | | | 1A1c | Other energy industries | 010505 | 230 | 234 | 239 | 243 | 248 | 252 | 256 | 260 | 265 | 269 |
| | | | 1A2 | Industry | 030105 | | | | | | | | | 265 | 269 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 230 | 234 | 239 | 243 | 248 | 252 | 256 | 260 | 265 | 269 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 230 | 234 | 239 | 243 | 248 | 252 | 256 | 260 | 265 | 269 |
| | | STRAW | 1A1a | Electricity and heat production | 010200 | 600 | 554 | 508 | 463 | | | | | | |
| | | | | | 010202 | | | | | 417 | 371 | 325 | 325 | 325 | 325 |
| | | | | | 010203 | | | | | 417 | 371 | 325 | 325 | 325 | 325 |
| | | | 1A4b i | Residential | 020200 | 8500 | 8500 | 8500 | 8500 | 8500 | 7500 | 6500 | 5500 | 4500 | 4000 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 8500 | 8500 | 8500 | 8500 | 8500 | 7500 | 6500 | 5500 | 4500 | 4000 |
| | | WOOD | 1A1a | Electricity and heat production | 010200 | 400 | 373 | 347 | 320 | | | | | | |
| | | | | | 010202 | | | | | 293 | 267 | 240 | 240 | 240 | 240 |
| | | | | | 010203 | | | | | 293 | 267 | 240 | 240 | 240 | 240 |
| | | | 1A2 | Industry | 030100 | 400 | 373 | 347 | 320 | 293 | 267 | 240 | 240 | 240 | 240 |
| | | | | | 030103 | | | | | 293 | 267 | 240 | 240 | 240 | 240 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 400 | 373 | 347 | 320 | 293 | 267 | 240 | 240 | 240 | 240 |
| | | | 1A4b i | Residential | 020200 | 4146 | 4146 | 4146 | 4146 | 4146 | 4146 | 4146 | 4146 | 4146 | 4146 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 400 | 373 | 347 | 320 | 293 | 267 | 240 | 240 | 240 | 240 |
| | GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010104 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 |
| | | | | | 010105 | 189 | 211 | 212 | 227 | 226 | 222 | 221 | 182 | 182 | 182 |
| | | | | | 010205 | | | | | 226 | 222 | 221 | 182 | 182 | 182 |
| | | | 1A1c | Other energy industries | 010505 | 189 | 211 | 212 | 227 | 226 | 222 | 221 | 182 | 182 | 182 |
| | | | 1A2 | Industry | 030104 | 6.2 | | | | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 |
| | | | | | 030105 | 189 | 211 | 212 | 227 | 226 | 222 | 221 | 182 | 182 | 182 |
| | | | 1A4a | Commercial/ Institutional | 020104 | | | | | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 |
| | | | | | 020105 | 189 | 211 | 212 | 227 | 226 | 222 | 221 | 182 | 182 | 182 |
| | | | 1A4b i | Residential | 020204 | | 211 | 212 | 227 | 226 | 222 | 221 | 182 | 182 | 182 |
| | | | 1A4c i | Agriculture/ Forestry | 020303 | | | | | | | 6.2 | 6.2 | 6.2 | 6.2 |
| | | | | | 020304 | 189 | 211 | 212 | 227 | 226 | 222 | 221 | 182 | 182 | 182 |
| | LIQUID | REFINERY GAS | 1A1b | Petroleum refining | 010306 | 15 | 15 | 15 | 15 | | | | | | |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | | | | | 7.4 | 7.4 | | | 7.4 | 7.4 |

| | | | | | | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 010103 | | | | | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |
| | | | | | 010104 | | | | | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |
| | | | | | 010200 | 100 | 85 | 70 | 55 | | | | | | |
| | | | | | 010202 | | | | | 40 | 25 | | | | |
| | | | | | 010203 | | | | | 40 | 25 | 10 | 10 | 10 | 10 |
| | | | 1A2 | Industry | 030100 | 100 | 85 | 70 | 55 | 40 | 25 | 10 | 10 | 10 | 10 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 100 | 85 | 70 | 55 | 40 | 25 | 10 | 10 | 10 | 10 |
| | | | | | 020103 | | | | | 40 | 25 | 10 | 10 | 10 | 10 |

Table 2A-4.2b $SO_2$, $NO_x$, NMVOC and CO emission factors time-series, g pr GJ for the years 2000 to 2008.

| | | | | | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pol_abbr | fuel_type | fuel_gr_abbr | nfr_id_EA | nfr_name | snap_id | | | | | | | | | |
| $SO_2$ | LIQUID | GAS OIL | 1A1a | Electricity and heat production | 010101 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010102 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010103 | | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010104 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010105 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010201 | | | | | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010202 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010203 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 010205 | | | | | 23 | 23 | 23 | 23 | 23 |
| | | | 1A1b | Petroleum refining | 010306 | | | | 23 | 23 | 23 | 23 | 23 | 23 |
| | | | 1A2 | Industry | 030100 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 030103 | 23 | 23 | 23 | | | | 23 | | 23 |
| | | | | | 030105 | 23 | 23 | | | | | | | 23 |
| | | | | | 030106 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 020102 | | | | | | | | | |
| | | | | | 020103 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | | | | | 020105 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | | | 1A4b i | Residential | 020200 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | | |
| | | ORIMULSION | 1A1a | Electricity and heat production | 010101 | | 10 | 12 | 12 | 12 | | | | |
| | | PETROLEUM COKE | 1A2 | Industry | 030100 | 787 | 605 | 605 | 605 | 605 | 605 | 605 | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 787 | 605 | 605 | 605 | | 605 | 605 | 605 | 605 |
| | | | 1A4b i | Residential | 020200 | 787 | 605 | 605 | 605 | 605 | 605 | 605 | 605 | 605 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 787 | 605 | 605 | 605 | | | | | |
| | | REFINERY GAS | 1A1b | Petroleum refining | 010306 | | | | | | 1 | 1 | 1 | 1 |
| | | RESIDUAL OIL | 1A1a | Electricity and heat production | 010100 | | | | | | | | | |
| | | | | | 010101 | 403 | 315 | 290 | 334 | 349 | 283 | 308 | 206 | 82 |
| | | | | | 010102 | 403 | 315 | 290 | 334 | 349 | 283 | 308 | 206 | 82 |
| | | | | | 010103 | 403 | 315 | 290 | 334 | 349 | | | | 82 |
| | | | | | 010104 | 403 | 315 | 290 | 334 | 349 | 283 | 308 | 206 | 82 |
| | | | | | 010105 | 403 | 315 | 290 | 334 | 349 | | | | |
| | | | | | 010202 | 344 | 344 | 344 | 344 | 344 | 344 | 344 | 344 | 344 |

| | | | | | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 010203 | 344 | 344 | 344 | 344 | 344 | 344 | 344 | 344 | 344 |
| | | | 1A1b | Petroleum refining | 010306 | 537 | 537 | 537 | 537 | 537 | 537 | 537 | 537 | 537 |
| | | | 1A2 | Industry | 030100 | 344 | 344 | 344 | 344 | 344 | 344 | 344 | 344 | 344 |
| | | | | | 030102 | 344 | 344 | 344 | 344 | 344 | 344 | 344 | 344 | 344 |
| | | | | | 030103 | 344 | 344 | | | | | | | 344 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 344 | 344 | 344 | 344 | 344 | 344 | 344 | 344 | 344 |
| | | | 1A4b i | Residential | 020200 | 344 | 344 | 344 | 344 | 344 | 344 | 344 | 344 | 344 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 344 | 344 | 344 | 344 | 344 | 344 | 344 | 344 | 344 |
| | SOLID | COAL | 1A1a | Electricity and heat production | 010100 | | | | | | | | | |
| | | | | | 010101 | 64 | 47 | 45 | 61 | 42 | 41 | 37 | 40 | 26 |
| | | | | | 010102 | 64 | 47 | 45 | 61 | 42 | 41 | 37 | 40 | 26 |
| | | | | | 010103 | 64 | 47 | 45 | 61 | 42 | | | | 26 |
| | | | | | 010104 | | | | | | | | | |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | | | | | | | | | |
| | | | | | 010102 | 24 | 24 | 24 | 24 | 19 | 14 | 8.3 | 8.3 | 8.3 |
| | | | | | 010103 | 24 | 24 | 24 | 24 | 19 | 14 | 8.3 | 8.3 | 8.3 |
| | | | | | 010104 | 24 | | | 24 | | | 8.3 | | |
| | | | | | 010200 | | | | | | | | | |
| | | | | | 010202 | | | | | | | | | |
| | | | | | 010203 | 67 | 60 | 52 | 45 | 37 | 30 | 22 | 15 | 15 |
| | | | 1A2 | Industry | 030100 | | | | | | | | | |
| | | | | | 030102 | | | | 45 | 37 | 30 | 22 | | 15 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 67 | | | 45 | 37 | 30 | 22 | | |
| | | | | | 020103 | 67 | 60 | 52 | 45 | 37 | 30 | 22 | 15 | 15 |
| $NO_X$ | BIOMASS | BIOGAS | 1A1a | Electricity and heat production | 010105 | 540 | 484 | 427 | 371 | 315 | 259 | 202 | 202 | 202 |
| | | | | | 010205 | | | | | 315 | 259 | 202 | 202 | 202 |
| | | | 1A1c | Other energy industries | 010505 | 540 | 484 | 427 | 371 | 315 | 259 | 202 | 202 | |
| | | | 1A2 | Industry | 030105 | 540 | 484 | 427 | 371 | 315 | | 202 | 202 | 202 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 540 | 484 | 427 | 371 | 315 | 259 | 202 | 202 | 202 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 540 | 484 | 427 | 371 | 315 | 259 | 202 | 202 | 202 |
| | | FISH & RAPE OIL | 1A1a | Electricity and heat production | 010200 | | | | | | | | | |
| | | | | | 010203 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| | | WOOD | 1A1a | Electricity and heat production | 010202 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| | | | | | 010203 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| | | | 1A2 | Industry | 030100 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| | | | | | 030102 | 90 | 90 | | | | | 90 | 90 | 90 |
| | | | | | 030103 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| | | | | | 020105 | | 90 | 90 | | 90 | 90 | 90 | 90 | |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| | | | | | 020304 | 90 | 90 | | | | | | | |
| | GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010100 | 115 | 115 | 115 | 115 | 97 | | 97 | 97 | |
| | | | | | 010101 | | 115 | 115 | 115 | 97 | 97 | 97 | 97 | 97 |
| | | | | | 010102 | 115 | 115 | 115 | 115 | 97 | 97 | 97 | 97 | 97 |
| | | | | | 010104 | 124 | 119 | 113 | 108 | 103 | 98 | 73 | 48 | 48 |
| | | | | | 010105 | 168 | 163 | 158 | 153 | 148 | 143 | 139 | 135 | 135 |
| | | | | | 010205 | 168 | 163 | 158 | 153 | 148 | 143 | 139 | 135 | 135 |
| | | | 1A1c | Other energy industries | 010505 | 168 | 163 | 158 | 153 | 148 | 143 | 139 | 135 | 135 |

| | | | | | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1A2 | Industry | 030104 | 124 | 119 | 113 | 108 | 103 | 98 | 73 | 48 | 48 |
| | | | | | 030105 | 168 | 163 | 158 | 153 | 148 | 143 | 139 | 135 | 135 |
| | | | 1A4a | Commercial/ Institutional | 020104 | 124 | 119 | 113 | 108 | 103 | 98 | 73 | 48 | |
| | | | | | 020105 | 168 | 163 | 158 | 153 | 148 | 143 | 139 | 135 | 135 |
| | | | 1A4b i | Residential | 020204 | 168 | 163 | 158 | 153 | 148 | 143 | 139 | 135 | 135 |
| | | | 1A4c i | Agriculture/ Forestry | 020303 | 124 | 119 | 113 | 108 | 103 | 98 | 73 | 48 | 48 |
| | | | | | 020304 | 168 | 163 | 158 | 153 | 148 | 143 | 139 | 135 | 135 |
| | LIQUID | GAS OIL | 1A1a | Electricity and heat production | 010103 | | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| | | | | | 010105 | 942 | 942 | 942 | 942 | 942 | 942 | 942 | 942 | 942 |
| | | | | | 010200 | | | | | | | | | |
| | | | | | 010201 | | | | | 65 | 65 | 65 | 65 | 65 |
| | | | | | 010202 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| | | | | | 010203 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| | | | | | 010205 | | | | | 942 | 942 | 942 | 942 | 942 |
| | | | 1A1b | Petroleum refining | 010306 | | | | 65 | 65 | 65 | 65 | 65 | 65 |
| | | | 1A2 | Industry | 030100 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| | | | | | 030102 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| | | | | | 030103 | 65 | 65 | 65 | | | | 65 | | 65 |
| | | | | | 030105 | 942 | 942 | | | | | | | 942 |
| | | | | | 030106 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | | |
| | | | 1A4a | Commercial/ Institutional | 020105 | 942 | 942 | 942 | 942 | 942 | 942 | 942 | 942 | 942 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 942 | 942 | 942 | 942 | | 942 | 942 | 942 | |
| | | ORIMULSION | 1A1a | Electricity and heat production | 010101 | | 88 | 86 | 86 | 86 | | | | |
| | | PETROLEUM COKE | 1A2 | Industry | 030100 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | | |
| | | REFINERY GAS | 1A1b | Petroleum refining | 010306 | | | | | | 80 | 80 | 80 | 80 |
| | | RESIDUAL OIL | 1A1a | Electricity and heat production | 010100 | | | | | | | | | |
| | | | | | 010101 | 129 | 122 | 130 | 144 | 131 | 127 | 109 | 98 | 1717 |
| | | | | | 010102 | 129 | 122 | 130 | 144 | 131 | 127 | 109 | 98 | 1717 |
| | | | | | 010103 | 129 | 122 | 130 | 144 | 131 | | | | 1717 |
| | | | | | 010104 | 129 | 122 | 130 | 144 | 131 | 127 | 109 | 98 | 1717 |
| | | | | | 010105 | 129 | 122 | 130 | 144 | 131 | | | | |
| | SOLID | BROWN COAL BRI. | 1A4b i | Residential | 020200 | 95 | 95 | 95 | 95 | | | | | |
| | | COAL | 1A1a | Electricity and heat production | 010100 | | | | | | | | | |
| | | | | | 010101 | 129 | 122 | 130 | 144 | 131 | 127 | 109 | 98 | 59 |
| | | | | | 010102 | 129 | 122 | 130 | 144 | 131 | 127 | 109 | 98 | 59 |
| | | | | | 010103 | 129 | 122 | 130 | 144 | 131 | | | | 59 |
| | | | | | 010104 | | | | | | | | | |
| | | | | | 010202 | 95 | 95 | 95 | 95 | 95 | 95 | | 95 | |
| | | | | | 010203 | 95 | 95 | | | | 95 | | | |
| | | | 1A2 | Industry | 030100 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| | | | 1A4a | Commercial/ Institutional | 020100 | | | | | 95 | | | | |
| | | | 1A4b i | Residential | 020200 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| | | COKE OVEN COKE | 1A2 | Industry | 030100 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| | | | 1A4b i | Residential | 020200 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | 124 | 124 | 124 | 124 | 117 | 110 | 102 | 102 | 102 |
| | | | | | 010103 | 124 | 124 | 124 | 124 | 117 | 110 | 102 | 102 | 102 |
| | | | | | 010104 | 124 | | | 124 | | | 102 | | |

| | | | | | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NMVOC | BIOMASS | BIOGAS | 1A1a | Electricity and heat production | 010105 | 14 | 13 | 13 | 12 | 11 | 10 | 10 | 10 | 10 |
| | | | | | 010205 | | | | | 11 | 10 | 10 | 10 | 10 |
| | | | 1A1c | Other energy industries | 010505 | 14 | 13 | 13 | 12 | 11 | 10 | 10 | 10 | |
| | | | 1A2 | Industry | 030105 | 14 | 13 | 13 | 12 | 11 | | 10 | 10 | 10 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 14 | 13 | 13 | 12 | 11 | 10 | 10 | 10 | 10 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 14 | 13 | 13 | 12 | 11 | 10 | 10 | 10 | 10 |
| | | STRAW | 1A2 | Industry | 030100 | | | | | | | | | |
| | | | 1A4b i | Residential | 020200 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| | | WOOD | 1A2 | Industry | 030100 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | | | | | 030103 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | |
| | | | 1A4b i | Residential | 020200 | 650 | 582 | 557 | 554 | 550 | 528 | 508 | 508 | 476 |
| | GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010104 | 1.4 | 1.4 | 1.5 | 1.5 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| | | | | | 010105 | 121 | 114 | 108 | 101 | 95 | 88 | 90 | 92 | 92 |
| | | | | | 010205 | 121 | 114 | 108 | 101 | 95 | 88 | 90 | 92 | 92 |
| | | | 1A1c | Other energy industries | 010505 | 121 | 114 | 108 | 101 | 95 | 88 | 90 | 92 | 92 |
| | | | 1A2 | Industry | 030104 | 1.4 | 1.4 | 1.5 | 1.5 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| | | | | | 030105 | 121 | 114 | 108 | 101 | 95 | 88 | 90 | 92 | 92 |
| | | | 1A4a | Commercial/ Institutional | 020104 | 1.4 | 1.4 | 1.5 | 1.5 | 1.6 | 1.6 | 1.6 | 1.6 | |
| | | | | | 020105 | 121 | 114 | 108 | 101 | 95 | 88 | 90 | 92 | 92 |
| | | | 1A4b i | Residential | 020204 | 121 | 114 | 108 | 101 | 95 | 88 | 90 | 92 | 92 |
| | | | 1A4c i | Agriculture/ Forestry | 020303 | 1.4 | 1.4 | 1.5 | 1.5 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| | | | | | 020304 | 121 | 114 | 108 | 101 | 95 | 88 | 90 | 92 | 92 |
| | LIQUID | REFINERY GAS | 1A1b | Petroleum refining | 010306 | | | | | | 1.4 | 1.4 | 1.4 | 1.4 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | 1 | 1 | 1 | 1 | 0.85 | 0.71 | 0.56 | 0.56 | 0.56 |
| | | | | | 010103 | 1 | 1 | 1 | 1 | 0.85 | 0.71 | 0.56 | 0.56 | 0.56 |
| | | | | | 010104 | 1 | | | 1 | | | 0.56 | | |
| CO | BIOMASS | BIOGAS | 1A1a | Electricity and heat production | 010105 | 273 | 279 | 285 | 292 | 298 | 304 | 310 | 310 | 310 |
| | | | | | 010205 | | | | | 298 | 304 | 310 | 310 | 310 |
| | | | 1A1c | Other energy industries | 010505 | 273 | 279 | 285 | 292 | 298 | 304 | 310 | 310 | |
| | | | 1A2 | Industry | 030105 | 273 | 279 | 285 | 292 | 298 | | 310 | 310 | 310 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 273 | 279 | 285 | 292 | 298 | 304 | 310 | 310 | 310 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 273 | 279 | 285 | 292 | 298 | 304 | 310 | 310 | 310 |
| | | STRAW | 1A1a | Electricity and heat production | 010200 | | | | | | | | | |
| | | | | | 010202 | 325 | 325 | | | 325 | 325 | 325 | 325 | 325 |
| | | | | | 010203 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 |
| | | | 1A4b i | Residential | 020200 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| | | WOOD | 1A1a | Electricity and heat production | 010200 | | | | | | | | | |
| | | | | | 010202 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 |
| | | | | | 010203 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 |
| | | | 1A2 | Industry | 030100 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 |
| | | | | | 030103 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 |
| | | | 1A4b i | Residential | 020200 | 4146 | 3779 | 3656 | 3659 | 3657 | 3546 | 3436 | 3491 | 3353 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 |
| | GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010104 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 5.5 | 4.8 | 4.8 |
| | | | | | 010105 | 183 | 163 | 142 | 122 | 101 | 81 | 70 | 58 | 58 |

| | | | | | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 010205 | 183 | 163 | 142 | 122 | 101 | 81 | 70 | 58 | 58 |
| | | | 1A1c | Other energy industries | 010505 | 183 | 163 | 142 | 122 | 101 | 81 | 70 | 58 | 58 |
| | | | 1A2 | Industry | 030104 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 5.5 | 4.8 | 4.8 |
| | | | | | 030105 | 183 | 163 | 142 | 122 | 101 | 81 | 70 | 58 | 58 |
| | | | 1A4a | Commercial/ Institutional | 020104 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 5.5 | 4.8 | |
| | | | | | 020105 | 183 | 163 | 142 | 122 | 101 | 81 | 70 | 58 | 58 |
| | | | 1A4b i | Residential | 020204 | 183 | 163 | 142 | 122 | 101 | 81 | 70 | 58 | 58 |
| | | | 1A4c i | Agriculture/ Forestry | 020303 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 5.5 | 4.8 | 4.8 |
| | | | | | 020304 | 183 | 163 | 142 | 122 | 101 | 81 | 70 | 58 | 58 |
| | LIQUID | REFINERY GAS | 1A1b | Petroleum refining | 010306 | | | | | | 6.2 | 6.2 | 6.2 | 6.2 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | 8 | 8 | 8 | 8 | 6.6 | 5.3 | 3.9 | 3.9 | 3.9 |
| | | | | | 010103 | 8 | 8 | 8 | 8 | 6.6 | 5.3 | 3.9 | 3.9 | 3.9 |
| | | | | | 010104 | 8 | | | 8 | | | 3.9 | | |
| | | | | | 010200 | | | | | | | | | |
| | | | | | 010202 | | | | | | | | | |
| | | | | | 010203 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | | | 1A2 | Industry | 030100 | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 10 | | | 10 | 10 | 10 | 10 | | |
| | | | | | 020103 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

Table 2A-4.3 PM emission factors and references, 2008.

| fuel_type | fuel_gr_abbr | NFR | nfr_name | snap | TSP g pr GJ | Ref. | $PM_{10}$ g pr GJ | Ref. | $PM_{2.5}$ g pr GJ | Ref. |
|---|---|---|---|---|---|---|---|---|---|---|
| BIOMASS | WOOD | 1A1a | Electricity and heat production | 010102 | 10 | 18 | 1.94 | 3 | 1.23 | 3 |
| | | | | 010103 | 10 | 18 | 1.94 | 3 | 1.23 | 3 |
| | | | | 010104 | 10 | 18 | 1.94 | 3 | 1.23 | 3 |
| | | | | 010202 | 19 | 1 | 13 | 2 | 10 | 2 |
| | | | | 010203 | 19 | 1 | 13 | 2 | 10 | 2 |
| | | 1A2 | Industry | 030100 | 19 | 1 | 13 | 2 | 10 | 2 |
| | | | | 030102 | 19 | 1 | 13 | 2 | 10 | 2 |
| | | 1A4a | Commercial/ Institutional | 020100 | 143 | 1 | 143 | 9 | 135 | 9 |
| | | 1A4b i | Residential | 020200 | 570 | 17 | 543 | 17 | 533 | 17 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 143 | 1 | 143 | 9 | 135 | 9 |
| | STRAW | 1A1a | Electricity and heat production | 010101 | 2.3 | 18 | 0.133 | 3 | 0.102 | 3 |
| | | | | 010102 | 2.3 | 18 | 0.133 | 3 | 0.102 | 3 |
| | | | | 010103 | 2.3 | 18 | 0.133 | 3 | 0.102 | 3 |
| | | | | 010104 | 2.3 | 18 | 0.133 | 3 | 0.102 | 3 |
| | | | | 010202 | 21 | 1 | 15 | 2 | 12 | 2 |
| | | | | 010203 | 21 | 1 | 15 | 2 | 12 | 2 |
| | | 1A4b i | Residential | 020200 | 234 | 4 | 222 | 5 | 211 | 5 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 234 | 4 | 222 | 5 | 211 | 5 |
| | FISH & RAPE OIL | 1A1a | Electricity and heat production | 010101 | 5 | 15 | 5 | 15 | 5 | 15 |
| | | | | 010102 | 5 | 15 | 5 | 15 | 5 | 15 |
| | | | | 010103 | 5 | 15 | 5 | 15 | 5 | 15 |
| | | | | 010202 | 5 | 15 | 5 | 15 | 5 | 15 |
| | | | | 010203 | 5 | 15 | 5 | 15 | 5 | 15 |
| | | 1A2 | Industry | 030105 | 5 | 15 | 5 | 15 | 5 | 15 |
| | | 1A4b i | Residential | 020200 | 5 | 15 | 5 | 15 | 5 | 15 |
| | BIOGAS | 1A1a | Electricity and heat production | 010102 | 1.5 | 6 | 1.5 | 7 | 1.5 | 7 |
| | | | | 010103 | 1.5 | 6 | 1.5 | 7 | 1.5 | 7 |
| | | | | 010105 | 2.63 | 3 | 0.451 | 3 | 0.206 | 3 |
| | | | | 010203 | 1.5 | 6 | 1.5 | 7 | 1.5 | 7 |
| | | | | 010205 | 2.63 | 3 | 0.451 | 3 | 0.206 | 3 |
| | | 1A2 | Industry | 030100 | 1.5 | 6 | 1.5 | 7 | 1.5 | 7 |
| | | | | 030102 | 1.5 | 6 | 1.5 | 7 | 1.5 | 7 |
| | | | | 030103 | 1.5 | 6 | 1.5 | 7 | 1.5 | 7 |
| | | | | 030105 | 2.63 | 3 | 0.451 | 3 | 0.206 | 3 |
| | | 1A4a | Commercial/ Institutional | 020100 | 1.5 | 6 | 1.5 | 7 | 1.5 | 7 |
| | | | | 020103 | 1.5 | 6 | 1.5 | 7 | 1.5 | 7 |
| | | | | 020105 | 2.63 | 3 | 0.451 | 3 | 0.206 | 3 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 1.5 | 6 | 1.5 | 7 | 1.5 | 7 |
| | | | | 020304 | 2.63 | 3 | 0.451 | 3 | 0.206 | 3 |
| | BIO PROD GAS | 1A1a | Electricity and heat production | 010105 | 2.63 | 19 | 0.451 | 19 | 0.206 | 19 |
| | | 1A2 | Industry | 030105 | 2.63 | 19 | 0.451 | 19 | 0.206 | 19 |
| | | 1A4a | Commercial/ Institutional | 020105 | 2.63 | 19 | 0.451 | 19 | 0.206 | 19 |
| WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | 0.29 | 18 | 1.126[16] | 3 | 1.084[16] | 3 |
| | | | | 010103 | 0.29 | 18 | 1.126[16] | 3 | 1.084[16] | 3 |
| | | | | 010203 | 4.2 | 20 | 3.2 | 11 | 2.1 | 11 |
| | | 1A2 | Industry | 030102 | 4.2 | 20 | 3.2 | 11 | 2.1 | 11 |
| | | 1A4a | Commercial/ Institutional | 020103 | 4.2 | 20 | 3.2 | 11 | 2.1 | 11 |
| GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010101 | 0.1 | 9 | 0.1 | 9 | 0.1 | 9 |
| | | | | 010102 | 0.1 | 9 | 0.1 | 9 | 0.1 | 9 |
| | | | | 010103 | 0.1 | 9 | 0.1 | 9 | 0.1 | 9 |
| | | | | 010104 | 0.1 | 3 | 0.061 | 3 | 0.051 | 3 |
| | | | | 010105 | 0.76 | 3 | 0.189 | 3 | 0.161 | 3 |
| | | | | 010202 | 0.1 | 9 | 0.1 | 9 | 0.1 | 9 |
| | | | | 010203 | 0.1 | 9 | 0.1 | 9 | 0.1 | 9 |
| | | | | 010205 | 0.76 | 9 | 0.189 | 9 | 0.161 | 9 |
| | | 1A1c | Other energy industries | 010504 | 0.1 | 3 | 0.061 | 3 | 0.051 | 3 |
| | | | | 010505 | 0.76 | 3 | 0.189 | 3 | 0.161 | 3 |
| | | 1A2 | Industry | 030100 | 0.1 | 9 | 0.1 | 9 | 0.1 | 9 |
| | | | | 030103 | 0.1 | 9 | 0.1 | 9 | 0.1 | 9 |
| | | | | 030104 | 0.1 | 3 | 0.061 | 3 | 0.051 | 3 |
| | | | | 030105 | 0.76 | 3 | 0.189 | 3 | 0.161 | 3 |
| | | 1A4a | Commercial/ Institutional | 020100 | 0.1 | 9 | 0.1 | 9 | 0.1 | 9 |
| | | | | 020103 | 0.1 | 9 | 0.1 | 9 | 0.1 | 9 |
| | | | | 020105 | 0.76 | 3 | 0.189 | 3 | 0.161 | 3 |
| | | 1A4b i | Residential | 020200 | 0.1 | 9 | 0.1 | 9 | 0.1 | 9 |

[16] The emission factor is higher than the TSP emission factor and will be corrected in the next inventory.

| fuel_type | fuel_gr_abbr | NFR | nfr_name | snap | TSP g pr GJ | Ref. | PM$_{10}$ g pr GJ | Ref. | PM$_{2.5}$ g pr GJ | Ref. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 020202 | 0.1 | 9 | 0.1 | 9 | 0.1 | 9 |
| | | | | 020204 | 0.76 | 3 | 0.189 | 3 | 0.161 | 3 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 0.1 | 9 | 0.1 | 9 | 0.1 | 9 |
| | | | | 020303 | 0.1 | 3 | 0.061 | 3 | 0.051 | 3 |
| | | | | 020304 | 0.76 | 3 | 0.189 | 3 | 0.161 | 3 |
| LIQUID | PETROLEUM COKE | 1A4a | Commercial/ Institutional | 020100 | 100 | 9 | 60 | 9 | 30 | 9 |
| | | 1A4b i | Residential | 020200 | 100 | 9 | 60 | 9 | 30 | 9 |
| | RESIDUAL OIL | 1A1a | Electricity and heat production | 010101 | 3 | 9 | 3 | 9 | 2.5 | 9 |
| | | | | 010102 | 9.5 | 18 | 9.5 | 13 | 7.9 | 13 |
| | | | | 010103 | 9.5 | 18 | 9.5 | 13 | 7.9 | 13 |
| | | | | 010104 | 3 | 9 | 3 | 9 | 2.5 | 9 |
| | | | | 010202 | 3 | 9 | 3 | 9 | 2.5 | 9 |
| | | | | 010203 | 3 | 9 | 3 | 9 | 2.5 | 9 |
| | | 1A1b | Petroleum refining | 010306 | 50 | 9 | 40 | 9 | 35 | 9 |
| | | 1A2 | Industry | 030100 | 14 | 6 | 10.5 | 13 | 7 | 13 |
| | | | | 030102 | 9.5 | 18 | 7.1 | 13 | 4.8 | 13 |
| | | | | 030103 | 9.5 | 18 | 7.1 | 13 | 4.8 | 13 |
| | | | | 030105 | 14 | 6 | 10.5 | 13 | 7 | 13 |
| | | 1A4a | Commercial/ Institutional | 020100 | 14 | 6 | 10.5 | 13 | 7 | 13 |
| | | 1A4b i | Residential | 020200 | 14 | 6 | 10.5 | 13 | 7 | 13 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 14 | 6 | 10.5 | 13 | 7 | 13 |
| | | | | 020302 | 14 | 6 | 10.5 | 13 | 7 | 13 |
| | GAS OIL | 1A1a | Electricity and heat production | 010101 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 010102 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 010103 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 010104 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 010105 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 010201 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 010202 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 010203 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 010205 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | 1A1b | Petroleum refining | 010306 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | 1A2 | Industry | 030100 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 030102 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 030103 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 030104 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 030105 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | 1A4a | Commercial/ Institutional | 020100 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 020103 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 020105 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | 1A4b i | Residential | 020200 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 020204 | 5 | 9 | 5 | 9 | 5 | 9 |
| | KEROSENE | 1A2 | Industry | 030100 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | 1A4a | Commercial/ Institutional | 020100 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | 1A4b i | Residential | 020200 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 5 | 9 | 5 | 9 | 5 | 9 |
| | LPG | 1A1a | Electricity and heat production | 010102 | 0.2 | 9 | 0.2 | 9 | 0.2 | 9 |
| | | | | 010203 | 0.2 | 9 | 0.2 | 9 | 0.2 | 9 |
| | | 1A2 | Industry | 030100 | 0.2 | 9 | 0.2 | 9 | 0.2 | 9 |
| | | 1A4a | Commercial/ Institutional | 020100 | 0.2 | 9 | 0.2 | 9 | 0.2 | 9 |
| | | | | 020105 | 0.2 | 9 | 0.2 | 9 | 0.2 | 9 |
| | | 1A4b i | Residential | 020200 | 0.2 | 9 | 0.2 | 9 | 0.2 | 9 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 0.2 | 9 | 0.2 | 9 | 0.2 | 9 |
| | REFINERY GAS | 1A1b | Petroleum refining | 010304 | 5 | 9 | 5 | 9 | 5 | 9 |
| | | | | 010306 | 5 | 9 | 5 | 9 | 5 | 9 |
| SOLID | COAL | 1A1a | Electricity and heat production | 010101 | 3 | 12 | 2.6 | 12 | 2.1 | 12 |
| | | | | 010102 | 3 | 12 | 2.6 | 12 | 2.1 | 12 |
| | | | | 010103 | 3 | 12 | 2.6 | 12 | 2.1 | 12 |
| | | 1A2 | Industry | 030100 | 17 | 6 | 12 | 14 | 7 | 14 |
| | | 1A4b i | Residential | 020200 | 17 | 6 | 12 | 14 | 7 | 14 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 17 | 6 | 12 | 14 | 7 | 14 |
| | COKE OVEN COKE | 1A2 | Industry | 030100 | 17 | 16 | 12 | 16 | 7 | 16 |
| | | 1A4b i | Residential | 020200 | 17 | 16 | 12 | 16 | 7 | 16 |


1. Danish legislation, Miljøstyrelsen 2001. Luftvejledningen, Begrænsning af luftforurening fra virksomheder, Vejledning fra Miljøstyrelsen nr 2 2001.
2. Particulate size distribution for wood and straw combustion in power plants refers to the TNO CEPMEIP emission factor database 2001 (wood). Available on the internet at: http://www.air.sk/tno/cepmeip/ (25-02-2009).
3. Nielsen, M. & Illerup, J.B: 2003. Emissionsfaktorer og emissionsopgørelse for decentral kraftvarme. Eltra PSO projekt 3141. Kortlægning af emissioner fra decentrale kraftvarmeværker. Delrapport 6. Danmarks Miljøundersøgelser. 116 s. –

Faglig rapport fra DMU nr. 442.(In Danish, whith an english summary). Available on the Internet at :http://www.dmu.dk/1_viden/2_Publikationer/3_fagrapporter/rapporter/FR442.pdf (25-02-2009).

4. German, L., 2003. The Danish Technological Institute, Personal communication, rough estimate.
5. Particulate size distribution for wood and straw combustion in residential plants refers to the TNO CEPMEIP emission factor database 2001 (wood). Available on the internet at: http://www.air.sk/tno/cepmeip/ (25-02-2009).
6. Danish legislation. Miljøstyrelsen 1990, Bekendtgørelse 689, 15/10/1990, Bekendtgørelse om begrænsning af emissioner af svovldioxid, kvælstofoxider og støv fra store fyringsanlæg. (and Bekendtgørelse 518/1995).
7. All TSP emission is assumed to be <2,5µm (NERI assumption).
8. -
9. The TNO CEPMEIP emission factor database 2001. Available on the internet at: http://www.air.sk/tno/cepmeip/ (25-02-2009).
10. -
11. Particulate size distribution is unknown. The $PM_{10}$ fraction is assumed to equal 85 % of TSP and the $PM_{2.5}$ fraction is assumed to equal 70 % of TSP (NERI assumption).
12. Livbjerg, H. Thellefsen, M. Sander, B. Simonsen, P., Lund, C., Poulsen, K.& Fogh, C.L., 2001. Feltstudier af Forbrændingsaerosoler, EFP -98 Projekt, Aerosollaboratoriet DTU, FLS Miljø, Forskningscenter Risø, Elsam, Energi E2 (in Danish).
13. Particulate size distribution for residual oil combustion refers to the TNO CEPMEIP emission factor database 2001. Available on the internet at: http://www.air.sk/tno/cepmeip/ (25-02-2009).
14. Particulate size distribution for coal combustion refers to the TNO CEPMEIP emission factor database 2001. Available on the internet at: http://www.air.sk/tno/cepmeip/.
15. Assuming same emission factors as for gas oil (NERI assumption).
16. Same emission factor as for coal is assumed (NERI assumption).
17. Illerup, J. B., Henriksen, T. C., Lundhede, T., Breugel C. v., Jensen, N. Z. (2008) "Brændeovne og små kedler - partikelemissioner og reduktionstiltag". Miljøprojekt nr. 1164 2008. Miljøstyrelsen. Available on the internet at: http://www2.mst.dk/common/Udgivramme/Frame.asp?pg=http://www2.mst.dk/Udgiv/publikationer/2008/978-87-7052-451-3/html/default.htm.
18. Nielsen, M., Nielsen, O.K. & Thomsen, M. 2010c: Emissionskortlægning for decentral kraftvarme, Energinet.dk miljøprojekt nr. 07/1882. Delrapport 5. Emissionsfaktorer og emissionsopgørelse for decentral kraftvarme, 2006. National Environmental Research Institute, University of Aarhus.
19. Same emission factor as for biogas assumed (NERI assumption)
20. The emission factor have been estimated by NERI based on plant specific data from MSW incineration plants, district heating, 2008.

Table 2A-4.4a PM emission factors, time-series for the years 1990 to 1999

| | | | | | | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TSP | BIOMASS | WOOD | 1A4b i | Residential | 020200 | 807 | 807 | 807 | 807 | 807 | 807 | 807 | 807 | 807 | 807 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | | | | | 2.02 | 2.02 | | | 2.02 | 2.02 |
| | | | | | 010103 | | | | | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 |
| | | | | | 010104 | | | | | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 |
| | | | | | 010203 | | | | | 6 | 6 | 6 | 6 | 6 | 6 |
| | | | 1A2 | Industry | 030102 | | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | | | | | 020103 | | | | | 6 | 6 | 6 | 6 | 6 | 6 |
| $PM_{10}$ | BIOMASS | WOOD | 1A4b i | Residential | 020200 | | | | | | | | | | |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010203 | | | | | 5 | 5 | 5 | 5 | | |
| | | | 1A2 | Industry | 030102 | | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | | | | | | | | | | |
| | | | | | 020103 | | | | | 5 | 5 | 5 | 5 | 5 | |
| $PM_{2.5}$ | BIOMASS | WOOD | 1A4b i | Residential | 020200 | | | | | | | | | | |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010203 | | | | | 4 | 4 | 4 | 4 | | |
| | | | 1A2 | Industry | 030102 | | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | | | | | | | | | | |
| | | | | | 020103 | | | | | 4 | 4 | 4 | 4 | 4 | |

Table 2A-4.4b PM emission factors, time-series for the years 2000 to 2008

| | | | | | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TSP | BIOMASS | WOOD | 1A4b i | Residential | 020200 | 760 | 681 | 651 | 647 | 641 | 614 | 592 | 600 | 570 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | 2.02 | 2.02 | 2.02 | 2.02 | 1.44 | 0.87 | 0.29 | 0.29 | 0.29 |
| | | | | | 010103 | 2.02 | 2.02 | 2.02 | 2.02 | 1.44 | 0.87 | 0.29 | 0.29 | 0.29 |
| | | | | | 010104 | 2.02 | | | 2.02 | | | 0.29 | | |
| | | | | | 010203 | 6 | 5.7 | 5.5 | 5.2 | 5 | 4.7 | 4.5 | 4.2 | 4.2 |
| | | | 1A2 | Industry | 030102 | | | | 5.2 | 5 | 4.7 | 4.5 | | 4.2 |
| | | | 1A4a | Commercial/ Institutio-nal | 020100 | 6 | | | 5.2 | 5 | 4.7 | 4.5 | | |
| | | | | | 020103 | 6 | 5.7 | 5.5 | 5.2 | 5 | 4.7 | 4.5 | 4.2 | 4.2 |
| $PM_{10}$ | BIOMASS | WOOD | 1A4b i | Residential | 020200 | 723 | 648 | 620 | 615 | 610 | 585 | 564 | 571 | 543 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010203 | 4.6 | 4.4 | 4.2 | 4 | 3.8 | 3.6 | 3.4 | 3.2 | 3.2 |
| | | | 1A2 | Industry | 030102 | | | | 4 | 3.8 | 3.6 | 3.4 | | 3.2 |
| | | | 1A4a | Commercial/ Institutio-nal | 020100 | 4.6 | | | 4 | 3.8 | 3.6 | 3.4 | | |
| | | | | | 020103 | 4.6 | 4.4 | 4.2 | 4 | 3.8 | 3.6 | 3.4 | 3.2 | 3.2 |
| $PM_{2.5}$ | BIOMASS | WOOD | 1A4b i | Residential | 020200 | 708 | 635 | 607 | 603 | 598 | 573 | 553 | 560 | 533 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010203 | 3 | 2.9 | 2.7 | 2.6 | 2.5 | 2.4 | 2.2 | 2.1 | 2.1 |
| | | | 1A2 | Industry | 030102 | | | | 2.6 | 2.5 | 2.4 | 2.2 | | 2.1 |
| | | | 1A4a | Commercial/ Institutio-nal | 020100 | 3 | | | 2.6 | 2.5 | 2.4 | 2.2 | | |
| | | | | | 020103 | 3 | 2.9 | 2.7 | 2.6 | 2.5 | 2.4 | 2.2 | 2.1 | 2.1 |

Table 2A-4.5 HM emission factors and references 2008.

| Fuel | IPCC sector | SNAP | As, mg/GJ | Reference | Cd, mg/GJ | Reference | Cr , mg/GJ | Reference | Cu, mg/GJ | Reference | Hg, mg/GJ | Reference | Ni, mg/GJ | Reference | Pb, mg/GJ | Reference | Se, mg/GJ | Reference | Zn, mg/GJ | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COAL | all | all | 3.2 | 1 | 0.1 | 1 | 2.3 | 1 | 3.1 | 1 | 1.7 | 1 | 4.4 | 1 | 6 | 1 | 0.5 | 1 | 10.5 | 1 |
| COKE OV.COKE | all | all | 3.2 | 1 | 0.1 | 1 | 2.3 | 1 | 3.1 | 1 | 1.7 | 1 | 4.4 | 1 | 6 | 1 | 0.5 | 1 | 10.5 | 1 |
| PETROLEUM COKE | all | all | 3.2 | 1 | 0.1 | 1 | 2.3 | 1 | 3.1 | 1 | 1.7 | 1 | 4.4 | 1 | 6 | 1 | 0.5 | 1 | 10.5 | 1 |
| WOOD AND SIMIL. | 1A1a | 010102, 010103, 010104 | 2.34 | 2 | 0.27 | 4 | 2.34 | 2 | 2.6 | 2 | 0.4 | 4 | 2.34 | 2 | 3.62 | 2 | 1.2 | 4 | 2.3 | 4 |
| WOOD AND SIMIL. | 1A1a 1A2 1A4a 1A4b 1A4c | 010202, 010203, 030100, 030102, 020100, 020200, 020300 | - | - | 6.8 | 1 | - | - | 6.8 | 1 | 6.8 | 1 | - | - | 3.4 | 1 | 1.2 | 4 | 136 | 1 |
| MUNICIP. WASTES | 1A1a | 010102, 010103 | 0.59 | 4 | 0.44 | 4 | 1.56 | 4 | 1.3 | 4 | 1.79 | 4 | 2.06 | 4 | 5.52 | 4 | 1.11 | 4 | 2.33 | 4 |
| MUNICIP. WASTES | 1A1a 1A4a | 010203, 030102, 020103 | 3.53 | 1 | 9.21 | 1 | 32.97 | 1 | 31.8 | 1 | 58.7 | 1 | 55.4 | 1 | 137.57 | 1 | 1.11 | 4 | 2.33 | 4 |
| STRAW | 1A1a | 010101, 010102, 010103, 010104 | 2 | 2 | 0.32 | 4 | 1.52 | 2 | 1.66 | 2 | 0.31 | 4 | 1.62 | 2 | 6.12 | 2 | 1.2 | 4 | 0.41 | 4 |
| STRAW | 1A1a, 1A4b, 1A4c | 010202, 010203, 020200, 020300 | - | - | 0.62 | 1 | 0.62 | 1 | 1.06 | 1 | 6.8 | 1 | 0.53 | 1 | 3.22 | 1 | 1.2 | 4 | 8.39 | 1 |
| RESIDUAL OIL | all | all | 14.07 | 1 | 13.5 | 1 | 33.33 | 1 | 12.96 | 1 | 4.3 | 1 | 642 | 1 | 23.46 | 1 | 12.3 | 1 | 2.72 | 1 |
| GAS OIL | all | Not engines | 1.17 | 1 | 0.23 | 1 | 0.94 | 1 | 1.17 | 1 | 1.17 | 1 | 0.64 | 1 | 2.34 | 1 | 4.68 | 1 | 11.7 | 1 |
| GAS OIL | all | Engines | 0.055 | 4 | 0.011 | 4 | 0.2 | 4 | 0.3 | 4 | 0.11 | 4 | 0.013 | 4 | 0.15 | 4 | 0.22 | 4 | 58 | 4 |
| FISH & RAPE OIL | All | all | 1.17 | 3 | 0.23 | 3 | 0.94 | 3 | 1.17 | 3 | 1.17 | 3 | 0.64 | 3 | 2.34 | 3 | 4.68 | 3 | 11.7 | 3 |
| NATURAL GAS | All | Engines | 0.05 | 4 | 0.003 | 4 | 0.05 | 4 | 0.01 | 4 | 0.1 | 4 | 0.05 | 4 | 0.04 | 4 | 0.01 | 4 | 2.9 | 4 |
| BIOGAS | all | all | 0.04 | 4 | 0.002 | 4 | 0.18 | 4 | 0.31 | 4 | 0.12 | 4 | 0.23 | 4 | 0.005 | 4 | 0.21 | 4 | 3.95 | 4 |
| BIO PROD GAS | all | all | 0.12 | 4 | 0.009 | 4 | 0.029 | 4 | 0.045 | 4 | 0.54 | 4 | 0.014 | 4 | 0.022 | 4 | 0.18 | 4 | 0.058 | 4 |

1. Illerup, J.B., Geertinger, A., Hoffmann, L. & Christiansen, K., 1999. Emissionsfaktorer for tungmetaller 1990-1996. Danmarks Miljøundersøgelser. 66 s. – Faglig rapport fra DMU nr. 301. (In Danish) Available at: http://www.dmu.dk/1_viden/2_Publikationer/3_fagrapporter/rapporter/fr301.pdf (26-02-2009).
2. Nielsen, M. & Illerup, J.B. 2003. Emissionsfaktorer og emissionsopgørelse for decentral kraftvarme. Eltra PSO projekt 3141. Kortlægning af emissioner fra decentrale kraftvarmeværker. Delrapport 6. Danmarks Miljøundersøgelser. 116 s. –Faglig rapport fra DMU nr. 442.(In Danish, whith an english summary). Available at : http://www.dmu.dk/1_viden/2_Publikationer/3_fagrapporter/rapporter/FR442.pdf (26-02-2009).
3. Assumed same emission factors as for gas oil boilers (NERI assumption).
4. Nielsen, M., Nielsen, O.K. & Thomsen, M. 2010c: Emissionskortlægning for decentral kraftvarme, Energinet.dk miljøprojekt nr. 07/1882. Delrapport 5. Emissionsfaktorer og emissionsopgørelse for decentral kraftvarme, 2006. National Environmental Research Institute, University of Aarhus.

For large power plants combusting coal or residual oil other emission factors are applied for point sources than for area sources. The emission inventories are however mainly based on plants specific emission data from each plant. The large point source emission factors that differ from the area source emission factors are shown below.

Table 2A-4.6 HM emission factors for large point sources, mg per GJ. Only emission factors that differ from the area source emission factors are included.

| Fuel | SNAP | As | Cd | Cr | Cu | Hg | Ni | Pb | Se | Zn |
|---|---|---|---|---|---|---|---|---|---|---|
| Coal | 010102 | 3.3 | 0.1 | 8.02 | 4.41 | 2.2 | 6.81 | 6 | 13 | 10.5 |
| Residual oil | 010101, 010102 | 1.48 | 4.43 | 1.33 | 1.48 | 0.15 | 191 | 1.48 | 0.59 | 11.7 |

Table 2A-4.7a HM emission factors time-series for municipal waste, mg pr GJ for the years 1990 to 1999.

| | | | | | | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pol_abbr | fuel_type | fuel_gr_abbr | nfr_id_EA | nfr_name | snap_id | | | | | | | | | | |
| As | BIO-MASS | STRAW | 1A4b i | Residential | 020200 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | 7.82 | 7.207 | 6.74 | 6.74 | | | | | | |
| | | | | | 010102 | | | | | 6.74 | 6.74 | | | 6.74 | 6.74 |
| | | | | | 010103 | | | | | 6.74 | 6.74 | 6.74 | 6.74 | 6.74 | 6.74 |
| | | | | | 010104 | | | | | 6.74 | 6.74 | 6.74 | 6.74 | 6.74 | 6.74 |
| | | | | | 010200 | 7.82 | 7.207 | 6.594 | 5.981 | | | | | | |
| | | | 1A2 | Industry | 030100 | 7.82 | 7.207 | 6.594 | 5.981 | 5.369 | 4.756 | 4.143 | 3.53 | 3.53 | 3.53 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 7.82 | 7.207 | 6.594 | 5.981 | 5.369 | 4.756 | 4.143 | 3.53 | 3.53 | 3.53 |
| Cd | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | 31.32 | 28.161 | 25.003 | 21.844 | | | | | | |
| | | | | | 010102 | | | | | 18.686 | 15.527 | | | 9.21 | 9.21 |
| | | | | | 010103 | | | | | 18.686 | 15.527 | 12.369 | 9.21 | 9.21 | 9.21 |
| | | | | | 010104 | | | | | 4.73 | 4.73 | 4.73 | 4.73 | 4.73 | 4.73 |
| | | | | | 010200 | 31.32 | 28.161 | 25.003 | 21.844 | | | | | | |
| | | | 1A2 | Industry | 030100 | 31.32 | 28.161 | 25.003 | 21.844 | 18.686 | 15.527 | 12.369 | 9.21 | 9.21 | 9.21 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 31.32 | 28.161 | 25.003 | 21.844 | 18.686 | 15.527 | 12.369 | 9.21 | 9.21 | 9.21 |
| Cr | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | 186.1 | 164.224 | 142.349 | 120.473 | | | | | | |
| | | | | | 010102 | | | | | 98.597 | 76.721 | | | 32.97 | 32.97 |
| | | | | | 010103 | | | | | 98.597 | 76.721 | 54.846 | 32.97 | 32.97 | 32.97 |
| | | | | | 010104 | | | | | 2.43 | 98.6 | 54.846 | 32.97 | 32.97 | 32.97 |
| | | | | | 010200 | 186.1 | 164.224 | 142.349 | 120.473 | | | | | | |
| | | | 1A2 | Industry | 030100 | 186.1 | 164.224 | 142.349 | 120.473 | 98.597 | 76.721 | 54.846 | 32.97 | 32.97 | 32.97 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 186.1 | 164.224 | 142.349 | 120.473 | 98.597 | 76.721 | 54.846 | 32.97 | 32.97 | 32.97 |
| Cu | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | 123.49 | 110.391 | 97.293 | 84.194 | | | | | | |
| | | | | | 010102 | | | | | 71.096 | 57.997 | | | 31.8 | 31.8 |
| | | | | | 010103 | | | | | 71.096 | 57.997 | 44.899 | 31.8 | 31.8 | 31.8 |
| | | | | | 010104 | | | | | 71.096 | 57.997 | 44.899 | 31.8 | 31.8 | 31.8 |
| | | | | | 010200 | 123.49 | 110.391 | 97.293 | 84.194 | | | | | | |
| | | | 1A2 | Industry | 030100 | 123.49 | 110.391 | 97.293 | 84.194 | 71.096 | 57.997 | 44.899 | 31.8 | 31.8 | 31.8 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 123.49 | 110.391 | 97.293 | 84.194 | 71.096 | 57.997 | 44.899 | 31.8 | 31.8 | 31.8 |
| Hg | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | 132.42 | 121.889 | 111.357 | 100.826 | | | | | | |
| | | | | | 010102 | | | | | 90.294 | 79.763 | | | 58.7 | 58.7 |
| | | | | | 010103 | | | | | 90.294 | 79.763 | 69.231 | 58.7 | 58.7 | 58.7 |
| | | | | | 010104 | | | | | 90.294 | 79.763 | 69.231 | 58.7 | 58.7 | 58.7 |
| | | | | | 010200 | 132.42 | 121.889 | 111.357 | 100.826 | | | | | | |
| | | | 1A2 | Industry | 030100 | 132.42 | 121.889 | 111.357 | 100.826 | 90.294 | 79.763 | 69.231 | 58.7 | 58.7 | 58.7 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 132.42 | 121.889 | 111.357 | 100.826 | 90.294 | 79.763 | 69.231 | 58.7 | 58.7 | 58.7 |

| | | | | | | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ni | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | 191.96 | 172.451 | 152.943 | 133.434 | | | | | | |
| | | | | | 010102 | | | | | 113.926 | 94.417 | | | 55.4 | 55.4 |
| | | | | | 010103 | | | | | 113.926 | 94.417 | 74.909 | 55.4 | 55.4 | 55.4 |
| | | | | | 010104 | | | | | 113.926 | 94.417 | 74.909 | 55.4 | 55.4 | 55.4 |
| | | | | | 010200 | 191.96 | 172.451 | 152.943 | 133.434 | | | | | | |
| | | | 1A2 | Industry | 030100 | 191.96 | 172.451 | 152.943 | 133.434 | 113.926 | 94.417 | 74.909 | 55.4 | 55.4 | 55.4 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 191.96 | 172.451 | 152.943 | 133.434 | 113.926 | 94.417 | 74.909 | 55.4 | 55.4 | 55.4 |
| Pb | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | 639.024 | 639.024 | 555.449 | 471.873 | | | | | | |
| | | | | | 010102 | | | | | 388.297 | 304.721 | | | 137.57 | 137.57 |
| | | | | | 010103 | | | | | 388.297 | 304.721 | 221.146 | 137.57 | 137.57 | 137.57 |
| | | | | | 010104 | | | | | 388.297 | 304.721 | 221.146 | 137.57 | 137.57 | 137.57 |
| | | | | | 010200 | 722.6 | 639.024 | 555.449 | 471.873 | | | | | | |
| | | | 1A2 | Industry | 030100 | 722.6 | 639.024 | 555.449 | 471.873 | 388.297 | 304.721 | 221.146 | 137.57 | 137.57 | 137.57 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 722.6 | 639.024 | 555.449 | 471.873 | 388.297 | 304.721 | 221.146 | 137.57 | 137.57 | 137.57 |
| Se | BIO-MASS | STRAW | 1A1a | Electricity and heat production | 010102 | | | | | 1.2 | 1.2 | 1.2 | 1 | | 1.2 |
| | | | 1A4b i | Residential | 020200 | 1.2 | 0 | 0 | 0 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | | 0 | 0 | 0 | 1.2 | 1.2 | 1.2 | | | |
| | | WOOD | 1A2 | Industry | 030100 | | 0 | 0 | 0 | 1.2 | 1.2 | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | | 0 | 0 | 0 | 1.2 | 1.2 | | | | |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | | 0 | 0 | 0 | 1.2 | 1.2 | | | | |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | | | | | 25 | 25 | | | 25 | 25 |
| | | | | | 010103 | | | | | 25 | 25 | 25 | 25 | 25 | 25 |
| | | | | | 010104 | | | | | 25 | 25 | 25 | 25 | 25 | 25 |
| | | | | | 010203 | | | | | 25 | 25 | 25 | 25 | 25 | 25 |
| | | | 1A2 | Industry | 030102 | | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | | | | | 020103 | | | | | 25 | 25 | 25 | 25 | 25 | 25 |
| Zn | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | | | | | 52 | 52 | | | 52 | 52 |
| | | | | | 010103 | | | | | 52 | 52 | 52 | 52 | 52 | 52 |
| | | | | | 010104 | | | | | 52 | 52 | 52 | 52 | 52 | 52 |
| | | | | | 010203 | | | | | 52 | 52 | 52 | 52 | 52 | 52 |
| | | | 1A2 | Industry | 030102 | | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 |
| | | | | | 020103 | | | | | 52 | 52 | 52 | 52 | 52 | 52 |

Table 2A-4.7b HM emission factors time-series for municipal waste, mg pr GJ for the years 2000 to 2008.

| pol_abbr | fuel_type | fuel_gr_abbr | nfr_id_EA | nfr_name | snap_id | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| As | BIO-MASS | STRAW | 1A4b i | Residential | 020200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | | | | | | | | | |
| | | | | | 010102 | 6.8 | 6.8 | 6.8 | 6.8 | 4.7 | 2.7 | 0.59 | 0.59 | 0.59 |
| | | | | | 010103 | 6.8 | 6.8 | 6.8 | 6.8 | 4.7 | 2.7 | 0.59 | 0.59 | 0.59 |
| | | | | | 010104 | 6.8 | | | 6.8 | | | 0.59 | | |
| | | | | | 010200 | | | | | | | | | |
| | | | 1A2 | Industry | 030100 | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 3.53 | | | 3.53 | 3.53 | 3.53 | 3.53 | | |
| Cd | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | | | | | | | | | |
| | | | | | 010102 | 4.8 | 4.8 | 4.8 | 4.8 | 3.3 | 1.9 | 0.44 | 0.44 | 0.44 |
| | | | | | 010103 | 4.8 | 4.8 | 4.8 | 4.8 | 3.3 | 1.9 | 0.44 | 0.44 | 0.44 |
| | | | | | 010104 | 4.8 | | | 4.8 | | | 0.44 | | |
| | | | | | 010200 | | | | | | | | | |
| | | | 1A2 | Industry | 030100 | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 9.21 | | | 9.21 | 9.21 | 9.21 | 9.21 | | |
| Cr | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | | | | | | | | | |
| | | | | | 010102 | 2.5 | 2.5 | 2.5 | 2.5 | 2.2 | 1.9 | 1.56 | 1.56 | 1.56 |
| | | | | | 010103 | 2.5 | 2.5 | 2.5 | 2.5 | 2.2 | 1.9 | 1.56 | 1.56 | 1.56 |
| | | | | | 010104 | 2.5 | | | 2.5 | | | 1.56 | | |
| | | | | | 010200 | | | | | | | | | |
| | | | 1A2 | Industry | 030100 | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 32.97 | | | 32.97 | 32.97 | 32.97 | 32.97 | | |
| Cu | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | | | | | | | | | |
| | | | | | 010102 | 10.1 | 10.1 | 10.1 | 10.1 | 7.2 | 4.2 | 1.3 | 1.3 | 1.3 |
| | | | | | 010103 | 10.1 | 10.1 | 10.1 | 10.1 | 7.2 | 4.2 | 1.3 | 1.3 | 1.3 |
| | | | | | 010104 | 10.1 | | | 10.1 | | | 1.3 | | |
| | | | | | 010200 | | | | | | | | | |
| | | | 1A2 | Industry | 030100 | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 31.8 | | | 31.8 | 31.8 | 31.8 | 31.8 | | |
| Hg | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | | | | | | | | | |
| | | | | | 010102 | 7.4 | 7.4 | 7.4 | 7.4 | 5.5 | 3.7 | 1.79 | 1.79 | 1.79 |
| | | | | | 010103 | 7.4 | 7.4 | 7.4 | 7.4 | 5.5 | 3.7 | 1.79 | 1.79 | 1.79 |
| | | | | | 010104 | 7.4 | | | 7.4 | | | 1.79 | | |
| | | | | | 010200 | | | | | | | | | |
| | | | 1A2 | Industry | 030100 | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 58.7 | | | 58.7 | 58.7 | 58.7 | 58.7 | | |

| | | | | | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ni | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | | | | | | | | | |
| | | | | | 010102 | 4.8 | 4.8 | 4.8 | 4.8 | 3.9 | 3 | 2.06 | 2.06 | 2.06 |
| | | | | | 010103 | 4.8 | 4.8 | 4.8 | 4.8 | 3.9 | 3 | 2.06 | 2.06 | 2.06 |
| | | | | | 010104 | 4.8 | | | 4.8 | | | 2.06 | | |
| | | | | | 010200 | | | | | | | | | |
| | | | 1A2 | Industry | 030100 | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 55.4 | | | 55.4 | 55.4 | 55.4 | 55.4 | | |
| Pb | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | | | | | | | | | |
| | | | | | 010102 | 123 | 123 | 123 | 123 | 84 | 45 | 5.52 | 5.52 | 5.52 |
| | | | | | 010103 | 123 | 123 | 123 | 123 | 84 | 45 | 5.52 | 5.52 | 5.52 |
| | | | | | 010104 | 123 | | | 123 | | | 5.52 | | |
| | | | | | 010200 | | | | | | | | | |
| | | | 1A2 | Industry | 030100 | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 137.57 | | | 137.57 | 137.57 | 137.57 | 137.57 | | |
| Se | BIO-MASS | STRAW | 1A1a | Electricity and heat production | 010102 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| | | | 1A4b i | Residential | 020200 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| | | WOOD | 1A2 | Industry | 030100 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| | | | 1A4c i | Agriculture/ Forestry | 020300 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | 25 | 25 | 25 | 25 | 17 | 9 | 1.11 | 1.11 | 1.11 |
| | | | | | 010103 | 25 | 25 | 25 | 25 | 17 | 9 | 1.11 | 1.11 | 1.11 |
| | | | | | 010104 | 25 | | | 25 | | | 1.11 | | |
| | | | | | 010203 | 25 | 25 | 25 | 25 | 17 | 9 | 1.11 | 1.11 | 1.11 |
| | | | 1A2 | Industry | 030102 | | | | 25 | 17 | 9 | 1.11 | | 1.11 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 25 | | | 25 | 17 | 9 | 1.11 | | |
| | | | | | 020103 | 25 | 25 | 25 | 25 | 17 | 9 | 1.11 | 1.11 | 1.11 |
| Zn | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | 52 | 52 | 52 | 52 | 35 | 19 | 2.33 | 2.33 | 2.33 |
| | | | | | 010103 | 52 | 52 | 52 | 52 | 35 | 19 | 2.33 | 2.33 | 2.33 |
| | | | | | 010104 | 52 | | | 52 | | | 2.33 | | |
| | | | | | 010203 | 52 | 52 | 52 | 52 | 35 | 19 | 2.33 | 2.33 | 2.33 |
| | | | 1A2 | Industry | 030102 | | | | 52 | 35 | 19 | 2.33 | | 2.33 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 52 | | | 52 | 35 | 19 | 2.33 | | |
| | | | | | 020103 | 52 | 52 | 52 | 52 | 35 | 19 | 2.33 | 2.33 | 2.33 |

Table 2A-4.8 PAH emission factors 2008.

| fuel_type | fuel_gr_abbr | nfr_id_EA | nfr_name | snap_id | Benzo(a)-pyrene µg per GJ | Ref. | Benzo(b)-flouran-thene µg per GJ | Ref. | Benzo(k)-flouran-thene µg per GJ | Ref. | Indeno-(1,2,3-c,d)-pyrene µg per GJ | Ref. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BIOMASS | WOOD | 1A1a | Electricity and heat production | 010102 | 11 | 7 | 15 | 7 | 5 | 7 | 0.8 | 7 |
| | | | | 010103 | 11 | 7 | 15 | 7 | 5 | 7 | 0.8 | 7 |
| | | | | 010104 | 11 | 7 | 15 | 7 | 5 | 7 | 0.8 | 7 |
| | | | | 010202 | 6.46 | 4 | 1292.52 | 4 | 1292.52 | 4 | 11.56 | 4 |
| | | | | 010203 | 6.46 | 4 | 1292.52 | 4 | 1292.52 | 4 | 11.56 | 4 |
| | | 1A2 | Industry | 030100 | 6.46 | 4 | 1292.52 | 4 | 1292.52 | 4 | 11.56 | 4 |
| | | | | 030102 | 6.46 | 4 | 1292.52 | 4 | 1292.52 | 4 | 11.56 | 4 |
| | | 1A4a | Commercial/ Institutional | 020100 | 168707 | 4 | 221769 | 4 | 73469 | 4 | 119728 | 4 |
| | | 1A4b i | Residential | 020200 | 122087 | 10 | 125450 | 10 | 72444 | 10 | 82722 | 10 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 168707 | 4 | 221769 | 4 | 73469 | 4 | 119728 | 4 |
| | STRAW | 1A1a | Electricity and heat production | 010101 | 0.5 | 7 | 0.5 | 7 | 0.5 | 7 | 0.5 | 7 |
| | | | | 010102 | 0.5 | 7 | 0.5 | 7 | 0.5 | 7 | 0.5 | 7 |
| | | | | 010103 | 0.5 | 7 | 0.5 | 7 | 0.5 | 7 | 0.5 | 7 |
| | | | | 010104 | 0.5 | 7 | 0.5 | 7 | 0.5 | 7 | 0.5 | 7 |
| | | | | 010202 | 1529 | 2 | 3452 | 2 | 1400 | 2 | 1029 | 2 |
| | | | | 010203 | 1529 | 2 | 3452 | 2 | 1400 | 2 | 1029 | 2 |
| | | 1A4b i | Residential | 020200 | 12956 | 2 | 12828 | 2 | 6912 | 2 | 4222 | 2 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 12956 | 2 | 12828 | 2 | 6912 | 2 | 4222 | 2 |
| | FISH & RAPE OIL | 1A1a | Electricity and heat production | 010101 | 109.6 | 3 | 475.41 | 3 | 93.21 | 3 | 177.28 | 3 |
| | | | | 010102 | 109.6 | 3 | 475.41 | 3 | 93.21 | 3 | 177.28 | 3 |
| | | | | 010103 | 109.6 | 3 | 475.41 | 3 | 93.21 | 3 | 177.28 | 3 |
| | | | | 010202 | 109.6 | 3 | 475.41 | 3 | 93.21 | 3 | 177.28 | 3 |
| | | | | 010203 | 109.6 | 3 | 475.41 | 3 | 93.21 | 3 | 177.28 | 3 |
| | | 1A2 | Industry | 030105 | 80 | 3 | 42 | 3 | 66 | 3 | 160 | 3 |
| | | 1A4b i | Residential | 020200 | 80 | 3 | 42 | 3 | 66 | 3 | 160 | 3 |
| | BIOGAS | 1A1a | Electricity and heat production | 010105 | 1.3 | 7 | 1.2 | 7 | 1.2 | 7 | 0.6 | 7 |
| | | | | 010205 | 1.3 | 7 | 1.2 | 7 | 1.2 | 7 | 0.6 | 7 |
| | | 1A2 | Industry | 030105 | 1.3 | 7 | 1.2 | 7 | 1.2 | 7 | 0.6 | 7 |
| | | 1A4a | Commercial/ Institutional | 020105 | 1.3 | 7 | 1.2 | 7 | 1.2 | 7 | 0.6 | 7 |
| | | 1A4c i | Agriculture/ Forestry | 020304 | 1.3 | 7 | 1.2 | 7 | 1.2 | 7 | 0.6 | 7 |
| | BIO PROD GAS | 1A1a | Electricity and heat production | 010105 | 2 | 7 | 2 | 7 | 2 | 7 | 2 | 7 |
| | | 1A2 | Industry | 030105 | 2 | 7 | 2 | 7 | 2 | 7 | 2 | 7 |
| | | 1A4a | Commercial/ Institutional | 020105 | 2 | 7 | 2 | 7 | 2 | 7 | 2 | 7 |
| WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | 0.8 | 7 | 1.7 | 7 | 0.9 | 7 | 1.1 | 7 |
| | | | | 010103 | 0.8 | 7 | 1.7 | 7 | 0.9 | 7 | 1.1 | 7 |
| | | | | 010203 | 0.8 | 7 | 1.7 | 7 | 0.9 | 7 | 1.1 | 7 |
| | | 1A2 | Industry | 030102 | 0.8 | 7 | 1.7 | 7 | 0.9 | 7 | 1.1 | 7 |
| | | 1A4a | Commercial/ Institutional | 020103 | 0.8 | 7 | 1.7 | 7 | 0.9 | 7 | 1.1 | 7 |
| GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010104 | 1 | 8 | 1 | 8 | 2 | 8 | 3 | 8 |
| | | | | 010105 | 1.2 | 7 | 9 | 7 | 1.7 | 7 | 1.8 | 7 |

| | | | | | Benzo(a)-pyrene | | Benzo(b)-flouran-thene | | Benzo(k)-flouran-thene | | Indeno-(1,2,3-c,d)-pyrene | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 010205 | 1.2 | 7 | 9 | 7 | 1.7 | 7 | 1.8 | 7 |
| | | 1A1c | Other energy industries | 010504 | 1 | 8 | 1 | 8 | 2 | 8 | 3 | 8 |
| | | | | 010505 | 1.2 | 7 | 9 | 7 | 1.7 | 7 | 1.8 | 7 |
| | | 1A2 | Industry | 030104 | 1 | 8 | 1 | 8 | 2 | 8 | 3 | 8 |
| | | | | 030105 | 1.2 | 7 | 9 | 7 | 1.7 | 7 | 1.8 | 7 |
| | | 1A4a | Commercial/ Institutional | 020105 | 1.2 | 7 | 9 | 7 | 1.7 | 7 | 1.8 | 7 |
| | | 1A4b i | Residential | 020202 | 0.133 | 6 | 0.663 | 6 | 0.265 | 6 | 2.653 | 6 |
| | | | | 020204 | 1.2 | 7 | 9 | 7 | 1.7 | 7 | 1.8 | 7 |
| | | 1A4c i | Agriculture/ Forestry | 020303 | 1 | 8 | 1 | 8 | 2 | 8 | 3 | 8 |
| | | | | 020304 | 1.2 | 7 | 9 | 7 | 1.7 | 7 | 1.8 | 7 |
| LIQUID | PETROLEUM COKE | 1A4a | Commercial/ Institutional | 020100 | 3184 | 5 | 9554 | 5 | - | - | - | - |
| | | 1A4b i | Residential | 020200 | 3184 | 5 | 9554 | 5 | - | - | - | - |
| | RESIDUAL OIL | 1A1a | Electricity and heat production | 010101 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | | | 010102 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | | | 010103 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | | | 010104 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | | | 010202 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | | | 010203 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | 1A1b | Petroleum refining | 010306 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | 1A2 | Industry | 030100 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |
| | | | | 030102 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |
| | | | | 030103 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |
| | | | | 030105 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |
| | | 1A4a | Commercial/ Institutional | 020100 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |
| | | 1A4b i | Residential | 020200 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |
| | | | | 020302 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |
| | GAS OIL | 1A1a | Electricity and heat production | 010101 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | | | 010102 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | | | 010103 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | | | 010104 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | | | 010105 | 1.9 | 7 | 15 | 7 | 1.7 | 7 | 1.5 | 7 |
| | | | | 010201 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | | | 010202 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | | | 010203 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | | | 010205 | 1.9 | 7 | 15 | 7 | 1.7 | 7 | 1.5 | 7 |
| | | 1A1b | Petroleum refining | 010306 | 109.6 | 4 | 475.41 | 4 | 93.21 | 4 | 177.28 | 4 |
| | | 1A2 | Industry | 030100 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |
| | | | | 030102 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |
| | | | | 030103 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |
| | | | | 030104 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |
| | | | | 030105 | 1.9 | 7 | 15 | 7 | 1.7 | 7 | 1.5 | 7 |
| | | 1A4a | Commercial/ Institutional | 020100 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |

| | | | | | Benzo(a)-pyrene | | Benzo(b)-flouran-thene | | Benzo(k)-flouran-thene | | Indeno-(1,2,3-c,d)-pyrene | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 020103 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |
| | | | | 020105 | 1.9 | 7 | 15 | 7 | 1.7 | 7 | 1.5 | 7 |
| | | 1A4b i | Residential | 020200 | 80 | 4 | 42 | 4 | 66 | 4 | 160 | 4 |
| | | | | 020204 | 1.9 | 7 | 15 | 7 | 1.7 | 7 | 1.5 | 7 |
| SOLID | COAL | 1A1a | Electricity and heat production | 010101 | 0.14 | 4 | 0.29 | 4 | 0.29 | 4 | 0.28 | 4 |
| | | | | 010102 | 0.14 | 4 | 0.29 | 4 | 0.29 | 4 | 0.28 | 4 |
| | | | | 010103 | 0.14 | 4 | 0.29 | 4 | 0.29 | 4 | 0.28 | 4 |
| | | 1A2 | Industry | 030100 | 23 | 4 | 929 | 4 | 929 | 4 | 698 | 4 |
| | | 1A4b i | Residential | 020200 | 59524 | 4 | 63492 | 4 | 1984 | 4 | 119048 | 4 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 59524 | 4 | 63492 | 4 | 1984 | 4 | 119048 | 4 |
| | COKE OVEN COKE | 1A2 | Industry | 030100 | 23 | 4 (9) | 929 | 4 (9) | 929 | 4 (9) | 698 | 4 (9) |
| | | 1A4b i | Residential | 020200 | 59524 | 4 (9) | 63492 | 4 (9) | 1984 | 4 (9) | 119048 | 4 (9) |

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8. Same emission factor as for coal is assumed (NERI assumption).
9. Aggregated emission factor based on the technology distribution in the sector and guidebook (EEA 2008) emission factors. Technology distribution based on: (Illerup, J. B., Henriksen, T. C., Lundhede, T., Breugel C. v., Jensen, N. Z. (2008) "Brændeovne og små kedler - partikelemissioner og reduktionstiltag". Miljøprojekt nr. 1164 2008. Miljøstyrelsen. Available on the Internet at: http://www2.mst.dk/common/Udgivramme/Frame.asp?pg=http://www2.mst.dk/Udgiv/publikationer/2008/978-87-7052-451-3/html/default.htm.

Table 2A-4.9a PAH emission factors time-series, µg pr GJ for the years 1990 to 1999.

| | | | | | | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Benzo(a)pyrene | BIOMASS | BIOGAS | 1A1a | Electricity and heat production | 010105 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | | 010205 | | | | | 1 | | | | | |
| | | | 1A1c | Other energy industries | 010505 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | 1A2 | Industry | 030105 | | | | | | | | | 1 | 1 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | WOOD | 1A4b i | Residential | 020200 | 158978 | 158978 | 158978 | 158978 | 158978 | 158978 | 158978 | 158978 | 158978 | 158978 |
| | GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010105 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | | | | | 010205 | | | | | 3 | 3 | 3 | 3 | 3 | 3 |
| | | | 1A1c | Other energy industries | 010505 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | | | 1A2 | Industry | 030105 | 3 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | | | 1A4b i | Residential | 020204 | | 3 | 3 | 3 | 3 | 3 | | 3 | 3 | 3 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | | | | | 0.8 | 0.8 | | | 0.8 | 0.8 |
| | | | | | 010103 | | | | | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| | | | | | 010104 | | | | | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| | | | | | 010203 | | | | | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| | | | 1A2 | Industry | 030102 | | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| | | | | | 020103 | | | | | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| Benzo(b)flouranthene | BIOMASS | BIOGAS | 1A1a | Electricity and heat production | 010105 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | | 010205 | | | | | 1 | | | | | |
| | | | 1A1c | Other energy industries | 010505 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | 1A2 | Industry | 030105 | | | | | | | | | 1 | 1 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | WOOD | 1A4b i | Residential | 020200 | 169294 | 169294 | 169294 | 169294 | 169294 | 169294 | 169294 | 169294 | 169294 | 169294 |
| | GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010105 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| | | | | | 010205 | | | | | 42 | 42 | 42 | 42 | 42 | 42 |
| | | | 1A1c | Other energy industries | 010505 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| | | | 1A2 | Industry | 030105 | 42 | | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| | | | 1A4b i | Residential | 020204 | | 42 | 42 | 42 | 42 | 42 | | 42 | 42 | 42 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| Benzo(k)flouranthene | BIOMASS | BIOGAS | 1A1a | Electricity and heat production | 010105 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| | | | | | 010205 | | | | | 0.4 | | | | | |
| | | | 1A1c | Other energy industries | 010505 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| | | | 1A2 | Industry | 030105 | | | | | | | | | 0.4 | 0.4 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| | | WOOD | 1A4b i | Residential | 020200 | 98916 | 98916 | 98916 | 98916 | 98916 | 98916 | 98916 | 98916 | 98916 | 98916 |
| | GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010105 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | | | | | 010205 | | | | | 24 | 24 | 24 | 24 | 24 | 24 |
| | | | 1A1c | Other energy industries | 010505 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |

| | | | | | | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1A2 | Industry | 030105 | 24 | | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | | | 1A4b i | Residential | 020204 | | 24 | 24 | 24 | 24 | 24 | | 24 | 24 | 24 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | | | | | 0.8 | 0.8 | | | 0.8 | 0.8 |
| | | | | | 010103 | | | | | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| | | | | | 010104 | | | | | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| | | | | | 010203 | | | | | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| | | | 1A2 | Industry | 030102 | | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| | | | | | 020103 | | | | | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| Indeno(1,2,3-c,d)pyrene | BIOMASS | BIOGAS | 1A1a | Electricity and heat production | 010105 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| | | | | | 010205 | | | | | 1.1 | | | | | |
| | | | 1A1c | Other energy industries | 010505 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| | | | 1A2 | Industry | 030105 | | | | | | | | | 1.1 | 1.1 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| | | WOOD | 1A4b i | Residential | 020200 | 110462 | 110462 | 110462 | 110462 | 110462 | 110462 | 110462 | 110462 | 110462 | 110462 |
| | GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010105 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | | | | | 010205 | | | | | 6 | 6 | 6 | 6 | 6 | 6 |
| | | | 1A1c | Other energy industries | 010505 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | | | 1A2 | Industry | 030105 | 6 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | | | 1A4b i | Residential | 020204 | | 6 | 6 | 6 | 6 | 6 | | 6 | 6 | 6 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | | | | | 0.9 | 0.9 | | | 0.9 | 0.9 |
| | | | | | 010103 | | | | | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| | | | | | 010104 | | | | | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| | | | | | 010203 | | | | | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| | | | 1A2 | Industry | 030102 | | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| | | | | | 020103 | | | | | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |

Table 2A-4.9b PAH emission factors time-series, µg pr GJ for the years 2000 to 2008.

| | | | | | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Benzo(a)pyrene | BIOMASS | BIOGAS | 1A1a | Electricity and heat production | 010105 | 1 | 1.1 | 1.1 | 1.2 | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 |
| | | | | | 010205 | | | | | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 |
| | | | 1A1c | Other energy industries | 010505 | 1 | 1.1 | 1.1 | 1.2 | 1.2 | 1.3 | 1.3 | 1.3 | |
| | | | 1A2 | Industry | 030105 | 1 | 1.1 | 1.1 | 1.2 | 1.2 | | 1.3 | 1.3 | 1.3 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 1 | 1.1 | 1.1 | 1.2 | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 1 | 1.1 | 1.1 | 1.2 | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 |
| | | WOOD | 1A4b i | Residential | 020200 | 158978 | 143819 | 138366 | 137886 | 137246 | 132394 | 127943 | 128724 | 122087 |
| | GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010105 | 3 | 2.7 | 2.5 | 2.2 | 2 | 1.7 | 1.5 | 1.2 | 1.2 |
| | | | | | 010205 | 3 | 2.7 | 2.5 | 2.2 | 2 | 1.7 | 1.5 | 1.2 | 1.2 |
| | | | 1A1c | Other energy industries | 010505 | 3 | 2.7 | 2.5 | 2.2 | 2 | 1.7 | 1.5 | 1.2 | 1.2 |
| | | | 1A2 | Industry | 030105 | 3 | 2.7 | 2.5 | 2.2 | 2 | 1.7 | 1.5 | 1.2 | 1.2 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 3 | 2.7 | 2.5 | 2.2 | 2 | 1.7 | 1.5 | 1.2 | 1.2 |
| | | | 1A4b i | Residential | 020204 | 3 | 2.7 | 2.5 | 2.2 | 2 | 1.7 | 1.5 | 1.2 | 1.2 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 3 | 2.7 | 2.5 | 2.2 | 2 | 1.7 | 1.5 | 1.2 | 1.2 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.8 | 0.8 | 0.8 | 0.8 |
| | | | | | 010103 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.8 | 0.8 | 0.8 | 0.8 |
| | | | | | 010104 | 0.9 | | | 0.9 | | | 0.8 | | |
| | | | | | 010203 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.8 | 0.8 | 0.8 | 0.8 |
| | | | 1A2 | Industry | 030102 | | | | 0.9 | 0.9 | 0.8 | 0.8 | | 0.8 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 0.9 | | | 0.9 | 0.9 | 0.8 | 0.8 | | |
| | | | | | 020103 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.8 | 0.8 | 0.8 | 0.8 |
| Benzo(b)flouranthene | BIOMASS | BIOGAS | 1A1a | Electricity and heat production | 010105 | 1 | 1 | 1.1 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 |
| | | | | | 010205 | | | | | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 |
| | | | 1A1c | Other energy industries | 010505 | 1 | 1 | 1.1 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 | |
| | | | 1A2 | Industry | 030105 | 1 | 1 | 1.1 | 1.1 | 1.1 | | 1.2 | 1.2 | 1.2 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 1 | 1 | 1.1 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 1 | 1 | 1.1 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 |
| | | WOOD | 1A4b i | Residential | 020200 | 169294 | 152421 | 145960 | 144786 | 143466 | 137800 | 133097 | 133116 | 125450 |
| | GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010105 | 42 | 37 | 33 | 28 | 23 | 18 | 14 | 9 | 9 |
| | | | | | 010205 | 42 | 37 | 33 | 28 | 23 | 18 | 14 | 9 | 9 |
| | | | 1A1c | Other energy industries | 010505 | 42 | 37 | 33 | 28 | 23 | 18 | 14 | 9 | 9 |
| | | | 1A2 | Industry | 030105 | 42 | 37 | 33 | 28 | 23 | 18 | 14 | 9 | 9 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 42 | 37 | 33 | 28 | 23 | 18 | 14 | 9 | 9 |
| | | | 1A4b i | Residential | 020204 | 42 | 37 | 33 | 28 | 23 | 18 | 14 | 9 | 9 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 42 | 37 | 33 | 28 | 23 | 18 | 14 | 9 | 9 |
| Benzo(k)flouranthene | BIOMASS | BIOGAS | 1A1a | Electricity and heat production | 010105 | 0.4 | 0.5 | 0.7 | 0.8 | 0.9 | 1 | 1.2 | 1.2 | 1.2 |
| | | | | | 010205 | | | | | 0.9 | 1 | 1.2 | 1.2 | 1.2 |
| | | | 1A1c | Other energy industries | 010505 | 0.4 | 0.5 | 0.7 | 0.8 | 0.9 | 1 | 1.2 | 1.2 | |
| | | | 1A2 | Industry | 030105 | 0.4 | 0.5 | 0.7 | 0.8 | 0.9 | | 1.2 | 1.2 | 1.2 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 0.4 | 0.5 | 0.7 | 0.8 | 0.9 | 1 | 1.2 | 1.2 | 1.2 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 0.4 | 0.5 | 0.7 | 0.8 | 0.9 | 1 | 1.2 | 1.2 | 1.2 |
| | | WOOD | 1A4b i | Residential | 020200 | 98916 | 89076 | 85286 | 84566 | 83767 | 80458 | 77736 | 77311 | 72444 |
| | GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010105 | 24 | 21 | 18 | 14 | 11 | 8 | 5 | 1.7 | 1.7 |
| | | | | | 010205 | 24 | 21 | 18 | 14 | 11 | 8 | 5 | 1.7 | 1.7 |
| | | | 1A1c | Other energy industries | 010505 | 24 | 21 | 18 | 14 | 11 | 8 | 5 | 1.7 | 1.7 |
| | | | 1A2 | Industry | 030105 | 24 | 21 | 18 | 14 | 11 | 8 | 5 | 1.7 | 1.7 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 24 | 21 | 18 | 14 | 11 | 8 | 5 | 1.7 | 1.7 |
| | | | 1A4b i | Residential | 020204 | 24 | 21 | 18 | 14 | 11 | 8 | 5 | 1.7 | 1.7 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 24 | 21 | 18 | 14 | 11 | 8 | 5 | 1.7 | 1.7 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 |
| | | | | | 010103 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 |
| | | | | | 010104 | 0.8 | | | 0.8 | | | 0.9 | | |
| | | | | | 010203 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 |
| | | | 1A2 | Industry | 030102 | | | | 0.8 | 0.8 | 0.9 | 0.9 | | 0.9 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 0.8 | | | 0.8 | 0.8 | 0.9 | 0.9 | | |
| | | | | | 020103 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 |
| Indeno(1,2,3-c,d)pyrene | BIOMASS | BIOGAS | 1A1a | Electricity and heat production | 010105 | 1.1 | 1 | 0.9 | 0.9 | 0.8 | 0.7 | 0.6 | 0.6 | 0.6 |
| | | | | | 010205 | | | | | 0.8 | 0.7 | 0.6 | 0.6 | 0.6 |
| | | | 1A1c | Other energy industries | 010505 | 1.1 | 1 | 0.9 | 0.9 | 0.8 | 0.7 | 0.6 | 0.6 | |
| | | | 1A2 | Industry | 030105 | 1.1 | 1 | 0.9 | 0.9 | 0.8 | | 0.6 | 0.6 | 0.6 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 1.1 | 1 | 0.9 | 0.9 | 0.8 | 0.7 | 0.6 | 0.6 | 0.6 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 1.1 | 1 | 0.9 | 0.9 | 0.8 | 0.7 | 0.6 | 0.6 | 0.6 |
| | | WOOD | 1A4b i | Residential | 020200 | 110462 | 99570 | 95544 | 95023 | 94398 | 90846 | 87681 | 87784 | 82722 |
| | GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010105 | 6 | 5.4 | 4.8 | 4.2 | 3.6 | 3 | 2.4 | 1.8 | 1.8 |
| | | | | | 010205 | 6 | 5.4 | 4.8 | 4.2 | 3.6 | 3 | 2.4 | 1.8 | 1.8 |
| | | | 1A1c | Other energy industries | 010505 | 6 | 5.4 | 4.8 | 4.2 | 3.6 | 3 | 2.4 | 1.8 | 1.8 |
| | | | 1A2 | Industry | 030105 | 6 | 5.4 | 4.8 | 4.2 | 3.6 | 3 | 2.4 | 1.8 | 1.8 |
| | | | 1A4a | Commercial/ Institutional | 020105 | 6 | 5.4 | 4.8 | 4.2 | 3.6 | 3 | 2.4 | 1.8 | 1.8 |
| | | | 1A4b i | Residential | 020204 | 6 | 5.4 | 4.8 | 4.2 | 3.6 | 3 | 2.4 | 1.8 | 1.8 |
| | | | 1A4c i | Agriculture/ Forestry | 020304 | 6 | 5.4 | 4.8 | 4.2 | 3.6 | 3 | 2.4 | 1.8 | 1.8 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | 0.9 | 0.9 | 0.9 | 0.9 | 1 | 1 | 1.1 | 1.1 | 1.1 |
| | | | | | 010103 | 0.9 | 0.9 | 0.9 | 0.9 | 1 | 1 | 1.1 | 1.1 | 1.1 |
| | | | | | 010104 | 0.9 | | | 0.9 | | | 1.1 | | |
| | | | | | 010203 | 0.9 | 0.9 | 0.9 | 0.9 | 1 | 1 | 1.1 | 1.1 | 1.1 |
| | | | 1A2 | Industry | 030102 | | | | 0.9 | 1 | 1 | 1.1 | | 1.1 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 0.9 | | | 0.9 | 1 | 1 | 1.1 | | |
| | | | | | 020103 | 0.9 | 0.9 | 0.9 | 0.9 | 1 | 1 | 1.1 | 1.1 | 1.1 |

Table 2A-4.10 Dioxin and HCB emission factors 2008.

| | | | | | Dioxin, ng pr GJ | HCB, ng pr GJ |
|---|---|---|---|---|---|---|
| BIOMASS | WOOD | 1A1a | Electricity and heat production | 010102 | 14 | 4000 |
| | | | | 010103 | 14 | 4000 |
| | | | | 010104 | 14 | 4000 |
| | | | | 010202 | 1 | 4000 |
| | | | | 010203 | 1 | 4000 |
| | | 1A2 | Industry | 030100 | 1 | 4000 |
| | | | | 030102 | 1 | 4000 |
| | | 1A4a | Commercial/ Institutional | 020100 | 400 | 4000 |
| | | 1A4b i | Residential | 020200 | 427 | 4000 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 400 | 4000 |
| | STRAW | 1A1a | Electricity and heat production | 010101 | 19 | 113 |
| | | | | 010102 | 19 | 113 |
| | | | | 010103 | 19 | 113 |
| | | | | 010104 | 19 | 113 |
| | | | | 010202 | 22 | 113 |
| | | | | 010203 | 22 | 113 |
| | | 1A4b i | Residential | 020200 | 500 | 113 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 400 | 113 |
| | FISH & RAPE OIL | 1A1a | Electricity and heat production | 010101 | 0.882 | |
| | | | | 010102 | 0.882 | |
| | | | | 010103 | 0.882 | |
| | | | | 010202 | 0.882 | |
| | | | | 010203 | 0.882 | |
| | | 1A2 | Industry | 030105 | 0.882 | |
| | | 1A4b i | Residential | 020200 | 10 | |
| | BIOGAS | 1A1a | Electricity and heat production | 010102 | 0.025 | |
| | | | | 010103 | 0.025 | |
| | | | | 010105 | 0.96 | 190 |
| | | | | 010203 | 0.025 | |
| | | | | 010205 | 0.96 | 190 |
| | | 1A2 | Industry | 030100 | 0.025 | |
| | | | | 030102 | 0.025 | |
| | | | | 030103 | 0.025 | |
| | | | | 030105 | 0.96 | 190 |
| | | 1A4a | Commercial/ Institutional | 020100 | 2 | |
| | | | | 020103 | 2 | |
| | | | | 020105 | 0.96 | 190 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 2 | |
| | | | | 020304 | 0.96 | 190 |
| | BIO PROD GAS | 1A1a | Electricity and heat production | 010105 | 1.7 | |
| | | 1A2 | Industry | 030105 | 1.7 | |
| | | 1A4a | Commercial/ Institutional | 020105 | 1.7 | |
| WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | 5 | 4300 |
| | | | | 010103 | 5 | 4300 |
| | | | | 010203 | 5 | 4300 |
| | | 1A2 | Industry | 030102 | 5 | 4300 |
| | | 1A4a | Commercial/ Institutional | 020103 | 5 | 4300 |
| GAS | NATURAL GAS | 1A1a | Electricity and heat production | 010101 | 0.025 | |
| | | | | 010102 | 0.025 | |
| | | | | 010103 | 0.025 | |
| | | | | 010104 | 0.025 | |
| | | | | 010105 | 0.57 | |
| | | | | 010202 | 0.025 | |
| | | | | 010203 | 0.025 | |
| | | | | 010205 | 0.57 | |
| | | 1A1c | Other energy industries | 010504 | 0.025 | |
| | | | | 010505 | 0.57 | |
| | | 1A2 | Industry | 030100 | 0.025 | |
| | | | | 030103 | 0.025 | |
| | | | | 030104 | 0.025 | |
| | | | | 030105 | 0.57 | |
| | | 1A4a | Commercial/ Institutional | 020100 | 2 | |
| | | | | 020103 | 2 | |
| | | | | 020105 | 0.57 | |
| | | 1A4b i | Residential | 020200 | 2 | |
| | | | | 020202 | 2 | |
| | | | | 020204 | 0.57 | |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 2 | |
| | | | | 020303 | 2 | |
| | | | | 020304 | 0.57 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| LIQUID | PETROLEUM COKE | 1A4a | Commercial/ Institutional | 020100 | 300 | |
| | | 1A4b i | Residential | 020200 | 800 | |
| | RESIDUAL OIL | 1A1a | Electricity and heat production | 010101 | 0.882 | |
| | | | | 010102 | 0.882 | |
| | | | | 010103 | 0.882 | |
| | | | | 010104 | 0.882 | |
| | | | | 010202 | 0.882 | |
| | | | | 010203 | 0.882 | |
| | | 1A1b | Petroleum refining | 010306 | 0.882 | |
| | | 1A2 | Industry | 030100 | 0.882 | |
| | | | | 030102 | 0.882 | |
| | | | | 030103 | 0.882 | |
| | | | | 030105 | 0.882 | |
| | | 1A4a | Commercial/ Institutional | 020100 | 10 | |
| | | 1A4b i | Residential | 020200 | 10 | |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 10 | |
| | | | | 020302 | 10 | |
| | GAS OIL | 1A1a | Electricity and heat production | 010101 | 0.882 | |
| | | | | 010102 | 0.882 | |
| | | | | 010103 | 0.882 | |
| | | | | 010104 | 0.882 | |
| | | | | 010105 | 0.99 | 220 |
| | | | | 010201 | 0.882 | |
| | | | | 010202 | 0.882 | |
| | | | | 010203 | 0.882 | |
| | | | | 010205 | 0.99 | 220 |
| | | 1A1b | Petroleum refining | 010306 | 0.882 | |
| | | 1A2 | Industry | 030100 | 0.882 | |
| | | | | 030102 | 0.882 | |
| | | | | 030103 | 0.882 | |
| | | | | 030104 | 0.882 | |
| | | | | 030105 | 0.99 | 220 |
| | | 1A4a | Commercial/ Institutional | 020100 | 10 | |
| | | | | 020103 | 10 | |
| | | | | 020105 | 0.99 | 220 |
| | | 1A4b i | Residential | 020200 | 10 | |
| | | | | 020204 | 0.99 | |
| | KEROSENE | 1A2 | Industry | 030100 | 0.882 | |
| | | 1A4a | Commercial/ Institutional | 020100 | 10 | |
| | | 1A4b i | Residential | 020200 | 10 | |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 10 | |
| | LPG | 1A1a | Electricity and heat production | 010102 | 0.025 | |
| | | | | 010203 | 0.025 | |
| | | 1A2 | Industry | 030100 | 0.025 | |
| | | 1A4a | Commercial/ Institutional | 020100 | 2 | |
| | | | | 020105 | 2 | |
| | | 1A4b i | Residential | 020200 | 2 | |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 2 | |
| | REFINERY GAS | 1A1b | Petroleum refining | 010304 | 0.025 | |
| | | | | 010306 | 0.025 | |
| SOLID | COAL | 1A1a | Electricity and heat production | 010101 | 1.32 | 640 |
| | | | | 010102 | 1.32 | 640 |
| | | | | 010103 | 1.32 | 640 |
| | | 1A2 | Industry | 030100 | 1.32 | 640 |
| | | 1A4b i | Residential | 020200 | 800 | 640 |
| | | 1A4c i | Agriculture/ Forestry | 020300 | 300 | 640 |
| | COKE OVEN COKE | 1A2 | Industry | 030100 | 1.32 | |
| | | 1A4b i | Residential | 020200 | 800 | |

Table 2A-4.11a Dioxin and HCB emission factor time-series for the years 1990 to 1999.

| | | | | | | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DIOXIN | BIOMASS | WOOD | 1A4b i | Residential | 020200 | 547 | 547 | 547 | 547 | 547 | 547 | 547 | 547 | 547 | 547 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | 2095 | 1746 | 1396 | 1047 | | | | | | |
| | | | | | 010102 | | | | | 907 | 767 | | | 348 | 253 |
| | | | | | 010103 | | | | | 907 | 767 | 628 | 488 | 348 | 253 |
| | | | | | 010104 | | | | | 907 | 767 | 628 | 488 | 348 | 253 |
| | | | | | 010200 | 2095 | 1746 | 1396 | 1047 | | | | | | |
| | | | | | 010202 | | | | | 907 | 767 | | | | |
| | | | | | 010203 | | | | | 907 | 767 | 628 | 488 | 348 | 348 |
| | | | 1A2 | Industry | 030100 | 2095 | 1746 | 1396 | 1047 | 907 | 767 | 628 | 488 | 348 | 348 |
| | | | | | 030102 | | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 2095 | 1746 | 1396 | 1047 | 907 | 767 | 628 | 488 | 348 | 348 |
| | | | | | 020103 | | | | | 907 | 767 | 628 | 488 | 348 | 348 |
| HCB | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | 190000 | 158000 | 127000 | 95000 | | | | | | |
| | | | | | 010102 | | | | | 82000 | 70000 | | | 32000 | 23000 |
| | | | | | 010103 | | | | | 82000 | 70000 | 57000 | 45000 | 32000 | 23000 |
| | | | | | 010104 | | | | | 82000 | 70000 | 57000 | 45000 | 32000 | 23000 |
| | | | | | 010200 | 190000 | 158000 | 127000 | 95000 | | | | | | |
| | | | | | 010202 | | | | | 82000 | 70000 | | | | |
| | | | | | 010203 | | | | | 82000 | 70000 | 57000 | 45000 | 32000 | 23000 |
| | | | 1A2 | Industry | 030100 | 190000 | 158000 | 127000 | 95000 | 82000 | 70000 | 57000 | 45000 | 32000 | 23000 |
| | | | | | 030102 | | | | | | | | | | |
| | | | 1A4a | Commercial/ Institutional | 020100 | 190000 | 158000 | 127000 | 95000 | 82000 | 70000 | 57000 | 45000 | 32000 | 23000 |
| | | | | | 020103 | | | | | 82000 | 70000 | 57000 | 45000 | 32000 | 23000 |

Table 2A-4.11b Dioxin and HCB emission factor time-series for the years 2000 to 2008.

| | | | | | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DIOXIN | BIOMASS | WOOD | 1A4b i | Residential | 020200 | 547 | 494 | 476 | 475 | 474 | 457 | 441 | 448 | 427 |
| | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | | | | | | | | | |
| | | | | | 010102 | 157 | 157 | 157 | 157 | 81 | 5 | 5 | 5 | 5 |
| | | | | | 010103 | 157 | 157 | 157 | 157 | 81 | 5 | 5 | 5 | 5 |
| | | | | | 010104 | 157 | | | 157 | | | 5 | | |
| | | | | | 010200 | | | | | | | | | |
| | | | | | 010202 | | | | | | | | | |
| | | | | | 010203 | 348 | 348 | 348 | 348 | 177 | 5 | 5 | 5 | 5 |
| | | | 1A2 | Industry | 030100 | | | | | | | | | |
| | | | | | 030102 | | | | 348 | 177 | 5 | 5 | | 5 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 348 | | | 348 | 177 | 5 | 5 | | |
| | | | | | 020103 | 348 | 348 | 348 | 348 | 177 | 5 | 5 | 5 | 5 |
| HCB | WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010100 | | | | | | | | | |
| | | | | | 010102 | 14000 | 12000 | 10000 | 8000 | 6000 | 4300 | 4300 | 4300 | 4300 |
| | | | | | 010103 | 14000 | 12000 | 10000 | 8000 | 6000 | 4300 | 4300 | 4300 | 4300 |
| | | | | | 010104 | 14000 | | | 8000 | | | 4300 | | |
| | | | | | 010200 | | | | | | | | | |
| | | | | | 010202 | | | | | | | | | |
| | | | | | 010203 | 14000 | 12000 | 10000 | 8000 | 6000 | 4300 | 4300 | 4300 | 4300 |
| | | | 1A2 | Industry | 030100 | | | | | | | | | |
| | | | | | 030102 | | | | 8000 | 6000 | 4300 | 4300 | | 4300 |
| | | | 1A4a | Commercial/ Institutional | 020100 | 14000 | | | 8000 | 6000 | 4300 | 4300 | | |
| | | | | | 020103 | 14000 | 12000 | 10000 | 8000 | 6000 | 4300 | 4300 | 4300 | 4300 |

Table 2A-4.12 $NH_3$ emission factors 2008.

| Fuel gr | Fuel | NFR | | SNAP | $NH_3$ g/GJ |
|---|---|---|---|---|---|
| BIOMASS | WOOD | 1A4b i | Residential | 020200 | 5 |
| | STRAW | 1A4b i | Residential | 020200 | 3.8 |
| WASTE | MUNICIP. WASTES | 1A1a | Electricity and heat production | 010102 | 0.29 |
| | | | | 010103 | 0.29 |
| SOLID | COAL | 1A4b i | Residential | 020200 | 3.8 |
| | COKE OVEN COKE | 1A4b i | Residential | 020200 | 3.8 |

## Annex 2A-5 Implied emission factors for municipal waste incineration plants and power plants combustion coal

Table 74 Implied emission factors for municipal waste incineration plants 2008.

| Pollutant | Implied Emission factor | Unit |
|---|---|---|
| $SO_2$ | 8 | G pr GJ |
| $NO_x$ | 110 | g pr GJ |
| TSP | 1.2 | g pr GJ |
| $PM_{10}$ | 1.1 | g pr GJ |
| $PM_{2.5}$ | 0.9 | g pr GJ |
| As | 0.76 | mg pr GJ |
| Cd | 1.1 | mg pr GJ |
| Cr | 3.3 | mg pr GJ |
| Cu | 3.4 | mg pr GJ |
| Hg | 4.1 | mg pr GJ |
| Ni | 7.0 | mg pr GJ |
| Pb | 13 | mg pr GJ |
| Se | 1.1 | mg pr GJ |
| Zn | 2.5 | mg pr GJ |

Table 75 Implied emission factors for power plants combusting coal, 2008.

| Pollutant | Implied Emission factor | Unit |
|---|---|---|
| $SO_2$ | 23 | g pr GJ |
| $NO_x$ | 63 | g pr GJ |
| TSP | 3.4 | g pr GJ |
| $PM_{10}$ | 2.7 | g pr GJ |
| $PM_{2.5}$ | 2.2 | g pr GJ |
| As | 0.60 | mg pr GJ |
| Cd | 0.09 | mg pr GJ |
| Cr | 1.1 | mg pr GJ |
| Cu | 0.61 | mg pr GJ |
| Hg | 1.1 | mg pr GJ |
| Ni | 1.2 | mg pr GJ |
| Pb | 0.80 | mg pr GJ |
| Se | 4.6 | mg pr GJ |
| Zn | 2.4 | mg pr GJ |

# Annex 2A-6 Large point sources

Table 2A-6.1 Large point sources, fuel consumption in 2008 (1A1, 1A2 and 1A4).

| NFR_id | NFR_name | snap | lps | lps_name | part_id | Fuel | Fuel_rate_TJ |
|---|---|---|---|---|---|---|---|
| 1A1a | Electricity and heat production | 010101 | 001 | Amagervaerket | 02 | WOOD | 268 |
| 1A1a | Electricity and heat production | 010101 | 001 | Amagervaerket | 02 | STRAW | 768 |
| 1A1a | Electricity and heat production | 010101 | 001 | Amagervaerket | 02 | RESIDUAL OIL | 53 |
| 1A1a | Electricity and heat production | 010101 | 001 | Amagervaerket | 03 | COAL | 11468 |
| 1A1a | Electricity and heat production | 010101 | 001 | Amagervaerket | 03 | RESIDUAL OIL | 149 |
| 1A1a | Electricity and heat production | 010101 | 003 | H.C.Oerstedsvaerket | 03 | RESIDUAL OIL | 65 |
| 1A1a | Electricity and heat production | 010101 | 003 | H.C.Oerstedsvaerket | 03 | GAS OIL | 29 |
| 1A1a | Electricity and heat production | 010101 | 003 | H.C.Oerstedsvaerket | 03 | NATURAL GAS | 487 |
| 1A1a | Electricity and heat production | 010101 | 003 | H.C.Oerstedsvaerket | 07 | RESIDUAL OIL | 403 |
| 1A1a | Electricity and heat production | 010101 | 003 | H.C.Oerstedsvaerket | 07 | NATURAL GAS | 3001 |
| 1A1a | Electricity and heat production | 010101 | 004 | Kyndbyvaerket | 21 | GAS OIL | 530 |
| 1A1a | Electricity and heat production | 010101 | 004 | Kyndbyvaerket | 22 | GAS OIL | 228 |
| 1A1a | Electricity and heat production | 010101 | 004 | Kyndbyvaerket | 26 | GAS OIL | 15 |
| 1A1a | Electricity and heat production | 010101 | 007 | Stigsnaesvaerket | 01 | COAL | 76 |
| 1A1a | Electricity and heat production | 010101 | 007 | Stigsnaesvaerket | 01 | RESIDUAL OIL | 17 |
| 1A1a | Electricity and heat production | 010101 | 007 | Stigsnaesvaerket | 02 | COAL | 5806 |
| 1A1a | Electricity and heat production | 010101 | 007 | Stigsnaesvaerket | 02 | RESIDUAL OIL | 202 |
| 1A1a | Electricity and heat production | 010101 | 008 | Asnaesvaerket | 02 | COAL | 5393 |
| 1A1a | Electricity and heat production | 010101 | 008 | Asnaesvaerket | 02 | RESIDUAL OIL | 46 |
| 1A1a | Electricity and heat production | 010101 | 008 | Asnaesvaerket | 05 | COAL | 20360 |
| 1A1a | Electricity and heat production | 010101 | 008 | Asnaesvaerket | 05 | RESIDUAL OIL | 545 |
| 1A1a | Electricity and heat production | 010101 | 010 | Avedoerevaerket | 01 | COAL | 10693 |
| 1A1a | Electricity and heat production | 010101 | 010 | Avedoerevaerket | 01 | RESIDUAL OIL | 228 |
| 1A1a | Electricity and heat production | 010101 | 010 | Avedoerevaerket | 01 | GAS OIL | 20 |
| 1A1a | Electricity and heat production | 010101 | 011 | Fynsvaerket+Odense kraftvarmevaerk | 03 | COAL | 2913 |
| 1A1a | Electricity and heat production | 010101 | 011 | Fynsvaerket+Odense kraftvarmevaerk | 03 | RESIDUAL OIL | 202 |
| 1A1a | Electricity and heat production | 010101 | 011 | Fynsvaerket+Odense kraftvarmevaerk | 07 | COAL | 17725 |
| 1A1a | Electricity and heat production | 010101 | 011 | Fynsvaerket+Odense kraftvarmevaerk | 07 | RESIDUAL OIL | 250 |
| 1A1a | Electricity and heat production | 010101 | 012 | Studstrupvaerket | 03 | COAL | 12841 |
| 1A1a | Electricity and heat production | 010101 | 012 | Studstrupvaerket | 03 | STRAW | 348 |
| 1A1a | Electricity and heat production | 010101 | 012 | Studstrupvaerket | 03 | RESIDUAL OIL | 219 |
| 1A1a | Electricity and heat production | 010101 | 012 | Studstrupvaerket | 04 | COAL | 16030 |
| 1A1a | Electricity and heat production | 010101 | 012 | Studstrupvaerket | 04 | STRAW | 685 |
| 1A1a | Electricity and heat production | 010101 | 012 | Studstrupvaerket | 04 | RESIDUAL OIL | 151 |
| 1A1a | Electricity and heat production | 010101 | 014 | Nordjyllandsvaerket | 02 | COAL | 3355 |
| 1A1a | Electricity and heat production | 010101 | 014 | Nordjyllandsvaerket | 02 | RESIDUAL OIL | 84 |
| 1A1a | Electricity and heat production | 010101 | 014 | Nordjyllandsvaerket | 03 | COAL | 17917 |
| 1A1a | Electricity and heat production | 010101 | 014 | Nordjyllandsvaerket | 03 | RESIDUAL OIL | 233 |
| 1A1a | Electricity and heat production | 010101 | 018 | Skaerbaekvaerket | 03 | GAS OIL | 117 |
| 1A1a | Electricity and heat production | 010101 | 018 | Skaerbaekvaerket | 03 | NATURAL GAS | 10428 |
| 1A1a | Electricity and heat production | 010101 | 019 | Enstedvaerket | 03 | COAL | 22777 |
| 1A1a | Electricity and heat production | 010101 | 019 | Enstedvaerket | 03 | RESIDUAL OIL | 109 |
| 1A1a | Electricity and heat production | 010101 | 019 | Enstedvaerket | 04 | WOOD | 264 |
| 1A1a | Electricity and heat production | 010101 | 019 | Enstedvaerket | 04 | STRAW | 1386 |
| 1A1a | Electricity and heat production | 010101 | 019 | Enstedvaerket | 04 | FISH & RAPE OIL | 12 |
| 1A1a | Electricity and heat production | 010101 | 020 | Esbjergvaerket | 03 | COAL | 12086 |
| 1A1a | Electricity and heat production | 010101 | 020 | Esbjergvaerket | 03 | MUNICIP. WASTES | 28 |
| 1A1a | Electricity and heat production | 010101 | 020 | Esbjergvaerket | 03 | RESIDUAL OIL | 312 |
| 1A1a | Electricity and heat production | 010101 | 020 | Esbjergvaerket | 03 | LPG | 0 |
| 1A1a | Electricity and heat production | 010102 | 005 | Masnedoevaerket | 12 | WOOD | 63 |
| 1A1a | Electricity and heat production | 010102 | 005 | Masnedoevaerket | 12 | STRAW | 483 |
| 1A1a | Electricity and heat production | 010102 | 011 | Fynsvaerket+Odense kraftvarmevaerk | 08 | MUNICIP. WASTES | 2741 |
| 1A1a | Electricity and heat production | 010102 | 011 | Fynsvaerket+Odense kraftvarmevaerk | 08 | GAS OIL | 16 |
| 1A1a | Electricity and heat production | 010102 | 022 | Oestkraft | 05 | RESIDUAL OIL | 3 |
| 1A1a | Electricity and heat production | 010102 | 022 | Oestkraft | 06 | COAL | 592 |
| 1A1a | Electricity and heat production | 010102 | 022 | Oestkraft | 06 | WOOD | 37 |
| 1A1a | Electricity and heat production | 010102 | 022 | Oestkraft | 06 | RESIDUAL OIL | 43 |
| 1A1a | Electricity and heat production | 010102 | 025 | Horsens Kraftvarmevaerk | 01 | WOOD | 9 |
| 1A1a | Electricity and heat production | 010102 | 025 | Horsens Kraftvarmevaerk | 01 | MUNICIP. WASTES | 1055 |
| 1A1a | Electricity and heat production | 010102 | 026 | Herningvaerket | 01 | WOOD | 2739 |
| 1A1a | Electricity and heat production | 010102 | 026 | Herningvaerket | 01 | RESIDUAL OIL | 313 |
| 1A1a | Electricity and heat production | 010102 | 026 | Herningvaerket | 01 | NATURAL GAS | 703 |
| 1A1a | Electricity and heat production | 010102 | 027 | I/S Vestforbraending | 01 | MUNICIP. WASTES | 2217 |
| 1A1a | Electricity and heat production | 010102 | 027 | I/S Vestforbraending | 01 | GAS OIL | 11 |
| 1A1a | Electricity and heat production | 010102 | 027 | I/S Vestforbraending | 02 | MUNICIP. WASTES | 913 |
| 1A1a | Electricity and heat production | 010102 | 027 | I/S Vestforbraending | 02 | NATURAL GAS | 22 |
| 1A1a | Electricity and heat production | 010102 | 027 | I/S Vestforbraending | 03 | MUNICIP. WASTES | 2785 |
| 1A1a | Electricity and heat production | 010102 | 027 | I/S Vestforbraending | 03 | NATURAL GAS | 25 |
| 1A1a | Electricity and heat production | 010102 | 028 | Amagerforbraending | 01 | MUNICIP. WASTES | 4577 |
| 1A1a | Electricity and heat production | 010102 | 029 | Energi Randers Produktion | 01 | COAL | 1627 |
| 1A1a | Electricity and heat production | 010102 | 029 | Energi Randers Produktion | 01 | WOOD | 1093 |
| 1A1a | Electricity and heat production | 010102 | 029 | Energi Randers Produktion | 01 | BIOGAS | 12 |
| 1A1a | Electricity and heat production | 010102 | 029 | Energi Randers Produktion | 02 | GAS OIL | 29 |
| 1A1a | Electricity and heat production | 010102 | 030 | Grenaa Kraftvarmevaerk | 01 | COAL | 594 |
| 1A1a | Electricity and heat production | 010102 | 030 | Grenaa Kraftvarmevaerk | 01 | STRAW | 577 |
| 1A1a | Electricity and heat production | 010102 | 030 | Grenaa Kraftvarmevaerk | 01 | RESIDUAL OIL | 14 |
| 1A1a | Electricity and heat production | 010102 | 030 | Grenaa Kraftvarmevaerk | 01 | GAS OIL | 5 |
| 1A1a | Electricity and heat production | 010102 | 037 | Maabjergvaerket | 02 | WOOD | 371 |

| NFR_id | NFR_name | snap | lps | lps_name | part_id | Fuel | Fuel_rate_TJ |
|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | |
| 1A1a | Electricity and heat production | 010102 | 037 | Maabjergvaerket | 02 | MUNICIP. WASTES | 1841 |
| 1A1a | Electricity and heat production | 010102 | 037 | Maabjergvaerket | 02 | STRAW | 396 |
| 1A1a | Electricity and heat production | 010102 | 037 | Maabjergvaerket | 02 | NATURAL GAS | 80 |
| 1A1a | Electricity and heat production | 010102 | 038 | Soenderborg Kraftvarmevaerk | 01 | WOOD | 4 |
| 1A1a | Electricity and heat production | 010102 | 038 | Soenderborg Kraftvarmevaerk | 01 | MUNICIP. WASTES | 715 |
| 1A1a | Electricity and heat production | 010102 | 039 | I/S Kara Affaldsforbraendingsanlaeg | 01 | MUNICIP. WASTES | 2493 |
| 1A1a | Electricity and heat production | 010102 | 039 | I/S Kara Affaldsforbraendingsanlaeg | 01 | NATURAL GAS | 9 |
| 1A1a | Electricity and heat production | 010102 | 042 | I/S Nordforbraending | 01 | WOOD | 170 |
| 1A1a | Electricity and heat production | 010102 | 042 | I/S Nordforbraending | 01 | MUNICIP. WASTES | 1251 |
| 1A1a | Electricity and heat production | 010102 | 046 | Affaldscenter aarhus - Forbraendsanlaegget | 01 | MUNICIP. WASTES | 2405 |
| 1A1a | Electricity and heat production | 010102 | 053 | Svendborg Kraftvarmevaerk | 01 | MUNICIP. WASTES | 502 |
| 1A1a | Electricity and heat production | 010102 | 053 | Svendborg Kraftvarmevaerk | 01 | NATURAL GAS | 3 |
| 1A1a | Electricity and heat production | 010102 | 054 | Kommunekemi | 01 | MUNICIP. WASTES | 650 |
| 1A1a | Electricity and heat production | 010102 | 054 | Kommunekemi | 01 | RESIDUAL OIL | 104 |
| 1A1a | Electricity and heat production | 010102 | 054 | Kommunekemi | 01 | GAS OIL | 8 |
| 1A1a | Electricity and heat production | 010102 | 054 | Kommunekemi | 02 | MUNICIP. WASTES | 533 |
| 1A1a | Electricity and heat production | 010102 | 054 | Kommunekemi | 02 | RESIDUAL OIL | 68 |
| 1A1a | Electricity and heat production | 010102 | 054 | Kommunekemi | 02 | GAS OIL | 10 |
| 1A1a | Electricity and heat production | 010102 | 054 | Kommunekemi | 03 | MUNICIP. WASTES | 574 |
| 1A1a | Electricity and heat production | 010102 | 054 | Kommunekemi | 03 | RESIDUAL OIL | 59 |
| 1A1a | Electricity and heat production | 010102 | 054 | Kommunekemi | 03 | GAS OIL | 5 |
| 1A1a | Electricity and heat production | 010102 | 085 | L90 Affaldsforbraending | 01 | MUNICIP. WASTES | 2347 |
| 1A1a | Electricity and heat production | 010102 | 085 | L90 Affaldsforbraending | 01 | GAS OIL | 7 |
| 1A1a | Electricity and heat production | 010102 | 087 | Koege Kraftvarmevaerk | 07 | WOOD | 1287 |
| 1A1a | Electricity and heat production | 010102 | 087 | Koege Kraftvarmevaerk | 07 | RESIDUAL OIL | 39 |
| 1A1a | Electricity and heat production | 010103 | 007 | Stigsnaesvaerket | 03 | RESIDUAL OIL | 108 |
| 1A1a | Electricity and heat production | 010103 | 007 | Stigsnaesvaerket | 03 | GAS OIL | 0 |
| 1A1a | Electricity and heat production | 010103 | 036 | Kolding Forbraendingsanlaeg | 01 | WOOD | 5 |
| 1A1a | Electricity and heat production | 010103 | 036 | Kolding Forbraendingsanlaeg | 01 | MUNICIP. WASTES | 674 |
| 1A1a | Electricity and heat production | 010103 | 047 | I/S Reno Nord | 01 | MUNICIP. WASTES | 1938 |
| 1A1a | Electricity and heat production | 010103 | 047 | I/S Reno Nord | 01 | GAS OIL | 5 |
| 1A1a | Electricity and heat production | 010103 | 051 | AVV Forbraendingsanlaeg | 01 | MUNICIP. WASTES | 872 |
| 1A1a | Electricity and heat production | 010103 | 052 | Affaldsforbraendingsanlaeg I/S REFA | 01 | MUNICIP. WASTES | 1235 |
| 1A1a | Electricity and heat production | 010103 | 058 | I/S Reno Syd | 01 | MUNICIP. WASTES | 635 |
| 1A1a | Electricity and heat production | 010103 | 059 | I/S Kraftvarmevaerk Thisted | 01 | WOOD | 12 |
| 1A1a | Electricity and heat production | 010103 | 059 | I/S Kraftvarmevaerk Thisted | 01 | MUNICIP. WASTES | 543 |
| 1A1a | Electricity and heat production | 010103 | 059 | I/S Kraftvarmevaerk Thisted | 01 | STRAW | 1 |
| 1A1a | Electricity and heat production | 010103 | 060 | Knudmosevaerket | 01 | MUNICIP. WASTES | 501 |
| 1A1a | Electricity and heat production | 010103 | 060 | Knudmosevaerket | 01 | NATURAL GAS | 44 |
| 1A1a | Electricity and heat production | 010103 | 061 | Kavo I/S Energien+Slagelse Kraftvarmevaerk | 01 | MUNICIP. WASTES | 211 |
| 1A1a | Electricity and heat production | 010103 | 061 | Kavo I/S Energien+Slagelse Kraftvarmevaerk | 02 | MUNICIP. WASTES | 490 |
| 1A1a | Electricity and heat production | 010103 | 061 | Kavo I/S Energien+Slagelse Kraftvarmevaerk | 02 | STRAW | 368 |
| 1A1a | Electricity and heat production | 010103 | 065 | Haderslev Kraftvarmevaerk | 01 | MUNICIP. WASTES | 588 |
| 1A1a | Electricity and heat production | 010103 | 065 | Haderslev Kraftvarmevaerk | 01 | NATURAL GAS | 16 |
| 1A1a | Electricity and heat production | 010103 | 066 | Frederiskhavn Affaldskraftvarmevaerk | 01 | MUNICIP. WASTES | 397 |
| 1A1a | Electricity and heat production | 010103 | 066 | Frederiskhavn Affaldskraftvarmevaerk | 01 | GAS OIL | 3 |
| 1A1a | Electricity and heat production | 010103 | 067 | Vejen Kraftvarmevaerk | 01 | WOOD | 3 |
| 1A1a | Electricity and heat production | 010103 | 067 | Vejen Kraftvarmevaerk | 01 | MUNICIP. WASTES | 373 |
| 1A1a | Electricity and heat production | 010104 | 002 | Svanemoellevaerket | 07 | GAS OIL | 12 |
| 1A1a | Electricity and heat production | 010104 | 002 | Svanemoellevaerket | 07 | NATURAL GAS | 3653 |
| 1A1a | Electricity and heat production | 010104 | 003 | H.C.Oerstedsvaerket | 08 | RESIDUAL OIL | 242 |
| 1A1a | Electricity and heat production | 010104 | 003 | H.C.Oerstedsvaerket | 08 | NATURAL GAS | 1800 |
| 1A1a | Electricity and heat production | 010104 | 004 | Kyndbyvaerket | 51 | GAS OIL | 14 |
| 1A1a | Electricity and heat production | 010104 | 004 | Kyndbyvaerket | 52 | GAS OIL | 12 |
| 1A1a | Electricity and heat production | 010104 | 005 | Masnedoevaerket | 31 | GAS OIL | 31 |
| 1A1a | Electricity and heat production | 010104 | 010 | Avedoerevaerket | 02 | WOOD | 5947 |
| 1A1a | Electricity and heat production | 010104 | 010 | Avedoerevaerket | 02 | STRAW | 815 |
| 1A1a | Electricity and heat production | 010104 | 010 | Avedoerevaerket | 02 | RESIDUAL OIL | 4227 |
| 1A1a | Electricity and heat production | 010104 | 010 | Avedoerevaerket | 02 | NATURAL GAS | 9204 |
| 1A1a | Electricity and heat production | 010104 | 025 | Horsens Kraftvarmevaerk | 02 | NATURAL GAS | 813 |
| 1A1a | Electricity and heat production | 010104 | 031 | Hilleroed Kraftvarmevaerk | 01 | NATURAL GAS | 2065 |
| 1A1a | Electricity and heat production | 010104 | 032 | Helsingoer Kraftvarmevaerk | 01 | NATURAL GAS | 1431 |
| 1A1a | Electricity and heat production | 010104 | 038 | Soenderborg Kraftvarmevaerk | 02 | NATURAL GAS | 991 |
| 1A1a | Electricity and heat production | 010104 | 040 | Viborg Kraftvarme | 01 | NATURAL GAS | 2051 |
| 1A1a | Electricity and heat production | 010104 | 048 | Silkeborg Kraftvarmevaerk | 01 | NATURAL GAS | 3280 |
| 1A1a | Electricity and heat production | 010104 | 069 | DTU | 01 | NATURAL GAS | 1319 |
| 1A1a | Electricity and heat production | 010104 | 070 | Naestved Kraftvarmevaerk | 01 | NATURAL GAS | 106 |
| 1A1a | Electricity and heat production | 010104 | 072 | Hjoerring Varmeforsyning | 01 | NATURAL GAS | 13 |
| 1A1a | Electricity and heat production | 010105 | 004 | Kyndbyvaerket | 41 | GAS OIL | 3 |
| 1A1a | Electricity and heat production | 010105 | 032 | Helsingoer Kraftvarmevaerk | 02 | NATURAL GAS | 7 |
| 1A1a | Electricity and heat production | 010203 | 036 | Kolding Forbraendingsanlaeg | 05 | MUNICIP. WASTES | 633 |
| 1A1a | Electricity and heat production | 010203 | 036 | Kolding Forbraendingsanlaeg | 05 | GAS OIL | 2 |
| 1A1a | Electricity and heat production | 010203 | 050 | Fasan+Naestved Kraftvarmevaerk | 01 | MUNICIP. WASTES | 1147 |
| 1A1a | Electricity and heat production | 010203 | 055 | I/S Faelles Forbraending | 01 | MUNICIP. WASTES | 330 |
| 1A1a | Electricity and heat production | 010203 | 068 | Bofa I/S | 01 | MUNICIP. WASTES | 243 |
| 1A1a | Electricity and heat production | 010203 | 072 | Hjoerring Varmeforsyning | 02 | WOOD | 362 |
| 1A1a | Electricity and heat production | 010203 | 086 | Hammel Fjernvarme | 01 | MUNICIP. WASTES | 311 |
| 1A1a | Electricity and heat production | 010203 | 086 | Hammel Fjernvarme | 01 | FISH & RAPE OIL | 3 |
| 1A1a | Electricity and heat production | 010203 | 088 | Skagen Forbraendingen | 01 | MUNICIP. WASTES | 132 |
| 1A1b | Petroleum refining | 010304 | 017 | Shell Raffinaderi | 05 | REFINERY GAS | 1834 |
| 1A1b | Petroleum refining | 010306 | 009 | Statoil Raffinaderi | 01 | GAS OIL | 3 |
| 1A1b | Petroleum refining | 010306 | 009 | Statoil Raffinaderi | 01 | REFINERY GAS | 8367 |
| 1A1b | Petroleum refining | 010306 | 017 | Shell Raffinaderi | 01 | RESIDUAL OIL | 894 |

| NFR_id | NFR_name | snap | lps | lps_name | part_id | Fuel | Fuel_rate_TJ |
|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | |
| 1A1b | Petroleum refining | 010306 | 017 | Shell Raffinaderi | 01 | REFINERY GAS | 3865 |
| 1A1c | Other energy industries | 010502 | 024 | Nybro Gasbehandlingsanlaeg | 01 | NATURAL GAS | 354 |
| 1A2 | Industry | 030100 | 081 | Haldor Topsoee | 02 | GAS OIL | 1 |
| 1A2 | Industry | 030100 | 081 | Haldor Topsoee | 02 | NATURAL GAS | 580 |
| 1A2 | Industry | 030100 | 081 | Haldor Topsoee | 02 | LPG | 0 |
| 1A2 | Industry | 030102 | 023 | Danisco Grindsted | 01 | COAL | 468 |
| 1A2 | Industry | 030102 | 023 | Danisco Grindsted | 01 | GAS OIL | 13 |
| 1A2 | Industry | 030102 | 023 | Danisco Grindsted | 01 | NATURAL GAS | 26 |
| 1A2 | Industry | 030102 | 033 | DanSteel | 01 | NATURAL GAS | 1361 |
| 1A2 | Industry | 030102 | 034 | Dalum Papir | 01 | WOOD | 1184 |
| 1A2 | Industry | 030102 | 034 | Dalum Papir | 01 | NATURAL GAS | 111 |
| 1A2 | Industry | 030102 | 082 | Danisco Sugar Nakskov | 02 | COAL | 748 |
| 1A2 | Industry | 030102 | 082 | Danisco Sugar Nakskov | 02 | COKE OVEN COKE | 61 |
| 1A2 | Industry | 030102 | 082 | Danisco Sugar Nakskov | 02 | RESIDUAL OIL | 708 |
| 1A2 | Industry | 030102 | 082 | Danisco Sugar Nakskov | 02 | GAS OIL | 4 |
| 1A2 | Industry | 030102 | 082 | Danisco Sugar Nakskov | 02 | BIOGAS | 51 |
| 1A2 | Industry | 030102 | 083 | Danisco Sugar Nykoebing | 02 | COAL | 252 |
| 1A2 | Industry | 030102 | 083 | Danisco Sugar Nykoebing | 02 | COKE OVEN COKE | 46 |
| 1A2 | Industry | 030102 | 083 | Danisco Sugar Nykoebing | 02 | RESIDUAL OIL | 1005 |
| 1A2 | Industry | 030102 | 083 | Danisco Sugar Nykoebing | 02 | BIOGAS | 50 |
| 1A2 | Industry | 030102 | 089 | AarhusKarlshamn Denmark A/S | 01 | MUNICIP. WASTES | 42 |
| 1A2 | Industry | 030102 | 089 | AarhusKarlshamn Denmark A/S | 01 | RESIDUAL OIL | 1189 |
| 1A2 | Industry | 030102 | 089 | AarhusKarlshamn Denmark A/S | 01 | GAS OIL | 1 |
| 1A2 | Industry | 030104 | 071 | Maricogen | 01 | NATURAL GAS | 34 |
| 1A2 | Industry | 030311 | 045 | Aalborg Portland | 01 | COAL | 3544 |
| 1A2 | Industry | 030311 | 045 | Aalborg Portland | 01 | PETROLEUM COKE | 6835 |
| 1A2 | Industry | 030311 | 045 | Aalborg Portland | 01 | MUNICIP. WASTES | 1956 |
| 1A2 | Industry | 030311 | 045 | Aalborg Portland | 01 | RESIDUAL OIL | 512 |
| 1A2 | Industry | 030315 | 078 | Rexam Glass Holmegaard A/S | 01 | GAS OIL | 0 |
| 1A2 | Industry | 030315 | 078 | Rexam Glass Holmegaard A/S | 01 | NATURAL GAS | 869 |
| 1A2 | Industry | 030318 | 075 | Rockwool A/S Hedehusene | 01 | NATURAL GAS | 47 |
| 1A2 | Industry | 030318 | 076 | Rockwool A/S Vamdrup | 01 | COKE OVEN COKE | 410 |
| 1A2 | Industry | 030318 | 076 | Rockwool A/S Vamdrup | 01 | NATURAL GAS | 274 |
| 1A2 | Industry | 030318 | 077 | Rockwool A/S Doense | 01 | COKE OVEN COKE | 372 |
| 1A2 | Industry | 030318 | 077 | Rockwool A/S Doense | 01 | NATURAL GAS | 248 |
| 1A4a | Commercial/ Institutional | 020103 | 049 | Rensningsanlaegget Lynetten | 01 | MUNICIP. WASTES | 62 |
| 1A4a | Commercial/ Institutional | 020103 | 049 | Rensningsanlaegget Lynetten | 01 | GAS OIL | 15 |
| 1A4a | Commercial/ Institutional | 020103 | 049 | Rensningsanlaegget Lynetten | 01 | BIOGAS | 114 |
| 1A1, 1A2 and 1A4 | Stationary combustion | | | | | | 309276 |

Table 2A-6.2 Large point sources, plant specific emissions (IPCC 1A1, 1A2 and 1A4)[1].

| LPS id | LPS name | NFR | SNAP | $SO_2$ | $NO_x$ | NMVOC | CO | $NH_3$ | TSP | $PM_{10}$[2] | $PM_{2.5}$[2] | As | Cd | Cr | Cu | Hg | Ni | Pb | Se | Zn | Dioxin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 001 | Amagervaerket | 1A1a | 010101 | x | x | | | | x | x | x | x | x | x | x | x | x | x | x | x | |
| 002 | Svanemoellevaerket | 1A1a | 010104 | x | x | | | | | | | | | | | | | | | | |
| 003 | H.C.Oerstedsvaerket | 1A1a | 010101 | x | x | x | x | | x | x | x | x | x | x | x | x | x | x | x | x | |
| | | | 010104 | x | x | | | | | | | | | | | | | | | | |
| 004 | Kyndbyvaerket | 1A1a | 010101 | x | x | x | x | | x | x | x | x | x | x | x | x | x | x | x | x | |
| | | | 010104 | | | | | | | | | | | | | | | | | | |
| | | | 010105 | x | x | | | | | | | | | | | | | | | | |
| 005 | Masnedoevaerket | 1A1a | 010102 | x | x | | | | x | x | x | | | | | | | | | | |
| | | | 010104 | x | x | | | | | | | | | | | | | | | | |
| 007 | Stigsnaesvaerket | 1A1a | 010101 | x | x | | | | x | x | x | x | x | x | x | x | x | x | x | x | |
| 008 | Asnaesvaerket | 1A1a | 010101 | x | x | | | | x | x | x | x | x | x | x | x | x | x | x | x | |
| 009 | Statoil Raffinaderi | 1A1b | 010306 | x | x | | | | | | | | | | | | | | | | |
| 010 | Avedoerevaerket | 1A1a | 010101 | x | x | x | x | | x | x | x | x | x | x | x | x | x | x | x | x | |
| | | | 010104 | x | x | x | x | | x | x | x | x | x | x | x | x | x | x | x | x | |
| 011 | Fynsvaerket+Odense kraftvarmevaerk | 1A1a | 010101 | x | x | | | | x | x | x | x | x | x | x | x | x | x | x | x | |
| | | | 010102 | x | x | | x | | x | x | x | x | x | x | x | x | x | x | | | x |
| 012 | Studstrupvaerket | 1A1a | 010101 | x | x | | | | x | x | x | x | x | x | x | x | x | x | x | x | |
| 014 | Nordjyllandsvaerket | 1A1a | 010101 | x | x | | | | x | x | x | x | x | x | x | x | x | x | x | x | |
| 017 | Shell Raffinaderi | 1A1b | 010304 | x | x | | | | | | | | | | | | | | | | |
| | | | 010306 | x | x | | | | | | | | | | | | | | | | |
| 018 | Skaerbaekvaerket | 1A1a | 010101 | x | x | | x | | x | x | x | x | x | x | x | x | x | x | x | x | |
| 019 | Enstedvaerket | 1A1a | 010101 | x | x | | x | | x | x | x | x | x | x | x | x | x | x | x | x | |
| 020 | Esbjergvaerket | 1A1a | 010101 | x | x | | x | | x | x | x | x | x | x | x | x | x | x | x | x | |
| 022 | Oestkraft | 1A1a | 010102 | x | x | | x | | | | | | | | | | | | | | |
| 023 | Danisco Grindsted | 1A2f | 030102 | x | x | | | | | | | | | | | | | | | | |
| 024 | Nybro Gasbehandlingsanlaeg | 1A1c | 010502 | | x | | | | | | | | | | | | | | | | |
| 025 | Horsens Kraftvarmevaerk | 1A1a | 010102 | x | x | | x | | x | x | x | x | x | x | x | x | x | x | | | x |
| | | | 010104 | | x | | | | | | | | | | | | | | | | |
| 026 | Herningvaerket | 1A1a | 010102 | x | x | | x | | x | x | x | x | x | x | x | x | x | x | x | x | |
| 027 | I/S Vestforbraending | 1A1a | 010102 | x | x | | | | x | x | x | x | x | x | x | x | x | x | | | x |
| 028 | Amagerforbraending | 1A1a | 010102 | x | x | | x | | x | x | x | | x | | | x | | x | | | x |
| 029 | Energi Randers Produktion | 1A1a | 010102 | x | x | | | | x | x | x | | | | | | | | | | |
| 030 | Grenaa Kraftvarmevaerk | 1A1a | 010102 | x | x | | x | | x | x | x | x | x | x | x | x | x | x | | x | |
| 031 | Hilleroed Kraftvarmevaerk | 1A1a | 010104 | x | x | | | | | | | | | | | | | | | | |
| 032 | Helsingoer Kraftvarmevaerk | 1A1a | 010104 | x | x | | | | | | | | | | | | | | | | |
| | | | 010105 | | | | | | | | | | | | | | | | | | |
| 034 | Dalum Papir | 1A2f | 030102 | | x | | | | | | | | | | | | | | | | |
| 036 | Kolding Forbraendingsanlaeg | 1A1a | 010103 | x | x | x | x | | x | x | x | | | | | x | | | | | x |
| | | | 010203 | x | x | x | x | | x | x | x | | | | | x | | | | | x |
| 037 | Maabjergvaerket | 1A1a | 010102 | x | x | x | x | | x | x | x | x | x | x | x | x | x | x | | | x |
| 038 | Soenderborg Kraftvarmevaerk | 1A1a | 010102 | x | x | | x | | x | x | x | x | x | x | x | x | x | x | | | x |
| | | | 010104 | | x | | | | | | | | | | | | | | | | |
| 039 | I/S Kara Affaldsforbraendingsanlaeg | 1A1a | 010102 | x | | | x | | x | x | x | | | | | x | | | | | x |
| 040 | Viborg Kraftvarme | 1A1a | 010104 | | x | | | | | | | | | | | | | | | | |
| 042 | I/S Nordforbraending | 1A1a | 010102 | x | x | | x | | x | x | x | | | | | | | | | | x |
| 045 | Aalborg Portland | 1A2f | 030311 | x | x | | x | | x | x | x | | | | | | | | | | |
| 046 | Affaldscenter aarhus - Forbraendsanlaegget | 1A1a | 010102 | x | x | x | | | x | x | x | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | | | | | | | | | | | | | | | |
| 047 | I/S Reno Nord | 1A1a | 010103 | x | x | | x | | | | | | | | | | | | | | |
| 048 | Silkeborg Kraftvarmevaerk | 1A1a | 010104 | | x | | | | | | | | | | | | | | | | |
| 049 | Rensningsanlaegget Lynetten | 1A4a | 020103 | x | | | | | x | x | x | x | x | x | x | x | x | x | | | x |
| 050 | Fasan+Naestved Kraftvarmevaerk | 1A1a | 010203 | x | x | | x | | x | x | x | | | | | x | | | | | x |
| 051 | AVV Forbraendingsanlaeg | 1A1a | 010103 | x | x | | x | | x | x | x | | | | | x | | | | | x |
| 052 | Affaldsforbraendingsanlaeg I/S REFA | 1A1a | 010103 | x | x | | x | | | | | x | x | x | x | x | x | x | | | x |
| 053 | Svendborg Kraftvarmevaerk | 1A1a | 010102 | x | x | x | x | | x | x | x | | | | | | | x | | | x |
| 054 | Kommunekemi | 1A1a | 010102 | x | x | | x | | x | x | x | | | | | x | | | | | x |
| 055 | I/S Faelles Forbraending | 1A1a | 010203 | | | | x | | x | x | x | | | | | x | | | | | x |
| 058 | I/S Reno Syd | 1A1a | 010103 | x | | | x | | x | x | x | | | | | x | | | | | x |
| 059 | I/S Kraftvarmevaerk Thisted | 1A1a | 010103 | x | x | | x | | x | x | x | | | | | | | | | | x |
| 060 | Knudmosevaerket | 1A1a | 010103 | x | x | | x | | x | x | x | | | | | x | | | | | x |
| 061 | Kavo I/S Energien+Slagelse Kraftvarmevaerk | 1A1a | 010103 | x | x | | x | | x | x | x | | | | | x | | | | | x |
| 065 | Haderslev Kraftvarmevaerk | 1A1a | 010103 | x | x | | x | | x | x | x | x | x | x | x | x | x | x | | | x |
| 066 | Frederiskhavn Affaldskraftvarmevaerk | 1A1a | 010103 | x | x | | x | | x | x | x | x | x | x | x | x | x | x | | | x |
| 067 | Vejen Kraftvarmevaerk | 1A1a | 010103 | x | x | x | x | | x | x | x | x | x | x | x | x | x | x | | | x |
| 068 | Bofa I/S | 1A1a | 010203 | x | x | | x | | x | x | x | | | | | x | | x | | | x |
| 069 | DTU | 1A1a | 010104 | x | x | | | | | | | | | | | | | | | | |
| 070 | Naestved Kraftvarmevaerk | 1A1a | 010104 | | x | | x | | | | | | | | | | | | | | |
| 071 | Maricogen | 1A2f | 030104 | x | x | | | | | | | | | | | | | | | | |
| 072 | Hjoerring Varmeforsyning | 1A1a | 010104 | | x | | x | | | | | | | | | | | | | | |
| 076 | Rockwool A/S Vamdrup | 1A2f | 030318 | x | | x | x | x | x | x | x | | | | | | | | | | x |
| 077 | Rockwool A/S Doense | 1A2f | 030318 | x | | x | x | x | x | x | x | | | | | | | | | | x |
| 078 | Rexam Glass Holmegaard A/S | 1A2f | 030315 | | x | | x | | x | x | x | | | | | | | x | x | x | |
| 080 | Saint-Gobain Isover A/S | 1A2f | 030316 | | | | | x | x | x | x | | | | | | | | | | |
| 081 | Haldor Topsoee | | 030100 | | | | | | x | x | x | | | | | | | | | | |
| 082 | Danisco Sugar Nakskov | 1A2f | 030102 | x | | | | | x | x | x | | | | | | | | | | |
| 083 | Danisco Sugar Nykoebing | 1A2f | 030102 | x | | | | | x | x | x | | | | | | | | | | |
| 085 | L90 Affaldsforbraending | 1A1a | 010102 | x | x | | x | | x | x | x | | | | | x | | | | | |
| 086 | Hammel Fjernvarme | 1A1a | 010203 | x | x | | x | | x | x | x | | | | | x | | | | | x |
| 087 | Koege Kraftvarmevaerk | 1A1a | 010102 | x | x | x | x | | x | x | x | | | | | | | | | | |
| 088 | Skagen Forbraendingen | 1A1a | 010203 | x | | x | | | x | x | x | | | | | | | x | | | x |
| 089 | AarhusKarlshamn Denmark A/S | 1A2f | 030102 | x | x | | | | x | x | x | | | | | | | | | | |
| Grand Total | | | | 8903 | 26951 | 95 | 12015 | 374 | 1068 | 870 | 641 | 108 | 28 | 169 | 115 | 329 | 649 | 242 | 930 | 400 | 596 |
| Share of total emission from stationary combustion, % | | | | 55% | 54% | 0% | 7% | 65% | 5% | 4% | 3% | 26% | 8% | 20% | 14% | 44% | 10% | 8% | 56% | 6% | 3% |

1) Emissions of the pollutants marked with "x" are plant specific. Emission of other pollutants is estimated based on emission factors. The total shown *in this table* only includes plant specific data.

2) Based on particle size distribution.

## Annex 2A-7 Uncertainty estimates 2008

Table 2A-7.1 Uncertainty estimation.

| SNAP | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | Mg SO2 | Mg SO2 | % | % | % | % | % | % | % | % | % |
| 01 | $SO_2$ | 129601.820 | 6605.660 | 2.000 | 10.000 | 10.198 | 4.133 | -0.043 | 0.042 | -0.426 | 0.118 | 0.442 |
| 02 | $SO_2$ | 11491.140 | 4310.020 | 2.000 | 20.000 | 20.100 | 5.315 | 0.020 | 0.027 | 0.396 | 0.077 | 0.403 |
| 03 | $SO_2$ | 16707.890 | 5383.140 | 2.000 | 10.000 | 10.198 | 3.368 | 0.023 | 0.034 | 0.232 | 0.096 | 0.251 |
| Total | $SO_2$ | 157800.850 | 16298.820 | | | | 56.678 | | | | | 0.421 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 7.528 | | | Trend uncertainty (%): | | 0.649 |

| SNAP | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | Mg NOx | Mg NOx | % | % | % | % | % | % | % | % | % |
| 01 | $NO_x$ | 94757.620 | 32576.490 | 2.000 | 20.000 | 20.100 | 13.002 | -0.075 | 0.282 | -1.506 | 0.798 | 1.704 |
| 02 | $NO_x$ | 7517.560 | 8228.340 | 2.000 | 50.000 | 50.040 | 8.176 | 0.043 | 0.071 | 2.142 | 0.202 | 2.151 |
| 03 | $NO_x$ | 13167.170 | 9556.630 | 2.000 | 20.000 | 20.100 | 3.814 | 0.033 | 0.083 | 0.660 | 0.234 | 0.700 |
| Total | $NO_x$ | 115442.350 | 50361.460 | | | | 250.433 | | | | | 8.023 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 15.825 | | | Trend uncertainty (%): | | 2.832 |

| SNAP | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | Mg NMVOC | Mg NMVOC | % | % | % | % | % | % | % | % | % |
| 01 | NMVOC | 533.840 | 1878.640 | 2.000 | 50.000 | 50.040 | 4.213 | 0.072 | 0.126 | 3.623 | 0.358 | 3.640 |
| 02 | NMVOC | 13056.210 | 20062.690 | 2.000 | 50.000 | 50.040 | 44.994 | 0.031 | 1.350 | 1.533 | 3.818 | 4.115 |
| 03 | NMVOC | 1270.910 | 371.300 | 2.000 | 50.000 | 50.040 | 0.833 | -0.103 | 0.025 | -5.166 | 0.071 | 5.167 |
| Total | NMVOC | 14860.960 | 22312.630 | | | | 2042.913 | | | | | 56.881 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 45.199 | | | Trend uncertainty (%): | | 7.542 |

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| SNAP | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | Mg CO | Mg CO | % | % | % | % | % | % | % | % | % |
| 01 | CO | 8263.640 | 8211.300 | 2.000 | 20.000 | 20.100 | 1.000 | -0.010 | 0.058 | -0.193 | 0.163 | 0.253 |
| 02 | CO | 118173.190 | 143986.000 | 2.000 | 50.000 | 50.040 | 43.647 | 0.048 | 1.012 | 2.408 | 2.862 | 3.740 |
| 03 | CO | 15876.600 | 12879.360 | 2.000 | 20.000 | 20.100 | 1.568 | -0.039 | 0.090 | -0.777 | 0.256 | 0.818 |
| Total | CO | 142313.430 | 165076.660 | | | | 1908.496 | | | | | 14.721 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 43.686 | | | Trend uncertainty (%): | | 3.837 |

| SNAP | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | Mg NH3 | Mg NH3 | % | % | % | % | % | % | % | % | % |
| 01 | $NH_3$ | 0.290 | 10.460 | 2.000 | 1000.000 | 1000.002 | 18.260 | 0.018 | 0.019 | 18.262 | 0.053 | 18.262 |
| 02 | $NH_3$ | 66.940 | 188.680 | 2.000 | 1000.000 | 1000.002 | 329.371 | 0.215 | 0.339 | 214.981 | 0.959 | 214.983 |
| 03 | $NH_3$ | 489.190 | 373.710 | 2.000 | 1000.000 | 1000.002 | 652.371 | -0.231 | 0.672 | -231.466 | 1.900 | 231.474 |
| Total | $NH_3$ | 556.420 | 572.850 | | | | 534406.867 | | | | | 100131.358 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 731.031 | | | Trend uncertainty (%): | | 316.435 |

| SNAP | Gas | Base year emission (year 2000) | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | Mg TSP | Mg TSP | % | % | % | % | % | % | % | % | % |
| 01 | TSP | 1161.630 | 990.500 | 2.000 | 50.000 | 50.040 | 2.092 | -0.055 | 0.066 | -2.753 | 0.186 | 2.759 |
| 02 | TSP | 12782.410 | 21833.390 | 2.000 | 500.000 | 500.004 | 460.880 | 0.117 | 1.446 | 58.444 | 4.090 | 58.587 |
| 03 | TSP | 1154.180 | 862.910 | 2.000 | 50.000 | 50.040 | 1.823 | -0.063 | 0.057 | -3.136 | 0.162 | 3.141 |
| Total | TSP | 15098.220 | 23686.800 | | | | 212418.463 | | | | | 3449.908 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 460.889 | | | Trend uncertainty (%): | | 58.736 |

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| SNAP | Gas | Base year emission (year 2000) | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | Mg PM10 | Mg PM10 | % | % | % | % | % | % | % | % | % |
| 01 | $PM_{10}$ | 942.180 | 760.610 | 2.000 | 50.000 | 50.040 | 1.720 | -0.053 | 0.055 | -2.642 | 0.154 | 2.646 |
| 02 | $PM_{10}$ | 12137.330 | 20746.270 | 2.000 | 500.000 | 500.004 | 468.710 | 0.104 | 1.489 | 51.994 | 4.213 | 52.164 |
| 03 | $PM_{10}$ | 849.100 | 624.560 | 2.000 | 50.000 | 50.040 | 1.412 | -0.052 | 0.045 | -2.600 | 0.127 | 2.603 |
| Total | $PM_{10}$ | 13928.610 | 22131.440 | | | | 219693.624 | | | | | 2734.901 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 468.715 | | | Trend uncertainty (%): | | 52.296 |

| SNAP | Gas | Base year emission (year 2000) | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | Mg PM2,5 | Mg PM2,5 | % | % | % | % | % | % | % | % | % |
| 01 | $PM_{2,5}$ | 804.990 | 639.660 | 2.000 | 50.000 | 50.040 | 1.504 | -0.051 | 0.049 | -2.532 | 0.138 | 2.535 |
| 02 | $PM_{2,5}$ | 11821.070 | 20274.910 | 2.000 | 500.000 | 500.004 | 476.276 | 0.084 | 1.544 | 41.989 | 4.367 | 42.216 |
| 03 | $PM_{2,5}$ | 504.490 | 370.440 | 2.000 | 50.000 | 50.040 | 0.871 | -0.034 | 0.028 | -1.703 | 0.080 | 1.705 |
| Total | $PM_{2,5}$ | 13130.550 | 21285.010 | | | | 226841.699 | | | | | 1791.489 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 476.279 | | | Trend uncertainty (%): | | 42.326 |

| SNAP | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg As | kg As | % | % | % | % | % | % | % | % | % |
| 01 | As | 965.460 | 168.050 | 2.000 | 100.000 | 100.020 | 41.101 | -0.070 | 0.115 | -7.023 | 0.326 | 7.030 |
| 02 | As | 141.830 | 66.860 | 2.000 | 1000.000 | 1000.002 | 163.492 | 0.019 | 0.046 | 18.547 | 0.130 | 18.547 |
| 03 | As | 349.470 | 174.040 | 2.000 | 100.000 | 100.020 | 42.566 | 0.052 | 0.119 | 5.200 | 0.338 | 5.211 |
| Total | As | 1456.760 | 408.950 | | | | 30230.900 | | | | | 420.582 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 173.870 | | | Trend uncertainty (%): | | 20.508 |

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| SNAP | | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg Cd | kg Cd | % | % | % | % | % | % | % | % | % |
| 01 | Cd | 591.770 | 126.780 | 2.000 | 100.000 | 100.020 | 36.264 | -0.080 | 0.127 | -7.982 | 0.359 | 7.990 |
| 02 | Cd | 92.720 | 66.790 | 2.000 | 1000.000 | 1000.002 | 191.009 | 0.034 | 0.067 | 34.338 | 0.189 | 34.338 |
| 03 | Cd | 314.980 | 156.100 | 2.000 | 100.000 | 100.020 | 44.651 | 0.046 | 0.156 | 4.578 | 0.442 | 4.600 |
| Total | Cd | 999.470 | 349.670 | | | | 39793.269 | | | | | 1264.121 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 199.483 | | | Trend uncertainty (%): | | 35.554 |

| SNAP | | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg Cr | kg Cr | % | % | % | % | % | % | % | % | % |
| 01 | Cr | 4674.120 | 362.340 | 2.000 | 100.000 | 100.020 | 43.882 | -0.043 | 0.059 | -4.349 | 0.167 | 4.353 |
| 02 | Cr | 343.690 | 138.020 | 2.000 | 1000.000 | 1000.002 | 167.119 | 0.015 | 0.023 | 14.964 | 0.064 | 14.964 |
| 03 | Cr | 1103.560 | 325.520 | 2.000 | 100.000 | 100.020 | 39.423 | 0.029 | 0.053 | 2.880 | 0.150 | 2.884 |
| Total | Cr | 6121.370 | 825.880 | | | | 31408.561 | | | | | 251.183 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 177.225 | | | Trend uncertainty (%): | | 15.849 |

| SNAP | | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg Cu | kg Cu | % | % | % | % | % | % | % | % | % |
| 01 | Cu | 2915.020 | 320.550 | 2.000 | 100.000 | 100.020 | 38.660 | -0.094 | 0.088 | -9.420 | 0.250 | 9.423 |
| 02 | Cu | 312.280 | 344.640 | 2.000 | 1000.000 | 1000.002 | 415.570 | 0.075 | 0.095 | 75.182 | 0.268 | 75.183 |
| 03 | Cu | 405.380 | 164.130 | 2.000 | 100.000 | 100.020 | 19.795 | 0.020 | 0.045 | 1.968 | 0.128 | 1.973 |
| Total | Cu | 3632.680 | 829.320 | | | | 174585.025 | | | | | 5745.144 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 417.834 | | | Trend uncertainty (%): | | 75.797 |

*Continued*

| SNAP | | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emis-sions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emis-sions introduced by emission factor uncertainty | Uncertainty in trend in national emissions intro-duced by activity data uncertainty | Uncertainty introduced into the trend in total national emis-sions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg Hg | kg Hg | % | % | % | % | % | % | % | % | % |
| 01 | Hg | 2508.790 | 433.410 | 2.000 | 100.000 | 100.020 | 57.399 | -0.064 | 0.144 | -6.381 | 0.406 | 6.394 |
| 02 | Hg | 272.250 | 89.720 | 2.000 | 1000.000 | 1000.002 | 118.798 | 0.007 | 0.030 | 7.152 | 0.084 | 7.152 |
| 03 | Hg | 237.710 | 232.100 | 2.000 | 100.000 | 100.020 | 30.739 | 0.057 | 0.077 | 5.714 | 0.217 | 5.718 |
| Total | Hg | 3018.750 | 755.230 | | | | 18352.614 | | | | | 124.738 |
| Total uncertainties | | | | | Overall uncer-tainty i the year (%): | | 135.472 | | | Trend uncertainty (%): | | 11.169 |

| SNAP | | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emis-sions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emis-sions introduced by emission factor uncertainty | Uncertainty in trend in national emissions intro-duced by activity data uncertainty | Uncertainty introduced into the trend in total national emis-sions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg Ni | kg Ni | % | % | % | % | % | % | % | % | % |
| 01 | Ni | 8383.710 | 1588.410 | 2.000 | 100.000 | 100.020 | 24.096 | -0.046 | 0.074 | -4.633 | 0.210 | 4.638 |
| 02 | Ni | 1869.680 | 835.760 | 2.000 | 1000.000 | 1000.002 | 126.757 | 0.012 | 0.039 | 12.122 | 0.110 | 12.123 |
| 03 | Ni | 11142.140 | 4169.230 | 2.000 | 100.000 | 100.020 | 63.246 | 0.034 | 0.195 | 3.420 | 0.551 | 3.464 |
| Total | Ni | 21395.530 | 6593.400 | | | | 20648.081 | | | | | 180.470 |
| Total uncertainties | | | | | Overall uncer-tainty i the year (%): | | 143.694 | | | Trend uncertainty (%): | | 13.434 |

| SNAP | | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emis-sions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emis-sions introduced by emission factor uncertainty | Uncertainty in trend in national emissions intro-duced by activity data uncertainty | Uncertainty introduced into the trend in total national emis-sions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg Pb | kg Pb | % | % | % | % | % | % | % | % | % |
| 01 | Pb | 11993.830 | 748.700 | 2.000 | 100.000 | 100.020 | 24.438 | -0.101 | 0.048 | -10.083 | 0.135 | 10.084 |
| 02 | Pb | 1273.190 | 1532.020 | 2.000 | 1000.000 | 1000.002 | 499.960 | 0.082 | 0.098 | 81.735 | 0.276 | 81.735 |
| 03 | Pb | 2421.510 | 783.570 | 2.000 | 100.000 | 100.020 | 25.576 | 0.020 | 0.050 | 1.977 | 0.141 | 1.982 |
| Total | Pb | 15688.530 | 3064.290 | | | | 251211.561 | | | | | 6786.268 |
| Total uncertainties | | | | | Overall uncer-tainty i the year (%): | | 501.210 | | | Trend uncertainty (%): | | 82.379 |

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| SNAP | | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg Se | kg Se | % | % | % | % | % | % | % | % | % |
| 01 | Se | 3324.500 | 1009.270 | 2.000 | 100.000 | 100.020 | 60.791 | -0.033 | 0.213 | -3.302 | 0.603 | 3.357 |
| 02 | Se | 341.430 | 130.340 | 2.000 | 1000.000 | 1000.002 | 78.492 | 0.002 | 0.028 | 2.223 | 0.078 | 2.224 |
| 03 | Se | 1066.080 | 520.940 | 2.000 | 100.000 | 100.020 | 31.378 | 0.031 | 0.110 | 3.096 | 0.311 | 3.112 |
| Total | Se | 4732.010 | 1660.550 | | | | 10841.192 | | | | | 25.898 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 104.121 | | | Trend uncertainty (%): | | 5.089 |

| SNAP | | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg Zn | kg Zn | % | % | % | % | % | % | % | % | % |
| 01 | Zn | 3840.490 | 1552.510 | 2.000 | 100.000 | 100.020 | 22.130 | -0.286 | 0.211 | -28.616 | 0.597 | 28.623 |
| 02 | Zn | 1801.140 | 4021.380 | 2.000 | 1000.000 | 1000.002 | 573.117 | 0.312 | 0.547 | 312.427 | 1.548 | 312.430 |
| 03 | Zn | 1707.780 | 1442.810 | 2.000 | 100.000 | 100.020 | 20.567 | -0.025 | 0.196 | -2.547 | 0.555 | 2.607 |
| Total | Zn | 7349.410 | 7016.700 | | | | 329375.506 | | | | | 98438.801 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 573.912 | | | Trend uncertainty (%): | | 313.750 |

| SNAP | | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | g Dioxin | g Dioxin | % | % | % | % | % | % | % | % | % |
| 01 | Dioxin | 30.910 | 1.190 | 2.000 | 500.000 | 500.004 | 28.173 | -0.264 | 0.025 | -132.042 | 0.071 | 132.042 |
| 02 | Dioxin | 13.800 | 19.760 | 2.000 | 1000.000 | 1000.002 | 935.608 | 0.286 | 0.417 | 286.420 | 1.180 | 286.423 |
| 03 | Dioxin | 2.660 | 0.170 | 2.000 | 1000.000 | 1000.002 | 8.049 | -0.021 | 0.004 | -21.435 | 0.010 | 21.435 |
| Total | Dioxin | 47.370 | 21.120 | | | | 876220.687 | | | | | 99932.403 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 936.067 | | | Trend uncertainty (%): | | 316.121 |

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| SNAP | | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg Benzo(b) | kg Benzo(b) | % | % | % | % | % | % | % | % | % |
| 01 | Benzo(b) | 23.250 | 27.340 | 2.000 | 100.000 | 100.020 | 0.545 | -0.016 | 0.014 | -1.563 | 0.039 | 1.563 |
| 02 | Benzo(b) | 1920.680 | 4904.160 | 2.000 | 1000.000 | 1000.002 | 978.216 | 0.036 | 2.461 | 36.035 | 6.960 | 36.701 |
| 03 | Benzo(b) | 48.990 | 81.880 | 2.000 | 100.000 | 100.020 | 1.634 | -0.021 | 0.041 | -2.075 | 0.116 | 2.078 |
| Total | Benzo(b) | 1992.920 | 5013.380 | | | | 956910.007 | | | | | 1353.713 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 978.218 | | | Trend uncertainty (%): | | 36.793 |

| SNAP | | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg Benzo(k) | kg Benzo(k) | % | % | % | % | % | % | % | % | % |
| 01 | Benzo(k) | 10.540 | 15.170 | 2.000 | 100.000 | 100.020 | 0.556 | -0.013 | 0.015 | -1.317 | 0.042 | 1.317 |
| 02 | Benzo(k) | 976.460 | 2695.970 | 2.000 | 1000.000 | 1000.002 | 988.707 | 0.058 | 2.670 | 57.816 | 7.552 | 58.307 |
| 03 | Benzo(k) | 22.690 | 15.630 | 2.000 | 100.000 | 100.020 | 0.573 | -0.045 | 0.015 | -4.520 | 0.044 | 4.520 |
| Total | Benzo(k) | 1009.690 | 2726.770 | | | | 977541.304 | | | | | 3421.913 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 988.707 | | | Trend uncertainty (%): | | 58.497 |

| SNAP | | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg Benzo(a) | kg Benzo(a) | % | % | % | % | % | % | % | % | % |
| 01 | Benzo(a) | 7.030 | 6.930 | 2.000 | 100.000 | 100.020 | 0.146 | -0.006 | 0.004 | -0.634 | 0.011 | 0.634 |
| 02 | Benzo(a) | 1792.350 | 4709.440 | 2.000 | 1000.000 | 1000.002 | 993.760 | 0.009 | 2.602 | 9.353 | 7.359 | 11.901 |
| 03 | Benzo(a) | 10.800 | 22.650 | 2.000 | 100.000 | 100.020 | 0.478 | -0.003 | 0.013 | -0.311 | 0.035 | 0.313 |
| Total | Benzo(a) | 1810.180 | 4739.020 | | | | 987559.567 | | | | | 142.130 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 993.760 | | | Trend uncertainty (%): | | 11.922 |

*Continued*

| SNAP | | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty i trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg Indeno | kg Indeno | % | % | % | % | % | % | % | % | % |
| 01 | Indeno | 6.310 | 6.180 | 2.000 | 100.000 | 100.020 | 0.185 | -0.005 | 0.004 | -0.534 | 0.012 | 0.534 |
| 02 | Indeno | 1468.800 | 3321.100 | 2.000 | 1000.000 | 1000.002 | 996.213 | 0.021 | 2.231 | 21.226 | 6.310 | 22.144 |
| 03 | Indeno | 13.580 | 6.450 | 2.000 | 100.000 | 100.020 | 0.194 | -0.016 | 0.004 | -1.609 | 0.012 | 1.609 |
| Total | Indeno | 1488.690 | 3333.730 | | | | 992441.296 | | | | | 493.245 |
| Total uncertainties | | | | | Overall uncertainty i the year (%): | | 996.213 | | | Trend uncertainty (%): | | 22.209 |

# Annex 2A-8 Emission inventory 2008 based on SNAP sectors

Table 104 Emission inventory 2008 based on SNAP sectors.

| SNAP | $SO_2$ Mg | $NO_x$ Mg | NMVOC Mg | $CH_4$ Mg | CO Mg | $CO_2$ [1)] Gg | $N_2O$ Mg | $NH_3$ Mg | TSP Mg | $PM_{10}$ Mg | $PM_{2.5}$ Mg | As kg | Cd kg | Cr kg | Cu kg | Hg kg | Ni kg | Pb kg | Se kg | Zn kg | HCB kg | Dioxin g I-TEQ | Benzo(b) kg | Benzo(k) kg | Benzo(a) kg | Indeno kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total 01 | 6606 | 32576 | 1879 | 8693 | 8211 | 29989 | 428 | 10 | 991 | 761 | 640 | 168 | 127 | 362 | 321 | 433 | 1588 | 749 | 1009 | 1553 | 0.35 | 1.19 | 27 | 15 | 7 | 6 |
| 101 | 5582 | 22532 | 1738 | 8180 | 5003 | 25795 | 273 | 10 | 656 | 498 | 413 | 142 | 38 | 233 | 166 | 332 | 781 | 349 | 974 | 557 | 0.31 | 1.08 | 5 | 1 | 1 | 2 |
| 10100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10101 | 4415 | 10878 | 239 | 337 | 1914 | 16476 | 154 | 0 | 491 | 391 | 325 | 87 | 14 | 146 | 82 | 183 | 590 | 105 | 840 | 349 | 0.1 | 0.28 | 2 | 0 | 0 | 1 |
| 10102 | 788 | 5011 | 57 | 59 | 699 | 4435 | 50 | 8 | 102 | 83 | 68 | 42 | 20 | 63 | 64 | 68 | 129 | 179 | 76 | 124 | 0.14 | 0.46 | 1 | 0 | 0 | 0 |
| 10103 | 145 | 1536 | 14 | 43 | 289 | 1357 | 16 | 2 | 22 | 10 | 9 | 11 | 4 | 20 | 18 | 75 | 44 | 63 | 14 | 26 | 0.04 | 0.23 | 0 | 0 | 0 | 0 |
| 10104 | 201 | 2802 | 71 | 78 | 741 | 2564 | 42 | 0 | 25 | 11 | 8 | 1 | 0 | 3 | 2 | 4 | 17 | 2 | 43 | 9 | 0.02 | 0.1 | 2 | 1 | 1 | 1 |
| 10105 | 34 | 2305 | 1357 | 7663 | 1361 | 962 | 11 | 0 | 15 | 4 | 3 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 0 | 49 | 0 | 0.01 | 0 | 0 | 0 | 0 |
| 102 | 699 | 1524 | 100 | 463 | 2906 | 1674 | 59 | 0 | 213 | 150 | 120 | 13 | 77 | 99 | 143 | 97 | 225 | 378 | 24 | 993 | 0.04 | 0.11 | 21 | 14 | 5 | 4 |
| 10200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10201 | 1 | 4 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10202 | 46 | 106 | 6 | 24 | 187 | 120 | 4 | 0 | 15 | 11 | 9 | 1 | 5 | 2 | 5 | 5 | 26 | 4 | 3 | 82 | 0 | 0 | 1 | 1 | 0 | 0 |
| 10203 | 652 | 1393 | 81 | 367 | 2704 | 1540 | 55 | 0 | 198 | 140 | 111 | 12 | 72 | 97 | 138 | 92 | 199 | 374 | 21 | 909 | 0.04 | 0.11 | 20 | 13 | 5 | 4 |
| 10204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10205 | 0 | 22 | 13 | 72 | 12 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 103 | 316 | 1490 | 1 | 4 | 119 | 912 | 34 | 0 | 119 | 110 | 106 | 13 | 12 | 30 | 12 | 4 | 582 | 21 | 11 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10301 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10302 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10303 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10304 | 6 | 408 | 1 | 4 | 16 | 145 | 6 | 0 | 13 | 13 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10305 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10306 | 310 | 1082 | 0 | 0 | 103 | 767 | 29 | 0 | 107 | 97 | 93 | 13 | 12 | 30 | 12 | 4 | 582 | 21 | 11 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 104 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10400 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10401 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10402 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10403 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10404 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10405 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10406 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10407 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 105 | 9 | 7031 | 40 | 45 | 183 | 1608 | 62 | 0 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10501 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10502 | 0 | 38 | 1 | 2 | 10 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10503 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10504 | 8 | 6993 | 39 | 42 | 173 | 1588 | 62 | 0 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10505 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10506 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total 2 | 4310 | 8228 | 20063 | 10365 | 143986 | 8656 | 263 | 189 | 21833 | 20746 | 20275 | 67 | 67 | 138 | 345 | 90 | 836 | 1532 | 130 | 4021 | 0.15 | 19.76 | 4904 | 2696 | 4709 | 3321 |
| 201 | 273 | 811 | 271 | 848 | 839 | 1015 | 22 | 0 | 176 | 172 | 161 | 9 | 14 | 18 | 16 | 13 | 300 | 20 | 16 | 174 | 0 | 0.48 | 237 | 79 | 180 | 128 |
| 20100 | 260 | 595 | 192 | 280 | 655 | 913 | 21 | 0 | 173 | 170 | 159 | 9 | 14 | 17 | 16 | 12 | 300 | 19 | 16 | 169 | 0 | 0.48 | 237 | 79 | 180 | 128 |
| 20101 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20102 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20103 | 4 | 16 | 1 | 1 | 7 | 21 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

| SNAP | $SO_2$ Mg | $NO_x$ Mg | NMVOC Mg | $CH_4$ Mg | CO Mg | $CO_2$ [1)] Gg | $N_2O$ Mg | $NH_3$ Mg | TSP Mg | $PM_{10}$ Mg | $PM_{2.5}$ Mg | As kg | Cd kg | Cr kg | Cu kg | Hg kg | Ni kg | Pb kg | Se kg | Zn kg | HCB kg | Dioxin g I-TEQ | Ben-zo(b) kg | Ben-zo(k) kg | Ben-zo(a) kg | Indeno kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20104 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20105 | 8 | 200 | 78 | 567 | 177 | 81 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20106 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 202 | 2466 | 6702 | 19222 | 8477 | 133437 | 6955 | 221 | 189 | 21150 | 20102 | 19676 | 42 | 42 | 93 | 312 | 56 | 98 | 1479 | 102 | 3796 | 0.14 | 17.91 | 4507 | 2595 | 4380 | 2954 |
| 20200 | 2465 | 6526 | 19110 | 7892 | 133364 | 6880 | 220 | 189 | 21149 | 20102 | 19675 | 42 | 42 | 92 | 312 | 56 | 98 | 1479 | 102 | 3791 | 0.14 | 17.9 | 4507 | 2595 | 4380 | 2954 |
| 20201 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20202 | 0 | 3 | 0 | 1 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20203 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20204 | 1 | 173 | 112 | 583 | 72 | 70 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20205 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 203 | 1572 | 715 | 570 | 1040 | 9709 | 686 | 19 | 0 | 508 | 472 | 438 | 15 | 11 | 28 | 17 | 20 | 438 | 33 | 12 | 52 | 0 | 1.38 | 160 | 23 | 149 | 239 |
| 20300 | 1558 | 530 | 468 | 448 | 9597 | 607 | 18 | 0 | 506 | 471 | 438 | 15 | 11 | 27 | 17 | 20 | 418 | 33 | 11 | 48 | 0 | 1.37 | 160 | 23 | 149 | 239 |
| 20301 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20302 | 11 | 4 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 20 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20303 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20304 | 3 | 179 | 102 | 592 | 111 | 75 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20305 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total 03 | 5383 | 9557 | 371 | 976 | 12879 | 4915 | 138 | 374 | 863 | 625 | 370 | 174 | 156 | 326 | 164 | 232 | 4169 | 784 | 521 | 1443 | 0.04 | 0.17 | 82 | 16 | 23 | 6 |
| 301 | 3508 | 3378 | 246 | 787 | 2645 | 3513 | 94 | 0 | 307 | 222 | 158 | 98 | 128 | 217 | 135 | 78 | 4018 | 193 | 86 | 911 | 0.03 | 0.02 | 11 | 12 | 1 | 3 |
| 30100 | 2124 | 2272 | 158 | 373 | 2162 | 2601 | 62 | 0 | 197 | 142 | 103 | 47 | 75 | 104 | 79 | 50 | 1929 | 98 | 44 | 721 | 0.02 | 0.01 | 8 | 8 | 0 | 2 |
| 30101 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30102 | 1261 | 735 | 33 | 75 | 354 | 598 | 26 | 0 | 106 | 77 | 53 | 46 | 48 | 102 | 52 | 26 | 1872 | 87 | 38 | 186 | 0.01 | 0.01 | 3 | 3 | 0 | 2 |
| 30103 | 116 | 67 | 1 | 8 | 15 | 54 | 2 | 0 | 3 | 2 | 2 | 5 | 5 | 11 | 4 | 1 | 217 | 8 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30104 | 1 | 180 | 6 | 6 | 18 | 212 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30105 | 5 | 125 | 47 | 325 | 96 | 47 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30106 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 302 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30203 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30205 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 303 | 1875 | 6178 | 125 | 189 | 10234 | 1403 | 44 | 374 | 556 | 402 | 213 | 76 | 28 | 109 | 29 | 154 | 151 | 591 | 435 | 531 | 0.01 | 0.15 | 70 | 4 | 22 | 3 |
| 30300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30301 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30302 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30303 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 148 | 44 | 7 | 22 | 10 | 82 | 0 | 0 | 96 | 534 | 371 | 371 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30304 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30305 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30306 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30307 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30308 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30309 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30310 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 33 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.04 | 0 | 0 | 0 | 0 |
| 30311 | 1397 | 5876 | 113 | 169 | 1792 | 1237 | 40 | 0 | 175 | 158 | 70 | 51 | 18 | 26 | 26 | 153 | 51 | 26 | 18 | 128 | 0.01 | 0.06 | 70 | 3 | 22 | 3 |
| 30312 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 13 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30313 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30314 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30315 | 0 | 204 | 2 | 5 | 59 | 49 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 46 | 25 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30316 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 155 | 54 | 49 | 38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30317 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30318 | 478 | 98 | 11 | 15 | 8383 | 117 | 3 | 219 | 112 | 101 | 78 | 3 | 0 | 2 | 2 | 1 | 3 | 5 | 0 | 8 | 0 | 0.06 | 1 | 1 | 0 | 1 |
| 30319 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| SNAP | $SO_2$ Mg | $NO_x$ Mg | NMVOC Mg | $CH_4$ Mg | CO Mg | $CO_2$ [1)] Gg | $N_2O$ Mg | $NH_3$ Mg | TSP Mg | $PM_{10}$ Mg | $PM_{2.5}$ Mg | As kg | Cd kg | Cr kg | Cu kg | Hg kg | Ni kg | Pb kg | Se kg | Zn kg | HCB kg | Dioxin g I-TEQ | Ben-zo(b) kg | Ben-zo(k) kg | Ben-zo(a) kg | Indeno kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30320 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30321 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30322 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30323 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30324 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30325 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30326 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30327 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

[1)] Including $CO_2$ emission from biomass.

## Annex 2A-9 Description of the Danish energy statistics

This description of the Danish energy statistics has been prepared by Denmark's National Environmental Research Institute (NERI) in co-operation with the Danish Energy Agency (DEA) as background information to the Danish National Inventory Report (NIR).

#### The Danish energy statistics system

DEA is responsible for the Danish energy balance. Main contributors to the energy statistics outside DEA are Statistics Denmark and Danish Energy Association (before Association of Danish Energy Companies). The statistics is performed using an integrated statistical system building on an Access database and Excel spreadsheets.

The DEA follows the recommendations of the International Energy Agency as well as Eurostat.

The national energy statistics is updated annually and all revisions are immediately included in the published statistics, which can be found on http://ens.dk/sw16508.asp. It is an easy task to check for breaks in a series because the statistics is 100% time-series oriented.

The national energy statistics does not include Greenland and Faroe Islands.

For historical reasons, DEA receive monthly information from the Danish oil companies regarding Danish deliveries of oil products to Greenland and Faroe Islands. But the monthly (MOS) and annual (AOS) reporting of oil statistics to Eurostat and IEA exclude Greenland and Faroe Islands. For all other energy products the Danish figures are also excluding Greenland and Faroe Islands.

#### Reporting to the Danish Energy Agency

The Danish Energy Agency receives monthly statistics for the following fuel groups:

- Crude oil and oil products.
  - Monthly data from 46 oil companies, the main purpose is monitoring oil stocks according to the oil preparedness system.
- Natural gas.
  - Fuel/flare from platforms in the North Sea.
  - Natural gas balance from the regulator Energinet.dk (National monopoly).
- Coal and coke.
  - Power plants (94 %).
  - Industry companies (4 %).
  - Coal and coke traders (2 %).
- Electricity.
  - Monthly reporting by e-mail from the regulator Energinet.dk (National monopoly).
  - The statistics covers:
  - Production by type of producer.
  - Own use of electricity.

        - Import and export by country.
        - Domestic supply (consumption + distribution loss).
    - Town gas (quarterly) from two town gas producers.

The large central power plants also report monthly consumption of biomass.

Annual data includes renewable energy including waste. The DEA conducts a biannual survey on wood pellets and wood fuel. Statistics Denmark conducts biannual surveys on the energy consumption in the service and industrial sectors. Statistics Denmark prepares annual surveys on forest (wood fuel) & straw.

Other annual data sources include:

- DEA.
    - Survey on production of electricity and heat and fuels used.
    - Survey on end use of oil.
    - Survey on end use of natural gas.
    - Survey on end use of coal and coke.
- National Environmental Research Institute (NERI), Aarhus University.
    - Energy consumption for domestic air transport.
- Danish Energy Association (Association of Danish Energy companies).
    - Survey on electricity consumption.
- Ministry of Taxation.
    - Border trade.
- Centre for Biomass Technology.
    - Annual estimates of final consumption of straw and wood chips.

#### Annual revisions

In general, DEA follows the same procedures as in the Danish national account. This means that normally only figures for the last two years are revised.

#### Aggregating the energy statistics on SNAP level

As part of the data delivery agreement between the DEA and NERI, the DEA supplies a version of the official energy statistics aggregated on SNAP level to be used in the emission calculation. In cooperation between DEA and NERI a fuel correspondence table has been developed mapping the fuels used by the DEA in the official energy statistics with the fuel codes used in the Danish national emission database. Similarly the sectors used in the official energy statistics have been mapped to SNAP categories, used in the Danish emission database. The fuel correspondence table between fuel categories used by the DEA, NERI and IPCC is presented in Annex 2A-3.

The mapping between the energy statistics and the SNAP and fuel codes used by NERI can be seen in the table below.

Table 105 Correspondance between the Danish national energy statistics and the snap nomenclature.

| Unit: TJ | Enduse | | | Transformation 1980-1993 | |
|---|---|---|---|---|---|
| | Snap | Fuel *(in Danish)* | Fuel-code | Snap | Fuel-code |
| Foreign Trade | | | | | |
| - *Border Trade* | | | | | |
| - - Motor Gasoline | | | | | |
| - - Gas-/Diesel Oil | | | | | |
| - - Petroleum Coke | 0202 | Petrokoks | 110A | | |
| Vessels in Foreign Trade | | | | | |
| - *International Marine Bunkers* | | | | | |
| - - Gas-/Diesel Oil | 080404 | Gas & Dieselolie | 204B | | |
| - - Fuel Oil | 080404 | Fuelolie & Spildolie | 203W | | |
| - - Lubricants | | | | | |
| Energy Sector | | | | | |
| Extraction and Gasification | | | | | |
| - *Extraction* | | | | | |
| - - Natural Gas | 010504 | Naturgas | 301A | | |
| - *Gasification* | | | | | |
| - - Biogas, Landfill | 091006 | Biogas | 309A | | |
| - - Biogas, Other | 091006 | Biogas | 309A | | |
| Refineries | | | | | |
| - Own Use | | | | | |
| - - Refinery Gas | 010306 | Raffinaderigas | 308A | | |
| - - LPG | 010306 | LPG | 303A | | |
| - - Gas-/Diesel Oil | 010306 | Gas & Dieselolie | 204A | | |
| - - Fuel Oil | 010306 | Fuelolie & Spildolie | 203A | | |
| Transformation Sector | | | | | |
| Large-scale Power Units | | | | | |
| - *Fuels Used for Power Production* | | | | | |
| - - Gas-/Diesel Oil | | | | 0101 | 204A |
| - - Fuel Oil | | | | 0101 | 203A |
| - - Electricity Plant Coal | | | | 0101 | 102A |
| - - Straw | | | | 0101 | 117A |
| Large-Scale CHP Units | | | | | |
| - *Fuels Used for Power Production* | | | | | |
| - - Refinery Gas | | | | 0103 | 308A |
| - - LPG | | | | 0101 | 303A |
| - - Naphtha (LVN) | | | | 0101 | 210A |
| - - Gas-/Diesel Oil | | | | 0101 | 204A |
| - - Fuel Oil | | | | 0101 | 203A |
| - - Petroleum Coke | | | | 0101 | 110A |
| - - Orimulsion | | | | 0101 | 225A |
| - - Natural Gas | | | | 0101 | 301A |
| - - Electricity Plant Coal | | | | 0101 | 102A |
| - - Straw | | | | 0101 | 117A |
| - - Wood Chips | | | | 0101 | 111A |
| - - Wood Pellets | | | | 0101 | 111A |
| - - Wood Waste | | | | 0101 | 111A |
| - - Biogas, Landfill | | | | 0101 | 309A |
| - - Biogas, Others | | | | 0101 | 309A |
| - - Waste, Non-renewable | | | | 0101 | 114A |
| - - Wastes, Renewable | | | | 0101 | 114A |
| - *Fuels Used for Heat Production* | | | | | |
| - - Refinery Gas | | | | 0103 | 308A |
| - - LPG | | | | 0101 | 303A |
| - - Naphtha (LVN) | | | | 0101 | 210A |
| - - Gas-/Diesel Oil | | | | 0101 | 204A |
| - - Fuel Oil | | | | 0101 | 203A |
| - - Petroleum Coke | | | | 0101 | 110A |
| - - Orimulsion | | | | 0101 | 225A |
| - - Natural Gas | | | | 0101 | 301A |
| - - Electricity Plant Coal | | | | 0101 | 102A |
| - - Straw | | | | 0101 | 117A |
| - - Wood Chips | | | | 0101 | 111A |
| - - Wood Pellets | | | | 0101 | 111A |
| - - Wood Waste | | | | 0101 | 111A |
| - - Biogas, Landfill | | | | 0101 | 309A |
| - - Biogas, Other | | | | 0101 | 309A |
| - - Waste, Non-renewable | | | | 0101 | 114A |
| - - Wastes, Renewable | | | | 0101 | 114A |
| Small-Scale CHP Units | | | | | |
| - *Fuels Used for Power Production* | | | | | |

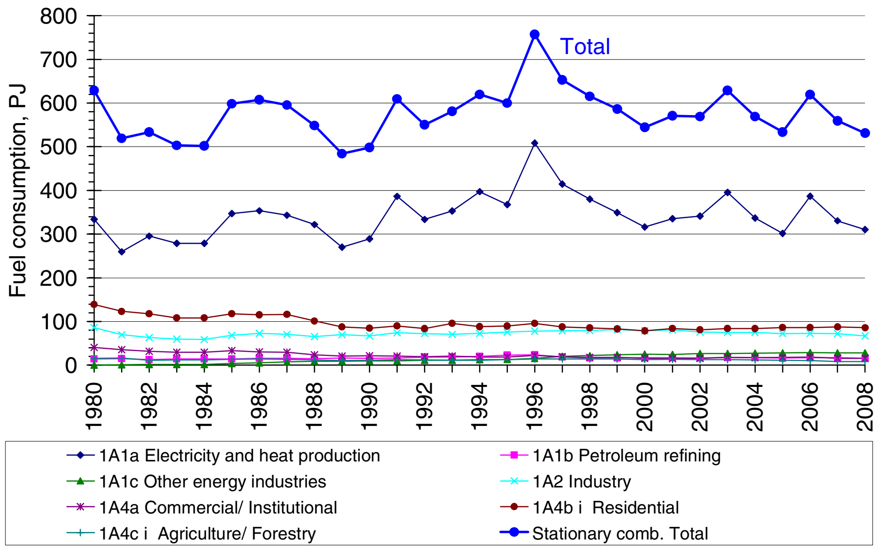
| | | |
|---|---|---|
| *Continued* | | |
| - - Gas-/Diesel Oil | 0101 | 204A |
| - - Fuel Oil | 0101 | 203A |
| - - Natural Gas | 0101 | 301A |
| - - Hard Coal | 0101 | 102A |
| - - Straw | 0101 | 117A |
| - - Wood Chips | 0101 | 111A |
| - - Wood Pellets | 0101 | 111A |
| - - Wood Waste | 0101 | 111A |
| - - Biogas, Landfill | 0101 | 309A |
| - - Biogas, Other | 0101 | 309A |
| - - Waste, Non-renewable | 0101 | 114A |
| - - Wastes, Renewable | 0101 | 114A |
| - *Fuels Used for Heat Production* | | |
| - - Gas-/Diesel Oil | 0101 | 204A |
| - - Fuel Oil | 0101 | 203A |
| - - Natural Gas | 0101 | 301A |
| - - Coal | 0101 | 102A |
| - - Straw | 0101 | 117A |
| - - Wood Chips | 0101 | 111A |
| - - Wood Pellets | 0101 | 111A |
| - - Wood Waste | 0101 | 111A |
| - - Biogas, Landfill | 0101 | 309A |
| - - Biogas, Other | 0101 | 309A |
| - - Waste, Non-renewable | 0101 | 114A |
| - - Wastes, Renewable | 0101 | 114A |
| District Heating Units | | |
| - *Fuels Used for Heat Production* | | |
| - - Refinery Gas | 0103 | 308A |
| - - LPG | 0102 | 303A |
| - - Gas-/Diesel Oil | 0102 | 204A |
| - - Fuel Oil | 0102 | 203A |
| - - Waste Oil | 0102 | 203A |
| - - Petroleum Coke | 0102 | 110A |
| - - Natural Gas | 0102 | 301A |
| - - Electricity Plant Coal | 0102 | 102A |
| - - Coal | 0102 | 102A |
| - - Straw | 0102 | 117A |
| - - Wood Chips | 0102 | 111A |
| - - Wood Pellets | 0102 | 111A |
| - - Wood Waste | 0102 | 111A |
| - - Biogas, Landfill | 0102 | 309A |
| - - Biogas, Sludge | 0102 | 309A |
| - - Biogas, Other | 0102 | 309A |
| - - Waste, Non-renewable | 0102 | 114A |
| - - Wastes, Renewable | 0102 | 114A |
| - - Fish Oil | 0102 | 215A |
| Autoproducers, Electricity Only | | |
| - Fuels Used for Power Production | | |
| - - Natural Gas | 0301 | 301A |
| - - Biogas, Landfill | 0301 | 309A |
| - - Biogas, Sewage Sludge | 0301 | 309A |
| - - Biogas, Other | 0301 | 309A |
| Autoproducers, CHP Units | | |
| - *Fuels Used for Power Production* | | |
| - - Refinery Gas | 0103 | 308A |
| - - Gas-/Diesel Oil | 0301 | 204A |
| - - Fuel Oil | 0301 | 203A |
| - - Waste Oil | 0301 | 203A |
| - - Natural Gas | 0301 | 301A |
| - - Coal | 0301 | 102A |
| - - Straw | 0301 | 117A |
| - - Wood Chips | 0301 | 111A |
| - - Wood Pellets | 0301 | 111A |
| - - Wood Waste | 0301 | 111A |
| - - Biogas, Landfill | 0301 | 309A |
| - - Biogas, Sludge | 0301 | 309A |
| - - Biogas, Other | 0301 | 309A |
| - - Fish Oil | 0301 | 215A |
| - - Waste, Non-renewable | 0301 | 114A |
| - - Wastes, Renewable | 0301 | 114A |
| - *Fuels Used for Heat Production* | | |
| - - Refinery Gas | 0103 | 308A |
| - - Gas-/Diesel Oil | 0301 | 204A |

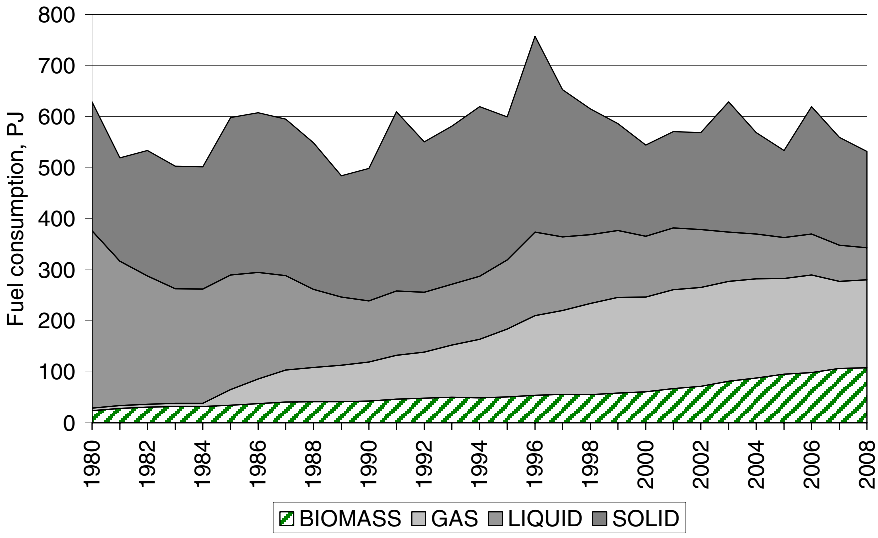
| | | | | | |
|---|---|---|---|---|---|
| *Continued* | | | | | |
| - - Fuel Oil | | | | 0301 | 203A |
| - - Waste Oil | | | | 0301 | 203A |
| - - Natural Gas | | | | 0301 | 301A |
| - - Coal | | | | 0301 | 102A |
| - - Wood Chips | | | | 0301 | 111A |
| - - Wood Waste | | | | 0301 | 111A |
| - - Biogas, Landfill | | | | 0301 | 309A |
| - - Biogas, Sludge | | | | 0301 | 309A |
| - - Biogas, Other | | | | 0301 | 309A |
| - - Waste, Non-renewable | | | | 0301 | 114A |
| - - Wastes, Renewable | | | | 0301 | 114A |
| Autoproducers, Heat Only | | | | | |
| - *Fuels Used for Heat Production* | | | | | |
| - - Gas-/Diesel Oil | | | | 0301 | 204A |
| - - Fuel Oil | | | | 0301 | 203A |
| - - Waste Oil | | | | 0301 | 203A |
| - - Natural Gas | | | | 0301 | 301A |
| - - Straw | | | | 0301 | 117A |
| - - Wood Chips | | | | 0301 | 111A |
| - - Wood Chips | | | | 0301 | 111A |
| - - Wood Waste | | | | 0301 | 111A |
| - - Biogas, Landfill | | | | 0301 | 309A |
| - - Biogas, Sludge | | | | 0301 | 309A |
| - - Biogas, Other | | | | 0301 | 309A |
| - - Waste, Non-renewable | | | | 0102 | 114A |
| - - Wastes, Renewable | | | | 0102 | 114A |
| Town Gas Units | 030106 | Naturgas | 301A | | |
| - Fuels Used for Production of District Heating | 030106 | Kul (-83) / Gasolie (84-) | 102A / 204A | | |
| Transport | | | | | |
| Military Transport | | | | | |
| - Aviation Gasoline | 0801 | Flyvebenzin | 209A | | |
| - Motor Gasoline | 0801 | Benzin og LVN | 2080 | | |
| - JP4 | 0801 | JP1 og JP4 | 207A | | |
| - JP1 | 0801 | JP1 og JP4 | 207A | | |
| - Gas-/Diesel Oil | 0801 | Gas & Dieselolie | 2050 | | |
| Road | | | | | |
| - LPG | 07 | LPG | 3030 | | |
| - Motor Gasoline | 07 | Benzin og LVN | 2080 | | |
| - Other Kerosene | 0202 | Petroleum | 206A | | |
| - Gas-/Diesel Oil | 07 | Gas & Dieselolie | 2050 | | |
| - Fuel Oil | 07 | Fuelolie & Spildolie | 203V | | |
| Rail | | | | | |
| - Motor Gasoline | 0802 | Benzin og LVN | 2080 | | |
| - Other Kerosene | 0802 | Petroleum | 206A | | |
| - Gas-/Diesel Oil | 0802 | Gas & Dieselolie | 2050 | | |
| - Electricity | | | | | |
| Domestic Sea Transport | | | | | |
| - LPG | 080402 | LPG | 3030 | | |
| - Other Kerosene | 080402 | Petroleum | 206A | | |
| - Gas-/Diesel Oil | 080402 | Gas & Dieselolie | 204B | | |
| - Fuel Oil | 080402 | Fuelolie & Spildolie | 203V | | |
| Air Transport, Domestic | | | | | |
| - LPG | 080501/080503 | LPG | 3030 | | |
| - Aviation Gasoline | 080501/080503 | Flyvebenzin | 209A | | |
| - Motor Gasoline | 080501/080503 | Benzin og LVN | 2080 | | |
| - Other Kerosene | 0201 | Petroleum | 206A | | |
| - JP1 | 080501/080503 | JP1 og JP4 | 207A | | |
| Air Transport, International | | | | | |
| - Aviation Gasoline | 080502/080504 | Flyvebenzin | 209A | | |
| - JP1 | 080502/080504 | JP1 og JP4 | 207A | | |
| Agriculture and Forestry | | | | | |
| - LPG | 0806-09 | LPG | 303A | | |
| - Motor Gasoline | 0806-09 | Benzin og LVN | 2080 | | |
| - Other Kerosene | 0203 | Petroleum | 206A | | |
| - Gas-/Diesel Oil | 0806-09 | Gas & Dieselolie | 204B | | |
| - Fuel Oil | 0203 | Fuelolie & Spildolie | 203A | | |
| - Petroleum Coke | 0203 | Petrokoks | 110A | | |
| - Natural Gas | 0203 | Naturgas | 301A | | |
| - Coal | 0203 | Kul | 102A | | |
| - Brown Coal Briquettes | 0203 | Brunkul | 106A | | |
| - Straw | 0203 | Halm | 117A | | |

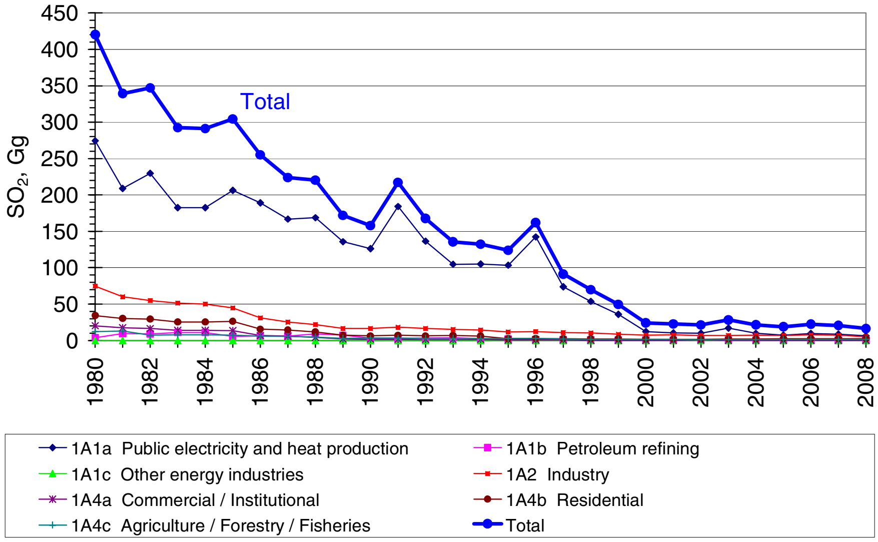
| *Continued* | | | |
|---|---|---|---|
| - Wood Chips | 0203 | Træ | 111A |
| - Wood Waste | 0203 | Træ | 111A |
| - Biogas, Other | 0203 | Biogas | 309A |
| Horticulture | | | |
| - LPG | 0806-09 | LPG | 3030 |
| - Motor Gasoline | 0806-09 | Benzin og LVN | 2080 |
| - Gas-/Diesel Oil | 0806-09 | Gas & Dieselolie | 204B |
| - Fuel Oil | 0203 | Fuelolie & Spildolie | 203A |
| - Petroleum Coke | 0203 | Petrokoks | 110A |
| - Natural Gas | 0203 | Naturgas | 301A |
| - Coal | 0203 | Kul | 102A |
| - Wood Waste | 0203 | Træ | 111A |
| Fishing | | | |
| - LPG | 080403 | LPG | 3030 |
| - Motor Gasoline | 080403 | Benzin og LVN | 2080 |
| - Other Kerosene | 080403 | Petroleum | 206A |
| - Gas-/Diesel Oil | 080403 | Gas & Dieselolie | 204B |
| - Fuel Oil | 080403 | Fuelolie & Spildolie | 203V |
| Manufacturing Industry | | | |
| - Refinery Gas | 0301 | Raffinaderigas | 308A |
| - LPG | 0806-09 | LPG | 3030 |
| - Naphtha (LVN) | 0806-09 | Benzin og LVN | 2080 |
| - Motor Gasoline | 0806-09 | Benzin og LVN | 2080 |
| - Other Kerosene | 0301 | Petroleum | 206A |
| - Gas-/Diesel Oil | 0806-09 | Gas & Dieselolie | 204B |
| - Fuel Oil | 0301 | Fuelolie & Spildolie | 203A |
| - Waste Oil | 0301 | Fuelolie & Spildolie | 203A |
| - Petroleum Coke | 0301 | Petrokoks | 110A |
| - Natural Gas | 0301 | Naturgas | 301A |
| - Coal | 0301 | Kul | 102A |
| - Coke | 0301 | Koks | 107A |
| - Brown Coal Briquettes | 0301 | Brunkul | 106A |
| - Wood Pellets | 0301 | Træ | 111A |
| - Wood Waste | 0301 | Træ | 111A |
| - Biogas, Landfill | 0301 | Biogas | 309A |
| - Biogas, Other | 0301 | Biogas | 309A |
| - Wastes, Non-renewable | 0301 | Affald | 114A |
| - Wastes, Renewable | 0301 | Affald | 114A |
| - Town Gas | 0301 | Naturgas | 301A |
| Construction | | | |
| - LPG | 0301 | LPG | 303A |
| - Motor Gasoline | 0806-09 | Benzin og LVN | 2080 |
| - Other Kerosene | 0301 | Petroleum | 206A |
| - Gas-/Diesel Oil | 0806-09 | Gas & Dieselolie | 204B |
| - Fuel Oil | 0301 | Fuelolie & Spildolie | 203A |
| - Natural Gas | 0301 | Naturgas | 301A |
| Wholesale | | | |
| - LPG | 0201 | LPG | 303A |
| - Motor Gasoline | 0201 | Petroleum | 206A |
| - Other Kerosene | 0201 | Gas & Dieselolie | 204A |
| - Gas-/Diesel Oil | 0201 | Fuelolie & Spildolie | 203A |
| - Petroleum Coke | 0201 | Petrokoks | 110A |
| - Natural Gas | 0201 | Naturgas | 301A |
| - Wood Waste | 0201 | Træ | 111A |
| Retail Trade | | | |
| - LPG | 0201 | LPG | 303A |
| - Other Kerosene | 0201 | Petroleum | 206A |
| - Gas-/Diesel Oil | 0201 | Gas & Dieselolie | 204A |
| - Fuel Oil | 0201 | Fuelolie & Spildolie | 203A |
| - Petroleum Coke | 0201 | Petrokoks | 110A |
| - Natural Gas | 0201 | Naturgas | 301A |
| Private Service | | | |
| - LPG | 0201 | LPG | 303A |
| - Other Kerosene | 0201 | Petroleum | 206A |
| - Gas-/Diesel Oil | 0201 | Gas & Dieselolie | 204A |
| - Fuel Oil | 0201 | Fuelolie & Spildolie | 203A |
| - Waste Oil | 0201 | Fuelolie & Spildolie | 203A |
| - Petroleum Coke | 0201 | Petrokoks | 110A |
| - Natural Gas | 0201 | Naturgas | 301A |
| - Wood Chips | 0201 | Træ | 111A |
| - Wood Waste | 0201 | Træ | 111A |
| - Biogas, Landfill | 0201 | Biogas | 309A |

| *Continued* | | | |
| --- | --- | --- | --- |
| - Biogas, Sludge | 0201 | Biogas | 309A |
| - Biogas, Other | 0201 | Biogas | 309A |
| - Wastes, Non-renewable | 0201 | Affald | 114A |
| - Wastes, Renewable | 0201 | Affald | 114A |
| - Town Gas | 0201 | Naturgas | 301A |
| Public Service | | | |
| - LPG | 0201 | LPG | 303A |
| - Other Kerosene | 0201 | Petroleum | 206A |
| - Gas-/Diesel Oil | 0201 | Gas & Dieselolie | 204A |
| - Fuel Oil | 0201 | Fuelolie & Spildolie | 203A |
| - Petroleum Coke | 0201 | Petrokoks | 110A |
| - Natural Gas | 0201 | Naturgas | 301A |
| - Coal | 0201 | Kul | 102A |
| - Brown Coal Briquettes | 0201 | Brunkul | 106A |
| - Wood Chips | 0201 | Træ | 111A |
| - Wood Pellets | 0201 | Træ | 111A |
| - Town Gas | 0201 | Naturgas | 301A |
| Single Family Houses | | | |
| - LPG | 0202 | LPG | 303A |
| - Motor Gasoline | 0806-09 | Benzin og LVN | 2080 |
| - Other Kerosene | 0202 | Petroleum | 206A |
| - Gas-/Diesel Oil | 0202 | Gas & Dieselolie | 204A |
| - Fuel Oil | 0202 | Fuelolie & Spildolie | 203A |
| - Petroleum Coke | 0202 | Petrokoks | 110A |
| - Natural Gas | 0202 | Naturgas | 301A |
| - Coal | 0202 | Kul | 102A |
| - Coke | 0202 | koks | 107A |
| - Brown Coal Briquettes | 0202 | Brunkul | 106A |
| - Straw | 0202 | Halm | 117A |
| - Firewood | 0202 | Træ | 111A |
| - Wood Chips | 0202 | Træ | 111A |
| - Wood Pellets | 0202 | Træ | 111A |
| - Town Gas | 0202 | Naturgas | 301A |
| Multi-family Houses | | | |
| - LPG | 0202 | LPG | 303A |
| - Other Kerosene | 0202 | Petroleum | 206A |
| - Gas-/Diesel Oil | 0202 | Gas & Dieselolie | 204A |
| - Fuel Oil | 0202 | Fuelolie & Spildolie | 203A |
| - Petroleum Coke | 0202 | Petrokoks | 110A |
| - Natural Gas | 0202 | Naturgas | 301A |
| - Coal | 0202 | Kul | 102A |
| - Coke | 0202 | Koks | 107A |
| - Brown Coal Briquettes | 0202 | Brunkul | 106A |
| - Town Gas | 0202 | Naturgas | 301A |

# Annex 2A-10 Time-series 1980-2008



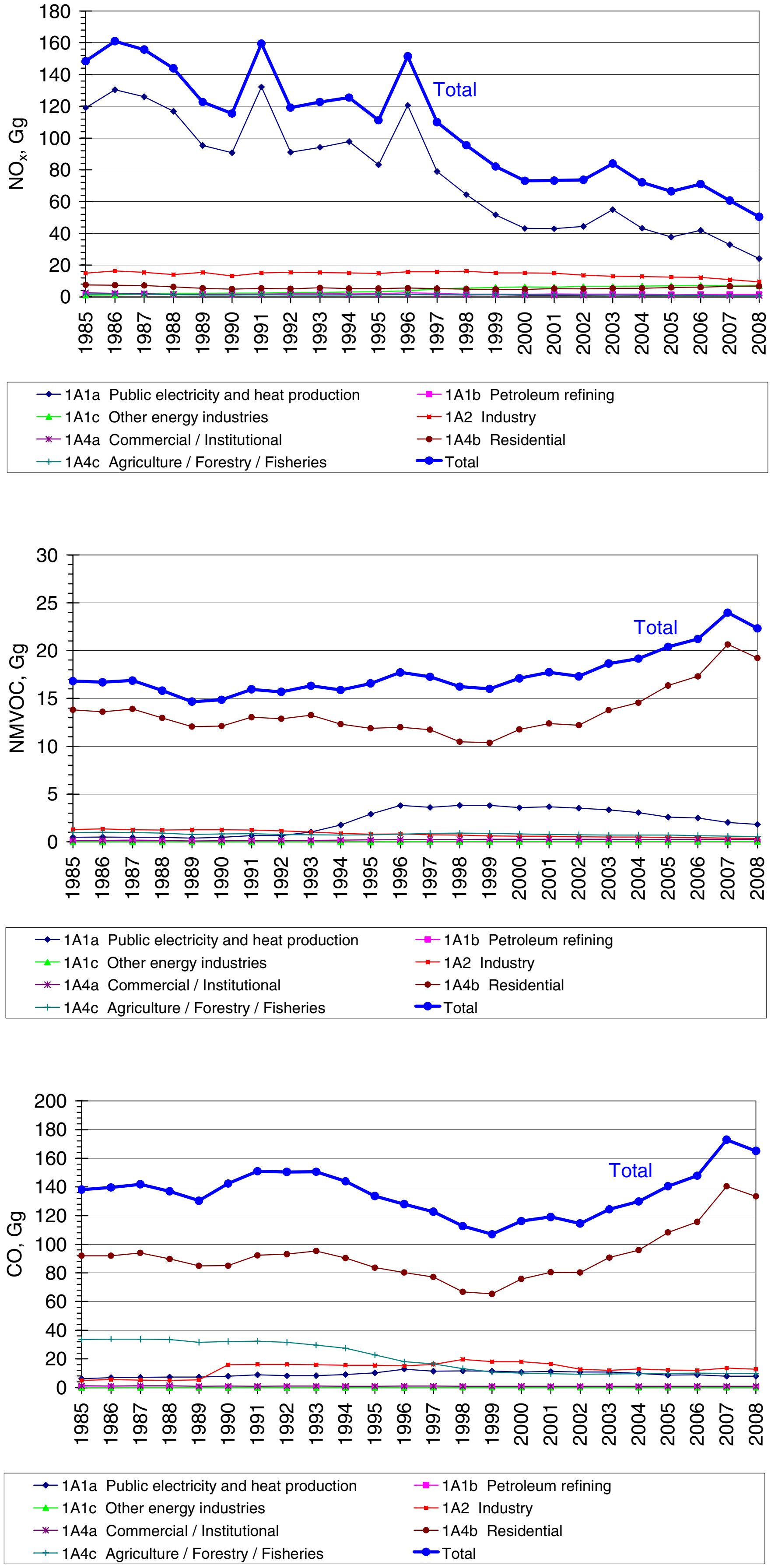



Figure 2A-10.1 Time-series for fuel consumption and emissions, 1980/1985 - 2008.

# Annex 2A-11 QA/QC for stationary combustion

### 10.1.3 Source specific QA/QC and verification

The elaboration of a formal QA/QC plan started in 2004. A first version is available from Sørensen et al. (2005).

The quality manual describes the concepts of quality work and definitions of sufficient quality, critical control points and a list of Point for Measuring (PM). Please see the general chapter on QA/QC.

The work on expanding the QC will be ongoing in future years.

### Data storage, level 1

Table 45 List of external data sources.

| Dataset | Description | AD or Emf. | Reference | Contact(s) | Data agreement/ Comment |
|---|---|---|---|---|---|
| Energiproducenttællingen.xls | Data set for all electricity and heat producing plants. | Activity data | The Danish Energy Agency (DEA) | Peter Dal | Data agreement in place |
| Gas consumption for gas engines and gas turbines 1990-1994 | | Activity data | DEA | Peter Dal | No data agreement. Historical data |
| Basic data (Grunddata.xls) | Data set used for IPCC reference approach | Activity data | DEA | Peter Dal | Not necessary. Published as part of national energy statistics |
| Energy statistics | The Danish energy statistics on SNAP level | Activity data | DEA | Peter Dal | Data agreement in place |
| $SO_2$ & $NO_x$ data, plants>25 $MW_e$ | | Emissions | DEA | Rasmus Sørensen | No data agreement in place |
| Emission factors | Emission factors stems from a large number of sources | Emission factors | See chapter regarding emission factors | | |
| HM and PM from public power plants | Emissions from the two large power plant operator in DK Elsam & E2 | Emissions | Dong Energy Vattenfall | Marina Snowman Møller, Heidi Demant | No formal data agreement in place |
| Environmental reports | Emissions from plants defined as large point sources | Emissions | Various plants | | No data agreement necessary. Plants are obligated by law. |
| EU ETS data | Plant specific $CO_2$ emission factors | Emission factors | DEA | Dorte Maimann Helen Falster | Plants are obligated by law. The availability of detailed information is part of a future data agreement with DEA. |

| | | | |
|---|---|---|---|
| Data Storage level 1 | 1. Accuracy | DS.1.1.1 | General level of uncertainty for every dataset including the reasoning for the specific values |

Since the DEA are responsible for the official Danish energy statistics as well as reporting to the IEA, NERI regards the data as being complete and in accordance with the official Danish energy statistics and IEA reporting. The uncertainties connected with estimating fuel consumption do not, therefore, influence the accordance between IEA data, the energy statistics and the dataset on SNAP level utilised by NERI. For the remainder of the datasets, it is assumed that the level of uncertainty is relatively low. For further comments regarding uncertainties, see Chapter 3.2.

| | | | |
|---|---|---|---|
| Data Storage level 1 | 1. Accuracy | DS.1.1.2 | Quantification of the uncertainty level of every single data value including the reasoning for the specific values. |

The uncertainty for external data is not quantified. The uncertainties of activity data and emission factors are quantified see Chapter 3.2.

| | | | |
|---|---|---|---|
| Data Storage level 1 | 2.Comparability | DS.1.2.1 | Comparability of the data values with similar data from other countries, which are comparable with Denmark, and evaluation of discrepancy. |

On the external data the comparability has not been checked. However, at CRF level a project has been carried out comparing the Danish inventories with those of other countries (Fauser et al. 2008).

| | | | |
|---|---|---|---|
| Data Storage level 1 | 3.Completeness | DS.1.3.1 | Documentation showing that all possible national data sources are included by setting up the reasoning for the selection of datasets. |

See the above Table 45 for an overview of external datasets.

### Danish Energy Authority

#### Statistic on fuel consumption from district heating and power plants

A spreadsheet from DEA is listing fuel consumption of all plants included as large point sources in the emission inventory. The statistic on fuel consumption from district heating and power plants is regarded as complete and with no significant uncertainty since the plants are bound by law to report their fuel consumption and other information.

#### Gas consumption for gas engines and gas turbines 1990-1994

For the years 1990-1994 DEA has estimated consumption of natural gas and biogas in gas engines and gas turbines. NERI assesses that the estimation by the DEA are the best available data.

#### Basic data

A spreadsheet from DEA is used for the $CO_2$ emission calculation in accordance with the IPCC reference approach. It is published annually on DEA's webpage; therefore, a formal data delivery agreement is not deemed necessary.

#### Energy statistics on SNAP level

The DEA reports fuel consumption statistics on SNAP level based on a correspondence table developed in co-operation with NERI. Both traded and non-traded fuels are included in the Danish energy statistics. Thus, for example, estimation of the annual consumption of non-traded wood is included. Petroleum coke, purchased abroad and combusted in Danish residential plants (border trade), is added to the apparent consumption of petroleum coke and the emissions are included in the inventory.

Emissions from non-energy use of fuels have been included in other source categories of the Danish inventory. The non-energy use of fuels is, however, included in the reference approach for Climate Convention reporting.

**$SO_2$ and $NO_x$ emission data from electricity producing plants > 25MWe**

Plants larger than 25 $MW_e$ are obligated to report emission data for $SO_2$ and $NO_x$ to the DEA annually. Data are on block level and classified. The data on plant level are part of the plants annually environmental reports. NERI's QC of the data consists of a comparison with data from previous years and with data from the plants' annual environmental reports.

**Emission factors from a wide range of sources**

For specific references, see the chapter regarding emission factors.

**Data for emission of heavy metals and particles from central power plants, Elsam and Energi E2**

The two major Danish power plant operators assess heavy metal emissions from their plants using model calculations based on fuel data and type of flue gas cleaning. NERI's QC of the data consists of a comparison with data from previous years and with data from the plants' annual environmental reports.

**Annual environmental reports from plants defined as large point sources**

A large number of plants are obligated by law to publish an annual environmental report with information on, among other things, emissions. NERI compares the data with those from previous years and large discrepancies are checked.

**EU ETS data**

EU ETS data are information on fuel consumption, heating values, carbon content of fuel, oxidation factor and $CO_2$ emissions. NERI receives the verified reports for all plants which utilises a detailed estimation methodology. NERI's QC of the received data consists of comparing to calculation using standard emission factors as well as comparing reported values with those for previous years.

| | | | |
|---|---|---|---|
| Data Storage level 1 | 4.Consistency | DS.1.4.1 | The origin of external data has to be preserved whenever possible without explicit arguments (referring to other PM's) |

It is ensured that all external data are archived at NERI. Subsequent data processing takes place in other spreadsheets or databases. The datasets are archived annually in order to ensure that the basic data for a given report are always available in their original form.

| | | | |
|---|---|---|---|
| Data Storage level 1 | 6.Robustness | DS.1.6.1 | Explicit agreements between the external institution of data delivery and NERI about the condition of delivery |

For stationary combustion a data delivery agreement is made with the DEA. Most of the other external data sources are available due to legislatory requirements. See Table 45.

| | | | |
|---|---|---|---|
| Data Storage level 1 | 7.Transparency | DS.1.7.1 | Summary of each dataset including the reasoning for selecting the specific dataset |

See DS 1.3.1

| | | | |
|---|---|---|---|
| Data Storage level 1 | 7.Transparenc y | DS.1.7.3 | References for citation for any external data set have to be available for any single number in any dataset. |

See Table 45 for general references. Much documentation already exists. However, some of the information used is classified and therefore not publicly available.

| | | | |
|---|---|---|---|
| Data Storage level 1 | 7.Transparenc y | DS.1.7.4 | Listing of external contacts for every dataset |

See Table 45.

**Data processing, level 1**

| | | | |
|---|---|---|---|
| Data Processing level 1 | 1. Accuracy | DP.1.1.1 | Uncertainty assessment for every data source as input to Data Storage level 2 in relation to type of variability. (Distribution as: normal, log normal or other type of variability) |

The uncertainty assessment of activity data and emission factors are discussed in the chapter concerning uncertainties.

| | | | |
|---|---|---|---|
| Data Processing level 1 | 1. Accuracy | DP.1.1.2 | Uncertainty assessment for every data source as input to Data Storage level 2 in relation to scale of variability (size of variation intervals) |

The uncertainty assessment of activity data and emission factors are discussed in the chapter concerning uncertainties.

| | | | |
|---|---|---|---|
| Data Processing level 1 | 1. Accuracy | DP.1.1.3 | Evaluation of the methodological approach using international guidelines |

The methodological approach is consistent with international guidelines. For the majority of sources tier 2 or tier 3 methodologies are used.

| | | | |
|---|---|---|---|
| Data Processing level 1 | 1. Accuracy | DP.1.1.4 | Verification of calculation results using guideline values |

Calculated emission factors are compared with guideline emission factors to ensure that they are within reason.

| | | | |
|---|---|---|---|
| Data Processing level 1 | 2.Comparability | DP.1.2.1 | The inventory calculation has to follow the international guidelines suggested by UNFCCC and IPCC. |

The calculations follow the principle in international guidelines.

| | | | |
|---|---|---|---|
| Data Processing level 1 | 3.Completeness | DP.1.3.1 | Assessment of the most important quantitative knowledge which is lacking. |

Regarding the distribution of energy consumption for industrial sources (CRF sector 1A2), a more detailed and frequently updated data material would be preferred. There is ongoing work to increase the accuracy and completeness of this IPCC source category. It is not assessed that this has any influence on the overall emission level of greenhouse gases.

| | | | |
|---|---|---|---|
| Data Processing level 1 | 3.Completeness | DP.1.3.2 | Assessment of the most important cases where accessibility to critical data sources that could improve quantitative knowledge is missing. |

There is no missing accessibility to critical data sources.

| | | | |
|---|---|---|---|
| Data Processing level 1 | 4.Consistency | DP.1.4.1 | In order to keep consistency at a higher level, an explicit description of the activities needs to accompany any change in the calculation procedure. |

A change in calculation procedure would entail that an updated description would be elaborated.

| | | | |
|---|---|---|---|
| Data Processing level 1 | 5.Correctness | DP.1.5.1 | Show at least once, by independent calculation, the correctness of every data manipulation. |

During data processing it is checked that calculations are done correctly. This is to a wide degree documented in the data processing spreadsheets.

| | | | |
|---|---|---|---|
| Data Processing level 1 | 5.Correctness | DP.1.5.2 | Verification of calculation results using time-series |

Time-series for activity data on SNAP level, as well as emission factors, are used to identify possible errors in the calculation procedure.

| | | | |
|---|---|---|---|
| Data Processing level 1 | 5.Correctness | DP.1.5.3 | Verification of calculation results using other measures |

The IPCC reference approach validates the fuel consumption rates and $CO_2$ emissions of fuel combustion. Fuel consumption rates and $CO_2$ emissions differ by less than 1.9 % (1990-2008). The reference approach is further discussed below.

| | | | |
|---|---|---|---|
| Data Processing level 1 | 5.Correctness | DP.1.5.4 | Show one-to-one correctness between external data sources and the databases at Data Storage level 2. |

There is a direct line between the external datasets, the calculation process and the input data used to Data Storage level 2. During the calculation process numerous controls are conducted to ensure correctness, e.g. sum checks of the various stages in the calculation procedure.

| | | | |
|---|---|---|---|
| Data Processing level 1 | 7.Transparency | DP.1.7.1 | The calculation principle and equations used must be described. |
| Data Processing level 1 | 7.Transparency | DP.1.7.2 | The theoretical reasoning for all methods must be described. |
| Data Processing level 1 | 7.Transparency | DP.1.7.3 | Explicit listing of assumptions behind all methods |

Where appropriate, this is included in the present report with annexes.

| | | | |
|---|---|---|---|
| Data Processing level 1 | 7.Transparency | DP.1.7.4 | Clear reference to dataset at Data Storage level 1 |

There is a clear line between the external data and the data processing.

| | | | |
|---|---|---|---|
| Data Processing level 1 | 7.Transparency | DP.1.7.5 | A manual log to collect information about recalculations |

At present, a manual log table is not in place at this level. However, this feature will be implemented in the future. A manual log table is incorporated in the national emission database, Data Storage level 2.

#### Data storage, level 2

| | | | |
|---|---|---|---|
| Data Storage level 2 | 5.Correctness | DS.2.5.1 | Documentation of a correct connection between all data types at level 2 to data at level 1 |

To ensure a correct connection between data on level 2 and data on level 1, different controls are in place, e.g. control of sums and random tests.

| | | | |
|---|---|---|---|
| Data Storage level 2 | 5.Correctness | DS.2.5.2 | Check if a correct data import to level 2 has been made. |

Data import is checked by use of sum control and random testing. The same procedure is applied every year in order to minimise the risk of data import errors.

#### Other QC procedures

The emission from each large point source is compared with the emission reported the previous year.

Some automated checks have been prepared for the emission databases:

- Check of units for fuel rate, emission factors and plant-specific emissions.
- Check of emission factors for large point sources. Emission factors for pollutants that are not plant-specific should be the same as those defined for area sources.
- Additional checks on database consistency.
- Most emission factor references are now incorporated in the emission database, itself.
- Annual environmental reports are kept for subsequent control of plant-specific emission data.
- QC checks of the country-specific emission factors have not been performed, but most factors are based on input from companies that have implemented some QA/QC work. The major power plant owner/operators in Denmark, DONG Energy has obtained the ISO 14001 certification for an environmental management system. The Danish Gas Technology Centre and Force Technology both run accredited laboratories for emission measurements.

#### Suggested QA/QC plan for stationary combustion

The following points make up the list of QA/QC tasks to be carried out directly in relation to the stationary combustion part of the Danish emission inventories. The time plan for the individual tasks has not yet been made.

*Data storage level 1*

A fully comprehensive list of references for emission factors and activity data.

A comparison with external data from other countries in order to evaluate discrepancies.

*Data processing level 1*

Documentation list of model and independent calculations to test every single mathematical relation.

# Annex 2B

## Transport

## List of content

## Annex 2B-1 Fleet data 1985-2008 for road transport (No. vehicles)

| Sector | Subsector | Tech 2 | FYear | LYear | 1985 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Cars | Gasoline <1,4 l | PRE ECE | 0 | 1969 | 80570 | 46208 | 44014 | 42804 | 36466 | 39959 | 37597 | 37130 | 3434 | 2761 | 2103 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/00-01 | 1970 | 1978 | 333715 | 187911 | 161642 | 139010 | 119424 | 80741 | 67991 | 53302 | 44338 | 31104 | 22511 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/02 | 1979 | 1980 | 104223 | 86056 | 79240 | 72588 | 65797 | 49614 | 42976 | 34748 | 25889 | 17458 | 10806 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/03 | 1981 | 1985 | 345946 | 301692 | 295677 | 288944 | 280769 | 262502 | 250449 | 233656 | 215509 | 183239 | 147178 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/04 | 1986 | 1990 | | 282011 | 280181 | 278685 | 278152 | 275859 | 272989 | 269953 | 275188 | 264791 | 254032 |
| Passenger Cars | Gasoline <1,4 l | Euro I | 1991 | 1996 | | | 39608 | 73527 | 101489 | 139813 | 169133 | 205235 | 210861 | 208281 | 206803 |
| Passenger Cars | Gasoline <1,4 l | Euro II | 1997 | 2000 | | | | | | | | | 38465 | 74495 | 108508 |
| Passenger Cars | Gasoline <1,4 l | Euro III | 2001 | 2005 | | | | | | | | | | | |
| Passenger Cars | Gasoline <1,4 l | Euro IV | 2006 | 2010 | | | | | | | | | | | |
| Passenger Cars | Gasoline 1,4 - 2,0 l | PRE ECE | 0 | 1969 | 61592 | 35940 | 34233 | 33292 | 28362 | 31079 | 29242 | 28879 | 2671 | 2148 | 1635 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/00-01 | 1970 | 1978 | 218180 | 127631 | 109640 | 94188 | 80844 | 54600 | 45991 | 36078 | 30465 | 21520 | 15647 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/02 | 1979 | 1980 | 60836 | 55062 | 50674 | 46402 | 42040 | 31712 | 27445 | 22173 | 16509 | 11141 | 6870 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/03 | 1981 | 1985 | 210574 | 174545 | 170749 | 166595 | 161591 | 150612 | 143385 | 133412 | 122642 | 103931 | 83270 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/04 | 1986 | 1990 | | 190297 | 188949 | 187872 | 187524 | 186044 | 184194 | 182297 | 186155 | 179510 | 172582 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro I | 1991 | 1996 | | | 35647 | 75763 | 119562 | 201007 | 288096 | 375253 | 383870 | 378063 | 375137 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro II | 1997 | 2000 | | | | | | | | | 95358 | 196046 | 274022 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro III | 2001 | 2005 | | | | | | | | | | | |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro IV | 2006 | 2010 | | | | | | | | | | | |
| Passenger Cars | Gasoline >2,0 l | PRE ECE | 0 | 1969 | 5923 | 3423 | 3260 | 3171 | 2701 | 2960 | 2785 | 2750 | 254 | 205 | 156 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/00-01 | 1970 | 1978 | 18532 | 10781 | 9234 | 7914 | 6781 | 4567 | 3849 | 3022 | 2619 | 1881 | 1366 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/02 | 1979 | 1980 | 8730 | 4392 | 4043 | 3702 | 3354 | 2531 | 2191 | 1770 | 1318 | 888 | 549 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/03 | 1981 | 1985 | 31066 | 24667 | 24157 | 23595 | 22912 | 21429 | 20432 | 19053 | 17571 | 14934 | 12016 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/04 | 1986 | 1990 | | 25679 | 25524 | 25389 | 25338 | 25120 | 24844 | 24546 | 24977 | 23975 | 22975 |
| Passenger Cars | Gasoline >2,0 l | Euro I | 1991 | 1996 | | | 3961 | 8129 | 12434 | 20068 | 27915 | 35770 | 36617 | 36081 | 35808 |
| Passenger Cars | Gasoline >2,0 l | Euro II | 1997 | 2000 | | | | | | | | | 12432 | 27315 | 44923 |
| Passenger Cars | Gasoline >2,0 l | Euro III | 2001 | 2005 | | | | | | | | | | | |
| Passenger Cars | Gasoline >2,0 l | Euro IV | 2006 | 2010 | | | | | | | | | | | |
| Passenger Cars | Diesel <2,0 l | Conventional | 0 | 1990 | 75828 | 79714 | 75794 | 72294 | 68535 | 62144 | 58848 | 55004 | 48251 | 43893 | 43004 |
| Passenger Cars | Diesel <2,0 l | Euro I | 1991 | 1996 | | | 4042 | 8018 | 11872 | 18305 | 24557 | 31177 | 31314 | 31730 | 35118 |
| Passenger Cars | Diesel <2,0 l | Euro II | 1997 | 2000 | | | | | | | | | 7046 | 14640 | 23084 |
| Passenger Cars | Diesel <2,0 l | Euro III | 2001 | 2005 | | | | | | | | | | | |
| Passenger Cars | Diesel <2,0 l | Euro IV | 2006 | 2010 | | | | | | | | | | | |
| Passenger Cars | Diesel >2,0 l | Conventional | 0 | 1990 | 3451 | 3703 | 3556 | 3425 | 3281 | 3040 | 2906 | 2747 | 2461 | 2266 | 2237 |
| Passenger Cars | Diesel >2,0 l | Euro I | 1991 | 1996 | | | 213 | 437 | 668 | 1078 | 1499 | 1921 | 1928 | 1952 | 2161 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | | | | | | | | | |
| Passenger Cars | Diesel >2,0 l | Euro II | 1997 | 2000 | | | | | | | | | 655 | 1478 | 2711 |
| Passenger Cars | Diesel >2,0 l | Euro III | 2001 | 2005 | | | | | | | | | | | |
| Passenger Cars | Diesel >2,0 l | Euro IV | 2006 | 2010 | | | | | | | | | | | |
| Passenger Cars | LPG | Conventional | 0 | 1990 | 287 | 286 | 286 | 288 | 289 | 289 | 301 | 311 | 172 | 97 | 44 |
| Passenger Cars | 2-Stroke | Conventional | 0 | 9999 | 4823 | 5417 | 4804 | 4308 | 3747 | 3029 | 2443 | 1824 | 1248 | 761 | 400 |
| Light Duty Vehicles | Gasoline <3,5t | Conventional | 0 | 1994 | 33049 | 42333 | 43215 | 44179 | 45486 | 47261 | 44601 | 41519 | 37209 | 34454 | 31489 |
| Light Duty Vehicles | Gasoline <3,5t | Euro I | 1995 | 1998 | | | | | | | 4259 | 8524 | 12645 | 17212 | 16632 |
| Light Duty Vehicles | Gasoline <3,5t | Euro II | 1999 | 2001 | | | | | | | | | | | 4705 |
| Light Duty Vehicles | Gasoline <3,5t | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Light Duty Vehicles | Gasoline <3,5t | Euro IV | 2007 | 2011 | | | | | | | | | | | |
| Light Duty Vehicles | Diesel <3,5 t | Conventional | 0 | 1994 | 121431 | 155543 | 158781 | 162324 | 167129 | 173650 | 163877 | 152553 | 142109 | 131572 | 122992 |
| Light Duty Vehicles | Diesel <3,5 t | Euro I | 1995 | 1998 | | | | | | | 15648 | 31318 | 48292 | 65727 | 64964 |
| Light Duty Vehicles | Diesel <3,5 t | Euro II | 1999 | 2001 | | | | | | | | | | | 18376 |
| Light Duty Vehicles | Diesel <3,5 t | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Light Duty Vehicles | Diesel <3,5 t | Euro IV | 2007 | 2011 | | | | | | | | | | | |
| Heavy Duty Vehicles | Gasoline >3,5 t | Conventional | 0 | 9999 | 251 | 250 | 255 | 260 | 268 | 279 | 288 | 295 | 261 | 274 | 253 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Conventional | 0 | 1993 | 5140 | 5108 | 5214 | 5330 | 5369 | 5087 | 4775 | 4418 | 3891 | 3585 | 2986 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro I | 1994 | 1996 | | | | | 120 | 616 | 1121 | 1488 | 1421 | 1415 | 1251 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro II | 1997 | 2001 | | | | | | | | 132 | 655 | 1213 | 1598 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro IV | 2007 | 2009 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro V | 2010 | 2014 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Conventional | 0 | 1993 | 10350 | 10286 | 10500 | 10734 | 10811 | 10243 | 9615 | 8897 | 7590 | 6413 | 5443 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro I | 1994 | 1996 | | | | | 241 | 1240 | 2257 | 2997 | 2772 | 2531 | 2281 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro II | 1997 | 2001 | | | | | | | | 265 | 1278 | 2171 | 2914 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro IV | 2007 | 2009 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro V | 2010 | 2014 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Conventional | 0 | 1993 | 13115 | 13034 | 13306 | 13602 | 13700 | 12981 | 12184 | 11274 | 10431 | 9548 | 8709 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro I | 1994 | 1996 | | | | | 305 | 1571 | 2860 | 3798 | 3810 | 3768 | 3649 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro II | 1997 | 2001 | | | | | | | | 336 | 1757 | 3232 | 4662 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro IV | 2007 | 2009 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro V | 2010 | 2014 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel >32t | Conventional | 0 | 1993 | 11517 | 11446 | 11684 | 11944 | 12030 | 11398 | 10699 | 9900 | 9086 | 8469 | 7931 |
| Heavy Duty Vehicles | Diesel >32t | Euro I | 1994 | 1996 | | | | | 268 | 1379 | 2511 | 3335 | 3318 | 3342 | 3323 |
| Heavy Duty Vehicles | Diesel >32t | Euro II | 1997 | 2001 | | | | | | | | 295 | 1530 | 2866 | 4246 |

*Continued*

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Heavy Duty Vehicles | Diesel >32t | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel >32t | Euro IV | 2007 | 2009 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel >32t | Euro V | 2010 | 2014 | | | | | | | | | | | |
| Buses | Urban Buses | Conventional | 0 | 1993 | 4712 | 4753 | 4561 | 4522 | 4490 | 4083 | 3635 | 3261 | 2946 | 2792 | 2542 |
| Buses | Urban Buses | Euro I | 1994 | 1996 | | | | | | 390 | 746 | 1084 | 1060 | 972 | 913 |
| Buses | Urban Buses | Euro II | 1997 | 2001 | | | | | | | | | 390 | 729 | 1053 |
| Buses | Urban Buses | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Buses | Urban Buses | Euro IV | 2007 | 2009 | | | | | | | | | | | |
| Buses | Coaches | Conventional | 0 | 1993 | 3298 | 3327 | 2868 | 3007 | 3086 | 2927 | 4507 | 4156 | 3662 | 3369 | 3007 |
| Buses | Coaches | Euro I | 1994 | 1996 | | | | | | 280 | 925 | 1381 | 1318 | 1173 | 1080 |
| Buses | Coaches | Euro II | 1997 | 2001 | | | | | | | | | 485 | 879 | 1246 |
| Buses | Coaches | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Buses | Coaches | Euro IV | 2007 | 2009 | | | | | | | | | | | |
| Mopeds | <50 cm³ | Conventional | 0 | 1999 | 151000 | 120000 | 118000 | 113000 | 109000 | 105000 | 114167 | 123333 | 132500 | 141667 | 150833 |
| Mopeds | <50 cm³ | Euro I | 2000 | 2003 | | | | | | | | | | | |
| Mopeds | <50 cm³ | Euro II | 2004 | 9999 | | | | | | | | | | | |
| Motorcycles | 2-stroke >50 cm³ | Conventional | 0 | 1999 | 6209 | 6617 | 6804 | 6904 | 7111 | 7406 | 7672 | 8214 | 8980 | 9598 | 10385 |
| Motorcycles | 4-stroke <250 cm³ | Conventional | 0 | 1999 | 7037 | 7499 | 7712 | 7824 | 8059 | 8394 | 8695 | 9310 | 10177 | 10878 | 11769 |
| Motorcycles | 4-stroke <250 cm³ | Euro I | 2000 | 2003 | | | | | | | | | | | |
| Motorcycles | 4-stroke <250 cm³ | Euro II | 2004 | 2006 | | | | | | | | | | | |
| Motorcycles | 4-stroke <250 cm³ | Euro III | 2007 | 9999 | | | | | | | | | | | |
| Motorcycles | 4-stroke 250 - 750 cm³ | Conventional | 0 | 1999 | 19352 | 20622 | 21207 | 21516 | 22162 | 23083 | 23911 | 25602 | 27986 | 29914 | 32365 |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro I | 2000 | 2003 | | | | | | | | | | | |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro II | 2004 | 2006 | | | | | | | | | | | |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro III | 2007 | 9999 | | | | | | | | | | | |
| Motorcycles | 4-stroke >750 cm³ | Conventional | 0 | 1999 | 8796 | 9374 | 9639 | 9780 | 10074 | 10492 | 10869 | 11637 | 12721 | 13597 | 14712 |
| Motorcycles | 4-stroke >750 cm³ | Euro I | 2000 | 2003 | | | | | | | | | | | |
| Motorcycles | 4-stroke >750 cm³ | Euro II | 2004 | 2006 | | | | | | | | | | | |
| Motorcycles | 4-stroke >750 cm³ | Euro III | 2007 | 9999 | | | | | | | | | | | |

| Sector | Subsector | Tech 2 | FYear | LYear | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Cars | Gasoline <1,4 l | PRE ECE | 0 | 1969 | 1744 | 1614 | 1475 | 1392 | 1313 | 1313 | 1313 | 1313 | 1313 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/00-01 | 1970 | 1978 | 17980 | 15837 | 14155 | 13149 | 12404 | 12335 | 12279 | 12102 | 11777 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/02 | 1979 | 1980 | 7298 | 5510 | 4178 | 3128 | 2433 | 2882 | 2869 | 2828 | 2746 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/03 | 1981 | 1985 | 118979 | 97964 | 79041 | 60723 | 45824 | 25489 | 14555 | 8865 | 6786 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/04 | 1986 | 1990 | 235890 | 219216 | 194543 | 171430 | 142490 | 133653 | 117770 | 97775 | 70786 |
| Passenger Cars | Gasoline <1,4 l | Euro I | 1991 | 1996 | 204184 | 201708 | 197423 | 192152 | 185488 | 183896 | 185747 | 175728 | 175378 |
| Passenger Cars | Gasoline <1,4 l | Euro II | 1997 | 2000 | 135030 | 132812 | 130153 | 128898 | 126400 | 133689 | 129230 | 130820 | 119275 |
| Passenger Cars | Gasoline <1,4 l | Euro III | 2001 | 2005 | | 21858 | 47428 | 70311 | 99658 | 126777 | 128423 | 137270 | 143825 |
| Passenger Cars | Gasoline <1,4 l | Euro IV | 2006 | 2010 | | | | | | | 31558 | 54861 | 78115 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | PRE ECE | 0 | 1969 | 1356 | 1255 | 1147 | 1083 | 1021 | 1021 | 1021 | 1021 | 1021 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/00-01 | 1970 | 1978 | 12537 | 11077 | 9923 | 9230 | 8707 | 8852 | 8964 | 8986 | 8876 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/02 | 1979 | 1980 | 4642 | 3500 | 2659 | 1987 | 1545 | 1858 | 1892 | 1908 | 1871 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/03 | 1981 | 1985 | 67222 | 55300 | 44572 | 34238 | 25810 | 14529 | 8564 | 5515 | 4331 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/04 | 1986 | 1990 | 160800 | 149915 | 133745 | 118448 | 99092 | 86463 | 72814 | 58779 | 41539 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro I | 1991 | 1996 | 370803 | 367136 | 359959 | 351645 | 340424 | 286124 | 227403 | 169862 | 145690 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro II | 1997 | 2000 | 326268 | 320971 | 314678 | 311808 | 305621 | 334798 | 342059 | 322170 | 270645 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro III | 2001 | 2005 | | 49700 | 105323 | 147067 | 195430 | 250309 | 274132 | 321955 | 346409 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro IV | 2006 | 2010 | | | | | | | 52995 | 96186 | 147652 |
| Passenger Cars | Gasoline >2,0 l | PRE ECE | 0 | 1969 | 129 | 120 | 109 | 103 | 97 | 97 | 97 | 97 | 97 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/00-01 | 1970 | 1978 | 1110 | 986 | 885 | 825 | 778 | 807 | 836 | 856 | 839 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/02 | 1979 | 1980 | 371 | 280 | 212 | 159 | 123 | 147 | 148 | 147 | 168 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/03 | 1981 | 1985 | 9722 | 8009 | 6459 | 4964 | 3744 | 2045 | 1103 | 592 | 373 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/04 | 1986 | 1990 | 21251 | 19699 | 17377 | 15265 | 12607 | 12107 | 10565 | 8778 | 6439 |
| Passenger Cars | Gasoline >2,0 l | Euro I | 1991 | 1996 | 35388 | 35024 | 34329 | 33516 | 32431 | 27636 | 23084 | 18339 | 16598 |
| Passenger Cars | Gasoline >2,0 l | Euro II | 1997 | 2000 | 61899 | 60799 | 59506 | 58896 | 57815 | 48867 | 39683 | 32828 | 25049 |
| Passenger Cars | Gasoline >2,0 l | Euro III | 2001 | 2005 | | 15179 | 30712 | 45080 | 65819 | 82828 | 77816 | 76346 | 70905 |
| Passenger Cars | Gasoline >2,0 l | Euro IV | 2006 | 2010 | | | | | | | 22245 | 36980 | 51240 |
| Passenger Cars | Diesel <2,0 l | Conventional | 0 | 1990 | 42604 | 42641 | 42100 | 40525 | 38619 | 38848 | 38848 | 38848 | 38848 |
| Passenger Cars | Diesel <2,0 l | Euro I | 1991 | 1996 | 39314 | 43578 | 48670 | 53462 | 59968 | 59968 | 59968 | 59968 | 59968 |
| Passenger Cars | Diesel <2,0 l | Euro II | 1997 | 2000 | 31541 | 34764 | 38842 | 43327 | 49262 | 49262 | 49262 | 49262 | 49262 |
| Passenger Cars | Diesel <2,0 l | Euro III | 2001 | 2005 | | 5482 | 13338 | 21371 | 33648 | 63606 | 63606 | 63606 | 63606 |
| Passenger Cars | Diesel <2,0 l | Euro IV | 2006 | 2010 | | | | | | | 36794 | 120859 | 178360 |
| Passenger Cars | Diesel >2,0 l | Conventional | 0 | 1990 | 2228 | 2229 | 2187 | 2096 | 1978 | 1978 | 1978 | 1978 | 1978 |
| Passenger Cars | Diesel >2,0 l | Euro I | 1991 | 1996 | 2420 | 2683 | 2998 | 3295 | 3698 | 3698 | 3698 | 3698 | 3698 |
| Passenger Cars | Diesel >2,0 l | Euro II | 1997 | 2000 | 4232 | 4658 | 5196 | 5790 | 6592 | 6592 | 6592 | 6592 | 6592 |
| Passenger Cars | Diesel >2,0 l | Euro III | 2001 | 2005 | | 1163 | 2682 | 4432 | 7505 | 10765 | 10765 | 10765 | 10765 |
| Passenger Cars | Diesel >2,0 l | Euro IV | 2006 | 2010 | | | | | | | 4004 | 13151 | 19408 |

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Cars | LPG | Conventional | 0 | 1990 | 32 | 63 | 21 | 15 | 15 | 15 | 15 | 10 | 12 |
| Passenger Cars | 2-Stroke | Conventional | 0 | 9999 | 300 | 200 | 150 | 100 | 50 | | | | |
| Light Duty Vehicles | Gasoline <3,5t | Conventional | 0 | 1994 | 28488 | 25423 | 21615 | 18838 | 14576 | 12300 | 9827 | 6041 | 3805 |
| Light Duty Vehicles | Gasoline <3,5t | Euro I | 1995 | 1998 | 15979 | 15527 | 15049 | 13949 | 14793 | 14462 | 13766 | 10509 | 8795 |
| Light Duty Vehicles | Gasoline <3,5t | Euro II | 1999 | 2001 | 9299 | 14017 | 13917 | 13805 | 14126 | 14061 | 13667 | 10693 | 9217 |
| Light Duty Vehicles | Gasoline <3,5t | Euro III | 2002 | 2006 | | | 5140 | 10719 | 16724 | 23033 | 29145 | 23176 | 20352 |
| Light Duty Vehicles | Gasoline <3,5t | Euro IV | 2007 | 2011 | | | | | | | | 5439 | 9887 |
| Light Duty Vehicles | Diesel <3,5 t | Conventional | 0 | 1994 | 115695 | 105397 | 92990 | 82927 | 66760 | 59477 | 51497 | 37477 | 25323 |
| Light Duty Vehicles | Diesel <3,5 t | Euro I | 1995 | 1998 | 64894 | 64370 | 64743 | 61406 | 67753 | 69932 | 72140 | 65198 | 58535 |
| Light Duty Vehicles | Diesel <3,5 t | Euro II | 1999 | 2001 | 37766 | 58112 | 59870 | 60771 | 64697 | 67990 | 71620 | 66341 | 61339 |
| Light Duty Vehicles | Diesel <3,5 t | Euro III | 2002 | 2006 | | | 22112 | 47186 | 76596 | 111375 | 152728 | 143794 | 135446 |
| Light Duty Vehicles | Diesel <3,5 t | Euro IV | 2007 | 2011 | | | | | | | | 33742 | 65803 |
| Heavy Duty Vehicles | Gasoline >3,5 t | Conventional | 0 | 9999 | 257 | 249 | 249 | 247 | 233 | 252 | 266 | 273 | 278 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Conventional | 0 | 1993 | 2329 | 1910 | 1671 | 1351 | 1007 | 766 | 542 | 343 | 197 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro I | 1994 | 1996 | 1042 | 936 | 938 | 796 | 883 | 803 | 711 | 624 | 730 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro II | 1997 | 2001 | 1682 | 1720 | 1788 | 1608 | 1768 | 1648 | 1504 | 1356 | 1564 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro III | 2002 | 2006 | 114 | 354 | 845 | 1279 | 1892 | 2309 | 2578 | 2387 | 2828 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro IV | 2007 | 2009 | | | | | | 16 | 90 | 452 | 868 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro V | 2010 | 2014 | | | | | | 5 | 32 | 169 | 530 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Conventional | 0 | 1993 | 4921 | 4063 | 3014 | 2468 | 1544 | 1142 | 826 | 531 | 204 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro I | 1994 | 1996 | 2201 | 1992 | 1692 | 1454 | 1354 | 1197 | 1083 | 967 | 759 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro II | 1997 | 2001 | 3556 | 3660 | 3226 | 2939 | 2711 | 2458 | 2291 | 2099 | 1625 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro III | 2002 | 2006 | 242 | 754 | 1525 | 2336 | 2901 | 3444 | 3926 | 3697 | 2938 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro IV | 2007 | 2009 | | | | | | 24 | 136 | 700 | 901 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro V | 2010 | 2014 | | | | | | 8 | 48 | 263 | 551 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Conventional | 0 | 1993 | 7677 | 6576 | 5309 | 4389 | 2930 | 2204 | 1601 | 1035 | 438 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro I | 1994 | 1996 | 3434 | 3224 | 2981 | 2585 | 2569 | 2311 | 2099 | 1884 | 1628 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro II | 1997 | 2001 | 5547 | 5923 | 5683 | 5225 | 5144 | 4745 | 4440 | 4089 | 3486 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro III | 2002 | 2006 | 377 | 1221 | 2686 | 4154 | 5505 | 6648 | 7609 | 7201 | 6304 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro IV | 2007 | 2009 | | | | | | 47 | 264 | 1363 | 1934 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro V | 2010 | 2014 | | | | | | 16 | 93 | 511 | 1181 |
| Heavy Duty Vehicles | Diesel >32t | Conventional | 0 | 1993 | 7123 | 6299 | 5272 | 4528 | 3092 | 2522 | 1942 | 1339 | 602 |
| Heavy Duty Vehicles | Diesel >32t | Euro I | 1994 | 1996 | 3186 | 3088 | 2960 | 2667 | 2711 | 2644 | 2547 | 2438 | 2236 |
| Heavy Duty Vehicles | Diesel >32t | Euro II | 1997 | 2001 | 5147 | 5673 | 5643 | 5391 | 5428 | 5428 | 5388 | 5293 | 4789 |
| Heavy Duty Vehicles | Diesel >32t | Euro III | 2002 | 2006 | 350 | 1169 | 2667 | 4286 | 5809 | 7605 | 9232 | 9320 | 8659 |
| Heavy Duty Vehicles | Diesel >32t | Euro IV | 2007 | 2009 | | | | | | 53 | 321 | 1764 | 2657 |
| Heavy Duty Vehicles | Diesel >32t | Euro V | 2010 | 2014 | | | | | | 18 | 113 | 662 | 1623 |

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Buses | Urban Buses | Conventional | 0 | 1993 | 2319 | 2159 | 1977 | 1859 | 1711 | 1551 | 1381 | 1210 | 1040 |
| Buses | Urban Buses | Euro I | 1994 | 1996 | 852 | 792 | 752 | 713 | 663 | 643 | 614 | 581 | 562 |
| Buses | Urban Buses | Euro II | 1997 | 2001 | 1345 | 1596 | 1525 | 1447 | 1345 | 1317 | 1273 | 1220 | 1170 |
| Buses | Urban Buses | Euro III | 2002 | 2006 | | | 346 | 670 | 951 | 1275 | 1585 | 1534 | 1487 |
| Buses | Urban Buses | Euro IV | 2007 | 2009 | | | | | | | | 344 | 684 |
| Buses | Coaches | Conventional | 0 | 1993 | 2724 | 2444 | 2165 | 1962 | 1773 | 1542 | 1328 | 1119 | 922 |
| Buses | Coaches | Euro I | 1994 | 1996 | 1001 | 896 | 823 | 752 | 687 | 639 | 591 | 538 | 498 |
| Buses | Coaches | Euro II | 1997 | 2001 | 1579 | 1807 | 1670 | 1527 | 1394 | 1309 | 1224 | 1128 | 1037 |
| Buses | Coaches | Euro III | 2002 | 2006 | | | 379 | 706 | 986 | 1267 | 1524 | 1418 | 1318 |
| Buses | Coaches | Euro IV | 2007 | 2009 | | | | | | | | 318 | 606 |
| Mopeds | <50 cm³ | Conventional | 0 | 1999 | 143607 | 136249 | 128209 | 120305 | 112262 | 103829 | 94855 | 86621 | 78814 |
| Mopeds | <50 cm³ | Euro I | 2000 | 2003 | 16393 | 28751 | 42791 | 48695 | 46069 | 43455 | 40746 | 37826 | 35231 |
| Mopeds | <50 cm³ | Euro II | 2004 | 9999 | | | | | 10669 | 21715 | 33399 | 44553 | 50954 |
| Motorcycles | 2-stroke >50 cm³ | Conventional | 0 | 1999 | 11054 | 11367 | 11582 | 11850 | 12326 | 13158 | 14241 | 15400 | 15790 |
| Motorcycles | 4-stroke <250 cm³ | Conventional | 0 | 1999 | 11909 | 12331 | 12662 | 13098 | 13716 | 14486 | 15411 | 16311 | 16873 |
| Motorcycles | 4-stroke <250 cm³ | Euro I | 2000 | 2003 | 619 | 1074 | 1568 | 2088 | 2087 | 2144 | 2240 | 2373 | 2462 |
| Motorcycles | 4-stroke <250 cm³ | Euro II | 2004 | 2006 | | | | | 694 | 1791 | 3236 | 3221 | 3196 |
| Motorcycles | 4-stroke <250 cm³ | Euro III | 2007 | 9999 | | | | | | | | 1798 | 3021 |
| Motorcycles | 4-stroke 250 - 750 cm³ | Conventional | 0 | 1999 | 32749 | 33910 | 34821 | 36019 | 37720 | 39837 | 42380 | 44855 | 46402 |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro I | 2000 | 2003 | 1703 | 2953 | 4311 | 5742 | 5739 | 5897 | 6159 | 6527 | 6769 |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro II | 2004 | 2006 | | | | | 1910 | 4925 | 8898 | 8857 | 8788 |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro III | 2007 | 9999 | | | | | | | | 4945 | 8307 |
| Motorcycles | 4-stroke >750 cm³ | Conventional | 0 | 1999 | 14886 | 15414 | 15828 | 16372 | 17146 | 18108 | 19264 | 20388 | 21092 |
| Motorcycles | 4-stroke >750 cm³ | Euro I | 2000 | 2003 | 774 | 1342 | 1960 | 2610 | 2609 | 2681 | 2800 | 2967 | 3077 |
| Motorcycles | 4-stroke >750 cm³ | Euro II | 2004 | 2006 | | | | | 868 | 2239 | 4045 | 4026 | 3995 |
| Motorcycles | 4-stroke >750 cm³ | Euro III | 2007 | 9999 | | | | | | | | 2248 | 3776 |

## Annex 2B-2 Mileage data 1985-2008 for road transport (km)

| Sector | Subsector | Tech 2 | FYear | LYear | 1985 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Cars | Gasoline <1,4 l | PRE ECE | 0 | 1969 | 9564 | 10458 | 11285 | 12005 | 12412 | 12729 | 12405 | 12060 | 12050 | 11999 | 11794 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/00-01 | 1970 | 1978 | 12115 | 10458 | 11285 | 12005 | 12412 | 12729 | 12405 | 12060 | 12050 | 11999 | 11794 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/02 | 1979 | 1980 | 16052 | 13358 | 12280 | 12005 | 12412 | 12729 | 12405 | 12060 | 12050 | 11999 | 11794 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/03 | 1981 | 1985 | 18800 | 16553 | 17094 | 17157 | 16720 | 16142 | 14571 | 12958 | 12050 | 11999 | 11794 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/04 | 1986 | 1990 | | 20257 | 20778 | 21152 | 20734 | 20113 | 18818 | 17553 | 16474 | 14970 | 13688 |
| Passenger Cars | Gasoline <1,4 l | Euro I | 1991 | 1996 | | | 24567 | 25667 | 25746 | 26068 | 24555 | 23306 | 22300 | 20949 | 19624 |
| Passenger Cars | Gasoline <1,4 l | Euro II | 1997 | 2000 | | | | | | | | | 26232 | 25674 | 24561 |
| Passenger Cars | Gasoline <1,4 l | Euro III | 2001 | 2005 | | | | | | | | | | | |
| Passenger Cars | Gasoline <1,4 l | Euro IV | 2006 | 2010 | | | | | | | | | | | |
| Passenger Cars | Gasoline 1,4 - 2,0 l | PRE ECE | 0 | 1969 | 9564 | 10458 | 11285 | 12005 | 12412 | 12729 | 12405 | 12060 | 12050 | 11999 | 11794 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/00-01 | 1970 | 1978 | 12033 | 10458 | 11285 | 12005 | 12412 | 12729 | 12405 | 12060 | 12050 | 11999 | 11794 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/02 | 1979 | 1980 | 16044 | 13352 | 12269 | 12005 | 12412 | 12729 | 12405 | 12060 | 12050 | 11999 | 11794 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/03 | 1981 | 1985 | 18883 | 16515 | 17059 | 17121 | 16659 | 16068 | 14525 | 12940 | 12050 | 11999 | 11794 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/04 | 1986 | 1990 | | 20402 | 20935 | 21291 | 20886 | 20231 | 18942 | 17667 | 16584 | 15142 | 13875 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro I | 1991 | 1996 | | | 24567 | 25726 | 25975 | 26475 | 25308 | 24084 | 23002 | 21643 | 20226 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro II | 1997 | 2000 | | | | | | | | | 26232 | 25700 | 24547 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro III | 2001 | 2005 | | | | | | | | | | | |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro IV | 2006 | 2010 | | | | | | | | | | | |
| Passenger Cars | Gasoline >2,0 l | PRE ECE | 0 | 1969 | 9564 | 10458 | 11285 | 12005 | 12412 | 12729 | 12405 | 12060 | 12050 | 11999 | 11794 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/00-01 | 1970 | 1978 | 12052 | 10458 | 11285 | 12005 | 12412 | 12729 | 12405 | 12060 | 12050 | 11999 | 11794 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/02 | 1979 | 1980 | 16050 | 13361 | 12285 | 12005 | 12412 | 12729 | 12405 | 12060 | 12050 | 11999 | 11794 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/03 | 1981 | 1985 | 18834 | 16582 | 17121 | 17200 | 16793 | 16180 | 14593 | 12966 | 12050 | 11999 | 11794 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/04 | 1986 | 1990 | | 20101 | 20643 | 21047 | 20575 | 20005 | 18715 | 17452 | 16353 | 14779 | 13551 |
| Passenger Cars | Gasoline >2,0 l | Euro I | 1991 | 1996 | | | 24567 | 25712 | 25924 | 26398 | 25184 | 23952 | 22880 | 21524 | 20119 |
| Passenger Cars | Gasoline >2,0 l | Euro II | 1997 | 2000 | | | | | | | | | 26232 | 25727 | 24744 |
| Passenger Cars | Gasoline >2,0 l | Euro III | 2001 | 2005 | | | | | | | | | | | |
| Passenger Cars | Gasoline >2,0 l | Euro IV | 2006 | 2010 | | | | | | | | | | | |
| Passenger Cars | Diesel <2,0 l | Conventional | 0 | 1990 | 27507 | 35246 | 35790 | 34175 | 33593 | 35025 | 32972 | 31446 | 29830 | 28040 | 26792 |
| Passenger Cars | Diesel <2,0 l | Euro I | 1991 | 1996 | | | 53405 | 51886 | 51281 | 54547 | 52029 | 50542 | 47495 | 43929 | 41339 |
| Passenger Cars | Diesel <2,0 l | Euro II | 1997 | 2000 | | | | | | | | | 54758 | 52749 | 50715 |
| Passenger Cars | Diesel <2,0 l | Euro III | 2001 | 2005 | | | | | | | | | | | |
| Passenger Cars | Diesel <2,0 l | Euro IV | 2006 | 2010 | | | | | | | | | | | |
| Passenger Cars | Diesel >2,0 l | Conventional | 0 | 1990 | 28763 | 36599 | 37134 | 35390 | 34573 | 35795 | 33528 | 31812 | 29953 | 27902 | 26613 |
| Passenger Cars | Diesel >2,0 l | Euro I | 1991 | 1996 | | | 53405 | 51916 | 51388 | 54734 | 52350 | 50846 | 47761 | 44191 | 41559 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Cars | Diesel >2,0 l | Euro II | 1997 | 2000 | | | | | | | | | 54758 | 52819 | 51115 |
| Passenger Cars | Diesel >2,0 l | Euro III | 2001 | 2005 | | | | | | | | | | | |
| Passenger Cars | Diesel >2,0 l | Euro IV | 2006 | 2010 | | | | | | | | | | | |
| Passenger Cars | LPG | Conventional | 0 | 1990 | 18832 | 16538 | 17080 | 17144 | 16698 | 16113 | 14553 | 12950 | 12050 | 11999 | 11794 |
| Passenger Cars | 2-Stroke | Conventional | 0 | 9999 | 18832 | 16538 | 17080 | 17144 | 16698 | 16113 | 14553 | 12950 | 12050 | 11999 | 11794 |
| Light Duty Vehicles | Gasoline <3,5t | Conventional | 0 | 1994 | 20184 | 17544 | 18019 | 18706 | 18894 | 18937 | 18138 | 17727 | 17852 | 17884 | 17453 |
| Light Duty Vehicles | Gasoline <3,5t | Euro I | 1995 | 1998 | | | | | | | 18138 | 17727 | 17852 | 17884 | 17453 |
| Light Duty Vehicles | Gasoline <3,5t | Euro II | 1999 | 2001 | | | | | | | | | | | 17453 |
| Light Duty Vehicles | Gasoline <3,5t | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Light Duty Vehicles | Gasoline <3,5t | Euro IV | 2007 | 2011 | | | | | | | | | | | |
| Light Duty Vehicles | Diesel <3,5 t | Conventional | 0 | 1994 | 26671 | 28095 | 28152 | 27146 | 26917 | 28220 | 27099 | 27047 | 26803 | 26381 | 25789 |
| Light Duty Vehicles | Diesel <3,5 t | Euro I | 1995 | 1998 | | | | | | | 27099 | 27047 | 26803 | 26381 | 25789 |
| Light Duty Vehicles | Diesel <3,5 t | Euro II | 1999 | 2001 | | | | | | | | | | | 25789 |
| Light Duty Vehicles | Diesel <3,5 t | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Light Duty Vehicles | Diesel <3,5 t | Euro IV | 2007 | 2011 | | | | | | | | | | | |
| Heavy Duty Vehicles | Gasoline >3,5 t | Conventional | 0 | 9999 | 38144 | 37941 | 38562 | 39503 | 37263 | 36784 | 36280 | 35574 | 32740 | 33082 | 33668 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Conventional | 0 | 1993 | 31320 | 40701 | 40359 | 38402 | 35562 | 36719 | 36309 | 36359 | 29998 | 30591 | 32927 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro I | 1994 | 1996 | | | | | 35562 | 36719 | 36309 | 36359 | 29998 | 30591 | 32927 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro II | 1997 | 2001 | | | | | | | | 36359 | 29998 | 30591 | 32927 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro IV | 2007 | 2009 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro V | 2010 | 2014 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Conventional | 0 | 1993 | 43637 | 49199 | 48785 | 46420 | 42987 | 44385 | 43890 | 43950 | 42070 | 40727 | 38392 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro I | 1994 | 1996 | | | | | 42987 | 44385 | 43890 | 43950 | 42070 | 40727 | 38392 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro II | 1997 | 2001 | | | | | | | | 43950 | 42070 | 40727 | 38392 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro IV | 2007 | 2009 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro V | 2010 | 2014 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Conventional | 0 | 1993 | 78794 | 92514 | 92692 | 88966 | 84356 | 87883 | 86776 | 87267 | 89143 | 88685 | 90421 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro I | 1994 | 1996 | | | | | 84356 | 87883 | 86776 | 87267 | 89143 | 88685 | 90421 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro II | 1997 | 2001 | | | | | | | | 87267 | 89143 | 88685 | 90421 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro IV | 2007 | 2009 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro V | 2010 | 2014 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel >32t | Conventional | 0 | 1993 | 78794 | 92514 | 92692 | 88966 | 84356 | 87883 | 86776 | 87267 | 89143 | 88685 | 90421 |
| Heavy Duty Vehicles | Diesel >32t | Euro I | 1994 | 1996 | | | | | 84356 | 87883 | 86776 | 87267 | 89143 | 88685 | 90421 |
| Heavy Duty Vehicles | Diesel >32t | Euro II | 1997 | 2001 | | | | | | | | 87267 | 89143 | 88685 | 90421 |
| Heavy Duty Vehicles | Diesel >32t | Euro III | 2002 | 2006 | | | | | | | | | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel >32t | Euro IV | 2007 | 2009 | | | | | | | | | | | |
| Heavy Duty Vehicles | Diesel >32t | Euro V | 2010 | 2014 | | | | | | | | | | | |
| Buses | Urban Buses | Conventional | 0 | 1993 | 80785 | 95104 | 98950 | 95563 | 97257 | 105266 | 104232 | 103899 | 101882 | 99194 | 97543 |
| Buses | Urban Buses | Euro I | 1994 | 1996 | | | | | | 105266 | 104232 | 103899 | 101882 | 99194 | 97543 |
| Buses | Urban Buses | Euro II | 1997 | 2001 | | | | | | | | | 101882 | 99194 | 97543 |
| Buses | Urban Buses | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Buses | Urban Buses | Euro IV | 2007 | 2009 | | | | | | | | | | | |
| Buses | Coaches | Conventional | 0 | 1993 | 50636 | 61288 | 71249 | 64953 | 66380 | 70950 | 51585 | 60972 | 61345 | 60215 | 59999 |
| Buses | Coaches | Euro I | 1994 | 1996 | | | | | | 70950 | 51585 | 60972 | 61345 | 60215 | 59999 |
| Buses | Coaches | Euro II | 1997 | 2001 | | | | | | | | | 61345 | 60215 | 59999 |
| Buses | Coaches | Euro III | 2002 | 2006 | | | | | | | | | | | |
| Buses | Coaches | Euro IV | 2007 | 2009 | | | | | | | | | | | |
| Mopeds | <50 cm³ | Conventional | 0 | 1999 | 2334 | 2182 | 2282 | 2393 | 2449 | 2510 | 2470 | 2439 | 2481 | 2498 | 2125 |
| Mopeds | <50 cm³ | Euro I | 2000 | 2003 | | | | | | | | | | | |
| Mopeds | <50 cm³ | Euro II | 2004 | 9999 | | | | | | | | | | | |
| Motorcycles | 2-stroke >50 cm³ | Conventional | 0 | 1999 | 6702 | 6471 | 6493 | 6824 | 6987 | 7148 | 7131 | 7033 | 7076 | 7168 | 7072 |
| Motorcycles | 4-stroke <250 cm³ | Conventional | 0 | 1999 | 6702 | 6471 | 6493 | 6824 | 6987 | 7148 | 7131 | 7033 | 7076 | 7168 | 7072 |
| Motorcycles | 4-stroke <250 cm³ | Euro I | 2000 | 2003 | | | | | | | | | | | |
| Motorcycles | 4-stroke <250 cm³ | Euro II | 2004 | 2006 | | | | | | | | | | | |
| Motorcycles | 4-stroke <250 cm³ | Euro III | 2007 | 9999 | | | | | | | | | | | |
| Motorcycles | 4-stroke 250 - 750 cm³ | Conventional | 0 | 1999 | 6702 | 6471 | 6493 | 6824 | 6987 | 7148 | 7131 | 7033 | 7076 | 7168 | 7072 |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro I | 2000 | 2003 | | | | | | | | | | | |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro II | 2004 | 2006 | | | | | | | | | | | |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro III | 2007 | 9999 | | | | | | | | | | | |
| Motorcycles | 4-stroke >750 cm³ | Conventional | 0 | 1999 | 6702 | 6471 | 6493 | 6824 | 6987 | 7148 | 7131 | 7033 | 7076 | 7168 | 7072 |
| Motorcycles | 4-stroke >750 cm³ | Euro I | 2000 | 2003 | | | | | | | | | | | |
| Motorcycles | 4-stroke >750 cm³ | Euro II | 2004 | 2006 | | | | | | | | | | | |
| Motorcycles | 4-stroke >750 cm³ | Euro III | 2007 | 9999 | | | | | | | | | | | |

| Sector | Subsector | Tech 2 | FYear | LYear | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Cars | Gasoline <1,4 l | PRE ECE | 0 | 1969 | 11677 | 11504 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/00-01 | 1970 | 1978 | 11677 | 11504 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/02 | 1979 | 1980 | 11677 | 11504 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/03 | 1981 | 1985 | 11677 | 11504 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/04 | 1986 | 1990 | 12800 | 11951 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline <1,4 l | Euro I | 1991 | 1996 | 18422 | 17424 | 16712 | 15589 | 14496 | 12881 | 11811 | 11033 | 10350 |
| Passenger Cars | Gasoline <1,4 l | Euro II | 1997 | 2000 | 23828 | 22163 | 21239 | 20530 | 19188 | 17538 | 16289 | 15389 | 14195 |
| Passenger Cars | Gasoline <1,4 l | Euro III | 2001 | 2005 | | 25043 | 24947 | 24562 | 24024 | 22075 | 20086 | 19011 | 17449 |
| Passenger Cars | Gasoline <1,4 l | Euro IV | 2006 | 2010 | | | | | | | 23373 | 22929 | 21645 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | PRE ECE | 0 | 1969 | 11677 | 11504 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/00-01 | 1970 | 1978 | 11677 | 11504 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/02 | 1979 | 1980 | 11677 | 11504 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/03 | 1981 | 1985 | 11677 | 11504 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/04 | 1986 | 1990 | 12961 | 12035 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro I | 1991 | 1996 | 18954 | 17941 | 17250 | 16312 | 15286 | 13748 | 12429 | 11245 | 10350 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro II | 1997 | 2000 | 23722 | 22075 | 21111 | 20421 | 19139 | 17548 | 16296 | 15412 | 14344 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro III | 2001 | 2005 | | 25043 | 24938 | 24490 | 23880 | 21952 | 20013 | 18933 | 17390 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro IV | 2006 | 2010 | | | | | | | 23373 | 22910 | 21545 |
| Passenger Cars | Gasoline >2,0 l | PRE ECE | 0 | 1969 | 11677 | 11504 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/00-01 | 1970 | 1978 | 11677 | 11504 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/02 | 1979 | 1980 | 11677 | 11504 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/03 | 1981 | 1985 | 11677 | 11504 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/04 | 1986 | 1990 | 12691 | 11880 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | Gasoline >2,0 l | Euro I | 1991 | 1996 | 18865 | 17852 | 17156 | 16192 | 15155 | 13644 | 12323 | 11196 | 10350 |
| Passenger Cars | Gasoline >2,0 l | Euro II | 1997 | 2000 | 24087 | 22507 | 21558 | 20798 | 19395 | 17838 | 16499 | 15494 | 14319 |
| Passenger Cars | Gasoline >2,0 l | Euro III | 2001 | 2005 | | 25043 | 24920 | 24519 | 24050 | 22131 | 20188 | 19199 | 17771 |
| Passenger Cars | Gasoline >2,0 l | Euro IV | 2006 | 2010 | | | | | | | 23373 | 22950 | 21695 |
| Passenger Cars | Diesel <2,0 l | Conventional | 0 | 1990 | 24900 | 22211 | 21536 | 23170 | 23513 | 21355 | 20114 | 18181 | 16266 |
| Passenger Cars | Diesel <2,0 l | Euro I | 1991 | 1996 | 37589 | 33363 | 31580 | 31623 | 30267 | 25831 | 22614 | 19064 | 16266 |
| Passenger Cars | Diesel <2,0 l | Euro II | 1997 | 2000 | 47581 | 41523 | 39148 | 40281 | 38628 | 33547 | 30147 | 26011 | 22027 |
| Passenger Cars | Diesel <2,0 l | Euro III | 2001 | 2005 | | 47051 | 46169 | 48325 | 48259 | 43896 | 39497 | 33853 | 29109 |
| Passenger Cars | Diesel <2,0 l | Euro IV | 2006 | 2010 | | | | | | | 43785 | 39174 | 34160 |
| Passenger Cars | Diesel >2,0 l | Conventional | 0 | 1990 | 24716 | 22091 | 21536 | 23170 | 23513 | 21355 | 20114 | 18181 | 16266 |
| Passenger Cars | Diesel >2,0 l | Euro I | 1991 | 1996 | 37788 | 33541 | 31759 | 31889 | 30564 | 26070 | 22752 | 19095 | 16266 |
| Passenger Cars | Diesel >2,0 l | Euro II | 1997 | 2000 | 48250 | 42286 | 39907 | 40960 | 39116 | 34134 | 30671 | 26328 | 22415 |
| Passenger Cars | Diesel >2,0 l | Euro III | 2001 | 2005 | | 47051 | 46130 | 48338 | 48504 | 43228 | 38770 | 33378 | 28399 |
| Passenger Cars | Diesel >2,0 l | Euro IV | 2006 | 2010 | | | | | | | 43785 | 39174 | 34160 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | | | | | | | |
| Passenger Cars | LPG | Conventional | 0 | 1990 | 11677 | 11504 | 11634 | 11765 | 11659 | 11083 | 10737 | 10686 | 10350 |
| Passenger Cars | 2-Stroke | Conventional | 0 | 9999 | 11677 | 11504 | 11634 | 11765 | 11659 | | | | |
| Light Duty Vehicles | Gasoline <3,5t | Conventional | 0 | 1994 | 17612 | 17589 | 17730 | 17631 | 17251 | 17074 | 16553 | 17102 | 17422 |
| Light Duty Vehicles | Gasoline <3,5t | Euro I | 1995 | 1998 | 17612 | 17589 | 17730 | 17631 | 17251 | 17074 | 16553 | 17102 | 17422 |
| Light Duty Vehicles | Gasoline <3,5t | Euro II | 1999 | 2001 | 17612 | 17589 | 17730 | 17631 | 17251 | 17074 | 16553 | 17102 | 17422 |
| Light Duty Vehicles | Gasoline <3,5t | Euro III | 2002 | 2006 | | | 17730 | 17631 | 17251 | 17074 | 16553 | 17102 | 17422 |
| Light Duty Vehicles | Gasoline <3,5t | Euro IV | 2007 | 2011 | | | | | | | | 17102 | 17422 |
| Light Duty Vehicles | Diesel <3,5 t | Conventional | 0 | 1994 | 25089 | 24880 | 24876 | 26109 | 26496 | 24965 | 23560 | 23799 | 24081 |
| Light Duty Vehicles | Diesel <3,5 t | Euro I | 1995 | 1998 | 25089 | 24880 | 24876 | 26109 | 26496 | 24965 | 23560 | 23799 | 24081 |
| Light Duty Vehicles | Diesel <3,5 t | Euro II | 1999 | 2001 | 25089 | 24880 | 24876 | 26109 | 26496 | 24965 | 23560 | 23799 | 24081 |
| Light Duty Vehicles | Diesel <3,5 t | Euro III | 2002 | 2006 | | | 24876 | 26109 | 26496 | 24965 | 23560 | 23799 | 24081 |
| Light Duty Vehicles | Diesel <3,5 t | Euro IV | 2007 | 2011 | | | | | | | | 23799 | 24081 |
| Heavy Duty Vehicles | Gasoline >3,5 t | Conventional | 0 | 9999 | 34672 | 40092 | 40735 | 40942 | 40462 | 37521 | 36968 | 36240 | 33226 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Conventional | 0 | 1993 | 33637 | 44221 | 44620 | 48583 | 47955 | 47526 | 49499 | 51804 | 49929 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro I | 1994 | 1996 | 33637 | 44221 | 44620 | 48583 | 47955 | 47526 | 49499 | 51804 | 49929 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro II | 1997 | 2001 | 33637 | 44221 | 44620 | 48583 | 47955 | 47526 | 49499 | 51804 | 49929 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro III | 2002 | 2006 | 33637 | 44221 | 44620 | 48583 | 47955 | 47526 | 49499 | 51804 | 49929 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro IV | 2007 | 2009 | | | | | | 47526 | 49499 | 51804 | 49929 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro V | 2010 | 2014 | | | | | | 47526 | 49499 | 51804 | 49929 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Conventional | 0 | 1993 | 36880 | 21003 | 18250 | 19640 | 20268 | 20087 | 20921 | 21895 | 21103 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro I | 1994 | 1996 | 36880 | 21003 | 18250 | 19640 | 20268 | 20087 | 20921 | 21895 | 21103 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro II | 1997 | 2001 | 36880 | 21003 | 18250 | 19640 | 20268 | 20087 | 20921 | 21895 | 21103 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro III | 2002 | 2006 | 36880 | 21003 | 18250 | 19640 | 20268 | 20087 | 20921 | 21895 | 21103 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro IV | 2007 | 2009 | | | | | | 20087 | 20921 | 21895 | 21103 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro V | 2010 | 2014 | | | | | | 20087 | 20921 | 21895 | 21103 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Conventional | 0 | 1993 | 87591 | 93250 | 93824 | 99077 | 103628 | 103746 | 107309 | 112235 | 111773 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro I | 1994 | 1996 | 87591 | 93250 | 93824 | 99077 | 103628 | 103746 | 107309 | 112235 | 111773 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro II | 1997 | 2001 | 87591 | 93250 | 93824 | 99077 | 103628 | 103746 | 107309 | 112235 | 111773 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro III | 2002 | 2006 | 87591 | 93250 | 93824 | 99077 | 103628 | 103746 | 107309 | 112235 | 111773 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro IV | 2007 | 2009 | | | | | | 103746 | 107309 | 112235 | 111773 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro V | 2010 | 2014 | | | | | | 103746 | 107309 | 112235 | 111773 |
| Heavy Duty Vehicles | Diesel >32t | Conventional | 0 | 1993 | 87591 | 93250 | 93824 | 99077 | 103628 | 103746 | 107309 | 112235 | 111773 |
| Heavy Duty Vehicles | Diesel >32t | Euro I | 1994 | 1996 | 87591 | 93250 | 93824 | 99077 | 103628 | 103746 | 107309 | 112235 | 111773 |
| Heavy Duty Vehicles | Diesel >32t | Euro II | 1997 | 2001 | 87591 | 93250 | 93824 | 99077 | 103628 | 103746 | 107309 | 112235 | 111773 |
| Heavy Duty Vehicles | Diesel >32t | Euro III | 2002 | 2006 | 87591 | 93250 | 93824 | 99077 | 103628 | 103746 | 107309 | 112235 | 111773 |
| Heavy Duty Vehicles | Diesel >32t | Euro IV | 2007 | 2009 | | | | | | 103746 | 107309 | 112235 | 111773 |
| Heavy Duty Vehicles | Diesel >32t | Euro V | 2010 | 2014 | | | | | | 103746 | 107309 | 112235 | 111773 |

*Continued*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Buses | Urban Buses | Conventional | 0 | 1993 | 95483 | 92967 | 92260 | 96890 | 98197 | 102087 | 106482 | 109874 | 112785 |
| Buses | Urban Buses | Euro I | 1994 | 1996 | 95483 | 92967 | 92260 | 96890 | 98197 | 102087 | 106482 | 109874 | 112785 |
| Buses | Urban Buses | Euro II | 1997 | 2001 | 95483 | 92967 | 92260 | 96890 | 98197 | 102087 | 106482 | 109874 | 112785 |
| Buses | Urban Buses | Euro III | 2002 | 2006 | | | 92260 | 96890 | 98197 | 102087 | 106482 | 109874 | 112785 |
| Buses | Urban Buses | Euro IV | 2007 | 2009 | | | | | | | | 109874 | 112785 |
| Buses | Coaches | Conventional | 0 | 1993 | 58236 | 58686 | 60044 | 63380 | 68429 | 70932 | 74526 | 80282 | 82284 |
| Buses | Coaches | Euro I | 1994 | 1996 | 58236 | 58686 | 60044 | 63380 | 68429 | 70932 | 74526 | 80282 | 82284 |
| Buses | Coaches | Euro II | 1997 | 2001 | 58236 | 58686 | 60044 | 63380 | 68429 | 70932 | 74526 | 80282 | 82284 |
| Buses | Coaches | Euro III | 2002 | 2006 | | | 60044 | 63380 | 68429 | 70932 | 74526 | 80282 | 82284 |
| Buses | Coaches | Euro IV | 2007 | 2009 | | | | | | | | 80282 | 82284 |
| Mopeds | <50 cm³ | Conventional | 0 | 1999 | 1919 | 1515 | 1536 | 1535 | 1505 | 1446 | 1404 | 1378 | 1318 |
| Mopeds | <50 cm³ | Euro I | 2000 | 2003 | 1919 | 1515 | 1536 | 1535 | 1505 | 1446 | 1404 | 1378 | 1318 |
| Mopeds | <50 cm³ | Euro II | 2004 | 9999 | | | | | 1505 | 1446 | 1404 | 1378 | 1318 |
| Motorcycles | 2-stroke >50 cm³ | Conventional | 0 | 1999 | 7170 | 7178 | 7321 | 7373 | 7270 | 7021 | 6420 | 6300 | 6165 |
| Motorcycles | 4-stroke <250 cm³ | Conventional | 0 | 1999 | 7170 | 7178 | 7321 | 7373 | 7270 | 7021 | 6420 | 6300 | 6165 |
| Motorcycles | 4-stroke <250 cm³ | Euro I | 2000 | 2003 | 7170 | 7178 | 7321 | 7373 | 7270 | 7021 | 6420 | 6300 | 6165 |
| Motorcycles | 4-stroke <250 cm³ | Euro II | 2004 | 2006 | | | | | 7270 | 7021 | 6420 | 6300 | 6165 |
| Motorcycles | 4-stroke <250 cm³ | Euro III | 2007 | 9999 | | | | | | | | 6300 | 6165 |
| Motorcycles | 4-stroke 250 - 750 cm³ | Conventional | 0 | 1999 | 7170 | 7178 | 7321 | 7373 | 7270 | 7021 | 6420 | 6300 | 6165 |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro I | 2000 | 2003 | 7170 | 7178 | 7321 | 7373 | 7270 | 7021 | 6420 | 6300 | 6165 |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro II | 2004 | 2006 | | | | | 7270 | 7021 | 6420 | 6300 | 6165 |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro III | 2007 | 9999 | | | | | | | | 6300 | 6165 |
| Motorcycles | 4-stroke >750 cm³ | Conventional | 0 | 1999 | 7170 | 7178 | 7321 | 7373 | 7270 | 7021 | 6420 | 6300 | 6165 |
| Motorcycles | 4-stroke >750 cm³ | Euro I | 2000 | 2003 | 7170 | 7178 | 7321 | 7373 | 7270 | 7021 | 6420 | 6300 | 6165 |
| Motorcycles | 4-stroke >750 cm³ | Euro II | 2004 | 2006 | | | | | 7270 | 7021 | 6420 | 6300 | 6165 |
| Motorcycles | 4-stroke >750 cm³ | Euro III | 2007 | 9999 | | | | | | | | 6300 | 6165 |

## Annex 2B-3 EU directive emission limits for road transportation vehicles

Private cars and light duty vehicles I (<1305 kg).

| G prkm | | EURO 1 | EURO 2 | EURO 3[1] | EURO 4 | EURO 5 | EURO 6 |
|---|---|---|---|---|---|---|---|
| Normal temp. | | | | | | | |
| CO | Gasoline | 2.72 | 2.2 | 2.3 | 1.0 | 1.0 | 1.0 |
| | Diesel | 2.72 | 1.0 | 0.64 | 0.5 | 0.5 | 0.5 |
| HC | Gasoline | - | - | 0.20 | 0.10 | 0.1 | 0.1 |
| NMHC | Gasoline | - | - | - | - | 0.068 | 0.068 |
| $NO_x$ | Gasoline | - | - | 0.15 | 0.08 | 0.06 | 0.06 |
| | Diesel | - | - | 0.5 | 0.25 | 0.18 | 0.08 |
| HC+$NO_x$ | Gasoline | 0.97 | 0.5 | - | - | | - |
| | Diesel | 0.97 | 0.7/0.9[2] | 0.56 | 0.30 | 0.23 | 0.17 |
| Particulates | Diesel | 0.14 | 0.08/0.10[2] | 0.05 | 0.025 | 0.005 | 0.005 |
| Low temp. | | | | | | | |
| CO | Gasoline | - | - | - | 15 | 15 | 15 |
| HC | Gasoline | - | - | - | 1.8 | 1.8 | 1.8 |
| Evaporation | | | | | | | |
| HC[3] | Gasoline | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |

[1] Changed test procedure at normal temperatures (40 s warm-up phase omitted) and for evaporation measurements.

[2] Less stringent emission limits for direct injection diesel engines.

[3] Unit: g/test.

Light duty vehicles II (1305-1760 kg).

| G pr km | | EURO 1 | EURO 2 | EURO 3[1] | EURO 4 | EURO 5 | EURO 6 |
|---|---|---|---|---|---|---|---|
| Normal temp. | | | | | | | |
| CO | Gasoline | 5.17 | 4.0 | 4.17 | 1.81 | 1.81 | 1.81 |
| | Diesel | 5.17 | 1.25 | 0.80 | 0.63 | 0.63 | 0.63 |
| HC | Gasoline | - | - | 0.25 | 0.13 | 0.13 | 0.13 |
| NMHC | Gasoline | - | - | - | - | 0.9 | 0.9 |
| $NO_x$ | Gasoline | - | - | 0.18 | 0.10 | 0.75 | 0.75 |
| | Diesel | - | - | 0.65 | 0.33 | 0.235 | 0.105 |
| HC+$NO_x$ | Gasoline | 1.4 | 0.6 | - | - | - | - |
| | Diesel | 1.4 | 1.0/1.3[2] | 0.72 | 0.39 | 0.295 | 0.195 |
| Particulates | Gasoline | | | | | 0.005 | 0.005 |
| | Diesel | 0.19 | 0.12/0.14[2] | 0.07 | 0.04 | 0.005 | 0.005 |
| Low temp. | | | | | | | |
| CO | Gasoline | - | - | - | 24 | 24 | 24 |
| HC | Gasoline | - | - | | 2.7 | 2.7 | 2.7 |
| Evaporation | | | | | | | |
| HC[3] | Gasoline | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |

[1] Changed test procedure at normal temperatures (40 s warm-up phase omitted) and for evaporation measurements

[2] Less stringent emission limits for direct injection diesel engines

[3] Unit: g/test

Light duty vehicles III (>1760 kg).

| G pr km | | EURO 1 | EURO 2 | EURO 3[1)] | EURO 4 | EURO 5 | EURO 6 |
|---|---|---|---|---|---|---|---|
| Normal temp. | | | | | | | |
| CO | Gasoline | 6.9 | 5.0 | 5.22 | 2.27 | 2.27 | 2.27 |
| | Diesel | 6.9 | 1.5 | 0.95 | 0.74 | 0.74 | 0.74 |
| HC | Gasoline | - | - | 0.29 | 0.16 | 0.16 | 0.16 |
| NMHC | Gasoline | | | | | 0.108 | 0.108 |
| $NO_x$ | Gasoline | - | - | 0.21 | 0.11 | 0.082 | 0.082 |
| | Diesel | - | - | 0.78 | 0.39 | 0.28 | 0.125 |
| $HC+NO_x$ | Gasoline | 1.7 | 0.7 | - | - | - | - |
| | Diesel | 1.7 | 1.2/1.6[2)] | 0.86 | 0.46 | 0.35 | 0.215 |
| Particulates | Gasoline | | | | | 0.005 | 0.005 |
| | Diesel | 0.25 | 0.17/0.20[2)] | 0.10 | 0.06 | 0.005 | 0.005 |
| Low temp. | | | | | | | |
| CO | Gasoline | - | - | - | 30 | 30 | 30 |
| HC | Gasoline | - | - | - | 3.2 | 3.2 | 3.2 |
| Evaporation | | | | | | | |
| HC[3)] | Gasoline | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |

[1)] Changed test procedure at normal temperatures (40 s warm-up phase omitted) and for evaporation measurements

[2)] Less stringent emission limits for direct injection diesel engines

[3)] Unit: g/test

Heavy duty diesel vehicles.

| (g pr kWh) | Test[1)] | EURO 1 1993 | EURO 2 1996 | EURO 3 2001 | EURO 4 2006 | EURO 5 2009 | EEV[2)] 2000 |
|---|---|---|---|---|---|---|---|
| CO | ECE/ESC | 4.5 | 4.0 | 2.1 | 1.5 | 1.5 | 1.5 |
| | ETC | - | - | (5.45) | 4.0 | 4.0 | 3.0 |
| HC | ECE/ESC | 1.1 | 1.1 | 0.66 | 0.46 | 0.46 | 0.25 |
| | ETC | - | - | (0.78) | 0.55 | 0.55 | 0.40 |
| $NO_x$ | ECE/ESC | 8.0 | 7.0 | 5.0 | 3.5 | 2.0 | 2.0 |
| | ETC | - | - | (5.0) | 3.5 | 2.0 | 2.0 |
| Particulates[3)] | ECE/ESC | 0.36/0.61 | 0.15/0.25 | 0.10/0.13 | 0.02 | 0.02 | 0.02 |
| | ETC | - | - | (0.16/0.21) | 0.03 | 0.03 | 0.02 |
| | ELR | - | - | 0.8 | 0.5 | 0.5 | 0.15 |

[1)] Test procedure: Euro 1 og Euro 2: ECE (stationary)
Euro 3: ESC (stationary) + ELR (load response)
Euro 4, Euro 5 og EEV: ESC (stationary) + ETC (transient) + ELR (load response)

[2)] EEV: Emission limits for extra environmental friendly vehicles, used as a basis for economical incitaments (gas fueled vehicles).

[3)] For Euro 1, Euro 2 og Euro 3 less stringent emission limits apply for small engines:
Euro 1: <85 kW
Euro 2: <0,7 l
Euro 3: <0,75 l

## Annex 2B-4 Basis emission factors (g pr km)

| Sector | Subsector | Tech 2 | FYear | LYear | FCu | FCr | FCh | COu | COr | COh | PMu | PMr | PMh | $NO_xu$ | $NO_xr$ | $NO_xh$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Cars | Gasoline <1,4 l | PRE ECE | 0 | 1969 | 67,499 | 55,000 | 62,743 | 27,505 | 19,333 | 15,520 | 0,063 | 0,044 | 0,041 | 1,849 | 2,062 | 2,023 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/00-01 | 1970 | 1978 | 58,240 | 44,460 | 48,600 | 18,966 | 14,480 | 18,620 | 0,063 | 0,044 | 0,041 | 1,849 | 2,062 | 2,023 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/02 | 1979 | 1980 | 53,248 | 45,170 | 51,200 | 15,859 | 8,200 | 8,260 | 0,063 | 0,044 | 0,041 | 1,619 | 2,102 | 2,909 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/03 | 1981 | 1985 | 53,248 | 45,170 | 51,200 | 16,752 | 8,793 | 7,620 | 0,042 | 0,029 | 0,029 | 1,680 | 2,253 | 3,276 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/04 | 1986 | 1990 | 51,420 | 43,440 | 47,700 | 9,087 | 4,956 | 4,292 | 0,030 | 0,020 | 0,020 | 1,691 | 2,089 | 2,662 |
| Passenger Cars | Gasoline <1,4 l | Euro I | 1991 | 1996 | 47,399 | 41,954 | 46,055 | 1,765 | 1,372 | 1,765 | 0,003 | 0,002 | 0,002 | 0,273 | 0,281 | 0,458 |
| Passenger Cars | Gasoline <1,4 l | Euro II | 1997 | 2000 | 46,486 | 39,509 | 44,016 | 0,659 | 0,575 | 0,749 | 0,003 | 0,002 | 0,002 | 0,154 | 0,154 | 0,181 |
| Passenger Cars | Gasoline <1,4 l | Euro III | 2001 | 2005 | 48,687 | 42,255 | 45,323 | 0,519 | 0,691 | 1,148 | 0,001 | 0,001 | 0,001 | 0,076 | 0,060 | 0,052 |
| Passenger Cars | Gasoline <1,4 l | Euro IV | 2006 | 2010 | 50,038 | 44,193 | 48,285 | 0,195 | 0,287 | 0,529 | 0,001 | 0,001 | 0,001 | 0,054 | 0,030 | 0,019 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | PRE ECE | 0 | 1969 | 79,277 | 67,000 | 76,386 | 27,505 | 19,333 | 15,520 | 0,063 | 0,044 | 0,041 | 2,164 | 2,683 | 3,130 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/00-01 | 1970 | 1978 | 67,779 | 51,090 | 60,300 | 18,966 | 14,480 | 18,620 | 0,063 | 0,044 | 0,041 | 2,164 | 2,683 | 3,130 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/02 | 1979 | 1980 | 61,731 | 50,686 | 59,680 | 15,859 | 8,200 | 8,260 | 0,063 | 0,044 | 0,041 | 1,831 | 2,377 | 3,283 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/03 | 1981 | 1985 | 61,731 | 50,686 | 59,680 | 16,752 | 8,793 | 7,620 | 0,042 | 0,029 | 0,029 | 1,917 | 2,580 | 3,472 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/04 | 1986 | 1990 | 61,652 | 49,112 | 52,052 | 9,087 | 4,956 | 4,292 | 0,030 | 0,020 | 0,020 | 2,122 | 2,757 | 3,524 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro I | 1991 | 1996 | 57,521 | 48,522 | 51,518 | 1,765 | 1,372 | 1,765 | 0,003 | 0,002 | 0,002 | 0,273 | 0,281 | 0,458 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro II | 1997 | 2000 | 56,324 | 47,687 | 48,786 | 0,659 | 0,575 | 0,749 | 0,003 | 0,002 | 0,002 | 0,154 | 0,154 | 0,181 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro III | 2001 | 2005 | 58,259 | 49,897 | 53,092 | 0,519 | 0,691 | 1,148 | 0,001 | 0,001 | 0,001 | 0,076 | 0,060 | 0,052 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro IV | 2006 | 2010 | 60,486 | 52,793 | 55,293 | 0,195 | 0,287 | 0,529 | 0,001 | 0,001 | 0,001 | 0,054 | 0,030 | 0,019 |
| Passenger Cars | Gasoline >2,0 l | PRE ECE | 0 | 1969 | 96,536 | 80,000 | 88,267 | 27,505 | 19,333 | 15,520 | 0,063 | 0,044 | 0,041 | 2,860 | 4,090 | 5,500 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/00-01 | 1970 | 1978 | 73,798 | 57,090 | 66,300 | 18,966 | 14,480 | 18,620 | 0,063 | 0,044 | 0,041 | 2,860 | 4,090 | 5,500 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/02 | 1979 | 1980 | 75,270 | 63,260 | 70,700 | 15,859 | 8,200 | 8,260 | 0,063 | 0,044 | 0,041 | 2,066 | 2,675 | 3,680 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/03 | 1981 | 1985 | 75,270 | 63,260 | 70,700 | 16,752 | 8,793 | 7,620 | 0,042 | 0,029 | 0,029 | 2,806 | 3,441 | 4,604 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/04 | 1986 | 1990 | 71,055 | 58,080 | 69,900 | 9,087 | 4,956 | 4,292 | 0,030 | 0,020 | 0,020 | 2,293 | 2,750 | 3,687 |
| Passenger Cars | Gasoline >2,0 l | Euro I | 1991 | 1996 | 74,616 | 61,902 | 65,020 | 1,765 | 1,372 | 1,765 | 0,003 | 0,002 | 0,002 | 0,273 | 0,281 | 0,458 |
| Passenger Cars | Gasoline >2,0 l | Euro II | 1997 | 2000 | 76,837 | 65,226 | 66,732 | 0,659 | 0,575 | 0,749 | 0,003 | 0,002 | 0,002 | 0,154 | 0,154 | 0,181 |
| Passenger Cars | Gasoline >2,0 l | Euro III | 2001 | 2005 | 70,798 | 57,424 | 56,826 | 0,519 | 0,691 | 1,148 | 0,001 | 0,001 | 0,001 | 0,076 | 0,060 | 0,052 |
| Passenger Cars | Gasoline >2,0 l | Euro IV | 2006 | 2010 | 86,099 | 67,877 | 65,859 | 0,195 | 0,287 | 0,529 | 0,001 | 0,001 | 0,001 | 0,054 | 0,030 | 0,019 |
| Passenger Cars | Diesel <2,0 l | Conventional | 0 | 1990 | 57,529 | 41,209 | 50,089 | 0,651 | 0,472 | 0,384 | 0,199 | 0,132 | 0,170 | 0,520 | 0,433 | 0,528 |
| Passenger Cars | Diesel <2,0 l | Euro I | 1991 | 1996 | 47,836 | 42,807 | 48,388 | 0,419 | 0,215 | 0,208 | 0,057 | 0,062 | 0,107 | 0,603 | 0,562 | 0,663 |
| Passenger Cars | Diesel <2,0 l | Euro II | 1997 | 2000 | 50,442 | 44,117 | 48,779 | 0,343 | 0,110 | 0,035 | 0,047 | 0,039 | 0,050 | 0,651 | 0,555 | 0,665 |
| Passenger Cars | Diesel <2,0 l | Euro III | 2001 | 2005 | 48,920 | 43,427 | 45,585 | 0,099 | 0,041 | 0,012 | 0,029 | 0,030 | 0,045 | 0,716 | 0,665 | 0,750 |
| Passenger Cars | Diesel <2,0 l | Euro IV | 2006 | 2010 | 48,920 | 43,427 | 45,585 | 0,083 | 0,034 | 0,021 | 0,029 | 0,024 | 0,026 | 0,539 | 0,424 | 0,576 |
| Passenger Cars | Diesel >2,0 l | Conventional | 0 | 1990 | 57,529 | 41,209 | 50,089 | 0,651 | 0,472 | 0,384 | 0,199 | 0,132 | 0,170 | 0,824 | 0,723 | 0,861 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Cars | Diesel >2,0 l | Euro I | 1991 | 1996 | 65,267 | 58,299 | 64,360 | 0,419 | 0,215 | 0,208 | 0,057 | 0,062 | 0,107 | 0,603 | 0,562 | 0,663 |
| Passenger Cars | Diesel >2,0 l | Euro II | 1997 | 2000 | 65,267 | 58,299 | 64,360 | 0,343 | 0,110 | 0,035 | 0,047 | 0,039 | 0,050 | 0,651 | 0,555 | 0,665 |
| Passenger Cars | Diesel >2,0 l | Euro III | 2001 | 2005 | 65,267 | 58,299 | 64,360 | 0,099 | 0,041 | 0,012 | 0,029 | 0,030 | 0,045 | 0,716 | 0,665 | 0,750 |
| Passenger Cars | Diesel >2,0 l | Euro IV | 2006 | 2010 | 65,267 | 58,299 | 64,360 | 0,083 | 0,034 | 0,021 | 0,029 | 0,024 | 0,026 | 0,539 | 0,424 | 0,576 |
| Passenger Cars | LPG | Conventional | 0 | 1990 | 59,000 | 45,000 | 54,000 | 2,043 | 2,373 | 9,723 | 0,040 | 0,030 | 0,025 | 2,203 | 2,584 | 2,861 |
| Light Duty Vehicles | Gasoline <3,5t | Conventional | 0 | 1994 | 82,270 | 59,883 | 56,470 | 14,925 | 6,075 | 7,389 | 0,040 | 0,040 | 0,040 | 2,671 | 3,118 | 3,387 |
| Light Duty Vehicles | Gasoline <3,5t | Euro I | 1995 | 1998 | 96,450 | 70,388 | 66,450 | 4,187 | 0,862 | 1,087 | 0,003 | 0,002 | 0,002 | 0,427 | 0,400 | 0,429 |
| Light Duty Vehicles | Gasoline <3,5t | Euro II | 1999 | 2001 | 96,450 | 70,388 | 66,450 | 2,554 | 0,526 | 0,663 | 0,003 | 0,002 | 0,002 | 0,145 | 0,136 | 0,146 |
| Light Duty Vehicles | Gasoline <3,5t | Euro III | 2002 | 2006 | 96,450 | 70,388 | 66,450 | 2,177 | 0,448 | 0,565 | 0,001 | 0,001 | 0,001 | 0,090 | 0,084 | 0,090 |
| Light Duty Vehicles | Gasoline <3,5t | Euro IV | 2007 | 2011 | 96,450 | 70,388 | 66,450 | 1,172 | 0,241 | 0,304 | 0,001 | 0,001 | 0,001 | 0,043 | 0,040 | 0,043 |
| Light Duty Vehicles | Diesel <3,5 t | Conventional | 0 | 1994 | 76,718 | 65,934 | 72,142 | 1,124 | 1,009 | 1,060 | 0,285 | 0,303 | 0,322 | 1,673 | 0,843 | 0,834 |
| Light Duty Vehicles | Diesel <3,5 t | Euro I | 1995 | 1998 | 68,860 | 58,185 | 63,660 | 0,393 | 0,328 | 0,423 | 0,070 | 0,066 | 0,090 | 1,138 | 0,975 | 1,022 |
| Light Duty Vehicles | Diesel <3,5 t | Euro II | 1999 | 2001 | 68,860 | 58,185 | 63,660 | 0,393 | 0,328 | 0,423 | 0,070 | 0,066 | 0,090 | 1,138 | 0,975 | 1,022 |
| Light Duty Vehicles | Diesel <3,5 t | Euro III | 2002 | 2006 | 68,860 | 58,185 | 63,660 | 0,322 | 0,269 | 0,347 | 0,047 | 0,044 | 0,061 | 0,740 | 0,634 | 0,664 |
| Light Duty Vehicles | Diesel <3,5 t | Euro IV | 2007 | 2011 | 68,860 | 58,185 | 63,660 | 0,255 | 0,213 | 0,275 | 0,024 | 0,023 | 0,032 | 0,319 | 0,273 | 0,286 |
| Heavy Duty Vehicles | Gasoline >3,5 t | Conventional | 0 | 9999 | 225,000 | 150,000 | 165,000 | 70,000 | 55,000 | 55,000 | 0,400 | 0,400 | 0,400 | 4,500 | 7,500 | 7,500 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Conventional | 0 | 1993 | 95,822 | 87,060 | 109,160 | 1,612 | 1,216 | 1,267 | 0,288 | 0,220 | 0,231 | 3,363 | 3,435 | 4,412 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro I | 1994 | 1996 | 77,226 | 74,990 | 96,471 | 0,533 | 0,417 | 0,496 | 0,111 | 0,085 | 0,090 | 2,343 | 2,497 | 3,204 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro II | 1997 | 2001 | 72,861 | 72,179 | 93,536 | 0,441 | 0,364 | 0,416 | 0,047 | 0,043 | 0,053 | 2,498 | 2,575 | 3,216 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro III | 2002 | 2006 | 77,798 | 76,111 | 97,038 | 0,528 | 0,372 | 0,375 | 0,051 | 0,037 | 0,037 | 1,955 | 1,896 | 2,330 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro IV | 2007 | 2009 | 72,942 | 71,399 | 91,133 | 0,042 | 0,030 | 0,031 | 0,010 | 0,007 | 0,006 | 1,186 | 1,206 | 1,520 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro V | 2010 | 2014 | 74,123 | 72,286 | 92,030 | 0,042 | 0,030 | 0,031 | 0,010 | 0,007 | 0,006 | 0,678 | 0,689 | 0,868 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Conventional | 0 | 1993 | 186,796 | 147,006 | 169,108 | 2,513 | 1,722 | 1,825 | 0,396 | 0,272 | 0,287 | 8,575 | 7,259 | 8,446 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro I | 1994 | 1996 | 157,382 | 126,707 | 149,418 | 1,190 | 0,822 | 0,874 | 0,235 | 0,160 | 0,170 | 5,118 | 4,333 | 5,002 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro II | 1997 | 2001 | 151,150 | 122,421 | 145,510 | 0,969 | 0,726 | 0,808 | 0,099 | 0,078 | 0,100 | 5,465 | 4,544 | 5,171 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro III | 2002 | 2006 | 158,817 | 127,460 | 150,203 | 1,163 | 0,780 | 0,821 | 0,104 | 0,071 | 0,076 | 4,431 | 3,535 | 3,915 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro IV | 2007 | 2009 | 148,977 | 119,369 | 139,890 | 0,085 | 0,058 | 0,059 | 0,020 | 0,013 | 0,013 | 2,649 | 2,173 | 2,456 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro V | 2010 | 2014 | 151,867 | 121,247 | 141,672 | 0,086 | 0,059 | 0,060 | 0,021 | 0,013 | 0,013 | 1,514 | 1,242 | 1,403 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Conventional | 0 | 1993 | 295,313 | 227,040 | 230,740 | 2,803 | 1,927 | 1,895 | 0,549 | 0,384 | 0,376 | 12,512 | 10,087 | 10,251 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro I | 1994 | 1996 | 255,466 | 198,864 | 203,490 | 1,975 | 1,387 | 1,365 | 0,389 | 0,264 | 0,255 | 8,507 | 6,835 | 6,905 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro II | 1997 | 2001 | 245,791 | 192,865 | 197,773 | 1,588 | 1,198 | 1,230 | 0,168 | 0,124 | 0,155 | 8,916 | 7,118 | 7,115 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro III | 2002 | 2006 | 255,628 | 198,692 | 202,461 | 1,886 | 1,298 | 1,279 | 0,168 | 0,114 | 0,111 | 7,153 | 5,549 | 5,512 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro IV | 2007 | 2009 | 238,931 | 185,357 | 188,314 | 0,134 | 0,092 | 0,087 | 0,032 | 0,021 | 0,019 | 4,345 | 3,428 | 3,456 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro V | 2010 | 2014 | 243,448 | 188,256 | 190,962 | 0,136 | 0,093 | 0,088 | 0,032 | 0,021 | 0,019 | 2,483 | 1,959 | 1,975 |
| Heavy Duty Vehicles | Diesel >32t | Conventional | 0 | 1993 | 392,838 | 311,460 | 297,380 | 3,143 | 2,293 | 2,190 | 0,683 | 0,506 | 0,478 | 16,482 | 13,628 | 12,693 |
| Heavy Duty Vehicles | Diesel >32t | Euro I | 1994 | 1996 | 346,235 | 276,687 | 264,125 | 2,662 | 2,009 | 1,913 | 0,524 | 0,373 | 0,347 | 11,621 | 9,581 | 8,935 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Heavy Duty Vehicles | Diesel >32t | Euro II | 1997 | 2001 | 336,196 | 270,809 | 257,607 | 2,161 | 1,731 | 1,720 | 0,237 | 0,175 | 0,223 | 12,060 | 9,895 | 9,161 |
| Heavy Duty Vehicles | Diesel >32t | Euro III | 2002 | 2006 | 346,156 | 276,262 | 262,095 | 2,497 | 1,841 | 1,759 | 0,219 | 0,155 | 0,143 | 9,625 | 7,809 | 7,238 |
| Heavy Duty Vehicles | Diesel >32t | Euro IV | 2007 | 2009 | 322,306 | 256,680 | 243,232 | 0,170 | 0,122 | 0,112 | 0,040 | 0,027 | 0,024 | 5,943 | 4,830 | 4,589 |
| Heavy Duty Vehicles | Diesel >32t | Euro V | 2010 | 2014 | 328,104 | 260,582 | 246,667 | 0,172 | 0,124 | 0,113 | 0,041 | 0,027 | 0,024 | 3,396 | 2,760 | 2,622 |
| Buses | Urban Buses | Conventional | 0 | 1993 | 315,796 | 253,287 | 219,035 | 4,741 | 3,178 | 2,375 | 0,751 | 0,498 | 0,374 | 14,511 | 12,324 | 10,937 |
| Buses | Urban Buses | Euro I | 1994 | 1996 | 268,961 | 219,461 | 190,892 | 2,274 | 1,532 | 1,059 | 0,407 | 0,290 | 0,211 | 8,836 | 7,474 | 6,391 |
| Buses | Urban Buses | Euro II | 1997 | 2001 | 259,715 | 216,150 | 190,405 | 2,004 | 1,359 | 0,914 | 0,187 | 0,141 | 0,118 | 9,441 | 7,809 | 6,730 |
| Buses | Urban Buses | Euro III | 2002 | 2006 | 273,102 | 224,893 | 195,747 | 2,218 | 1,456 | 0,988 | 0,176 | 0,127 | 0,101 | 7,997 | 6,112 | 4,916 |
| Buses | Urban Buses | Euro IV | 2007 | 2009 | 257,454 | 211,375 | 184,295 | 0,181 | 0,112 | 0,081 | 0,037 | 0,024 | 0,018 | 4,704 | 3,850 | 3,045 |
| Buses | Coaches | Conventional | 0 | 1993 | 281,771 | 214,600 | 198,320 | 2,640 | 1,684 | 1,409 | 0,538 | 0,364 | 0,312 | 10,938 | 8,865 | 8,559 |
| Buses | Coaches | Euro I | 1994 | 1996 | 259,336 | 198,133 | 182,616 | 2,140 | 1,405 | 1,179 | 0,425 | 0,277 | 0,227 | 8,372 | 6,741 | 6,409 |
| Buses | Coaches | Euro II | 1997 | 2001 | 258,542 | 198,791 | 182,581 | 1,787 | 1,213 | 1,071 | 0,183 | 0,134 | 0,119 | 9,357 | 7,401 | 6,978 |
| Buses | Coaches | Euro III | 2002 | 2006 | 276,957 | 213,400 | 197,945 | 2,202 | 1,453 | 1,231 | 0,202 | 0,140 | 0,117 | 8,039 | 6,015 | 5,526 |
| Buses | Coaches | Euro IV | 2007 | 2009 | 262,234 | 201,251 | 186,759 | 0,171 | 0,112 | 0,093 | 0,040 | 0,026 | 0,022 | 4,796 | 3,677 | 3,407 |
| Mopeds | <50 cm$^3$ | Conventional | 0 | 1999 | 25,000 | 25,000 | 0,000 | 13,800 | 13,800 | 0,000 | 0,188 | 0,188 | 0,000 | 0,020 | 0,020 | 0,000 |
| Mopeds | <50 cm$^3$ | Euro I | 2000 | 2003 | 15,000 | 15,000 | 0,000 | 5,600 | 5,600 | 0,000 | 0,076 | 0,076 | 0,000 | 0,020 | 0,020 | 0,000 |
| Mopeds | <50 cm$^3$ | Euro II | 2004 | 9999 | 12,080 | 12,080 | 0,000 | 1,300 | 1,300 | 0,000 | 0,038 | 0,038 | 0,000 | 0,260 | 0,260 | 0,000 |
| Motorcycles | 2-stroke >50 cm$^3$ | Conventional | 0 | 1999 | 30,368 | 32,375 | 36,950 | 23,380 | 25,490 | 27,500 | 0,200 | 0,200 | 0,200 | 0,032 | 0,088 | 0,133 |
| Motorcycles | 4-stroke <250 cm$^3$ | Conventional | 0 | 1999 | 23,340 | 26,690 | 35,600 | 22,380 | 26,300 | 38,600 | 0,020 | 0,020 | 0,020 | 0,130 | 0,242 | 0,362 |
| Motorcycles | 4-stroke <250 cm$^3$ | Euro I | 2000 | 2003 | 22,060 | 29,470 | 52,000 | 12,901 | 14,597 | 15,450 | 0,020 | 0,020 | 0,020 | 0,245 | 0,416 | 0,725 |
| Motorcycles | 4-stroke <250 cm$^3$ | Euro II | 2004 | 2006 | 22,060 | 29,470 | 52,000 | 6,472 | 5,947 | 9,309 | 0,005 | 0,005 | 0,005 | 0,195 | 0,265 | 0,531 |
| Motorcycles | 4-stroke <250 cm$^3$ | Euro III | 2007 | 9999 | 22,060 | 29,470 | 52,000 | 4,705 | 1,581 | 2,241 | 0,005 | 0,005 | 0,005 | 0,126 | 0,150 | 0,329 |
| Motorcycles | 4-stroke 250 - 750 cm$^3$ | Conventional | 0 | 1999 | 28,580 | 28,640 | 34,700 | 20,440 | 21,517 | 25,810 | 0,020 | 0,020 | 0,020 | 0,136 | 0,251 | 0,374 |
| Motorcycles | 4-stroke 250 - 750 cm$^3$ | Euro I | 2000 | 2003 | 28,964 | 29,336 | 41,300 | 9,538 | 13,315 | 19,810 | 0,020 | 0,020 | 0,020 | 0,292 | 0,477 | 0,757 |
| Motorcycles | 4-stroke 250 - 750 cm$^3$ | Euro II | 2004 | 2006 | 28,964 | 29,336 | 41,300 | 6,472 | 5,947 | 9,309 | 0,005 | 0,005 | 0,005 | 0,195 | 0,265 | 0,531 |
| Motorcycles | 4-stroke 250 - 750 cm$^3$ | Euro III | 2007 | 9999 | 28,964 | 29,336 | 41,300 | 4,705 | 1,581 | 2,241 | 0,005 | 0,005 | 0,005 | 0,126 | 0,150 | 0,329 |
| Motorcycles | 4-stroke >750 cm$^3$ | Conventional | 0 | 1999 | 37,520 | 34,340 | 38,600 | 14,880 | 18,030 | 24,300 | 0,020 | 0,020 | 0,020 | 0,148 | 0,266 | 0,392 |
| Motorcycles | 4-stroke >750 cm$^3$ | Euro I | 2000 | 2003 | 44,952 | 36,378 | 40,800 | 7,884 | 6,831 | 10,800 | 0,020 | 0,020 | 0,020 | 0,210 | 0,522 | 1,092 |
| Motorcycles | 4-stroke >750 cm$^3$ | Euro II | 2004 | 2006 | 44,952 | 36,378 | 40,800 | 6,472 | 5,947 | 9,309 | 0,005 | 0,005 | 0,005 | 0,195 | 0,265 | 0,531 |
| Motorcycles | 4-stroke >750 cm$^3$ | Euro III | 2007 | 9999 | 44,952 | 36,378 | 40,800 | 4,705 | 1,581 | 2,241 | 0,005 | 0,005 | 0,005 | 0,126 | 0,150 | 0,329 |

| Sector | Subsector | Tech 2 | FYear | LYear | $CH_4u$ | $CH_4r$ | $CH_4h$ | $N_2Ou$ | $N_2Or$ | $N_2Oh$ | $NH_3u$ | $NH_3r$ | $NH_3h$ | VOCu | VOCr | VOCh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Cars | Gasoline <1,4 l | PRE ECE | 0 | 1969 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 2,354 | 1,597 | 1,247 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/00-01 | 1970 | 1978 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 1,862 | 1,256 | 1,121 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/02 | 1979 | 1980 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 1,849 | 1,061 | 0,950 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/03 | 1981 | 1985 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 1,849 | 1,061 | 0,950 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/04 | 1986 | 1990 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 1,480 | 0,895 | 0,698 |
| Passenger Cars | Gasoline <1,4 l | Euro I | 1991 | 1996 | 0,026 | 0,016 | 0,014 | 0,024 | 0,009 | 0,005 | 0,070 | 0,132 | 0,074 | 0,177 | 0,121 | 0,111 |
| Passenger Cars | Gasoline <1,4 l | Euro II | 1997 | 2000 | 0,017 | 0,013 | 0,011 | 0,012 | 0,005 | 0,003 | 0,163 | 0,149 | 0,084 | 0,071 | 0,047 | 0,042 |
| Passenger Cars | Gasoline <1,4 l | Euro III | 2001 | 2005 | 0,003 | 0,002 | 0,004 | 0,001 | 0,000 | 0,000 | 0,002 | 0,029 | 0,065 | 0,015 | 0,015 | 0,025 |
| Passenger Cars | Gasoline <1,4 l | Euro IV | 2006 | 2010 | 0,002 | 0,002 | 0,000 | 0,002 | 0,000 | 0,000 | 0,002 | 0,029 | 0,065 | 0,012 | 0,014 | 0,017 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | PRE ECE | 0 | 1969 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 2,354 | 1,597 | 1,247 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/00-01 | 1970 | 1978 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 1,862 | 1,256 | 1,121 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/02 | 1979 | 1980 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 1,849 | 1,061 | 0,950 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/03 | 1981 | 1985 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 1,849 | 1,061 | 0,950 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/04 | 1986 | 1990 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 1,480 | 0,895 | 0,698 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro I | 1991 | 1996 | 0,026 | 0,016 | 0,014 | 0,024 | 0,009 | 0,005 | 0,070 | 0,132 | 0,074 | 0,177 | 0,121 | 0,111 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro II | 1997 | 2000 | 0,017 | 0,013 | 0,011 | 0,012 | 0,005 | 0,003 | 0,163 | 0,149 | 0,084 | 0,071 | 0,047 | 0,042 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro III | 2001 | 2005 | 0,003 | 0,002 | 0,004 | 0,001 | 0,000 | 0,000 | 0,002 | 0,030 | 0,065 | 0,015 | 0,015 | 0,025 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro IV | 2006 | 2010 | 0,002 | 0,002 | 0,000 | 0,002 | 0,000 | 0,000 | 0,002 | 0,029 | 0,065 | 0,012 | 0,014 | 0,017 |
| Passenger Cars | Gasoline >2,0 l | PRE ECE | 0 | 1969 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 2,354 | 1,597 | 1,247 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/00-01 | 1970 | 1978 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 1,862 | 1,256 | 1,121 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/02 | 1979 | 1980 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 1,849 | 1,061 | 0,950 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/03 | 1981 | 1985 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 1,849 | 1,061 | 0,950 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/04 | 1986 | 1990 | 0,092 | 0,029 | 0,026 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 1,480 | 0,895 | 0,698 |
| Passenger Cars | Gasoline >2,0 l | Euro I | 1991 | 1996 | 0,026 | 0,016 | 0,014 | 0,024 | 0,009 | 0,005 | 0,070 | 0,132 | 0,074 | 0,177 | 0,121 | 0,111 |
| Passenger Cars | Gasoline >2,0 l | Euro II | 1997 | 2000 | 0,017 | 0,013 | 0,011 | 0,012 | 0,005 | 0,003 | 0,163 | 0,149 | 0,084 | 0,071 | 0,047 | 0,042 |
| Passenger Cars | Gasoline >2,0 l | Euro III | 2001 | 2005 | 0,003 | 0,002 | 0,004 | 0,001 | 0,000 | 0,000 | 0,002 | 0,029 | 0,065 | 0,015 | 0,015 | 0,025 |
| Passenger Cars | Gasoline >2,0 l | Euro IV | 2006 | 2010 | 0,002 | 0,002 | 0,000 | 0,002 | 0,000 | 0,000 | 0,002 | 0,029 | 0,065 | 0,012 | 0,014 | 0,017 |
| Passenger Cars | Diesel <2,0 l | Conventional | 0 | 1990 | 0,028 | 0,012 | 0,008 | 0,000 | 0,000 | 0,000 | 0,001 | 0,001 | 0,001 | 0,145 | 0,086 | 0,062 |
| Passenger Cars | Diesel <2,0 l | Euro I | 1991 | 1996 | 0,011 | 0,009 | 0,003 | 0,002 | 0,004 | 0,004 | 0,001 | 0,001 | 0,001 | 0,053 | 0,031 | 0,026 |
| Passenger Cars | Diesel <2,0 l | Euro II | 1997 | 2000 | 0,007 | 0,003 | 0,002 | 0,004 | 0,006 | 0,006 | 0,001 | 0,001 | 0,001 | 0,034 | 0,021 | 0,015 |
| Passenger Cars | Diesel <2,0 l | Euro III | 2001 | 2005 | 0,003 | 0,000 | 0,000 | 0,009 | 0,004 | 0,004 | 0,001 | 0,001 | 0,001 | 0,018 | 0,011 | 0,009 |
| Passenger Cars | Diesel <2,0 l | Euro IV | 2006 | 2010 | 0,000 | 0,000 | 0,000 | 0,009 | 0,004 | 0,004 | 0,001 | 0,001 | 0,001 | 0,038 | 0,017 | 0,012 |
| Passenger Cars | Diesel >2,0 l | Conventional | 0 | 1990 | 0,028 | 0,012 | 0,008 | 0,000 | 0,000 | 0,000 | 0,001 | 0,001 | 0,001 | 0,145 | 0,086 | 0,062 |
| Passenger Cars | Diesel >2,0 l | Euro I | 1991 | 1996 | 0,011 | 0,009 | 0,003 | 0,002 | 0,004 | 0,004 | 0,001 | 0,001 | 0,001 | 0,080 | 0,046 | 0,034 |
| Passenger Cars | Diesel >2,0 l | Euro II | 1997 | 2000 | 0,007 | 0,003 | 0,002 | 0,004 | 0,006 | 0,006 | 0,001 | 0,001 | 0,001 | 0,098 | 0,058 | 0,038 |
| Passenger Cars | Diesel >2,0 l | Euro III | 2001 | 2005 | 0,003 | 0,000 | 0,000 | 0,009 | 0,004 | 0,004 | 0,001 | 0,001 | 0,001 | 0,038 | 0,017 | 0,012 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | | | | | | | | | | |
| Passenger Cars | Diesel >2,0 l | Euro IV | 2006 | 2010 | 0,000 | 0,000 | 0,000 | 0,009 | 0,004 | 0,004 | 0,001 | 0,001 | 0,001 | 0,011 | 0,006 | 0,006 |
| Passenger Cars | LPG | Conventional | 0 | 1990 | 0,080 | 0,035 | 0,025 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 1,082 | 0,667 | 0,490 |
| Light Duty Vehicles | Gasoline <3,5t | Conventional | 0 | 1994 | 0,150 | 0,040 | 0,025 | 0,010 | 0,007 | 0,007 | 0,002 | 0,002 | 0,002 | 1,877 | 0,729 | 0,446 |
| Light Duty Vehicles | Gasoline <3,5t | Euro I | 1995 | 1998 | 0,026 | 0,016 | 0,014 | 0,034 | 0,020 | 0,010 | 0,070 | 0,132 | 0,074 | 0,220 | 0,109 | 0,078 |
| Light Duty Vehicles | Gasoline <3,5t | Euro II | 1999 | 2001 | 0,017 | 0,013 | 0,011 | 0,023 | 0,013 | 0,008 | 0,163 | 0,149 | 0,084 | 0,053 | 0,026 | 0,019 |
| Light Duty Vehicles | Gasoline <3,5t | Euro III | 2002 | 2006 | 0,003 | 0,002 | 0,004 | 0,007 | 0,001 | 0,001 | 0,002 | 0,030 | 0,065 | 0,031 | 0,015 | 0,011 |
| Light Duty Vehicles | Gasoline <3,5t | Euro IV | 2007 | 2011 | 0,002 | 0,002 | 0,000 | 0,001 | 0,000 | 0,000 | 0,002 | 0,030 | 0,065 | 0,013 | 0,007 | 0,005 |
| Light Duty Vehicles | Diesel <3,5 t | Conventional | 0 | 1994 | 0,028 | 0,012 | 0,008 | 0,000 | 0,000 | 0,000 | 0,001 | 0,001 | 0,001 | 0,131 | 0,106 | 0,101 |
| Light Duty Vehicles | Diesel <3,5 t | Euro I | 1995 | 1998 | 0,011 | 0,009 | 0,003 | 0,002 | 0,004 | 0,004 | 0,001 | 0,001 | 0,001 | 0,131 | 0,106 | 0,101 |
| Light Duty Vehicles | Diesel <3,5 t | Euro II | 1999 | 2001 | 0,007 | 0,003 | 0,002 | 0,004 | 0,006 | 0,006 | 0,001 | 0,001 | 0,001 | 0,131 | 0,106 | 0,101 |
| Light Duty Vehicles | Diesel <3,5 t | Euro III | 2002 | 2006 | 0,003 | 0,000 | 0,000 | 0,009 | 0,004 | 0,004 | 0,001 | 0,001 | 0,001 | 0,081 | 0,065 | 0,063 |
| Light Duty Vehicles | Diesel <3,5 t | Euro IV | 2007 | 2011 | 0,000 | 0,000 | 0,000 | 0,009 | 0,004 | 0,004 | 0,001 | 0,001 | 0,001 | 0,030 | 0,024 | 0,023 |
| Heavy Duty Vehicles | Gasoline >3,5 t | Conventional | 0 | 9999 | 0,140 | 0,110 | 0,070 | 0,006 | 0,006 | 0,006 | 0,002 | 0,002 | 0,002 | 7,000 | 5,500 | 3,500 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Conventional | 0 | 1993 | 0,085 | 0,023 | 0,020 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 1,088 | 0,683 | 0,584 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro I | 1994 | 1996 | 0,085 | 0,023 | 0,020 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,217 | 0,146 | 0,139 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro II | 1997 | 2001 | 0,054 | 0,020 | 0,019 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,139 | 0,093 | 0,087 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro III | 2002 | 2006 | 0,048 | 0,021 | 0,018 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,126 | 0,083 | 0,074 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro IV | 2007 | 2009 | 0,003 | 0,002 | 0,001 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,007 | 0,004 | 0,003 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro V | 2010 | 2014 | 0,003 | 0,002 | 0,001 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,007 | 0,004 | 0,003 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Conventional | 0 | 1993 | 0,085 | 0,023 | 0,020 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 1,084 | 0,677 | 0,649 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro I | 1994 | 1996 | 0,085 | 0,023 | 0,020 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,453 | 0,296 | 0,294 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro II | 1997 | 2001 | 0,054 | 0,020 | 0,019 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,292 | 0,188 | 0,184 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro III | 2002 | 2006 | 0,048 | 0,021 | 0,018 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,259 | 0,166 | 0,165 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro IV | 2007 | 2009 | 0,003 | 0,002 | 0,001 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,013 | 0,008 | 0,008 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro V | 2010 | 2014 | 0,003 | 0,002 | 0,001 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,014 | 0,008 | 0,008 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Conventional | 0 | 1993 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 1,014 | 0,639 | 0,569 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro I | 1994 | 1996 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,711 | 0,465 | 0,425 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro II | 1997 | 2001 | 0,112 | 0,070 | 0,065 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,456 | 0,296 | 0,264 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro III | 2002 | 2006 | 0,098 | 0,074 | 0,064 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,404 | 0,261 | 0,237 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro IV | 2007 | 2009 | 0,005 | 0,006 | 0,004 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,021 | 0,013 | 0,012 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro V | 2010 | 2014 | 0,005 | 0,006 | 0,004 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,021 | 0,013 | 0,012 |
| Heavy Duty Vehicles | Diesel >32t | Conventional | 0 | 1993 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,958 | 0,626 | 0,539 |
| Heavy Duty Vehicles | Diesel >32t | Euro I | 1994 | 1996 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,888 | 0,606 | 0,528 |
| Heavy Duty Vehicles | Diesel >32t | Euro II | 1997 | 2001 | 0,112 | 0,070 | 0,065 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,563 | 0,383 | 0,323 |
| Heavy Duty Vehicles | Diesel >32t | Euro III | 2002 | 2006 | 0,098 | 0,074 | 0,064 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,492 | 0,332 | 0,290 |
| Heavy Duty Vehicles | Diesel >32t | Euro IV | 2007 | 2009 | 0,005 | 0,006 | 0,004 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,025 | 0,016 | 0,014 |

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| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Heavy Duty Vehicles | Diesel >32t | Euro V | 2010 | 2014 | 0,005 | 0,006 | 0,004 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,025 | 0,017 | 0,015 |
| Buses | Urban Buses | Conventional | 0 | 1993 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 1,791 | 1,159 | 0,848 |
| Buses | Urban Buses | Euro I | 1994 | 1996 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,738 | 0,507 | 0,387 |
| Buses | Urban Buses | Euro II | 1997 | 2001 | 0,114 | 0,052 | 0,046 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,480 | 0,330 | 0,257 |
| Buses | Urban Buses | Euro III | 2002 | 2006 | 0,103 | 0,047 | 0,041 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,428 | 0,294 | 0,226 |
| Buses | Urban Buses | Euro IV | 2007 | 2009 | 0,005 | 0,002 | 0,002 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,022 | 0,015 | 0,011 |
| Buses | Coaches | Conventional | 0 | 1993 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,927 | 0,559 | 0,415 |
| Buses | Coaches | Euro I | 1994 | 1996 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,860 | 0,545 | 0,434 |
| Buses | Coaches | Euro II | 1997 | 2001 | 0,114 | 0,052 | 0,046 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,573 | 0,368 | 0,285 |
| Buses | Coaches | Euro III | 2002 | 2006 | 0,103 | 0,047 | 0,041 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,529 | 0,342 | 0,284 |
| Buses | Coaches | Euro IV | 2007 | 2009 | 0,005 | 0,002 | 0,002 | 0,030 | 0,030 | 0,030 | 0,003 | 0,003 | 0,003 | 0,028 | 0,017 | 0,014 |
| Mopeds | <50 $cm^3$ | Conventional | 0 | 1999 | 0,219 | 0,219 | 0,000 | 0,001 | 0,001 | 0,001 | 0,001 | 0,001 | 0,001 | 13,910 | 13,910 | 0,000 |
| Mopeds | <50 $cm^3$ | Euro I | 2000 | 2003 | 0,044 | 0,044 | 0,000 | 0,001 | 0,001 | 0,001 | 0,001 | 0,001 | 0,001 | 2,730 | 2,730 | 0,000 |
| Mopeds | <50 $cm^3$ | Euro II | 2004 | 9999 | 0,024 | 0,024 | 0,000 | 0,001 | 0,001 | 0,001 | 0,001 | 0,001 | 0,001 | 1,560 | 1,560 | 0,000 |
| Motorcycles | 2-stroke >50 $cm^3$ | Conventional | 0 | 1999 | 0,150 | 0,150 | 0,150 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 9,340 | 8,402 | 8,360 |
| Motorcycles | 4-stroke <250 $cm^3$ | Conventional | 0 | 1999 | 0,200 | 0,200 | 0,200 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 1,550 | 0,960 | 1,320 |
| Motorcycles | 4-stroke <250 $cm^3$ | Euro I | 2000 | 2003 | 0,142 | 0,144 | 0,132 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 1,103 | 0,870 | 0,870 |
| Motorcycles | 4-stroke <250 $cm^3$ | Euro II | 2004 | 2006 | 0,136 | 0,092 | 0,092 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 1,053 | 0,557 | 0,612 |
| Motorcycles | 4-stroke <250 $cm^3$ | Euro III | 2007 | 9999 | 0,082 | 0,032 | 0,028 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,628 | 0,193 | 0,179 |
| Motorcycles | 4-stroke 250 - 750 $cm^3$ | Conventional | 0 | 1999 | 0,200 | 0,200 | 0,200 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 1,350 | 0,944 | 1,010 |
| Motorcycles | 4-stroke 250 - 750 $cm^3$ | Euro I | 2000 | 2003 | 0,148 | 0,174 | 0,156 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 1,002 | 0,753 | 0,790 |
| Motorcycles | 4-stroke 250 - 750 $cm^3$ | Euro II | 2004 | 2006 | 0,156 | 0,120 | 0,122 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 1,053 | 0,557 | 0,612 |
| Motorcycles | 4-stroke 250 - 750 $cm^3$ | Euro III | 2007 | 9999 | 0,094 | 0,042 | 0,036 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,628 | 0,193 | 0,179 |
| Motorcycles | 4-stroke >750 $cm^3$ | Conventional | 0 | 1999 | 0,200 | 0,200 | 0,200 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 2,520 | 1,610 | 1,190 |
| Motorcycles | 4-stroke >750 $cm^3$ | Euro I | 2000 | 2003 | 0,092 | 0,092 | 0,154 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 1,170 | 0,742 | 0,920 |
| Motorcycles | 4-stroke >750 $cm^3$ | Euro II | 2004 | 2006 | 0,084 | 0,062 | 0,102 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 1,053 | 0,557 | 0,612 |
| Motorcycles | 4-stroke >750 $cm^3$ | Euro III | 2007 | 9999 | 0,050 | 0,022 | 0,030 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,002 | 0,628 | 0,193 | 0,179 |

## Annex 2B-5 Reduction factors

| Sector | Subsector | Tech 2 | FYear | LYear | FCuR | FCrR | FChR | COuR | COrR | COhR | PMuR | PMrR | PMhR | $NO_xuR$ | $NO_xrR$ | $NO_xhR$ | VOCuR | VOCrR | VOChR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Cars | Gasoline <1,4 l | PRE ECE | 0 | 1969 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/00-01 | 1970 | 1978 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/02 | 1979 | 1980 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/03 | 1981 | 1985 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline <1,4 l | ECE 15/04 | 1986 | 1990 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline <1,4 l | Euro I | 1991 | 1996 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline <1,4 l | Euro II | 1997 | 2000 | 1,93 | 5,83 | 4,43 | 62,65 | 58,10 | 57,55 | 0,00 | 0,00 | 0,00 | 43,59 | 45,20 | 60,45 | 60,19 | 61,27 | 62,09 |
| Passenger Cars | Gasoline <1,4 l | Euro III | 2001 | 2005 | -2,72 | -0,72 | 1,59 | 70,59 | 49,62 | 34,95 | 60,25 | 54,57 | 37,37 | 72,16 | 78,49 | 88,69 | 91,74 | 87,53 | 77,02 |
| Passenger Cars | Gasoline <1,4 l | Euro IV | 2006 | 2010 | -5,57 | -5,34 | -4,84 | 88,95 | 79,10 | 70,06 | 60,25 | 54,57 | 37,37 | 80,12 | 89,24 | 95,86 | 93,34 | 88,71 | 84,51 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | PRE ECE | 0 | 1969 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/00-01 | 1970 | 1978 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/02 | 1979 | 1980 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/03 | 1981 | 1985 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | ECE 15/04 | 1986 | 1990 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro I | 1991 | 1996 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro II | 1997 | 2000 | 2,08 | 1,72 | 5,30 | 62,65 | 58,10 | 57,55 | 0,00 | 0,00 | 0,00 | 43,59 | 45,20 | 60,45 | 60,19 | 61,27 | 62,09 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro III | 2001 | 2005 | -1,28 | -2,83 | -3,05 | 70,59 | 49,62 | 34,95 | 60,25 | 54,57 | 37,37 | 72,16 | 78,49 | 88,69 | 91,74 | 87,53 | 77,02 |
| Passenger Cars | Gasoline 1,4 - 2,0 l | Euro IV | 2006 | 2010 | -5,15 | -8,80 | -7,33 | 88,95 | 79,10 | 70,06 | 60,25 | 54,57 | 37,37 | 80,12 | 89,24 | 95,86 | 93,34 | 88,71 | 84,51 |
| Passenger Cars | Gasoline >2,0 l | PRE ECE | 0 | 1969 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/00-01 | 1970 | 1978 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/02 | 1979 | 1980 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/03 | 1981 | 1985 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline >2,0 l | ECE 15/04 | 1986 | 1990 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline >2,0 l | Euro I | 1991 | 1996 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Gasoline >2,0 l | Euro II | 1997 | 2000 | -2,98 | -5,37 | -2,63 | 62,65 | 58,10 | 57,55 | 0,00 | 0,00 | 0,00 | 43,59 | 45,20 | 60,45 | 60,19 | 61,27 | 62,09 |
| Passenger Cars | Gasoline >2,0 l | Euro III | 2001 | 2005 | 5,12 | 7,23 | 12,60 | 70,59 | 49,62 | 34,95 | 60,25 | 54,57 | 37,37 | 72,16 | 78,49 | 88,69 | 91,74 | 87,53 | 77,02 |
| Passenger Cars | Gasoline >2,0 l | Euro IV | 2006 | 2010 | -15,39 | -9,65 | -1,29 | 88,95 | 79,10 | 70,06 | 60,25 | 54,57 | 37,37 | 80,12 | 89,24 | 95,86 | 93,34 | 88,71 | 84,51 |
| Passenger Cars | Diesel <2,0 l | Conventional | 0 | 1990 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Diesel <2,0 l | Euro I | 1991 | 1996 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Diesel <2,0 l | Euro II | 1997 | 2000 | -5,45 | -3,06 | -0,81 | 18,08 | 48,77 | 83,05 | 17,92 | 36,92 | 53,22 | -7,94 | 1,18 | -0,20 | 34,81 | 33,43 | 41,61 |
| Passenger Cars | Diesel <2,0 l | Euro III | 2001 | 2005 | -2,27 | -1,45 | 5,79 | 76,38 | 81,12 | 94,30 | 48,53 | 51,90 | 58,32 | -18,71 | -18,46 | -12,98 | 65,94 | 63,35 | 66,25 |
| Passenger Cars | Diesel <2,0 l | Euro IV | 2006 | 2010 | -2,27 | -1,45 | 5,79 | 80,09 | 84,22 | 89,72 | 49,02 | 60,57 | 75,83 | 10,60 | 24,53 | 13,19 | 27,61 | 44,26 | 51,85 |
| Passenger Cars | Diesel >2,0 l | Conventional | 0 | 1990 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Passenger Cars | Diesel >2,0 l | Euro I | 1991 | 1996 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |

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| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Cars | Diesel >2,0 l | Euro II | 1997 | 2000 | 0,00 | 0,00 | 0,00 | 18,08 | 48,77 | 83,05 | 17,92 | 36,92 | 53,22 | -7,94 | 1,18 | -0,20 | -22,14 | -25,38 | -11,51 |
| Passenger Cars | Diesel >2,0 l | Euro III | 2001 | 2005 | 0,00 | 0,00 | 0,00 | 76,38 | 81,12 | 94,30 | 48,53 | 51,90 | 58,32 | -18,71 | -18,46 | -12,98 | 52,23 | 62,67 | 63,93 |
| Passenger Cars | Diesel >2,0 l | Euro IV | 2006 | 2010 | 0,00 | 0,00 | 0,00 | 80,09 | 84,22 | 89,72 | 49,02 | 60,57 | 75,83 | 10,60 | 24,53 | 13,19 | 86,39 | 86,10 | 83,20 |
| Passenger Cars | LPG | Conventional | 0 | 1990 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Light Duty Vehicles | Gasoline <3,5t | Conventional | 0 | 1994 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Light Duty Vehicles | Gasoline <3,5t | Euro I | 1995 | 1998 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Light Duty Vehicles | Gasoline <3,5t | Euro II | 1999 | 2001 | 0,00 | 0,00 | 0,00 | 39,00 | 39,00 | 39,00 | 0,00 | 0,00 | 0,00 | 66,00 | 66,00 | 66,00 | 76,00 | 76,00 | 76,00 |
| Light Duty Vehicles | Gasoline <3,5t | Euro III | 2002 | 2006 | 0,00 | 0,00 | 0,00 | 48,00 | 48,00 | 48,00 | 60,25 | 54,57 | 37,37 | 79,00 | 79,00 | 79,00 | 86,00 | 86,00 | 86,00 |
| Light Duty Vehicles | Gasoline <3,5t | Euro IV | 2007 | 2011 | 0,00 | 0,00 | 0,00 | 72,00 | 72,00 | 72,00 | 60,25 | 54,57 | 37,37 | 90,00 | 90,00 | 90,00 | 94,00 | 94,00 | 94,00 |
| Light Duty Vehicles | Diesel <3,5 t | Conventional | 0 | 1994 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Light Duty Vehicles | Diesel <3,5 t | Euro I | 1995 | 1998 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Light Duty Vehicles | Diesel <3,5 t | Euro II | 1999 | 2001 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Light Duty Vehicles | Diesel <3,5 t | Euro III | 2002 | 2006 | 0,00 | 0,00 | 0,00 | 18,00 | 18,00 | 18,00 | 33,00 | 33,00 | 33,00 | 35,00 | 35,00 | 35,00 | 38,00 | 38,00 | 38,00 |
| Light Duty Vehicles | Diesel <3,5 t | Euro IV | 2007 | 2011 | 0,00 | 0,00 | 0,00 | 35,00 | 35,00 | 35,00 | 65,00 | 65,00 | 65,00 | 72,00 | 72,00 | 72,00 | 77,00 | 77,00 | 77,00 |
| Heavy Duty Vehicles | Gasoline >3,5 t | Conventional | 0 | 9999 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Conventional | 0 | 1993 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro I | 1994 | 1996 | 19,41 | 13,86 | 11,62 | 66,97 | 65,69 | 60,81 | 61,51 | 61,35 | 61,09 | 30,34 | 27,31 | 27,37 | 80,08 | 78,62 | 76,18 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro II | 1997 | 2001 | 23,96 | 17,09 | 14,31 | 72,63 | 70,07 | 67,15 | 83,57 | 80,45 | 77,17 | 25,72 | 25,03 | 27,10 | 87,19 | 86,41 | 85,11 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro III | 2002 | 2006 | 18,81 | 12,58 | 11,10 | 67,25 | 69,42 | 70,43 | 82,21 | 83,12 | 84,01 | 41,88 | 44,80 | 47,19 | 88,42 | 87,82 | 87,33 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro IV | 2007 | 2009 | 23,88 | 17,99 | 16,51 | 97,42 | 97,51 | 97,57 | 96,62 | 96,96 | 97,24 | 64,74 | 64,88 | 65,56 | 99,40 | 99,41 | 99,42 |
| Heavy Duty Vehicles | Diesel 3,5 - 7,5 t | Euro V | 2010 | 2014 | 22,65 | 16,97 | 15,69 | 97,40 | 97,51 | 97,58 | 96,59 | 96,94 | 97,22 | 79,85 | 79,93 | 80,32 | 99,39 | 99,41 | 99,42 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Conventional | 0 | 1993 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro I | 1994 | 1996 | 15,75 | 13,81 | 11,64 | 52,63 | 52,23 | 52,12 | 40,69 | 40,89 | 40,76 | 40,32 | 40,30 | 40,77 | 58,19 | 56,28 | 54,74 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro II | 1997 | 2001 | 19,08 | 16,72 | 13,95 | 61,42 | 57,82 | 55,75 | 74,97 | 71,26 | 65,26 | 36,26 | 37,39 | 38,77 | 73,08 | 72,27 | 71,62 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro III | 2002 | 2006 | 14,98 | 13,30 | 11,18 | 53,72 | 54,72 | 55,01 | 73,67 | 73,70 | 73,60 | 48,32 | 51,30 | 53,65 | 76,12 | 75,48 | 74,58 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro IV | 2007 | 2009 | 20,25 | 18,80 | 17,28 | 96,62 | 96,62 | 96,74 | 94,89 | 95,15 | 95,40 | 69,11 | 70,06 | 70,92 | 98,78 | 98,79 | 98,76 |
| Heavy Duty Vehicles | Diesel 7,5 - 16 t | Euro V | 2010 | 2014 | 18,70 | 17,52 | 16,22 | 96,58 | 96,59 | 96,71 | 94,81 | 95,08 | 95,34 | 82,35 | 82,89 | 83,38 | 98,75 | 98,77 | 98,74 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Conventional | 0 | 1993 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro I | 1994 | 1996 | 13,49 | 12,41 | 11,81 | 29,54 | 28,01 | 27,98 | 29,18 | 31,39 | 32,13 | 32,01 | 32,24 | 32,64 | 29,83 | 27,16 | 25,37 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro II | 1997 | 2001 | 16,77 | 15,05 | 14,29 | 43,36 | 37,86 | 35,12 | 69,41 | 67,64 | 58,86 | 28,74 | 29,44 | 30,59 | 55,02 | 53,74 | 53,55 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro III | 2002 | 2006 | 13,44 | 12,49 | 12,26 | 32,72 | 32,65 | 32,53 | 69,35 | 70,19 | 70,49 | 42,83 | 44,99 | 46,23 | 60,19 | 59,21 | 58,26 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro IV | 2007 | 2009 | 19,09 | 18,36 | 18,39 | 95,20 | 95,21 | 95,42 | 94,19 | 94,63 | 94,93 | 65,27 | 66,01 | 66,29 | 97,97 | 97,98 | 97,94 |
| Heavy Duty Vehicles | Diesel 16 - 32 t | Euro V | 2010 | 2014 | 17,56 | 17,08 | 17,24 | 95,14 | 95,16 | 95,37 | 94,10 | 94,56 | 94,87 | 80,15 | 80,58 | 80,74 | 97,93 | 97,94 | 97,90 |
| Heavy Duty Vehicles | Diesel >32t | Conventional | 0 | 1993 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Heavy Duty Vehicles | Diesel >32t | Euro I | 1994 | 1996 | 11,86 | 11,16 | 11,18 | 15,30 | 12,36 | 12,65 | 23,20 | 26,41 | 27,51 | 29,49 | 29,70 | 29,61 | 7,28 | 3,19 | 1,99 |
| Heavy Duty Vehicles | Diesel >32t | Euro II | 1997 | 2001 | 14,42 | 13,05 | 13,37 | 31,26 | 24,51 | 21,44 | 65,22 | 65,44 | 53,40 | 26,83 | 27,39 | 27,83 | 41,17 | 38,76 | 39,97 |
| Heavy Duty Vehicles | Diesel >32t | Euro III | 2002 | 2006 | 11,88 | 11,30 | 11,87 | 20,56 | 19,71 | 19,69 | 67,96 | 69,43 | 70,02 | 41,60 | 42,70 | 42,97 | 48,58 | 46,91 | 46,17 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Heavy Duty Vehicles | Diesel >32t | Euro IV | 2007 | 2009 | 17,95 | 17,59 | 18,21 | 94,59 | 94,67 | 94,89 | 94,14 | 94,70 | 94,98 | 63,94 | 64,56 | 63,85 | 97,40 | 97,39 | 97,34 |
| Heavy Duty Vehicles | Diesel >32t | Euro V | 2010 | 2014 | 16,48 | 16,34 | 17,05 | 94,52 | 94,60 | 94,86 | 94,04 | 94,62 | 94,91 | 79,40 | 79,75 | 79,34 | 97,35 | 97,34 | 97,29 |
| Buses | Urban Buses | Conventional | 0 | 1993 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Buses | Urban Buses | Euro I | 1994 | 1996 | 14,83 | 13,35 | 12,85 | 52,04 | 51,79 | 55,42 | 45,74 | 41,81 | 43,69 | 39,11 | 39,36 | 41,56 | 58,81 | 56,29 | 54,39 |
| Buses | Urban Buses | Euro II | 1997 | 2001 | 17,76 | 14,66 | 13,07 | 57,73 | 57,23 | 61,50 | 75,04 | 71,66 | 68,52 | 34,94 | 36,64 | 38,47 | 73,19 | 71,52 | 69,69 |
| Buses | Urban Buses | Euro III | 2002 | 2006 | 13,52 | 11,21 | 10,63 | 53,21 | 54,20 | 58,38 | 76,57 | 74,49 | 72,92 | 44,89 | 50,41 | 55,05 | 76,10 | 74,64 | 73,35 |
| Buses | Urban Buses | Euro IV | 2007 | 2009 | 18,47 | 16,55 | 15,86 | 96,18 | 96,48 | 96,59 | 95,01 | 95,23 | 95,20 | 67,58 | 68,76 | 72,16 | 98,77 | 98,75 | 98,71 |
| Buses | Coaches | Conventional | 0 | 1993 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Buses | Coaches | Euro I | 1994 | 1996 | 7,96 | 7,67 | 7,92 | 18,93 | 16,53 | 16,34 | 20,89 | 23,78 | 27,11 | 23,46 | 23,96 | 25,12 | 7,21 | 2,52 | -4,41 |
| Buses | Coaches | Euro II | 1997 | 2001 | 8,24 | 7,37 | 7,94 | 32,32 | 27,97 | 24,04 | 65,98 | 63,06 | 61,68 | 14,45 | 16,52 | 18,47 | 38,19 | 34,08 | 31,34 |
| Buses | Coaches | Euro III | 2002 | 2006 | 1,71 | 0,56 | 0,19 | 16,59 | 13,73 | 12,65 | 62,34 | 61,58 | 62,41 | 26,50 | 32,15 | 35,43 | 42,96 | 38,70 | 31,67 |
| Buses | Coaches | Euro IV | 2007 | 2009 | 6,93 | 6,22 | 5,83 | 93,52 | 93,34 | 93,37 | 92,49 | 92,91 | 92,91 | 56,15 | 58,53 | 60,19 | 97,02 | 96,87 | 96,57 |
| Mopeds | <50 cm³ | Conventional | 0 | 1999 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Mopeds | <50 cm³ | Euro I | 2000 | 2003 | 40,00 | 40,00 | 0,00 | 59,42 | 59,42 | 0,00 | 59,84 | 59,84 | 0,00 | 0,00 | 0,00 | 0,00 | 80,37 | 80,37 | 0,00 |
| Mopeds | <50 cm³ | Euro II | 2004 | 9999 | 51,68 | 51,68 | 0,00 | 90,58 | 90,58 | 0,00 | 80,00 | 80,00 | 0,00 | -1200,00 | -1200,00 | 0,00 | 88,79 | 88,79 | 0,00 |
| Motorcycles | 2-stroke >50 cm³ | Conventional | 0 | 1999 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Motorcycles | 4-stroke <250 cm³ | Conventional | 0 | 1999 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Motorcycles | 4-stroke <250 cm³ | Euro I | 2000 | 2003 | 5,48 | -10,42 | -46,07 | 42,35 | 44,50 | 59,97 | 0,00 | 0,00 | 0,00 | -88,74 | -72,00 | -100,28 | 28,85 | 9,38 | 34,09 |
| Motorcycles | 4-stroke <250 cm³ | Euro II | 2004 | 2006 | 5,48 | -10,42 | -46,07 | 71,08 | 77,39 | 75,88 | 75,00 | 75,00 | 75,00 | -50,00 | -9,50 | -46,69 | 32,06 | 41,98 | 53,64 |
| Motorcycles | 4-stroke <250 cm³ | Euro III | 2007 | 9999 | 5,48 | -10,42 | -46,07 | 78,98 | 93,99 | 94,19 | 75,00 | 75,00 | 75,00 | 3,08 | 38,02 | 9,12 | 59,48 | 79,90 | 86,44 |
| Motorcycles | 4-stroke 250 - 750 cm³ | Conventional | 0 | 1999 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro I | 2000 | 2003 | -1,34 | -2,43 | -19,02 | 53,34 | 38,12 | 23,25 | 0,00 | 0,00 | 0,00 | -114,62 | -90,19 | -102,41 | 25,75 | 20,22 | 21,78 |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro II | 2004 | 2006 | -1,34 | -2,43 | -19,02 | 68,34 | 72,36 | 63,93 | 75,00 | 75,00 | 75,00 | -43,38 | -5,58 | -41,98 | 22,00 | 41,00 | 39,41 |
| Motorcycles | 4-stroke 250 - 750 cm³ | Euro III | 2007 | 9999 | -1,34 | -2,43 | -19,02 | 76,98 | 92,65 | 91,32 | 75,00 | 75,00 | 75,00 | 7,35 | 40,24 | 12,03 | 53,48 | 79,56 | 82,28 |
| Motorcycles | 4-stroke >750 cm³ | Conventional | 0 | 1999 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| Motorcycles | 4-stroke >750 cm³ | Euro I | 2000 | 2003 | -19,81 | -5,93 | -5,70 | 47,02 | 62,11 | 55,56 | 0,00 | 0,00 | 0,00 | -41,89 | -96,35 | -178,57 | 53,59 | 53,89 | 22,69 |
| Motorcycles | 4-stroke >750 cm³ | Euro II | 2004 | 2006 | -19,81 | -5,93 | -5,70 | 56,51 | 67,02 | 61,69 | 75,00 | 75,00 | 75,00 | -31,76 | 0,38 | -35,46 | 58,21 | 65,40 | 48,57 |
| Motorcycles | 4-stroke >750 cm³ | Euro III | 2007 | 9999 | -19,81 | -5,93 | -5,70 | 68,38 | 91,23 | 90,78 | 75,00 | 75,00 | 75,00 | 14,86 | 43,61 | 16,07 | 75,08 | 88,01 | 84,96 |

## Annex 2B-6 Fuel consumption factors (MJ/km) and emission factors (g/km)

| Sector | ForecastYear | FCu (MJ) | FCr (MJ) | FCh (MJ) | $CO_2$u | $CO_2$r | $CO_2$h | $CH_4$u | $CH_4$r | $CH_4$h | $N_2O$u | $N_2O$r | $N_2O$h | $SO_2$u | $SO_2$r | $SO_2$h | $NO_x$u | $NO_x$r | $NO_x$h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Cars | 1985 | 3,233 | 2,102 | 2,411 | 236 | 154 | 176 | 0,143 | 0,028 | 0,024 | 0,009 | 0,006 | 0,006 | 0,067 | 0,041 | 0,050 | 1,862 | 2,206 | 2,823 |
| Passenger Cars | 1986 | 3,199 | 2,090 | 2,391 | 234 | 153 | 175 | 0,141 | 0,027 | 0,024 | 0,009 | 0,006 | 0,006 | 0,046 | 0,028 | 0,034 | 1,847 | 2,195 | 2,819 |
| Passenger Cars | 1987 | 3,187 | 2,080 | 2,370 | 233 | 152 | 173 | 0,142 | 0,027 | 0,024 | 0,009 | 0,006 | 0,006 | 0,046 | 0,029 | 0,034 | 1,849 | 2,192 | 2,816 |
| Passenger Cars | 1988 | 3,116 | 2,067 | 2,345 | 228 | 151 | 171 | 0,140 | 0,027 | 0,024 | 0,009 | 0,006 | 0,006 | 0,046 | 0,029 | 0,035 | 1,826 | 2,182 | 2,809 |
| Passenger Cars | 1989 | 3,086 | 2,061 | 2,333 | 226 | 151 | 171 | 0,138 | 0,027 | 0,024 | 0,009 | 0,006 | 0,006 | 0,034 | 0,021 | 0,026 | 1,813 | 2,174 | 2,806 |
| Passenger Cars | 1990 | 3,071 | 2,057 | 2,324 | 224 | 150 | 170 | 0,138 | 0,027 | 0,024 | 0,009 | 0,006 | 0,006 | 0,034 | 0,022 | 0,026 | 1,809 | 2,172 | 2,811 |
| Passenger Cars | 1991 | 3,088 | 2,053 | 2,311 | 226 | 150 | 169 | 0,133 | 0,026 | 0,023 | 0,010 | 0,006 | 0,006 | 0,034 | 0,021 | 0,026 | 1,726 | 2,036 | 2,641 |
| Passenger Cars | 1992 | 3,082 | 2,052 | 2,302 | 225 | 150 | 168 | 0,128 | 0,026 | 0,023 | 0,010 | 0,006 | 0,006 | 0,023 | 0,015 | 0,017 | 1,647 | 1,916 | 2,494 |
| Passenger Cars | 1993 | 3,093 | 2,049 | 2,291 | 226 | 150 | 167 | 0,122 | 0,025 | 0,022 | 0,011 | 0,006 | 0,006 | 0,013 | 0,008 | 0,010 | 1,581 | 1,801 | 2,355 |
| Passenger Cars | 1994 | 3,067 | 2,050 | 2,279 | 224 | 150 | 167 | 0,110 | 0,024 | 0,021 | 0,012 | 0,007 | 0,005 | 0,013 | 0,008 | 0,010 | 1,449 | 1,604 | 2,112 |
| Passenger Cars | 1995 | 3,101 | 2,052 | 2,271 | 227 | 150 | 166 | 0,104 | 0,023 | 0,020 | 0,012 | 0,007 | 0,005 | 0,013 | 0,008 | 0,010 | 1,370 | 1,459 | 1,932 |
| Passenger Cars | 1996 | 3,141 | 2,053 | 2,262 | 230 | 150 | 165 | 0,097 | 0,022 | 0,019 | 0,013 | 0,007 | 0,005 | 0,013 | 0,009 | 0,010 | 1,299 | 1,321 | 1,761 |
| Passenger Cars | 1997 | 3,070 | 2,040 | 2,230 | 224 | 149 | 163 | 0,086 | 0,020 | 0,017 | 0,013 | 0,007 | 0,005 | 0,013 | 0,008 | 0,010 | 1,176 | 1,158 | 1,561 |
| Passenger Cars | 1998 | 3,067 | 2,043 | 2,218 | 224 | 149 | 162 | 0,079 | 0,019 | 0,016 | 0,013 | 0,007 | 0,005 | 0,013 | 0,009 | 0,010 | 1,079 | 1,020 | 1,380 |
| Passenger Cars | 1999 | 3,047 | 2,045 | 2,210 | 223 | 149 | 162 | 0,071 | 0,018 | 0,015 | 0,013 | 0,006 | 0,004 | 0,010 | 0,007 | 0,008 | 0,998 | 0,906 | 1,227 |
| Passenger Cars | 2000 | 3,033 | 2,048 | 2,207 | 222 | 150 | 161 | 0,066 | 0,017 | 0,014 | 0,013 | 0,006 | 0,004 | 0,007 | 0,005 | 0,005 | 0,941 | 0,824 | 1,115 |
| Passenger Cars | 2001 | 3,065 | 2,054 | 2,208 | 224 | 150 | 161 | 0,061 | 0,016 | 0,013 | 0,012 | 0,006 | 0,004 | 0,007 | 0,005 | 0,005 | 0,897 | 0,765 | 1,031 |
| Passenger Cars | 2002 | 3,037 | 2,057 | 2,208 | 222 | 150 | 161 | 0,055 | 0,014 | 0,012 | 0,011 | 0,006 | 0,004 | 0,007 | 0,005 | 0,005 | 0,834 | 0,695 | 0,931 |
| Passenger Cars | 2003 | 3,043 | 2,059 | 2,206 | 223 | 151 | 161 | 0,050 | 0,013 | 0,011 | 0,011 | 0,005 | 0,003 | 0,007 | 0,005 | 0,005 | 0,788 | 0,640 | 0,850 |
| Passenger Cars | 2004 | 2,996 | 2,061 | 2,205 | 219 | 151 | 161 | 0,044 | 0,011 | 0,010 | 0,010 | 0,005 | 0,003 | 0,007 | 0,005 | 0,005 | 0,725 | 0,576 | 0,757 |
| Passenger Cars | 2005 | 3,014 | 2,055 | 2,193 | 221 | 150 | 161 | 0,040 | 0,010 | 0,009 | 0,010 | 0,004 | 0,003 | 0,001 | 0,001 | 0,001 | 0,680 | 0,524 | 0,675 |
| Passenger Cars | 2006 | 2,997 | 2,061 | 2,193 | 219 | 151 | 160 | 0,035 | 0,009 | 0,008 | 0,009 | 0,004 | 0,003 | 0,001 | 0,001 | 0,001 | 0,616 | 0,463 | 0,592 |
| Passenger Cars | 2007 | 2,970 | 2,062 | 2,190 | 217 | 151 | 160 | 0,029 | 0,007 | 0,006 | 0,009 | 0,003 | 0,003 | 0,001 | 0,001 | 0,001 | 0,559 | 0,408 | 0,519 |
| Passenger Cars | 2008 | 2,985 | 2,068 | 2,194 | 218 | 151 | 160 | 0,025 | 0,006 | 0,005 | 0,008 | 0,003 | 0,002 | 0,001 | 0,001 | 0,001 | 0,519 | 0,365 | 0,464 |
| Light Duty Vehicles | 1985 | 3,951 | 2,783 | 2,977 | 292 | 205 | 220 | 0,051 | 0,017 | 0,011 | 0,002 | 0,001 | 0,001 | 0,748 | 0,548 | 0,599 | 2,056 | 1,231 | 1,270 |
| Light Duty Vehicles | 1986 | 3,929 | 2,785 | 2,984 | 290 | 206 | 220 | 0,049 | 0,016 | 0,011 | 0,002 | 0,001 | 0,001 | 0,454 | 0,334 | 0,365 | 2,035 | 1,203 | 1,238 |
| Light Duty Vehicles | 1987 | 3,938 | 2,785 | 2,985 | 291 | 206 | 221 | 0,049 | 0,016 | 0,011 | 0,002 | 0,001 | 0,001 | 0,456 | 0,334 | 0,366 | 2,039 | 1,200 | 1,235 |
| Light Duty Vehicles | 1988 | 3,886 | 2,785 | 2,986 | 287 | 206 | 221 | 0,049 | 0,016 | 0,011 | 0,002 | 0,001 | 0,001 | 0,451 | 0,335 | 0,366 | 2,008 | 1,197 | 1,232 |
| Light Duty Vehicles | 1989 | 3,864 | 2,787 | 2,990 | 285 | 206 | 221 | 0,048 | 0,016 | 0,011 | 0,001 | 0,001 | 0,001 | 0,302 | 0,225 | 0,247 | 1,990 | 1,181 | 1,213 |
| Light Duty Vehicles | 1990 | 3,858 | 2,787 | 2,992 | 285 | 206 | 221 | 0,047 | 0,016 | 0,010 | 0,001 | 0,001 | 0,001 | 0,303 | 0,226 | 0,247 | 1,984 | 1,173 | 1,205 |
| Light Duty Vehicles | 1991 | 3,890 | 2,787 | 2,990 | 287 | 206 | 221 | 0,047 | 0,016 | 0,011 | 0,001 | 0,001 | 0,001 | 0,304 | 0,225 | 0,247 | 2,005 | 1,180 | 1,213 |
| Light Duty Vehicles | 1992 | 3,891 | 2,785 | 2,985 | 287 | 206 | 220 | 0,049 | 0,016 | 0,011 | 0,002 | 0,001 | 0,001 | 0,196 | 0,145 | 0,159 | 2,008 | 1,202 | 1,237 |
| Light Duty Vehicles | 1993 | 3,924 | 2,785 | 2,983 | 290 | 206 | 220 | 0,049 | 0,016 | 0,011 | 0,002 | 0,001 | 0,001 | 0,077 | 0,056 | 0,061 | 2,028 | 1,208 | 1,243 |
| Light Duty Vehicles | 1994 | 3,962 | 2,786 | 2,987 | 292 | 206 | 221 | 0,049 | 0,016 | 0,011 | 0,002 | 0,001 | 0,001 | 0,078 | 0,057 | 0,062 | 2,031 | 1,194 | 1,228 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Light Duty Vehicles | 1995 | 3,956 | 2,768 | 2,966 | 292 | 204 | 219 | 0,046 | 0,016 | 0,010 | 0,002 | 0,001 | 0,001 | 0,078 | 0,056 | 0,061 | 1,973 | 1,171 | 1,206 |
| Light Duty Vehicles | 1996 | 3,995 | 2,750 | 2,947 | 295 | 203 | 218 | 0,043 | 0,015 | 0,010 | 0,003 | 0,002 | 0,002 | 0,078 | 0,056 | 0,061 | 1,937 | 1,145 | 1,181 |
| Light Duty Vehicles | 1997 | 3,926 | 2,733 | 2,929 | 290 | 202 | 216 | 0,040 | 0,015 | 0,009 | 0,003 | 0,002 | 0,002 | 0,077 | 0,055 | 0,060 | 1,845 | 1,120 | 1,157 |
| Light Duty Vehicles | 1998 | 3,913 | 2,716 | 2,908 | 289 | 201 | 215 | 0,038 | 0,014 | 0,009 | 0,004 | 0,003 | 0,002 | 0,076 | 0,055 | 0,060 | 1,787 | 1,104 | 1,143 |
| Light Duty Vehicles | 1999 | 3,879 | 2,700 | 2,892 | 286 | 199 | 214 | 0,035 | 0,013 | 0,008 | 0,004 | 0,003 | 0,003 | 0,042 | 0,030 | 0,033 | 1,715 | 1,077 | 1,115 |
| Light Duty Vehicles | 2000 | 3,850 | 2,686 | 2,876 | 284 | 198 | 212 | 0,033 | 0,012 | 0,008 | 0,005 | 0,004 | 0,003 | 0,009 | 0,006 | 0,007 | 1,650 | 1,055 | 1,093 |
| Light Duty Vehicles | 2001 | 3,867 | 2,671 | 2,860 | 285 | 197 | 211 | 0,030 | 0,011 | 0,007 | 0,005 | 0,004 | 0,003 | 0,009 | 0,006 | 0,007 | 1,609 | 1,031 | 1,071 |
| Light Duty Vehicles | 2002 | 3,816 | 2,654 | 2,842 | 282 | 196 | 210 | 0,027 | 0,010 | 0,006 | 0,006 | 0,004 | 0,004 | 0,009 | 0,006 | 0,007 | 1,490 | 0,977 | 1,015 |
| Light Duty Vehicles | 2003 | 3,804 | 2,638 | 2,828 | 281 | 195 | 209 | 0,023 | 0,009 | 0,005 | 0,007 | 0,004 | 0,004 | 0,009 | 0,006 | 0,007 | 1,403 | 0,923 | 0,960 |
| Light Duty Vehicles | 2004 | 3,724 | 2,615 | 2,806 | 275 | 193 | 207 | 0,019 | 0,007 | 0,004 | 0,007 | 0,004 | 0,004 | 0,009 | 0,006 | 0,007 | 1,274 | 0,870 | 0,906 |
| Light Duty Vehicles | 2005 | 3,751 | 2,604 | 2,793 | 277 | 192 | 206 | 0,017 | 0,006 | 0,004 | 0,008 | 0,004 | 0,004 | 0,002 | 0,001 | 0,001 | 1,213 | 0,831 | 0,866 |
| Light Duty Vehicles | 2006 | 3,719 | 2,590 | 2,780 | 275 | 191 | 205 | 0,015 | 0,005 | 0,003 | 0,009 | 0,004 | 0,004 | 0,002 | 0,001 | 0,001 | 1,140 | 0,794 | 0,829 |
| Light Duty Vehicles | 2007 | 3,677 | 2,574 | 2,768 | 271 | 190 | 204 | 0,012 | 0,004 | 0,003 | 0,009 | 0,004 | 0,004 | 0,002 | 0,001 | 0,001 | 1,034 | 0,732 | 0,764 |
| Light Duty Vehicles | 2008 | 3,681 | 2,562 | 2,758 | 272 | 189 | 204 | 0,010 | 0,004 | 0,002 | 0,010 | 0,004 | 0,004 | 0,002 | 0,001 | 0,001 | 0,945 | 0,674 | 0,704 |
| Heavy Duty Vehicles | 1985 | 11,910 | 9,912 | 10,595 | 881 | 733 | 784 | 0,144 | 0,066 | 0,064 | 0,030 | 0,030 | 0,030 | 2,777 | 2,315 | 2,478 | 11,844 | 10,349 | 10,884 |
| Heavy Duty Vehicles | 1986 | 11,896 | 9,904 | 10,591 | 880 | 733 | 784 | 0,144 | 0,066 | 0,064 | 0,030 | 0,030 | 0,030 | 1,665 | 1,388 | 1,486 | 11,834 | 10,341 | 10,880 |
| Heavy Duty Vehicles | 1987 | 11,905 | 9,909 | 10,594 | 881 | 733 | 784 | 0,144 | 0,066 | 0,064 | 0,030 | 0,030 | 0,030 | 1,666 | 1,389 | 1,487 | 11,842 | 10,346 | 10,883 |
| Heavy Duty Vehicles | 1988 | 11,927 | 9,923 | 10,600 | 883 | 734 | 784 | 0,144 | 0,066 | 0,064 | 0,030 | 0,030 | 0,030 | 1,669 | 1,391 | 1,488 | 11,863 | 10,359 | 10,888 |
| Heavy Duty Vehicles | 1989 | 11,936 | 9,929 | 10,603 | 883 | 735 | 785 | 0,144 | 0,066 | 0,064 | 0,030 | 0,030 | 0,030 | 1,114 | 0,928 | 0,992 | 11,873 | 10,365 | 10,891 |
| Heavy Duty Vehicles | 1990 | 11,876 | 9,897 | 10,587 | 879 | 732 | 783 | 0,144 | 0,066 | 0,064 | 0,030 | 0,030 | 0,030 | 1,108 | 0,925 | 0,991 | 11,801 | 10,325 | 10,871 |
| Heavy Duty Vehicles | 1991 | 12,017 | 9,910 | 10,560 | 889 | 733 | 781 | 0,145 | 0,066 | 0,063 | 0,030 | 0,030 | 0,030 | 1,122 | 0,926 | 0,988 | 11,936 | 10,337 | 10,846 |
| Heavy Duty Vehicles | 1992 | 12,031 | 9,919 | 10,564 | 890 | 734 | 782 | 0,146 | 0,066 | 0,064 | 0,030 | 0,030 | 0,030 | 0,730 | 0,603 | 0,642 | 11,948 | 10,345 | 10,850 |
| Heavy Duty Vehicles | 1993 | 11,868 | 9,962 | 10,532 | 878 | 737 | 779 | 0,144 | 0,067 | 0,063 | 0,030 | 0,030 | 0,030 | 0,277 | 0,233 | 0,246 | 11,741 | 10,339 | 10,771 |
| Heavy Duty Vehicles | 1994 | 11,698 | 9,825 | 10,404 | 866 | 727 | 770 | 0,144 | 0,066 | 0,063 | 0,030 | 0,030 | 0,030 | 0,273 | 0,230 | 0,243 | 11,381 | 10,022 | 10,454 |
| Heavy Duty Vehicles | 1995 | 11,565 | 9,770 | 10,247 | 856 | 723 | 758 | 0,144 | 0,067 | 0,063 | 0,030 | 0,030 | 0,030 | 0,270 | 0,228 | 0,240 | 11,066 | 9,790 | 10,122 |
| Heavy Duty Vehicles | 1996 | 11,532 | 9,653 | 10,150 | 853 | 714 | 751 | 0,144 | 0,066 | 0,063 | 0,030 | 0,030 | 0,030 | 0,269 | 0,226 | 0,237 | 10,867 | 9,520 | 9,862 |
| Heavy Duty Vehicles | 1997 | 11,676 | 9,715 | 10,130 | 864 | 719 | 750 | 0,142 | 0,067 | 0,063 | 0,030 | 0,030 | 0,030 | 0,273 | 0,227 | 0,237 | 10,880 | 9,447 | 9,694 |
| Heavy Duty Vehicles | 1998 | 11,621 | 9,672 | 10,057 | 860 | 716 | 744 | 0,139 | 0,067 | 0,063 | 0,030 | 0,030 | 0,030 | 0,271 | 0,226 | 0,235 | 10,699 | 9,275 | 9,482 |
| Heavy Duty Vehicles | 1999 | 11,667 | 9,690 | 10,025 | 863 | 717 | 742 | 0,137 | 0,068 | 0,063 | 0,030 | 0,030 | 0,030 | 0,150 | 0,125 | 0,129 | 10,631 | 9,179 | 9,328 |
| Heavy Duty Vehicles | 2000 | 11,604 | 9,638 | 9,960 | 859 | 713 | 737 | 0,133 | 0,067 | 0,063 | 0,030 | 0,030 | 0,030 | 0,027 | 0,023 | 0,023 | 10,432 | 8,990 | 9,117 |
| Heavy Duty Vehicles | 2001 | 11,819 | 9,764 | 9,983 | 875 | 723 | 739 | 0,133 | 0,069 | 0,064 | 0,030 | 0,030 | 0,030 | 0,028 | 0,023 | 0,023 | 10,380 | 8,885 | 8,913 |
| Heavy Duty Vehicles | 2002 | 11,782 | 9,736 | 9,929 | 872 | 720 | 735 | 0,128 | 0,069 | 0,064 | 0,030 | 0,030 | 0,030 | 0,028 | 0,023 | 0,023 | 10,028 | 8,565 | 8,564 |
| Heavy Duty Vehicles | 2003 | 11,751 | 9,713 | 9,894 | 870 | 719 | 732 | 0,123 | 0,069 | 0,063 | 0,030 | 0,030 | 0,030 | 0,028 | 0,023 | 0,023 | 9,721 | 8,285 | 8,268 |
| Heavy Duty Vehicles | 2004 | 11,620 | 9,621 | 9,794 | 860 | 712 | 725 | 0,117 | 0,069 | 0,063 | 0,030 | 0,030 | 0,030 | 0,027 | 0,023 | 0,023 | 9,257 | 7,876 | 7,847 |
| Heavy Duty Vehicles | 2005 | 11,676 | 9,659 | 9,802 | 864 | 715 | 725 | 0,113 | 0,068 | 0,063 | 0,030 | 0,030 | 0,030 | 0,005 | 0,005 | 0,005 | 9,041 | 7,669 | 7,612 |
| Heavy Duty Vehicles | 2006 | 11,705 | 9,674 | 9,791 | 866 | 716 | 725 | 0,108 | 0,067 | 0,061 | 0,030 | 0,030 | 0,030 | 0,005 | 0,005 | 0,005 | 8,778 | 7,425 | 7,348 |
| Heavy Duty Vehicles | 2007 | 11,695 | 9,652 | 9,740 | 865 | 714 | 721 | 0,096 | 0,061 | 0,056 | 0,030 | 0,030 | 0,030 | 0,005 | 0,005 | 0,005 | 8,274 | 6,982 | 6,894 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Heavy Duty Vehicles | 2008 | 11,467 | 9,520 | 9,633 | 848 | 704 | 713 | 0,085 | 0,055 | 0,050 | 0,030 | 0,030 | 0,030 | 0,005 | 0,004 | 0,005 | 7,579 | 6,430 | 6,370 |
| Buses | 1985 | 13,144 | 10,264 | 8,850 | 973 | 760 | 655 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 3,078 | 2,404 | 2,073 | 13,673 | 11,169 | 9,586 |
| Buses | 1986 | 13,142 | 10,261 | 8,849 | 973 | 759 | 655 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 1,847 | 1,442 | 1,243 | 13,669 | 11,164 | 9,582 |
| Buses | 1987 | 13,148 | 10,269 | 8,853 | 973 | 760 | 655 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 1,847 | 1,443 | 1,244 | 13,683 | 11,181 | 9,595 |
| Buses | 1988 | 13,157 | 10,282 | 8,861 | 974 | 761 | 656 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 1,849 | 1,445 | 1,245 | 13,705 | 11,207 | 9,615 |
| Buses | 1989 | 13,153 | 10,276 | 8,858 | 973 | 760 | 655 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 1,232 | 0,963 | 0,830 | 13,695 | 11,195 | 9,606 |
| Buses | 1990 | 13,137 | 10,253 | 8,844 | 972 | 759 | 654 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 1,231 | 0,961 | 0,828 | 13,656 | 11,148 | 9,569 |
| Buses | 1991 | 13,133 | 10,262 | 8,843 | 972 | 759 | 654 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 1,230 | 0,961 | 0,828 | 13,646 | 11,165 | 9,567 |
| Buses | 1992 | 13,143 | 10,245 | 8,844 | 973 | 758 | 654 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 0,800 | 0,624 | 0,538 | 13,672 | 11,130 | 9,568 |
| Buses | 1993 | 13,114 | 10,263 | 8,848 | 970 | 759 | 655 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 0,307 | 0,240 | 0,207 | 13,599 | 11,167 | 9,580 |
| Buses | 1994 | 12,998 | 10,108 | 8,772 | 962 | 748 | 649 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 0,304 | 0,237 | 0,205 | 13,260 | 10,722 | 9,310 |
| Buses | 1995 | 12,794 | 9,930 | 8,658 | 947 | 735 | 641 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 0,300 | 0,233 | 0,203 | 12,710 | 10,244 | 8,947 |
| Buses | 1996 | 12,605 | 9,778 | 8,555 | 933 | 724 | 633 | 0,175 | 0,080 | 0,070 | 0,030 | 0,030 | 0,030 | 0,295 | 0,229 | 0,200 | 12,202 | 9,832 | 8,623 |
| Buses | 1997 | 12,445 | 9,683 | 8,486 | 921 | 717 | 628 | 0,170 | 0,078 | 0,068 | 0,030 | 0,030 | 0,030 | 0,291 | 0,227 | 0,199 | 11,889 | 9,585 | 8,429 |
| Buses | 1998 | 12,349 | 9,632 | 8,447 | 914 | 713 | 625 | 0,165 | 0,075 | 0,066 | 0,030 | 0,030 | 0,030 | 0,289 | 0,226 | 0,198 | 11,726 | 9,459 | 8,328 |
| Buses | 1999 | 12,234 | 9,566 | 8,398 | 905 | 708 | 621 | 0,161 | 0,073 | 0,064 | 0,030 | 0,030 | 0,030 | 0,158 | 0,123 | 0,108 | 11,511 | 9,289 | 8,194 |
| Buses | 2000 | 12,134 | 9,511 | 8,357 | 898 | 704 | 618 | 0,157 | 0,072 | 0,063 | 0,030 | 0,030 | 0,030 | 0,028 | 0,022 | 0,020 | 11,327 | 9,147 | 8,080 |
| Buses | 2001 | 12,054 | 9,465 | 8,324 | 892 | 700 | 616 | 0,153 | 0,070 | 0,061 | 0,030 | 0,030 | 0,030 | 0,028 | 0,022 | 0,019 | 11,184 | 9,033 | 7,991 |
| Buses | 2002 | 12,011 | 9,449 | 8,323 | 889 | 699 | 616 | 0,149 | 0,068 | 0,060 | 0,030 | 0,030 | 0,030 | 0,028 | 0,022 | 0,019 | 10,907 | 8,781 | 7,766 |
| Buses | 2003 | 11,991 | 9,451 | 8,332 | 887 | 699 | 617 | 0,146 | 0,067 | 0,058 | 0,030 | 0,030 | 0,030 | 0,028 | 0,022 | 0,020 | 10,698 | 8,589 | 7,587 |
| Buses | 2004 | 11,961 | 9,432 | 8,332 | 885 | 698 | 617 | 0,143 | 0,065 | 0,057 | 0,030 | 0,030 | 0,030 | 0,028 | 0,022 | 0,020 | 10,485 | 8,387 | 7,413 |
| Buses | 2005 | 11,921 | 9,424 | 8,332 | 882 | 697 | 617 | 0,139 | 0,064 | 0,056 | 0,030 | 0,030 | 0,030 | 0,006 | 0,004 | 0,004 | 10,246 | 8,176 | 7,218 |
| Buses | 2006 | 11,882 | 9,411 | 8,330 | 879 | 696 | 616 | 0,136 | 0,062 | 0,054 | 0,030 | 0,030 | 0,030 | 0,006 | 0,004 | 0,004 | 10,014 | 7,968 | 7,030 |
| Buses | 2007 | 11,796 | 9,355 | 8,292 | 873 | 692 | 614 | 0,125 | 0,057 | 0,050 | 0,030 | 0,030 | 0,030 | 0,006 | 0,004 | 0,004 | 9,557 | 7,601 | 6,705 |
| Buses | 2008 | 11,714 | 9,308 | 8,257 | 867 | 689 | 611 | 0,115 | 0,053 | 0,046 | 0,030 | 0,030 | 0,030 | 0,005 | 0,004 | 0,004 | 9,119 | 7,254 | 6,392 |
| Mopeds | 1985 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |
| Mopeds | 1986 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |
| Mopeds | 1987 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |
| Mopeds | 1988 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |
| Mopeds | 1989 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |
| Mopeds | 1990 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |
| Mopeds | 1991 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |
| Mopeds | 1992 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |
| Mopeds | 1993 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |
| Mopeds | 1994 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |
| Mopeds | 1995 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |
| Mopeds | 1996 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mopeds | 1997 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |
| Mopeds | 1998 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |
| Mopeds | 1999 | 1,095 | 1,095 | | 80 | 80 | | 0,219 | 0,219 | | 0,001 | 0,001 | | 0,003 | 0,003 | | 0,020 | 0,020 | |
| Mopeds | 2000 | 1,050 | 1,050 | | 77 | 77 | | 0,201 | 0,201 | | 0,001 | 0,001 | | 0,002 | 0,002 | | 0,020 | 0,020 | |
| Mopeds | 2001 | 1,019 | 1,019 | | 74 | 74 | | 0,188 | 0,188 | | 0,001 | 0,001 | | 0,002 | 0,002 | | 0,020 | 0,020 | |
| Mopeds | 2002 | 0,985 | 0,985 | | 72 | 72 | | 0,175 | 0,175 | | 0,001 | 0,001 | | 0,002 | 0,002 | | 0,020 | 0,020 | |
| Mopeds | 2003 | 0,969 | 0,969 | | 71 | 71 | | 0,169 | 0,169 | | 0,001 | 0,001 | | 0,002 | 0,002 | | 0,020 | 0,020 | |
| Mopeds | 2004 | 0,940 | 0,940 | | 69 | 69 | | 0,159 | 0,159 | | 0,001 | 0,001 | | 0,002 | 0,002 | | 0,035 | 0,035 | |
| Mopeds | 2005 | 0,910 | 0,910 | | 66 | 66 | | 0,149 | 0,149 | | 0,001 | 0,001 | | 0,000 | 0,000 | | 0,051 | 0,051 | |
| Mopeds | 2006 | 0,876 | 0,876 | | 64 | 64 | | 0,138 | 0,138 | | 0,001 | 0,001 | | 0,000 | 0,000 | | 0,067 | 0,067 | |
| Mopeds | 2007 | 0,848 | 0,848 | | 62 | 62 | | 0,128 | 0,128 | | 0,001 | 0,001 | | 0,000 | 0,000 | | 0,083 | 0,083 | |
| Mopeds | 2008 | 0,827 | 0,827 | | 60 | 60 | | 0,121 | 0,121 | | 0,001 | 0,001 | | 0,000 | 0,000 | | 0,094 | 0,094 | |
| Motorcycles | 1985 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 1986 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 1987 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 1988 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 1989 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 1990 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 1991 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 1992 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 1993 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 1994 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 1995 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 1996 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 1997 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 1998 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 1999 | 1,308 | 1,318 | 1,578 | 95 | 96 | 115 | 0,193 | 0,193 | 0,193 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,122 | 0,228 | 0,340 |
| Motorcycles | 2000 | 1,311 | 1,320 | 1,591 | 96 | 96 | 116 | 0,190 | 0,190 | 0,190 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,127 | 0,238 | 0,359 |
| Motorcycles | 2001 | 1,313 | 1,321 | 1,600 | 96 | 96 | 117 | 0,188 | 0,189 | 0,189 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,131 | 0,244 | 0,372 |
| Motorcycles | 2002 | 1,315 | 1,322 | 1,608 | 96 | 97 | 117 | 0,187 | 0,188 | 0,188 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,135 | 0,251 | 0,385 |
| Motorcycles | 2003 | 1,317 | 1,323 | 1,616 | 96 | 97 | 118 | 0,185 | 0,187 | 0,187 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,138 | 0,257 | 0,398 |
| Motorcycles | 2004 | 1,319 | 1,324 | 1,625 | 96 | 97 | 119 | 0,184 | 0,184 | 0,185 | 0,002 | 0,002 | 0,002 | 0,003 | 0,003 | 0,004 | 0,140 | 0,257 | 0,401 |
| Motorcycles | 2005 | 1,322 | 1,326 | 1,638 | 97 | 97 | 120 | 0,181 | 0,180 | 0,181 | 0,002 | 0,002 | 0,002 | 0,001 | 0,001 | 0,001 | 0,142 | 0,256 | 0,406 |
| Motorcycles | 2006 | 1,324 | 1,327 | 1,649 | 96 | 97 | 120 | 0,179 | 0,175 | 0,177 | 0,002 | 0,002 | 0,002 | 0,001 | 0,001 | 0,001 | 0,145 | 0,256 | 0,411 |
| Motorcycles | 2007 | 1,329 | 1,331 | 1,666 | 97 | 97 | 121 | 0,172 | 0,166 | 0,168 | 0,002 | 0,002 | 0,002 | 0,001 | 0,001 | 0,001 | 0,143 | 0,248 | 0,404 |
| Motorcycles | 2008 | 1,331 | 1,332 | 1,674 | 97 | 97 | 122 | 0,169 | 0,161 | 0,163 | 0,002 | 0,002 | 0,002 | 0,001 | 0,001 | 0,001 | 0,142 | 0,244 | 0,401 |

| Sector | ForecastYear | NMVOCu (exh) | NMVOCr (exh) | NMVOCh (exh) | NMVOCu (tot) | NMVOCr (tot) | NMVOCh (tot) | COu | COr | COh | $NH_3u$ | $NH_3r$ | $NH_3h$ | TSPu | TSPr | TSPh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Cars | 1985 | 3,123 | 1,055 | 0,930 | 5,012 | 1,447 | 1,005 | 37,032 | 10,189 | 10,610 | 0,002 | 0,002 | 0,002 | 0,081 | 0,045 | 0,047 |
| Passenger Cars | 1986 | 3,004 | 1,027 | 0,899 | 4,889 | 1,418 | 0,975 | 34,691 | 9,625 | 9,913 | 0,002 | 0,002 | 0,002 | 0,081 | 0,045 | 0,047 |
| Passenger Cars | 1987 | 2,967 | 1,003 | 0,870 | 4,832 | 1,390 | 0,945 | 33,230 | 9,054 | 9,244 | 0,002 | 0,002 | 0,002 | 0,080 | 0,043 | 0,046 |
| Passenger Cars | 1988 | 2,724 | 0,970 | 0,830 | 4,655 | 1,371 | 0,907 | 28,925 | 8,272 | 8,307 | 0,002 | 0,002 | 0,002 | 0,075 | 0,042 | 0,044 |
| Passenger Cars | 1989 | 2,615 | 0,948 | 0,806 | 4,560 | 1,351 | 0,883 | 27,096 | 7,843 | 7,749 | 0,002 | 0,002 | 0,002 | 0,074 | 0,041 | 0,044 |
| Passenger Cars | 1990 | 2,557 | 0,931 | 0,786 | 4,489 | 1,331 | 0,863 | 26,019 | 7,501 | 7,295 | 0,002 | 0,002 | 0,002 | 0,073 | 0,040 | 0,044 |
| Passenger Cars | 1991 | 2,551 | 0,867 | 0,731 | 4,358 | 1,225 | 0,802 | 26,050 | 6,987 | 6,770 | 0,005 | 0,010 | 0,007 | 0,070 | 0,037 | 0,041 |
| Passenger Cars | 1992 | 2,450 | 0,811 | 0,683 | 4,246 | 1,149 | 0,741 | 24,895 | 6,554 | 6,343 | 0,009 | 0,019 | 0,011 | 0,063 | 0,034 | 0,038 |
| Passenger Cars | 1993 | 2,438 | 0,755 | 0,636 | 4,041 | 1,057 | 0,687 | 24,716 | 6,112 | 5,934 | 0,012 | 0,026 | 0,015 | 0,060 | 0,032 | 0,035 |
| Passenger Cars | 1994 | 2,222 | 0,662 | 0,557 | 3,698 | 0,927 | 0,603 | 22,134 | 5,398 | 5,208 | 0,016 | 0,039 | 0,022 | 0,053 | 0,029 | 0,032 |
| Passenger Cars | 1995 | 2,188 | 0,595 | 0,500 | 3,564 | 0,829 | 0,536 | 21,617 | 4,921 | 4,801 | 0,020 | 0,048 | 0,027 | 0,049 | 0,026 | 0,030 |
| Passenger Cars | 1996 | 2,198 | 0,530 | 0,445 | 3,399 | 0,733 | 0,473 | 21,552 | 4,469 | 4,410 | 0,023 | 0,057 | 0,033 | 0,047 | 0,023 | 0,027 |
| Passenger Cars | 1997 | 1,848 | 0,443 | 0,374 | 2,901 | 0,621 | 0,398 | 17,531 | 3,693 | 3,769 | 0,033 | 0,070 | 0,040 | 0,038 | 0,020 | 0,023 |
| Passenger Cars | 1998 | 1,696 | 0,380 | 0,321 | 2,552 | 0,525 | 0,340 | 16,126 | 3,245 | 3,354 | 0,041 | 0,080 | 0,045 | 0,034 | 0,017 | 0,021 |
| Passenger Cars | 1999 | 1,484 | 0,326 | 0,276 | 2,225 | 0,452 | 0,292 | 13,999 | 2,858 | 3,002 | 0,048 | 0,087 | 0,049 | 0,031 | 0,016 | 0,020 |
| Passenger Cars | 2000 | 1,359 | 0,288 | 0,244 | 1,857 | 0,373 | 0,255 | 12,812 | 2,594 | 2,770 | 0,053 | 0,093 | 0,052 | 0,029 | 0,015 | 0,019 |
| Passenger Cars | 2001 | 1,319 | 0,260 | 0,221 | 1,752 | 0,334 | 0,231 | 12,650 | 2,428 | 2,652 | 0,050 | 0,089 | 0,053 | 0,029 | 0,014 | 0,018 |
| Passenger Cars | 2002 | 1,149 | 0,228 | 0,195 | 1,526 | 0,292 | 0,203 | 11,120 | 2,216 | 2,477 | 0,048 | 0,084 | 0,054 | 0,027 | 0,014 | 0,018 |
| Passenger Cars | 2003 | 1,064 | 0,201 | 0,172 | 1,385 | 0,255 | 0,179 | 10,462 | 2,009 | 2,289 | 0,045 | 0,080 | 0,053 | 0,028 | 0,014 | 0,018 |
| Passenger Cars | 2004 | 0,881 | 0,170 | 0,147 | 1,151 | 0,216 | 0,153 | 8,751 | 1,784 | 2,083 | 0,041 | 0,074 | 0,053 | 0,027 | 0,014 | 0,019 |
| Passenger Cars | 2005 | 0,841 | 0,144 | 0,124 | 1,084 | 0,185 | 0,130 | 8,677 | 1,570 | 1,877 | 0,038 | 0,069 | 0,052 | 0,027 | 0,014 | 0,019 |
| Passenger Cars | 2006 | 0,709 | 0,119 | 0,104 | 0,921 | 0,155 | 0,109 | 7,369 | 1,348 | 1,644 | 0,034 | 0,062 | 0,051 | 0,027 | 0,013 | 0,018 |
| Passenger Cars | 2007 | 0,584 | 0,095 | 0,084 | 0,749 | 0,123 | 0,087 | 6,176 | 1,117 | 1,395 | 0,028 | 0,053 | 0,048 | 0,027 | 0,013 | 0,017 |
| Passenger Cars | 2008 | 0,533 | 0,079 | 0,070 | 0,664 | 0,101 | 0,073 | 5,790 | 0,979 | 1,254 | 0,023 | 0,047 | 0,046 | 0,027 | 0,013 | 0,016 |
| Light Duty Vehicles | 1985 | 0,753 | 0,195 | 0,149 | 1,056 | 0,254 | 0,162 | 7,147 | 1,874 | 2,141 | 0,001 | 0,001 | 0,001 | 0,455 | 0,258 | 0,274 |
| Light Duty Vehicles | 1986 | 0,702 | 0,188 | 0,145 | 0,986 | 0,243 | 0,157 | 6,639 | 1,812 | 2,063 | 0,001 | 0,001 | 0,001 | 0,452 | 0,262 | 0,277 |
| Light Duty Vehicles | 1987 | 0,706 | 0,187 | 0,145 | 0,986 | 0,241 | 0,156 | 6,667 | 1,806 | 2,055 | 0,001 | 0,001 | 0,001 | 0,458 | 0,262 | 0,278 |
| Light Duty Vehicles | 1988 | 0,660 | 0,186 | 0,144 | 0,949 | 0,242 | 0,156 | 6,246 | 1,799 | 2,047 | 0,001 | 0,001 | 0,001 | 0,424 | 0,262 | 0,278 |
| Light Duty Vehicles | 1989 | 0,624 | 0,182 | 0,142 | 0,904 | 0,236 | 0,154 | 5,899 | 1,762 | 2,001 | 0,001 | 0,001 | 0,001 | 0,416 | 0,264 | 0,280 |
| Light Duty Vehicles | 1990 | 0,611 | 0,180 | 0,141 | 0,884 | 0,233 | 0,152 | 5,768 | 1,745 | 1,979 | 0,001 | 0,001 | 0,001 | 0,414 | 0,265 | 0,281 |
| Light Duty Vehicles | 1991 | 0,644 | 0,182 | 0,142 | 0,919 | 0,235 | 0,153 | 6,075 | 1,761 | 1,999 | 0,001 | 0,001 | 0,001 | 0,433 | 0,264 | 0,280 |
| Light Duty Vehicles | 1992 | 0,664 | 0,188 | 0,145 | 0,968 | 0,245 | 0,156 | 6,303 | 1,809 | 2,060 | 0,001 | 0,001 | 0,001 | 0,421 | 0,262 | 0,277 |
| Light Duty Vehicles | 1993 | 0,698 | 0,189 | 0,146 | 0,993 | 0,245 | 0,157 | 6,614 | 1,822 | 2,075 | 0,001 | 0,001 | 0,001 | 0,440 | 0,261 | 0,277 |
| Light Duty Vehicles | 1994 | 0,697 | 0,185 | 0,144 | 1,025 | 0,238 | 0,154 | 6,604 | 1,791 | 2,038 | 0,001 | 0,001 | 0,001 | 0,449 | 0,263 | 0,278 |
| Light Duty Vehicles | 1995 | 0,682 | 0,178 | 0,140 | 0,982 | 0,226 | 0,149 | 6,487 | 1,687 | 1,926 | 0,002 | 0,003 | 0,002 | 0,429 | 0,245 | 0,261 |
| Light Duty Vehicles | 1996 | 0,693 | 0,170 | 0,135 | 0,960 | 0,212 | 0,143 | 6,582 | 1,577 | 1,807 | 0,003 | 0,004 | 0,003 | 0,431 | 0,228 | 0,245 |
| Light Duty Vehicles | 1997 | 0,624 | 0,163 | 0,131 | 0,871 | 0,201 | 0,138 | 5,957 | 1,468 | 1,688 | 0,003 | 0,006 | 0,004 | 0,374 | 0,211 | 0,229 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Light Duty Vehicles | 1998 | 0,610 | 0,158 | 0,128 | 0,828 | 0,191 | 0,135 | 5,878 | 1,385 | 1,601 | 0,004 | 0,008 | 0,005 | 0,346 | 0,195 | 0,212 |
| Light Duty Vehicles | 1999 | 0,560 | 0,150 | 0,124 | 0,759 | 0,181 | 0,129 | 5,379 | 1,280 | 1,485 | 0,005 | 0,009 | 0,006 | 0,315 | 0,180 | 0,198 |
| Light Duty Vehicles | 2000 | 0,524 | 0,143 | 0,120 | 0,663 | 0,165 | 0,124 | 5,053 | 1,192 | 1,389 | 0,006 | 0,011 | 0,006 | 0,286 | 0,167 | 0,185 |
| Light Duty Vehicles | 2001 | 0,517 | 0,137 | 0,116 | 0,636 | 0,155 | 0,119 | 4,950 | 1,098 | 1,287 | 0,007 | 0,012 | 0,007 | 0,278 | 0,153 | 0,172 |
| Light Duty Vehicles | 2002 | 0,451 | 0,126 | 0,108 | 0,551 | 0,142 | 0,111 | 4,338 | 0,976 | 1,149 | 0,007 | 0,012 | 0,008 | 0,238 | 0,136 | 0,155 |
| Light Duty Vehicles | 2003 | 0,411 | 0,116 | 0,101 | 0,491 | 0,128 | 0,103 | 3,897 | 0,859 | 1,016 | 0,006 | 0,011 | 0,008 | 0,222 | 0,123 | 0,141 |
| Light Duty Vehicles | 2004 | 0,337 | 0,104 | 0,093 | 0,395 | 0,113 | 0,095 | 3,168 | 0,722 | 0,862 | 0,006 | 0,010 | 0,008 | 0,176 | 0,104 | 0,122 |
| Light Duty Vehicles | 2005 | 0,331 | 0,098 | 0,088 | 0,381 | 0,105 | 0,089 | 3,122 | 0,647 | 0,779 | 0,006 | 0,010 | 0,008 | 0,168 | 0,092 | 0,110 |
| Light Duty Vehicles | 2006 | 0,296 | 0,091 | 0,083 | 0,336 | 0,097 | 0,084 | 2,752 | 0,571 | 0,694 | 0,005 | 0,009 | 0,008 | 0,148 | 0,081 | 0,099 |
| Light Duty Vehicles | 2007 | 0,251 | 0,081 | 0,075 | 0,277 | 0,085 | 0,076 | 2,222 | 0,487 | 0,597 | 0,004 | 0,008 | 0,007 | 0,127 | 0,071 | 0,088 |
| Light Duty Vehicles | 2008 | 0,229 | 0,073 | 0,068 | 0,247 | 0,076 | 0,069 | 1,981 | 0,425 | 0,527 | 0,004 | 0,007 | 0,007 | 0,115 | 0,060 | 0,077 |
| Heavy Duty Vehicles | 1985 | 0,910 | 0,597 | 0,506 | 0,910 | 0,597 | 0,506 | 3,087 | 2,178 | 2,092 | 0,003 | 0,003 | 0,003 | 0,526 | 0,395 | 0,405 |
| Heavy Duty Vehicles | 1986 | 0,908 | 0,596 | 0,506 | 0,908 | 0,596 | 0,506 | 3,056 | 2,160 | 2,084 | 0,003 | 0,003 | 0,003 | 0,526 | 0,395 | 0,405 |
| Heavy Duty Vehicles | 1987 | 0,907 | 0,596 | 0,506 | 0,907 | 0,596 | 0,506 | 3,053 | 2,159 | 2,083 | 0,003 | 0,003 | 0,003 | 0,526 | 0,395 | 0,405 |
| Heavy Duty Vehicles | 1988 | 0,906 | 0,595 | 0,506 | 0,906 | 0,595 | 0,506 | 3,049 | 2,156 | 2,081 | 0,003 | 0,003 | 0,003 | 0,527 | 0,395 | 0,405 |
| Heavy Duty Vehicles | 1989 | 0,904 | 0,594 | 0,505 | 0,904 | 0,594 | 0,505 | 3,031 | 2,146 | 2,076 | 0,003 | 0,003 | 0,003 | 0,527 | 0,396 | 0,405 |
| Heavy Duty Vehicles | 1990 | 0,905 | 0,595 | 0,505 | 0,905 | 0,595 | 0,505 | 3,023 | 2,143 | 2,075 | 0,003 | 0,003 | 0,003 | 0,525 | 0,395 | 0,405 |
| Heavy Duty Vehicles | 1991 | 0,901 | 0,595 | 0,506 | 0,901 | 0,595 | 0,506 | 3,027 | 2,147 | 2,079 | 0,003 | 0,003 | 0,003 | 0,530 | 0,395 | 0,404 |
| Heavy Duty Vehicles | 1992 | 0,902 | 0,596 | 0,507 | 0,902 | 0,596 | 0,507 | 3,050 | 2,160 | 2,086 | 0,003 | 0,003 | 0,003 | 0,530 | 0,395 | 0,404 |
| Heavy Duty Vehicles | 1993 | 0,899 | 0,590 | 0,504 | 0,899 | 0,590 | 0,504 | 3,041 | 2,149 | 2,078 | 0,003 | 0,003 | 0,003 | 0,523 | 0,395 | 0,401 |
| Heavy Duty Vehicles | 1994 | 0,867 | 0,575 | 0,494 | 0,867 | 0,575 | 0,494 | 2,953 | 2,097 | 2,034 | 0,003 | 0,003 | 0,003 | 0,508 | 0,383 | 0,389 |
| Heavy Duty Vehicles | 1995 | 0,837 | 0,559 | 0,486 | 0,837 | 0,559 | 0,486 | 2,881 | 2,052 | 1,998 | 0,003 | 0,003 | 0,003 | 0,494 | 0,374 | 0,377 |
| Heavy Duty Vehicles | 1996 | 0,802 | 0,542 | 0,472 | 0,802 | 0,542 | 0,472 | 2,798 | 2,003 | 1,954 | 0,003 | 0,003 | 0,003 | 0,481 | 0,361 | 0,365 |
| Heavy Duty Vehicles | 1997 | 0,751 | 0,510 | 0,446 | 0,751 | 0,510 | 0,446 | 2,679 | 1,931 | 1,892 | 0,003 | 0,003 | 0,003 | 0,459 | 0,344 | 0,349 |
| Heavy Duty Vehicles | 1998 | 0,710 | 0,484 | 0,423 | 0,710 | 0,484 | 0,423 | 2,606 | 1,888 | 1,851 | 0,003 | 0,003 | 0,003 | 0,432 | 0,324 | 0,332 |
| Heavy Duty Vehicles | 1999 | 0,671 | 0,460 | 0,401 | 0,671 | 0,460 | 0,401 | 2,522 | 1,840 | 1,808 | 0,003 | 0,003 | 0,003 | 0,410 | 0,307 | 0,318 |
| Heavy Duty Vehicles | 2000 | 0,639 | 0,438 | 0,382 | 0,639 | 0,438 | 0,382 | 2,478 | 1,811 | 1,779 | 0,003 | 0,003 | 0,003 | 0,386 | 0,289 | 0,302 |
| Heavy Duty Vehicles | 2001 | 0,607 | 0,416 | 0,361 | 0,607 | 0,416 | 0,361 | 2,482 | 1,810 | 1,761 | 0,003 | 0,003 | 0,003 | 0,369 | 0,275 | 0,287 |
| Heavy Duty Vehicles | 2002 | 0,567 | 0,390 | 0,338 | 0,567 | 0,390 | 0,338 | 2,438 | 1,779 | 1,729 | 0,003 | 0,003 | 0,003 | 0,341 | 0,254 | 0,265 |
| Heavy Duty Vehicles | 2003 | 0,534 | 0,366 | 0,318 | 0,534 | 0,366 | 0,318 | 2,389 | 1,746 | 1,698 | 0,003 | 0,003 | 0,003 | 0,317 | 0,237 | 0,247 |
| Heavy Duty Vehicles | 2004 | 0,485 | 0,334 | 0,292 | 0,485 | 0,334 | 0,292 | 2,286 | 1,682 | 1,643 | 0,003 | 0,003 | 0,003 | 0,284 | 0,211 | 0,222 |
| Heavy Duty Vehicles | 2005 | 0,459 | 0,315 | 0,276 | 0,459 | 0,315 | 0,276 | 2,261 | 1,663 | 1,623 | 0,003 | 0,003 | 0,003 | 0,265 | 0,197 | 0,206 |
| Heavy Duty Vehicles | 2006 | 0,430 | 0,295 | 0,259 | 0,430 | 0,295 | 0,259 | 2,208 | 1,624 | 1,582 | 0,003 | 0,003 | 0,003 | 0,246 | 0,182 | 0,190 |
| Heavy Duty Vehicles | 2007 | 0,381 | 0,261 | 0,229 | 0,381 | 0,261 | 0,229 | 2,010 | 1,477 | 1,436 | 0,003 | 0,003 | 0,003 | 0,217 | 0,160 | 0,168 |
| Heavy Duty Vehicles | 2008 | 0,328 | 0,226 | 0,198 | 0,328 | 0,226 | 0,198 | 1,790 | 1,322 | 1,286 | 0,003 | 0,003 | 0,003 | 0,186 | 0,138 | 0,145 |
| Buses | 1985 | 1,413 | 0,879 | 0,532 | 1,413 | 0,879 | 0,532 | 4,248 | 2,679 | 1,826 | 0,003 | 0,003 | 0,003 | 0,701 | 0,453 | 0,339 |
| Buses | 1986 | 1,412 | 0,878 | 0,531 | 1,412 | 0,878 | 0,531 | 4,245 | 2,677 | 1,825 | 0,003 | 0,003 | 0,003 | 0,700 | 0,453 | 0,339 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Buses | 1987 | 1,416 | 0,881 | 0,534 | 1,416 | 0,881 | 0,534 | 4,254 | 2,684 | 1,830 | 0,003 | 0,003 | 0,003 | 0,701 | 0,454 | 0,339 |
| Buses | 1988 | 1,421 | 0,885 | 0,537 | 1,421 | 0,885 | 0,537 | 4,266 | 2,695 | 1,838 | 0,003 | 0,003 | 0,003 | 0,702 | 0,455 | 0,339 |
| Buses | 1989 | 1,419 | 0,883 | 0,536 | 1,419 | 0,883 | 0,536 | 4,261 | 2,690 | 1,835 | 0,003 | 0,003 | 0,003 | 0,702 | 0,454 | 0,339 |
| Buses | 1990 | 1,409 | 0,875 | 0,529 | 1,409 | 0,875 | 0,529 | 4,237 | 2,670 | 1,820 | 0,003 | 0,003 | 0,003 | 0,700 | 0,452 | 0,338 |
| Buses | 1991 | 1,407 | 0,878 | 0,529 | 1,407 | 0,878 | 0,529 | 4,232 | 2,677 | 1,819 | 0,003 | 0,003 | 0,003 | 0,699 | 0,453 | 0,338 |
| Buses | 1992 | 1,413 | 0,872 | 0,529 | 1,413 | 0,872 | 0,529 | 4,247 | 2,662 | 1,819 | 0,003 | 0,003 | 0,003 | 0,701 | 0,452 | 0,338 |
| Buses | 1993 | 1,395 | 0,878 | 0,531 | 1,395 | 0,878 | 0,531 | 4,204 | 2,678 | 1,824 | 0,003 | 0,003 | 0,003 | 0,696 | 0,453 | 0,338 |
| Buses | 1994 | 1,346 | 0,823 | 0,516 | 1,346 | 0,823 | 0,516 | 4,083 | 2,531 | 1,766 | 0,003 | 0,003 | 0,003 | 0,676 | 0,435 | 0,328 |
| Buses | 1995 | 1,246 | 0,762 | 0,483 | 1,246 | 0,762 | 0,483 | 3,836 | 2,369 | 1,669 | 0,003 | 0,003 | 0,003 | 0,644 | 0,415 | 0,316 |
| Buses | 1996 | 1,156 | 0,713 | 0,456 | 1,156 | 0,713 | 0,456 | 3,611 | 2,235 | 1,587 | 0,003 | 0,003 | 0,003 | 0,615 | 0,398 | 0,305 |
| Buses | 1997 | 1,078 | 0,671 | 0,433 | 1,078 | 0,671 | 0,433 | 3,436 | 2,137 | 1,528 | 0,003 | 0,003 | 0,003 | 0,573 | 0,373 | 0,287 |
| Buses | 1998 | 1,029 | 0,644 | 0,419 | 1,029 | 0,644 | 0,419 | 3,332 | 2,080 | 1,492 | 0,003 | 0,003 | 0,003 | 0,544 | 0,355 | 0,274 |
| Buses | 1999 | 0,973 | 0,613 | 0,403 | 0,973 | 0,613 | 0,403 | 3,206 | 2,009 | 1,450 | 0,003 | 0,003 | 0,003 | 0,513 | 0,336 | 0,260 |
| Buses | 2000 | 0,923 | 0,587 | 0,388 | 0,923 | 0,587 | 0,388 | 3,098 | 1,949 | 1,413 | 0,003 | 0,003 | 0,003 | 0,485 | 0,319 | 0,248 |
| Buses | 2001 | 0,884 | 0,565 | 0,377 | 0,884 | 0,565 | 0,377 | 3,011 | 1,900 | 1,384 | 0,003 | 0,003 | 0,003 | 0,462 | 0,306 | 0,239 |
| Buses | 2002 | 0,836 | 0,538 | 0,363 | 0,836 | 0,538 | 0,363 | 2,932 | 1,856 | 1,359 | 0,003 | 0,003 | 0,003 | 0,437 | 0,290 | 0,227 |
| Buses | 2003 | 0,801 | 0,520 | 0,353 | 0,801 | 0,520 | 0,353 | 2,882 | 1,830 | 1,345 | 0,003 | 0,003 | 0,003 | 0,419 | 0,279 | 0,219 |
| Buses | 2004 | 0,765 | 0,499 | 0,342 | 0,765 | 0,499 | 0,342 | 2,822 | 1,794 | 1,327 | 0,003 | 0,003 | 0,003 | 0,400 | 0,267 | 0,210 |
| Buses | 2005 | 0,723 | 0,476 | 0,331 | 0,723 | 0,476 | 0,331 | 2,754 | 1,758 | 1,305 | 0,003 | 0,003 | 0,003 | 0,378 | 0,254 | 0,200 |
| Buses | 2006 | 0,682 | 0,454 | 0,319 | 0,682 | 0,454 | 0,319 | 2,686 | 1,721 | 1,284 | 0,003 | 0,003 | 0,003 | 0,357 | 0,241 | 0,191 |
| Buses | 2007 | 0,618 | 0,413 | 0,293 | 0,618 | 0,413 | 0,293 | 2,475 | 1,588 | 1,188 | 0,003 | 0,003 | 0,003 | 0,326 | 0,220 | 0,175 |
| Buses | 2008 | 0,558 | 0,376 | 0,268 | 0,558 | 0,376 | 0,268 | 2,274 | 1,463 | 1,096 | 0,003 | 0,003 | 0,003 | 0,296 | 0,201 | 0,160 |
| Mopeds | 1985 | 13,691 | 13,691 | | 14,001 | 14,001 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |
| Mopeds | 1986 | 13,691 | 13,691 | | 14,008 | 14,008 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |
| Mopeds | 1987 | 13,691 | 13,691 | | 14,006 | 14,006 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |
| Mopeds | 1988 | 13,691 | 13,691 | | 14,027 | 14,027 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |
| Mopeds | 1989 | 13,691 | 13,691 | | 14,041 | 14,041 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |
| Mopeds | 1990 | 13,691 | 13,691 | | 14,034 | 14,034 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |
| Mopeds | 1991 | 13,691 | 13,691 | | 14,019 | 14,019 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |
| Mopeds | 1992 | 13,691 | 13,691 | | 14,022 | 14,022 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |
| Mopeds | 1993 | 13,691 | 13,691 | | 14,001 | 14,001 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |
| Mopeds | 1994 | 13,691 | 13,691 | | 14,013 | 14,013 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |
| Mopeds | 1995 | 13,691 | 13,691 | | 14,014 | 14,014 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |
| Mopeds | 1996 | 13,691 | 13,691 | | 14,001 | 14,001 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |
| Mopeds | 1997 | 13,691 | 13,691 | | 14,017 | 14,017 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |
| Mopeds | 1998 | 13,691 | 13,691 | | 14,002 | 14,002 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |
| Mopeds | 1999 | 13,691 | 13,691 | | 14,037 | 14,037 | | 13,800 | 13,800 | | 0,001 | 0,001 | | 0,188 | 0,188 | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | | | | | | | | | | |
| Mopeds | 2000 | 12,563 | 12,563 | | 12,849 | 12,849 | | 12,960 | 12,960 | | 0,001 | 0,001 | | 0,176 | 0,176 | |
| Mopeds | 2001 | 11,773 | 11,773 | | 12,085 | 12,085 | | 12,371 | 12,371 | | 0,001 | 0,001 | | 0,168 | 0,168 | |
| Mopeds | 2002 | 10,937 | 10,937 | | 11,258 | 11,258 | | 11,748 | 11,748 | | 0,001 | 0,001 | | 0,160 | 0,160 | |
| Mopeds | 2003 | 10,520 | 10,520 | | 10,838 | 10,838 | | 11,437 | 11,437 | | 0,001 | 0,001 | | 0,156 | 0,156 | |
| Mopeds | 2004 | 9,924 | 9,924 | | 10,244 | 10,244 | | 10,776 | 10,776 | | 0,001 | 0,001 | | 0,148 | 0,148 | |
| Mopeds | 2005 | 9,299 | 9,299 | | 9,652 | 9,652 | | 10,085 | 10,085 | | 0,001 | 0,001 | | 0,140 | 0,140 | |
| Mopeds | 2006 | 8,636 | 8,636 | | 9,006 | 9,006 | | 9,353 | 9,353 | | 0,001 | 0,001 | | 0,131 | 0,131 | |
| Mopeds | 2007 | 8,023 | 8,023 | | 8,389 | 8,389 | | 8,669 | 8,669 | | 0,001 | 0,001 | | 0,123 | 0,123 | |
| Mopeds | 2008 | 7,588 | 7,588 | | 7,952 | 7,952 | | 8,189 | 8,189 | | 0,001 | 0,001 | | 0,118 | 0,118 | |
| Motorcycles | 1985 | 2,639 | 2,014 | 2,011 | 3,494 | 2,239 | 2,039 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 1986 | 2,639 | 2,014 | 2,011 | 3,502 | 2,242 | 2,039 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 1987 | 2,639 | 2,014 | 2,011 | 3,497 | 2,240 | 2,039 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 1988 | 2,639 | 2,014 | 2,011 | 3,533 | 2,250 | 2,040 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 1989 | 2,639 | 2,014 | 2,011 | 3,554 | 2,255 | 2,041 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 1990 | 2,639 | 2,014 | 2,011 | 3,547 | 2,253 | 2,041 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 1991 | 2,639 | 2,014 | 2,011 | 3,409 | 2,276 | 2,046 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 1992 | 2,639 | 2,014 | 2,011 | 3,538 | 2,239 | 2,044 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 1993 | 2,639 | 2,014 | 2,011 | 3,367 | 2,267 | 2,048 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 1994 | 2,639 | 2,014 | 2,011 | 3,490 | 2,242 | 2,046 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 1995 | 2,639 | 2,014 | 2,011 | 3,544 | 2,254 | 2,037 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 1996 | 2,639 | 2,014 | 2,011 | 3,459 | 2,234 | 2,045 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 1997 | 2,639 | 2,014 | 2,011 | 3,496 | 2,244 | 2,047 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 1998 | 2,639 | 2,014 | 2,011 | 3,467 | 2,236 | 2,045 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 1999 | 2,639 | 2,014 | 2,011 | 3,496 | 2,244 | 2,046 | 20,029 | 22,185 | 27,917 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 2000 | 2,615 | 2,002 | 2,001 | 3,292 | 2,183 | 2,029 | 19,624 | 21,779 | 27,442 | 0,002 | 0,002 | 0,002 | 0,047 | 0,047 | 0,047 |
| Motorcycles | 2001 | 2,562 | 1,958 | 1,959 | 3,229 | 2,137 | 1,986 | 19,349 | 21,505 | 27,145 | 0,002 | 0,002 | 0,002 | 0,046 | 0,046 | 0,046 |
| Motorcycles | 2002 | 2,509 | 1,914 | 1,916 | 3,188 | 2,096 | 1,944 | 19,076 | 21,232 | 26,851 | 0,002 | 0,002 | 0,002 | 0,045 | 0,045 | 0,045 |
| Motorcycles | 2003 | 2,457 | 1,870 | 1,874 | 3,131 | 2,050 | 1,902 | 18,824 | 20,979 | 26,580 | 0,002 | 0,002 | 0,002 | 0,044 | 0,044 | 0,044 |
| Motorcycles | 2004 | 2,403 | 1,819 | 1,825 | 3,089 | 2,003 | 1,853 | 18,415 | 20,472 | 25,998 | 0,002 | 0,002 | 0,002 | 0,043 | 0,043 | 0,043 |
| Motorcycles | 2005 | 2,342 | 1,763 | 1,770 | 3,073 | 1,959 | 1,800 | 17,846 | 19,773 | 25,189 | 0,002 | 0,002 | 0,002 | 0,041 | 0,041 | 0,041 |
| Motorcycles | 2006 | 2,279 | 1,705 | 1,714 | 3,042 | 1,909 | 1,745 | 17,234 | 19,024 | 24,318 | 0,002 | 0,002 | 0,002 | 0,040 | 0,040 | 0,040 |
| Motorcycles | 2007 | 2,189 | 1,626 | 1,634 | 2,941 | 1,828 | 1,665 | 16,489 | 17,967 | 22,957 | 0,002 | 0,002 | 0,002 | 0,038 | 0,038 | 0,038 |
| Motorcycles | 2008 | 2,122 | 1,566 | 1,572 | 2,866 | 1,765 | 1,603 | 16,052 | 17,353 | 22,179 | 0,002 | 0,002 | 0,002 | 0,037 | 0,037 | 0,037 |

## Annex 2B-7 Fuel use (GJ) and emissions (tonnes) per vehicle category and as totals

| Sector | Year | FC (PJ) | $SO_2$ | NOx | NMVOC | $CH_4$ | CO | $CO_2$ | $N_2O$ | $NH_3$ | TSP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Cars | 1985 | 64,0 | 1299 | 52344 | 70562 | 1846 | 525966 | 4675 | 177 | 47 | 1485 |
| Passenger Cars | 1986 | 64,8 | 909 | 53218 | 70422 | 1870 | 504501 | 4739 | 180 | 48 | 1503 |
| Passenger Cars | 1987 | 65,2 | 925 | 53763 | 70143 | 1892 | 485678 | 4766 | 182 | 48 | 1484 |
| Passenger Cars | 1988 | 66,1 | 952 | 54936 | 69895 | 1927 | 440498 | 4831 | 187 | 49 | 1455 |
| Passenger Cars | 1989 | 65,5 | 705 | 54585 | 68434 | 1908 | 412887 | 4791 | 185 | 49 | 1436 |
| Passenger Cars | 1990 | 69,7 | 765 | 58210 | 71898 | 2030 | 422280 | 5095 | 197 | 52 | 1512 |
| Passenger Cars | 1991 | 74,1 | 799 | 58676 | 72452 | 2055 | 436147 | 5418 | 218 | 230 | 1509 |
| Passenger Cars | 1992 | 77,5 | 572 | 59061 | 71442 | 2026 | 425553 | 5666 | 238 | 423 | 1430 |
| Passenger Cars | 1993 | 79,6 | 326 | 57420 | 69137 | 1991 | 425998 | 5817 | 254 | 605 | 1382 |
| Passenger Cars | 1994 | 82,8 | 344 | 54306 | 64712 | 1882 | 392949 | 6051 | 278 | 927 | 1291 |
| Passenger Cars | 1995 | 83,7 | 348 | 51140 | 59841 | 1743 | 370186 | 6117 | 288 | 1171 | 1189 |
| Passenger Cars | 1996 | 84,7 | 355 | 47817 | 55346 | 1622 | 357307 | 6189 | 297 | 1394 | 1108 |
| Passenger Cars | 1997 | 86,7 | 360 | 44171 | 48990 | 1523 | 304314 | 6338 | 305 | 1821 | 954 |
| Passenger Cars | 1998 | 88,5 | 369 | 40307 | 43590 | 1428 | 282512 | 6466 | 305 | 2176 | 858 |
| Passenger Cars | 1999 | 89,1 | 298 | 36664 | 38252 | 1322 | 249033 | 6512 | 301 | 2433 | 807 |
| Passenger Cars | 2000 | 88,5 | 203 | 33606 | 31763 | 1227 | 226509 | 6468 | 294 | 2588 | 760 |
| Passenger Cars | 2001 | 87,2 | 200 | 30815 | 28987 | 1114 | 216346 | 6373 | 275 | 2459 | 717 |
| Passenger Cars | 2002 | 88,3 | 202 | 28665 | 25707 | 1019 | 195675 | 6457 | 262 | 2392 | 696 |
| Passenger Cars | 2003 | 90,2 | 207 | 27125 | 23597 | 951 | 186235 | 6596 | 252 | 2315 | 735 |
| Passenger Cars | 2004 | 90,9 | 208 | 24919 | 19989 | 851 | 161037 | 6651 | 238 | 2196 | 730 |
| Passenger Cars | 2005 | 89,2 | 41 | 22410 | 18048 | 758 | 151928 | 6530 | 217 | 2033 | 715 |
| Passenger Cars | 2006 | 89,7 | 41 | 20107 | 15404 | 659 | 130527 | 6558 | 201 | 1866 | 700 |
| Passenger Cars | 2007 | 94,8 | 43 | 19016 | 13232 | 579 | 115970 | 6929 | 199 | 1709 | 733 |
| Passenger Cars | 2008 | 93,4 | 43 | 16927 | 11316 | 485 | 105072 | 6827 | 185 | 1497 | 720 |
| Light Duty Vehicles | 1985 | 12,8 | 2484 | 6147 | 2232 | 118 | 15890 | 947 | 5 | 5 | 1331 |
| Light Duty Vehicles | 1986 | 14,3 | 1688 | 6754 | 2344 | 127 | 16665 | 1056 | 5 | 5 | 1489 |
| Light Duty Vehicles | 1987 | 14,7 | 1738 | 6939 | 2404 | 130 | 17157 | 1086 | 6 | 5 | 1542 |
| Light Duty Vehicles | 1988 | 15,1 | 1786 | 7092 | 2413 | 134 | 16887 | 1113 | 6 | 5 | 1529 |
| Light Duty Vehicles | 1989 | 15,5 | 1239 | 7241 | 2389 | 135 | 16650 | 1147 | 6 | 5 | 1567 |
| Light Duty Vehicles | 1990 | 16,6 | 1331 | 7717 | 2507 | 144 | 17498 | 1227 | 6 | 6 | 1677 |
| Light Duty Vehicles | 1991 | 17,1 | 1367 | 7990 | 2653 | 149 | 18677 | 1265 | 6 | 6 | 1761 |
| Light Duty Vehicles | 1992 | 17,0 | 876 | 8000 | 2734 | 150 | 19043 | 1257 | 7 | 6 | 1714 |
| Light Duty Vehicles | 1993 | 17,5 | 349 | 8254 | 2855 | 155 | 20208 | 1292 | 7 | 6 | 1794 |
| Light Duty Vehicles | 1994 | 18,8 | 377 | 8692 | 2953 | 157 | 20621 | 1385 | 7 | 7 | 1924 |

| *Continued* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Light Duty Vehicles | 1995 | 18,5 | 372 | 8424 | 2804 | 149 | 19833 | 1369 | 10 | 14 | 1801 |
| Light Duty Vehicles | 1996 | 18,8 | 378 | 8366 | 2716 | 142 | 19709 | 1391 | 12 | 21 | 1767 |
| Light Duty Vehicles | 1997 | 19,1 | 382 | 8266 | 2554 | 137 | 18413 | 1407 | 15 | 28 | 1624 |
| Light Duty Vehicles | 1998 | 19,4 | 386 | 8268 | 2486 | 134 | 18325 | 1432 | 19 | 36 | 1532 |
| Light Duty Vehicles | 1999 | 19,6 | 218 | 8154 | 2343 | 126 | 17138 | 1448 | 22 | 45 | 1437 |
| Light Duty Vehicles | 2000 | 20,1 | 47 | 8153 | 2139 | 121 | 16531 | 1481 | 25 | 54 | 1356 |
| Light Duty Vehicles | 2001 | 20,7 | 48 | 8225 | 2109 | 115 | 16422 | 1528 | 29 | 64 | 1324 |
| Light Duty Vehicles | 2002 | 21,5 | 50 | 8077 | 1949 | 106 | 15143 | 1585 | 33 | 66 | 1214 |
| Light Duty Vehicles | 2003 | 23,4 | 54 | 8333 | 1909 | 101 | 14785 | 1725 | 38 | 66 | 1219 |
| Light Duty Vehicles | 2004 | 25,3 | 59 | 8489 | 1746 | 92 | 13346 | 1869 | 45 | 71 | 1102 |
| Light Duty Vehicles | 2005 | 26,7 | 12 | 8533 | 1754 | 85 | 13488 | 1971 | 50 | 72 | 1066 |
| Light Duty Vehicles | 2006 | 28,0 | 13 | 8557 | 1662 | 76 | 12576 | 2069 | 54 | 71 | 998 |
| Light Duty Vehicles | 2007 | 27,5 | 13 | 7752 | 1390 | 61 | 10224 | 2031 | 55 | 61 | 857 |
| Light Duty Vehicles | 2008 | 27,6 | 13 | 7151 | 1247 | 51 | 9111 | 2037 | 57 | 57 | 756 |
| Heavy Duty Vehicles | 1985 | 27,2 | 6357 | 27900 | 1670 | 218 | 6117 | 2014 | 77 | 8 | 1106 |
| Heavy Duty Vehicles | 1986 | 30,7 | 4297 | 31427 | 1879 | 246 | 6842 | 2269 | 86 | 9 | 1246 |
| Heavy Duty Vehicles | 1987 | 30,2 | 4228 | 30924 | 1847 | 242 | 6723 | 2232 | 85 | 9 | 1226 |
| Heavy Duty Vehicles | 1988 | 29,6 | 4156 | 30391 | 1811 | 238 | 6592 | 2194 | 83 | 8 | 1204 |
| Heavy Duty Vehicles | 1989 | 30,9 | 2884 | 31626 | 1880 | 248 | 6824 | 2283 | 87 | 9 | 1253 |
| Heavy Duty Vehicles | 1990 | 31,7 | 2961 | 32450 | 1938 | 255 | 7019 | 2344 | 89 | 9 | 1288 |
| Heavy Duty Vehicles | 1991 | 32,4 | 3031 | 33210 | 1984 | 262 | 7190 | 2400 | 91 | 9 | 1319 |
| Heavy Duty Vehicles | 1992 | 31,8 | 1931 | 32550 | 1945 | 257 | 7083 | 2352 | 89 | 9 | 1293 |
| Heavy Duty Vehicles | 1993 | 30,8 | 720 | 31396 | 1867 | 248 | 6834 | 2279 | 87 | 9 | 1246 |
| Heavy Duty Vehicles | 1994 | 32,6 | 762 | 32718 | 1914 | 256 | 7072 | 2412 | 94 | 9 | 1289 |
| Heavy Duty Vehicles | 1995 | 33,0 | 770 | 32515 | 1900 | 261 | 7068 | 2438 | 96 | 10 | 1282 |
| Heavy Duty Vehicles | 1996 | 33,6 | 786 | 32660 | 1896 | 270 | 7114 | 2490 | 98 | 10 | 1279 |
| Heavy Duty Vehicles | 1997 | 34,4 | 804 | 32915 | 1811 | 275 | 6958 | 2544 | 100 | 10 | 1239 |
| Heavy Duty Vehicles | 1998 | 35,0 | 817 | 33011 | 1752 | 278 | 6944 | 2587 | 102 | 10 | 1197 |
| Heavy Duty Vehicles | 1999 | 36,3 | 467 | 33852 | 1722 | 287 | 7006 | 2685 | 106 | 11 | 1181 |
| Heavy Duty Vehicles | 2000 | 35,2 | 82 | 32329 | 1600 | 276 | 6722 | 2603 | 104 | 10 | 1087 |
| Heavy Duty Vehicles | 2001 | 36,3 | 85 | 32586 | 1547 | 285 | 6841 | 2689 | 106 | 11 | 1057 |
| Heavy Duty Vehicles | 2002 | 36,1 | 85 | 31309 | 1442 | 281 | 6700 | 2671 | 106 | 11 | 975 |
| Heavy Duty Vehicles | 2003 | 38,0 | 89 | 31957 | 1432 | 291 | 6938 | 2811 | 112 | 11 | 956 |
| Heavy Duty Vehicles | 2004 | 39,2 | 92 | 31676 | 1363 | 298 | 6969 | 2902 | 116 | 12 | 893 |
| Heavy Duty Vehicles | 2005 | 40,4 | 19 | 31652 | 1322 | 301 | 7071 | 2989 | 120 | 12 | 855 |
| Heavy Duty Vehicles | 2006 | 43,3 | 20 | 32840 | 1327 | 314 | 7396 | 3207 | 128 | 13 | 847 |
| Heavy Duty Vehicles | 2007 | 46,5 | 22 | 33245 | 1263 | 307 | 7241 | 3443 | 138 | 14 | 803 |

| Continued | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heavy Duty Vehicles | 2008 | 44,4 | 21 | 29660 | 1058 | 265 | 6273 | 3289 | 134 | 13 | 669 |
| Buses | 1985 | 6,3 | 1480 | 6707 | 607 | 68 | 1843 | 468 | 16 | 2 | 308 |
| Buses | 1986 | 6,9 | 967 | 7302 | 660 | 74 | 2006 | 509 | 18 | 2 | 336 |
| Buses | 1987 | 6,8 | 954 | 7211 | 653 | 74 | 1983 | 502 | 18 | 2 | 332 |
| Buses | 1988 | 6,8 | 962 | 7275 | 661 | 74 | 2005 | 506 | 18 | 2 | 335 |
| Buses | 1989 | 7,0 | 659 | 7471 | 678 | 76 | 2057 | 520 | 18 | 2 | 344 |
| Buses | 1990 | 7,6 | 708 | 8018 | 724 | 82 | 2200 | 559 | 20 | 2 | 368 |
| Buses | 1991 | 7,5 | 705 | 7989 | 718 | 81 | 2182 | 557 | 20 | 2 | 366 |
| Buses | 1992 | 7,2 | 440 | 7665 | 692 | 78 | 2102 | 535 | 19 | 2 | 352 |
| Buses | 1993 | 7,4 | 173 | 7809 | 700 | 80 | 2131 | 545 | 19 | 2 | 358 |
| Buses | 1994 | 7,9 | 184 | 8187 | 717 | 85 | 2203 | 583 | 21 | 2 | 372 |
| Buses | 1995 | 8,1 | 190 | 8231 | 693 | 89 | 2159 | 602 | 22 | 2 | 371 |
| Buses | 1996 | 8,5 | 200 | 8430 | 685 | 94 | 2160 | 632 | 24 | 2 | 378 |
| Buses | 1997 | 8,4 | 196 | 8157 | 637 | 91 | 2045 | 620 | 23 | 2 | 350 |
| Buses | 1998 | 8,2 | 192 | 7938 | 602 | 87 | 1960 | 608 | 23 | 2 | 329 |
| Buses | 1999 | 8,0 | 103 | 7670 | 562 | 83 | 1860 | 593 | 23 | 2 | 305 |
| Buses | 2000 | 7,8 | 18 | 7358 | 522 | 79 | 1756 | 574 | 22 | 2 | 282 |
| Buses | 2001 | 7,6 | 18 | 7118 | 491 | 76 | 1674 | 559 | 22 | 2 | 264 |
| Buses | 2002 | 7,6 | 18 | 6949 | 467 | 74 | 1638 | 560 | 22 | 2 | 251 |
| Buses | 2003 | 8,0 | 19 | 7193 | 475 | 77 | 1705 | 591 | 23 | 2 | 254 |
| Buses | 2004 | 8,2 | 19 | 7234 | 468 | 77 | 1717 | 606 | 24 | 2 | 250 |
| Buses | 2005 | 8,6 | 4 | 7387 | 465 | 79 | 1758 | 633 | 25 | 2 | 248 |
| Buses | 2006 | 8,9 | 4 | 7548 | 462 | 80 | 1799 | 661 | 26 | 3 | 246 |
| Buses | 2007 | 9,2 | 4 | 7498 | 438 | 77 | 1728 | 684 | 27 | 3 | 234 |
| Buses | 2008 | 9,4 | 4 | 7299 | 405 | 73 | 1623 | 694 | 28 | 3 | 218 |
| Mopeds | 1985 | 0,4 | 1 | 7 | 4935 | 77 | 4864 | 28 | 0 | 0 | 66 |
| Mopeds | 1986 | 0,3 | 1 | 6 | 4403 | 69 | 4337 | 25 | 0 | 0 | 59 |
| Mopeds | 1987 | 0,3 | 1 | 6 | 4055 | 63 | 3995 | 23 | 0 | 0 | 54 |
| Mopeds | 1988 | 0,3 | 1 | 5 | 3820 | 60 | 3758 | 22 | 0 | 0 | 51 |
| Mopeds | 1989 | 0,3 | 1 | 5 | 3621 | 56 | 3559 | 21 | 0 | 0 | 48 |
| Mopeds | 1990 | 0,3 | 1 | 5 | 3674 | 57 | 3613 | 21 | 0 | 0 | 49 |
| Mopeds | 1991 | 0,3 | 1 | 5 | 3775 | 59 | 3717 | 22 | 0 | 0 | 51 |
| Mopeds | 1992 | 0,3 | 1 | 5 | 3791 | 59 | 3731 | 22 | 0 | 0 | 51 |
| Mopeds | 1993 | 0,3 | 1 | 5 | 3737 | 58 | 3684 | 21 | 0 | 0 | 50 |
| Mopeds | 1994 | 0,3 | 1 | 5 | 3694 | 58 | 3638 | 21 | 0 | 0 | 50 |
| Mopeds | 1995 | 0,3 | 1 | 6 | 3952 | 62 | 3891 | 23 | 0 | 0 | 53 |
| Mopeds | 1996 | 0,3 | 1 | 6 | 4212 | 66 | 4152 | 24 | 0 | 0 | 57 |

| *Continued* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mopeds | 1997 | 0,4 | 1 | 7 | 4608 | 72 | 4536 | 26 | 0 | 0 | 62 |
| Mopeds | 1998 | 0,4 | 1 | 7 | 4956 | 78 | 4884 | 28 | 0 | 0 | 67 |
| Mopeds | 1999 | 0,4 | 1 | 6 | 4498 | 70 | 4423 | 26 | 0 | 0 | 60 |
| Mopeds | 2000 | 0,3 | 1 | 6 | 3946 | 62 | 3980 | 24 | 0 | 0 | 54 |
| Mopeds | 2001 | 0,3 | 1 | 5 | 3021 | 47 | 3093 | 19 | 0 | 0 | 42 |
| Mopeds | 2002 | 0,3 | 1 | 5 | 2957 | 46 | 3086 | 19 | 0 | 0 | 42 |
| Mopeds | 2003 | 0,3 | 1 | 5 | 2812 | 44 | 2967 | 18 | 0 | 0 | 40 |
| Mopeds | 2004 | 0,2 | 1 | 9 | 2605 | 40 | 2740 | 17 | 0 | 0 | 38 |
| Mopeds | 2005 | 0,2 | 0 | 12 | 2358 | 36 | 2464 | 16 | 0 | 0 | 34 |
| Mopeds | 2006 | 0,2 | 0 | 16 | 2137 | 33 | 2219 | 15 | 0 | 0 | 31 |
| Mopeds | 2007 | 0,2 | 0 | 19 | 1954 | 30 | 2019 | 14 | 0 | 0 | 29 |
| Mopeds | 2008 | 0,2 | 0 | 20 | 1729 | 26 | 1780 | 13 | 0 | 0 | 26 |
| Motorcycles | 1985 | 0,4 | 1 | 55 | 768 | 53 | 6156 | 27 | 1 | 1 | 13 |
| Motorcycles | 1986 | 0,4 | 1 | 55 | 765 | 53 | 6119 | 27 | 1 | 1 | 13 |
| Motorcycles | 1987 | 0,4 | 1 | 53 | 741 | 51 | 5933 | 26 | 1 | 1 | 13 |
| Motorcycles | 1988 | 0,4 | 1 | 54 | 757 | 52 | 6014 | 27 | 1 | 1 | 13 |
| Motorcycles | 1989 | 0,4 | 1 | 53 | 747 | 51 | 5914 | 26 | 1 | 1 | 13 |
| Motorcycles | 1990 | 0,4 | 1 | 57 | 799 | 55 | 6333 | 28 | 1 | 1 | 13 |
| Motorcycles | 1991 | 0,4 | 1 | 56 | 834 | 57 | 6440 | 29 | 1 | 1 | 14 |
| Motorcycles | 1992 | 0,4 | 1 | 62 | 878 | 60 | 6933 | 31 | 1 | 1 | 15 |
| Motorcycles | 1993 | 0,4 | 1 | 62 | 935 | 64 | 7217 | 33 | 1 | 1 | 16 |
| Motorcycles | 1994 | 0,5 | 1 | 68 | 989 | 68 | 7755 | 35 | 1 | 1 | 17 |
| Motorcycles | 1995 | 0,5 | 1 | 74 | 1014 | 70 | 8143 | 36 | 1 | 1 | 17 |
| Motorcycles | 1996 | 0,5 | 1 | 75 | 1072 | 74 | 8463 | 38 | 1 | 1 | 18 |
| Motorcycles | 1997 | 0,6 | 1 | 82 | 1188 | 82 | 9308 | 42 | 1 | 1 | 20 |
| Motorcycles | 1998 | 0,6 | 1 | 89 | 1279 | 88 | 10078 | 45 | 1 | 1 | 22 |
| Motorcycles | 1999 | 0,7 | 2 | 95 | 1373 | 94 | 10759 | 48 | 1 | 1 | 23 |
| Motorcycles | 2000 | 0,7 | 2 | 107 | 1418 | 100 | 11392 | 52 | 1 | 1 | 25 |
| Motorcycles | 2001 | 0,8 | 2 | 118 | 1479 | 106 | 11975 | 56 | 1 | 1 | 26 |
| Motorcycles | 2002 | 0,8 | 2 | 130 | 1567 | 114 | 12722 | 60 | 1 | 1 | 27 |
| Motorcycles | 2003 | 0,9 | 2 | 143 | 1642 | 121 | 13430 | 64 | 1 | 1 | 29 |
| Motorcycles | 2004 | 0,9 | 2 | 153 | 1718 | 127 | 13977 | 69 | 1 | 1 | 30 |
| Motorcycles | 2005 | 1,0 | 0 | 165 | 1818 | 134 | 14504 | 74 | 1 | 1 | 30 |
| Motorcycles | 2006 | 1,0 | 0 | 172 | 1843 | 135 | 14418 | 76 | 2 | 2 | 30 |
| Motorcycles | 2007 | 1,2 | 1 | 186 | 1964 | 143 | 15162 | 85 | 2 | 2 | 32 |
| Motorcycles | 2008 | 1,2 | 1 | 193 | 2000 | 146 | 15414 | 89 | 2 | 2 | 32 |
| Total | 1985 | 111,1 | 11621 | 93160 | 80775 | 2381 | 560836 | 8160 | 277 | 61 | 4311 |

| *Continued* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 1986 | 117,4 | 7862 | 98763 | 80473 | 2439 | 540471 | 8625 | 290 | 64 | 4645 |
| Total | 1987 | 117,6 | 7847 | 98895 | 79843 | 2453 | 521469 | 8636 | 291 | 64 | 4650 |
| Total | 1988 | 118,3 | 7857 | 99754 | 79356 | 2484 | 475754 | 8694 | 294 | 66 | 4587 |
| Total | 1989 | 119,6 | 5488 | 100981 | 77749 | 2475 | 447890 | 8789 | 297 | 66 | 4660 |
| Total | 1990 | 126,2 | 5767 | 106456 | 81541 | 2623 | 458943 | 9275 | 313 | 70 | 4908 |
| Total | 1991 | 131,9 | 5903 | 107926 | 82416 | 2662 | 474352 | 9690 | 336 | 248 | 5019 |
| Total | 1992 | 134,3 | 3820 | 107343 | 81482 | 2631 | 464445 | 9863 | 354 | 441 | 4854 |
| Total | 1993 | 136,0 | 1569 | 104946 | 79230 | 2596 | 466072 | 9987 | 367 | 622 | 4845 |
| Total | 1994 | 142,8 | 1669 | 103977 | 74979 | 2506 | 434238 | 10487 | 400 | 946 | 4943 |
| Total | 1995 | 144,1 | 1682 | 100389 | 70204 | 2374 | 411281 | 10585 | 416 | 1198 | 4713 |
| Total | 1996 | 146,6 | 1721 | 97354 | 65927 | 2268 | 398904 | 10764 | 433 | 1428 | 4606 |
| Total | 1997 | 149,5 | 1744 | 93597 | 59788 | 2179 | 345574 | 10978 | 445 | 1862 | 4248 |
| Total | 1998 | 152,0 | 1768 | 89621 | 54665 | 2093 | 324704 | 11166 | 450 | 2226 | 4004 |
| Total | 1999 | 154,0 | 1088 | 86441 | 48751 | 1983 | 290218 | 11312 | 453 | 2491 | 3813 |
| Total | 2000 | 152,5 | 352 | 81559 | 41387 | 1865 | 266890 | 11202 | 447 | 2656 | 3565 |
| Total | 2001 | 152,8 | 353 | 78866 | 37635 | 1744 | 256351 | 11223 | 433 | 2537 | 3430 |
| Total | 2002 | 154,5 | 357 | 75136 | 34090 | 1640 | 234964 | 11352 | 424 | 2472 | 3205 |
| Total | 2003 | 160,6 | 371 | 74757 | 31867 | 1584 | 226060 | 11806 | 425 | 2396 | 3234 |
| Total | 2004 | 164,8 | 381 | 72479 | 27888 | 1484 | 199785 | 12115 | 424 | 2282 | 3042 |
| Total | 2005 | 166,1 | 77 | 70161 | 25766 | 1393 | 191213 | 12214 | 413 | 2122 | 2948 |
| Total | 2006 | 171,3 | 79 | 69240 | 22835 | 1298 | 168936 | 12587 | 412 | 1954 | 2852 |
| Total | 2007 | 179,5 | 83 | 67717 | 20241 | 1197 | 152344 | 13186 | 421 | 1788 | 2688 |
| Total | 2008 | 176,2 | 82 | 61250 | 17754 | 1046 | 139272 | 12948 | 405 | 1572 | 2421 |

## Annex 2B-8 COPERT IV:DEA statistics fuel use ratios and mileage adjustment factors

| Sales | | | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fuel ratio | Gasoline | DEA:COPERT IV | 1,04 | 1,00 | 0,97 | 0,95 | 0,92 | 0,97 | 1,01 | 1,06 | 1,09 | 1,11 |
| | Diesel | DEA:COPERT IV | 1,08 | 1,15 | 1,12 | 1,11 | 1,14 | 1,23 | 1,25 | 1,22 | 1,23 | 1,32 |
| Consumption | | | | | | | | | | | | |
| Fuel ratio | Gasoline | DEA:COPERT IV | 1,08 | 1,08 | 1,07 | 1,08 | 1,07 | 1,06 | 1,06 | 1,07 | 1,07 | 1,08 |
| | Diesel | DEA:COPERT IV | 1,01 | 1,04 | 1,01 | 1,01 | 1,04 | 1,12 | 1,19 | 1,17 | 1,17 | 1,22 |
| *Continued* | | | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
| Fuel ratio | Gasoline | DEA:COPERT IV | 1,10 | 1,08 | 1,10 | 1,11 | 1,09 | 1,09 | 1,09 | 1,10 | 1,10 | 1,08 |
| | Diesel | DEA:COPERT IV | 1,30 | 1,31 | 1,31 | 1,30 | 1,27 | 1,24 | 1,22 | 1,22 | 1,28 | 1,31 |
| Consumption | | | | | | | | | | | | |
| Fuel ratio | Gasoline | DEA:COPERT IV | 1,09 | 1,09 | 1,11 | 1,11 | 1,13 | 1,15 | 1,13 | 1,13 | 1,12 | 1,10 |
| | Diesel | DEA:COPERT IV | 1,19 | 1,19 | 1,19 | 1,18 | 1,17 | 1,15 | 1,14 | 1,12 | 1,15 | 1,18 |
| *Continued* | | | 2005 | 2006 | 2007 | 2008 | | | | | | |
| Fuel ratio | Gasoline | DEA:COPERT IV | 1,04 | 1,01 | 0,99 | 0,94 | | | | | | |
| | Diesel | DEA:COPERT IV | 1,35 | 1,39 | 1,45 | 1,46 | | | | | | |
| Consumption | | | | | | | | | | | | |
| Fuel ratio | Gasoline | DEA:COPERT IV | 1,06 | 1,02 | 0,99 | 0,94 | | | | | | |
| | Diesel | DEA:COPERT IV | 1,22 | 1,26 | 1,33 | 1,34 | | | | | | |

# Annex 2B

## Transport

## List of content

## Annex 2B-9 Basis fuel consumption and emission factors, deterioration factors, transient factors and specific operational data for non road working machinery and equipment, and recreational craft

Basis factors for diesel fuelled non road machinery.

| Engine size [P=kW] | Emission Level | $NO_x$ | VOC | CO | $N_2O$ [g pr kWh] | $NH_3$ | TSP | Fuel |
|---|---|---|---|---|---|---|---|---|
| P<19 | <1981 | 12.0 | 5.0 | 7 | 0.035 | 0.002 | 2.8 | 300 |
| P<19 | 1981-1990 | 11.5 | 3.8 | 6 | 0.035 | 0.002 | 2.3 | 285 |
| P<19 | 1991-Stage I | 11.2 | 2.5 | 5 | 0.035 | 0.002 | 1.6 | 270 |
| P<19 | Stage I | 11.2 | 2.5 | 5 | 0.035 | 0.002 | 1.6 | 270 |
| P<19 | Stage II | 11.2 | 2.5 | 5 | 0.035 | 0.002 | 1.6 | 270 |
| P<19 | Stage IIIA | 11.2 | 2.5 | 5 | 0.035 | 0.002 | 1.6 | 270 |
| P<19 | Stage IIIB | 11.2 | 2.5 | 5 | 0.035 | 0.002 | 1.6 | 270 |
| P<19 | Stage IV | 11.2 | 2.5 | 5 | 0.035 | 0.002 | 1.6 | 270 |
| 19<=P<37 | <1981 | 18.0 | 2.5 | 6.5 | 0.035 | 0.002 | 2 | 300 |
| 19<=P<37 | 1981-1990 | 18.0 | 2.2 | 5.5 | 0.035 | 0.002 | 1.4 | 281 |
| 19<=P<37 | 1991-Stage I | 9.8 | 1.8 | 4.5 | 0.035 | 0.002 | 1.4 | 262 |
| 19<=P<37 | Stage I | 9.8 | 1.8 | 4.5 | 0.035 | 0.002 | 1.4 | 262 |
| 19<=P<37 | Stage II | 6.5 | 0.6 | 2.2 | 0.035 | 0.002 | 0.4 | 262 |
| 19<=P<37 | Stage IIIA | 6.2 | 0.6 | 2.2 | 0.035 | 0.002 | 0.4 | 262 |
| 19<=P<37 | Stage IIIB | 6.2 | 0.6 | 2.2 | 0.035 | 0.002 | 0.4 | 262 |
| 19<=P<37 | Stage IV | 6.2 | 0.6 | 2.2 | 0.035 | 0.002 | 0.4 | 262 |
| 37<=P<56 | <1981 | 7.7 | 2.4 | 6 | 0.035 | 0.002 | 1.8 | 290 |
| 37<=P<56 | 1981-1990 | 8.6 | 2.0 | 5.3 | 0.035 | 0.002 | 1.2 | 275 |
| 37<=P<56 | 1991-Stage I | 11.5 | 1.5 | 4.5 | 0.035 | 0.002 | 0.8 | 260 |
| 37<=P<56 | Stage I | 7.7 | 0.6 | 2.2 | 0.035 | 0.002 | 0.4 | 260 |
| 37<=P<56 | Stage II | 5.5 | 0.4 | 2.2 | 0.035 | 0.002 | 0.2 | 260 |
| 37<=P<56 | Stage IIIA | 3.9 | 0.4 | 2.2 | 0.035 | 0.002 | 0.2 | 260 |
| 37<=P<56 | Stage IIIB | 3.9 | 0.4 | 2.2 | 0.035 | 0.002 | 0.0225 | 260 |
| 37<=P<56 | Stage IV | 3.9 | 0.4 | 2.2 | 0.035 | 0.002 | 0.0225 | 260 |
| 56<=P<75 | <1981 | 7.7 | 2.0 | 5 | 0.035 | 0.002 | 1.4 | 290 |
| 56<=P<75 | 1981-1990 | 8.6 | 1.6 | 4.3 | 0.035 | 0.002 | 1 | 275 |
| 56<=P<75 | 1991-Stage I | 11.5 | 1.2 | 3.5 | 0.035 | 0.002 | 0.4 | 260 |
| 56<=P<75 | Stage I | 7.7 | 0.4 | 1.5 | 0.035 | 0.002 | 0.2 | 260 |
| 56<=P<75 | Stage II | 5.5 | 0.3 | 1.5 | 0.035 | 0.002 | 0.2 | 260 |
| 56<=P<75 | Stage IIIA | 4.0 | 0.3 | 1.5 | 0.035 | 0.002 | 0.2 | 260 |
| 56<=P<75 | Stage IIIB | 3.0 | 0.2 | 1.5 | 0.035 | 0.002 | 0.0225 | 260 |
| 56<=P<75 | Stage IV | 0.4 | 0.2 | 1.5 | 0.035 | 0.002 | 0.0225 | 260 |
| 75<=P<130 | <1981 | 10.5 | 2.0 | 5 | 0.035 | 0.002 | 1.4 | 280 |
| 75<=P<130 | 1981-1990 | 11.8 | 1.6 | 4.3 | 0.035 | 0.002 | 1 | 268 |
| 75<=P<130 | 1991-Stage I | 13.3 | 1.2 | 3.5 | 0.035 | 0.002 | 0.4 | 255 |
| 75<=P<130 | Stage I | 8.1 | 0.4 | 1.5 | 0.035 | 0.002 | 0.2 | 255 |
| 75<=P<130 | Stage II | 5.2 | 0.3 | 1.5 | 0.035 | 0.002 | 0.2 | 255 |
| 75<=P<130 | Stage IIIA | 3.4 | 0.3 | 1.5 | 0.035 | 0.002 | 0.2 | 255 |
| 75<=P<130 | Stage IIIB | 3.0 | 0.2 | 1.5 | 0.035 | 0.002 | 0.0225 | 255 |
| 75<=P<130 | Stage IV | 0.4 | 0.2 | 1.5 | 0.035 | 0.002 | 0.0225 | 255 |
| 130<=P<560 | <1981 | 17.8 | 1.5 | 2.5 | 0.035 | 0.002 | 0.9 | 270 |
| 130<=P<560 | 1981-1990 | 12.4 | 1.0 | 2.5 | 0.035 | 0.002 | 0.8 | 260 |
| 130<=P<560 | 1991-Stage I | 11.2 | 0.5 | 2.5 | 0.035 | 0.002 | 0.4 | 250 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 130<=P<560 | Stage I | 7.6 | 0.3 | 1.5 | 0.035 | 0.002 | 0.2 | 250 |
| 130<=P<560 | Stage II | 5.2 | 0.3 | 1.5 | 0.035 | 0.002 | 0.1 | 250 |
| 130<=P<560 | Stage IIIA | 3.4 | 0.3 | 1.5 | 0.035 | 0.002 | 0.1 | 250 |
| 130<=P<560 | Stage IIIB | 3.0 | 0.2 | 1.5 | 0.035 | 0.002 | 0.0225 | 250 |
| 130<=P<560 | Stage IV | 0.4 | 0.2 | 1.5 | 0.035 | 0.002 | 0.0225 | 250 |

Basis factors for 4-stroke gasoline non road machinery.

| Engine | Size code | Size classe [S=ccm] | Emission Level | $NO_x$ | VOC | CO | $N_2O$ [g pr kWh] | $NH_3$ | TSP | Fuel |
|---|---|---|---|---|---|---|---|---|---|---|
| 4-stroke | SH2 | 20<=S<50 | <1981 | 2.4 | 33 | 198 | 0.002 | 0.03 | 0.08 | 496 |
| 4-stroke | SH2 | 20<=S<50 | 1981-1990 | 3.5 | 27.5 | 165 | 0.002 | 0.03 | 0.08 | 474 |
| 4-stroke | SH2 | 20<=S<50 | 1991-Stage I | 4.7 | 22 | 132 | 0.002 | 0.03 | 0.08 | 451 |
| 4-stroke | SH2 | 20<=S<50 | Stage I | 4.7 | 22 | 132 | 0.002 | 0.03 | 0.08 | 406 |
| 4-stroke | SH2 | 20<=S<50 | Stage II | 4.7 | 22 | 132 | 0.002 | 0.03 | 0.08 | 406 |
| 4-stroke | SH3 | S>=50 | <1981 | 2.4 | 33 | 198 | 0.002 | 0.03 | 0.08 | 496 |
| 4-stroke | SH3 | S>=50 | 1981-1990 | 3.5 | 27.5 | 165 | 0.002 | 0.03 | 0.08 | 474 |
| 4-stroke | SH3 | S>=50 | 1991-Stage I | 4.7 | 22 | 132 | 0.002 | 0.03 | 0.08 | 451 |
| 4-stroke | SH3 | S>=50 | Stage I | 4.7 | 22 | 132 | 0.002 | 0.03 | 0.08 | 406 |
| 4-stroke | SH3 | S>=50 | Stage II | 4.7 | 22 | 132 | 0.002 | 0.03 | 0.08 | 406 |
| 4-stroke | SN1 | S<66 | <1981 | 1.2 | 26.9 | 822 | 0.002 | 0.03 | 0.08 | 603 |
| 4-stroke | SN1 | S<66 | 1981-1990 | 1.8 | 22.5 | 685 | 0.002 | 0.03 | 0.08 | 603 |
| 4-stroke | SN1 | S<66 | 1991-Stage I | 2.4 | 18 | 548 | 0.002 | 0.03 | 0.08 | 603 |
| 4-stroke | SN1 | S<66 | Stage I | 4.3 | 16.1 | 411 | 0.002 | 0.03 | 0.08 | 475 |
| 4-stroke | SN1 | S<66 | Stage II | 4.3 | 16.1 | 411 | 0.002 | 0.03 | 0.08 | 475 |
| 4-stroke | SN2 | 66<=S<100 | <1981 | 2.3 | 10.5 | 822 | 0.002 | 0.03 | 0.08 | 627 |
| 4-stroke | SN2 | 66<=S<100 | 1981-1990 | 3.5 | 8.7 | 685 | 0.002 | 0.03 | 0.08 | 599 |
| 4-stroke | SN2 | 66<=S<100 | 1991-Stage I | 4.7 | 7 | 548 | 0.002 | 0.03 | 0.08 | 570 |
| 4-stroke | SN2 | 66<=S<100 | Stage I | 4.7 | 7 | 467 | 0.002 | 0.03 | 0.08 | 450 |
| 4-stroke | SN2 | 66<=S<100 | Stage II | 4.7 | 7 | 467 | 0.002 | 0.03 | 0.08 | 450 |
| 4-stroke | SN3 | 100<=S<225 | <1981 | 2.6 | 19.1 | 525 | 0.002 | 0.03 | 0.08 | 601 |
| 4-stroke | SN3 | 100<=S<225 | 1981-1990 | 3.8 | 15.9 | 438 | 0.002 | 0.03 | 0.08 | 573 |
| 4-stroke | SN3 | 100<=S<225 | 1991-Stage I | 5.1 | 12.7 | 350 | 0.002 | 0.03 | 0.08 | 546 |
| 4-stroke | SN3 | 100<=S<225 | Stage I | 5.1 | 11.6 | 350 | 0.002 | 0.03 | 0.08 | 546 |
| 4-stroke | SN3 | 100<=S<225 | Stage II | 5.1 | 9.4 | 350 | 0.002 | 0.03 | 0.08 | 546 |
| 4-stroke | SN4 | S>=225 | <1981 | 1.3 | 11.1 | 657 | 0.002 | 0.03 | 0.08 | 539 |
| 4-stroke | SN4 | S>=225 | 1981-1990 | 2 | 9.3 | 548 | 0.002 | 0.03 | 0.08 | 514 |
| 4-stroke | SN4 | S>=225 | 1991-Stage I | 2.6 | 7.4 | 438 | 0.002 | 0.03 | 0.08 | 490 |
| 4-stroke | SN4 | S>=225 | Stage I | 2.6 | 7.4 | 438 | 0.002 | 0.03 | 0.08 | 490 |
| 4-stroke | SN4 | S>=225 | Stage II | 2.6 | 7.4 | 438 | 0.002 | 0.03 | 0.08 | 490 |

Basis factors for 2-stroke gasoline non road machinery.

| Engine | Size code | Size classe [ccm] | Emission Level | $NO_x$ | VOC | CO | $N_2O$ [g pr kWh] | $NH_3$ | TSP | Fuel |
|---|---|---|---|---|---|---|---|---|---|---|
| 2-stroke | SH2 | 20<=S<50 | <1981 | 1 | 305 | 695 | 0.002 | 0.01 | 7 | 882 |
| 2-stroke | SH2 | 20<=S<50 | 1981-1990 | 1 | 300 | 579 | 0.002 | 0.01 | 5.3 | 809 |
| 2-stroke | SH2 | 20<=S<50 | 1991-Stage I | 1.1 | 203 | 463 | 0.002 | 0.01 | 3.5 | 735 |
| 2-stroke | SH2 | 20<=S<50 | Stage I | 1.5 | 188 | 379 | 0.002 | 0.01 | 3.5 | 720 |
| 2-stroke | SH2 | 20<=S<50 | Stage II | 1.5 | 44 | 379 | 0.002 | 0.01 | 3.5 | 500 |
| 2-stroke | SH3 | S>=50 | <1981 | 1.1 | 189 | 510 | 0.002 | 0.01 | 3.6 | 665 |
| 2-stroke | SH3 | S>=50 | 1981-1990 | 1.1 | 158 | 425 | 0.002 | 0.01 | 2.7 | 609 |
| 2-stroke | SH3 | S>=50 | 1991-Stage I | 1.2 | 126 | 340 | 0.002 | 0.01 | 1.8 | 554 |
| 2-stroke | SH3 | S>=50 | Stage I | 2 | 126 | 340 | 0.002 | 0.01 | 1.8 | 529 |
| 2-stroke | SH3 | S>=50 | Stage II | 1.2 | 64 | 340 | 0.002 | 0.01 | 1.8 | 500 |
| 2-stroke | SN1 | S<66 | <1981 | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN1 | S<66 | 1981-1990 | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN1 | S<66 | 1991-Stage I | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN1 | S<66 | Stage I | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN1 | S<66 | Stage II | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN2 | 66<=S<100 | <1981 | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN2 | 66<=S<100 | 1981-1990 | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN2 | 66<=S<100 | 1991-Stage I | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN2 | 66<=S<100 | Stage I | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN2 | 66<=S<100 | Stage II | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN3 | 100<=S<225 | <1981 | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN3 | 100<=S<225 | 1981-1990 | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN3 | 100<=S<225 | 1991-Stage I | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN3 | 100<=S<225 | Stage I | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN3 | 100<=S<225 | Stage II | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN4 | S>=225 | <1981 | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN4 | S>=225 | 1981-1990 | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN4 | S>=225 | 1991-Stage I | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN4 | S>=225 | Stage I | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |
| 2-stroke | SN4 | S>=225 | Stage II | 0.5 | 155 | 418 | 0.002 | 0.01 | 2.6 | 652 |

Fuel consumption and emission factors LPG fork lifts.

| $NO_x$ [g pr kWh] | VOC [g pr kWh] | CO [g pr kWh] | $NH_3$ [g pr kWh] | $N_2O$ [g pr kWh] | TSP [g pr kWh] | FC [g pr kWh] |
|---|---|---|---|---|---|---|
| 19 | 2.2 | 1.5 | 0.003 | 0.05 | 0.07 | 311 |

Fuel consumption and emission factors for All Terrain Vehicles (ATV's).

| ATV type | $NO_x$ [g pr GJ] | VOC [g pr GJ] | CO [g pr GJ] | $NH_3$ [g pr GJ] | $N_2O$ [g pr GJ] | TSP [g pr GJ] | Fuel [kg pr hour] |
|---|---|---|---|---|---|---|---|
| Professional | 108 | 1077 | 16306 | 2 | 2 | 32 | 1.125 |
| Private | 128 | 1527 | 22043 | 2 | 2 | 39 | 0.75 |

Fuel consumption and emission factors for recreational craft.

| Fuel type | Vessel type | Engine | Engine type | Direktiv | Engine size | CO | VOC | $N_2O$ | $NH_3$ | $NO_x$ | TSP | Fuel |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | [kW] | [g pr kWh] | | | | | | |
| Gasoline | Other boats (< 20 ft) | Out board | 2-stroke | 2003/44 | 8 | 202.5 | 45.9 | 0.01 | 0.002 | 2 | 10 | 791 |
| Gasoline | Other boats (< 20 ft) | Out board | 2-stroke | Konv. | 8 | 427 | 257.0 | 0.01 | 0.002 | 2 | 10 | 791 |
| Gasoline | Other boats (< 20 ft) | Out board | 4-stroke | 2003/44 | 8 | 202.5 | 24.0 | 0.03 | 0.002 | 7 | 0.08 | 426 |
| Gasoline | Other boats (< 20 ft) | Out board | 4-stroke | Konv. | 8 | 520 | 24.0 | 0.03 | 0.002 | 7 | 0.08 | 426 |
| Gasoline | Yawls and cabin boats | Out board | 2-stroke | 2003/44 | 20 | 162 | 36.5 | 0.01 | 0.002 | 3 | 10 | 791 |
| Gasoline | Yawls and cabin boats | Out board | 2-stroke | Konv. | 20 | 374 | 172.0 | 0.01 | 0.002 | 3 | 10 | 791 |
| Gasoline | Yawls and cabin boats | Out board | 4-stroke | 2003/44 | 20 | 162 | 14.0 | 0.03 | 0.002 | 10 | 0.08 | 426 |
| Gasoline | Yawls and cabin boats | Out board | 4-stroke | Konv. | 20 | 390 | 14.0 | 0.03 | 0.002 | 10 | 0.08 | 426 |
| Gasoline | Sailing boats (< 26 ft) | Out board | 2-stroke | 2003/44 | 10 | 189 | 43.0 | 0.01 | 0.002 | 2 | 10 | 791 |
| Gasoline | Sailing boats (< 26 ft) | Out board | 2-stroke | Konv. | 10 | 427 | 257.0 | 0.01 | 0.002 | 2 | 10 | 791 |
| Gasoline | Sailing boats (< 26 ft) | Out board | 4-stroke | 2003/44 | 10 | 189 | 24.0 | 0.03 | 0.002 | 7 | 0.08 | 426 |
| Gasoline | Sailing boats (< 26 ft) | Out board | 4-stroke | Konv. | 10 | 520 | 24.0 | 0.03 | 0.002 | 7 | 0.08 | 426 |
| Gasoline | Speed boats | In board | 4-stroke | 2003/44 | 90 | 141 | 10.0 | 0.03 | 0.002 | 12 | 0.08 | 426 |
| Gasoline | Speed boats | In board | 4-stroke | Konv. | 90 | 346 | 10.0 | 0.03 | 0.002 | 12 | 0.08 | 426 |
| Gasoline | Speed boats | Out board | 2-stroke | 2003/44 | 50 | 145.8 | 31.8 | 0.01 | 0.002 | 3 | 10 | 791 |
| Gasoline | Speed boats | Out board | 2-stroke | Konv. | 50 | 374 | 172.0 | 0.01 | 0.002 | 3 | 10 | 791 |
| Gasoline | Speed boats | Out board | 4-stroke | 2003/44 | 50 | 145.8 | 14.0 | 0.03 | 0.002 | 10 | 0.08 | 426 |
| Gasoline | Speed boats | Out board | 4-stroke | Konv. | 50 | 390 | 14.0 | 0.03 | 0.002 | 10 | 0.08 | 426 |
| Gasoline | Water scooters | Built in | 2-stroke | 2003/44 | 45 | 147 | 32.2 | 0.01 | 0.002 | 3 | 10 | 791 |
| Gasoline | Water scooters | Built in | 2-stroke | Konv. | 45 | 374 | 172.0 | 0.01 | 0.002 | 3 | 10 | 791 |
| Gasoline | Water scooters | Built in | 4-stroke | 2003/44 | 45 | 147 | 14.0 | 0.03 | 0.002 | 10 | 0.08 | 426 |
| Gasoline | Water scooters | Built in | 4-stroke | Konv. | 45 | 390 | 14.0 | 0.03 | 0.002 | 10 | 0.08 | 426 |
| Diesel | Motor boats (27-34 ft) | In board | | 2003/44 | 150 | 5 | 1.7 | 0.035 | 0.002 | 8.6 | 1 | 275 |
| Diesel | Motor boats (27-34 ft) | In board | | Konv. | 150 | 5.3 | 2.0 | 0.035 | 0.002 | 8.6 | 1.2 | 275 |
| Diesel | Motor boats (> 34 ft) | In board | | 2003/44 | 250 | 5 | 1.6 | 0.035 | 0.002 | 8.6 | 1 | 275 |
| Diesel | Motor boats (> 34 ft) | In board | | Konv. | 250 | 5.3 | 2.0 | 0.035 | 0.002 | 8.6 | 1.2 | 275 |
| Diesel | Motor boats (< 27 ft) | In board | | 2003/44 | 40 | 5 | 1.8 | 0.035 | 0.002 | 9.8 | 1 | 281 |
| Diesel | Motor boats (< 27 ft) | In board | | Konv. | 40 | 5.5 | 2.2 | 0.035 | 0.002 | 18 | 1.4 | 281 |
| Diesel | Motor sailors | In board | | 2003/44 | 30 | 5 | 1.9 | 0.035 | 0.002 | 9.8 | 1 | 281 |
| Diesel | Motor sailors | In board | | Konv. | 30 | 5.5 | 2.2 | 0.035 | 0.002 | 18 | 1.4 | 281 |
| Diesel | Sailing boats (> 26 ft) | In board | | 2003/44 | 30 | 5 | 1.9 | 0.035 | 0.002 | 9.8 | 1 | 281 |
| Diesel | Sailing boats (> 26 ft) | In board | | Konv. | 30 | 5.5 | 2.2 | 0.035 | 0.002 | 18 | 1.4 | 281 |

$CH_4$ shares of VOC for diesel, gasoline and LPG.

| Fuel type | $CH_4$ share of VOC |
|---|---|
| Diesel | 0.016 |
| Gasoline 4-stroke | 0.1 |
| Gasoline 2-stroke | 0.009 |
| LPG | 0.05 |

Deterioration factors for diesel machinery.

| Emission Level | $NO_x$ | VOC | CO | TSP |
|---|---|---|---|---|
| <1981 | 0.024 | 0.047 | 0.185 | 0.473 |
| 1981-1990 | 0.024 | 0.047 | 0.185 | 0.473 |
| 1991-Stage I | 0.024 | 0.047 | 0.185 | 0.473 |
| Stage I | 0.024 | 0.036 | 0.101 | 0.473 |
| Stage II | 0.009 | 0.034 | 0.101 | 0.473 |
| Stage IIIA | 0.008 | 0.027 | 0.151 | 0.473 |
| Stage IIIB | 0.008 | 0.027 | 0.151 | 0.473 |
| Stage IV | 0.008 | 0.027 | 0.151 | 0.473 |

Deterioration factors for gasoline 2-stroke machinery.

| Engine | Size code | Size classe | Emission Level | $NO_x$ | VOC | CO | TSP |
|---|---|---|---|---|---|---|---|
| 2-stroke | SH2 | 20<=S<50 | <1981 | 0 | 0.2 | 0.2 | 0 |
| 2-stroke | SH2 | 20<=S<50 | 1981-1990 | 0 | 0.2 | 0.2 | 0 |
| 2-stroke | SH2 | 20<=S<50 | 1991-Stage I | 0 | 0.2 | 0.2 | 0 |
| 2-stroke | SH2 | 20<=S<50 | Stage I | 0 | 0.29 | 0.24 | 0 |
| 2-stroke | SH2 | 20<=S<50 | Stage II | 0 | 0.29 | 0.24 | 0 |
| 2-stroke | SH3 | S>=50 | <1981 | -0.031 | 0.2 | 0.2 | 0 |
| 2-stroke | SH3 | S>=50 | 1981-1990 | -0.031 | 0.2 | 0.2 | 0 |
| 2-stroke | SH3 | S>=50 | 1991-Stage I | -0.031 | 0.2 | 0.2 | 0 |
| 2-stroke | SH3 | S>=50 | Stage I | 0 | 0.266 | 0.231 | 0 |
| 2-stroke | SH3 | S>=50 | Stage II | 0 | 0.266 | 0.231 | 0 |
| 2-stroke | SN1 | S<66 | <1981 | -0.6 | 0.201 | 0.9 | 1.1 |
| 2-stroke | SN1 | S<66 | 1981-1990 | -0.6 | 0.201 | 0.9 | 1.1 |
| 2-stroke | SN1 | S<66 | 1991-Stage I | -0.6 | 0.201 | 0.9 | 1.1 |
| 2-stroke | SN1 | S<66 | Stage I | -0.33 | 0.266 | 1.109 | 5.103 |
| 2-stroke | SN1 | S<66 | Stage II | -0.33 | 0 | 1.109 | 5.103 |
| 2-stroke | SN2 | 66<=S<100 | <1981 | -0.6 | 0.201 | 0.9 | 1.1 |
| 2-stroke | SN2 | 66<=S<100 | 1981-1990 | -0.6 | 0.201 | 0.9 | 1.1 |
| 2-stroke | SN2 | 66<=S<100 | 1991-Stage I | -0.6 | 0.201 | 0.9 | 1.1 |
| 2-stroke | SN2 | 66<=S<100 | Stage I | -0.33 | 0.266 | 1.109 | 5.103 |
| 2-stroke | SN2 | 66<=S<100 | Stage II | -0.33 | 0 | 1.109 | 5.103 |
| 2-stroke | SN3 | 100<=S<225 | <1981 | -0.6 | 0.201 | 0.9 | 1.1 |
| 2-stroke | SN3 | 100<=S<225 | 1981-1990 | -0.6 | 0.201 | 0.9 | 1.1 |
| 2-stroke | SN3 | 100<=S<225 | 1991-Stage I | -0.6 | 0.201 | 0.9 | 1.1 |
| 2-stroke | SN3 | 100<=S<225 | Stage I | -0.33 | 0.266 | 1.109 | 5.103 |
| 2-stroke | SN3 | 100<=S<225 | Stage II | -0.33 | 0 | 1.109 | 5.103 |
| 2-stroke | SN4 | S>=225 | <1981 | -0.6 | 0.201 | 0.9 | 1.1 |
| 2-stroke | SN4 | S>=225 | 1981-1990 | -0.6 | 0.201 | 0.9 | 1.1 |
| 2-stroke | SN4 | S>=225 | 1991-Stage I | -0.6 | 0.201 | 0.9 | 1.1 |
| 2-stroke | SN4 | S>=225 | Stage I | -0.274 | 0 | 0.887 | 1.935 |
| 2-stroke | SN4 | S>=225 | Stage II | -0.274 | 0 | 0.887 | 1.935 |

Deterioration factors for gasoline 4-stroke machinery.

| Engine | Size code | Size classe | Emission Level | $NO_x$ | VOC | CO | TSP |
|---|---|---|---|---|---|---|---|
| 4-stroke | SN1 | S<66 | <1981 | -0.6 | 1.1 | 0.9 | 1.1 |
| 4-stroke | SN1 | S<66 | 1981-1990 | -0.6 | 1.1 | 0.9 | 1.1 |
| 4-stroke | SN1 | S<66 | 1991-Stage I | -0.6 | 1.1 | 0.9 | 1.1 |
| 4-stroke | SN1 | S<66 | Stage I | -0.3 | 1.753 | 1.051 | 1.753 |
| 4-stroke | SN1 | S<66 | Stage II | -0.3 | 1.753 | 1.051 | 1.753 |
| 4-stroke | SN2 | 66<=S<100 | <1981 | -0.6 | 1.1 | 0.9 | 1.1 |
| 4-stroke | SN2 | 66<=S<100 | 1981-1990 | -0.6 | 1.1 | 0.9 | 1.1 |
| 4-stroke | SN2 | 66<=S<100 | 1991-Stage I | -0.6 | 1.1 | 0.9 | 1.1 |
| 4-stroke | SN2 | 66<=S<100 | Stage I | -0.3 | 1.753 | 1.051 | 1.753 |
| 4-stroke | SN2 | 66<=S<100 | Stage II | -0.3 | 1.753 | 1.051 | 1.753 |
| 4-stroke | SN3 | 100<=S<225 | <1981 | -0.6 | 1.1 | 0.9 | 1.1 |
| 4-stroke | SN3 | 100<=S<225 | 1981-1990 | -0.6 | 1.1 | 0.9 | 1.1 |
| 4-stroke | SN3 | 100<=S<225 | 1991-Stage I | -0.6 | 1.1 | 0.9 | 1.1 |
| 4-stroke | SN3 | 100<=S<225 | Stage I | -0.3 | 1.753 | 1.051 | 1.753 |
| 4-stroke | SN3 | 100<=S<225 | Stage II | -0.3 | 1.753 | 1.051 | 1.753 |
| 4-stroke | SN4 | S>=225 | <1981 | -0.6 | 1.1 | 0.9 | 1.1 |
| 4-stroke | SN4 | S>=225 | 1981-1990 | -0.6 | 1.1 | 0.9 | 1.1 |
| 4-stroke | SN4 | S>=225 | 1991-Stage I | -0.6 | 1.1 | 0.9 | 1.1 |
| 4-stroke | SN4 | S>=225 | Stage I | -0.599 | 1.095 | 1.307 | 1.095 |
| 4-stroke | SN4 | S>=225 | Stage II | -0.599 | 1.095 | 1.307 | 1.095 |
| 4-stroke | SH2 | 20<=S<50 | <1981 | 0 | 0 | 0 | 0 |
| 4-stroke | SH2 | 20<=S<50 | 1981-1990 | 0 | 0 | 0 | 0 |
| 4-stroke | SH2 | 20<=S<50 | 1991-Stage I | 0 | 0 | 0 | 0 |
| 4-stroke | SH2 | 20<=S<50 | Stage I | 0 | 0 | 0 | 0 |
| 4-stroke | SH2 | 20<=S<50 | Stage II | 0 | 0 | 0 | 0 |
| 4-stroke | SH3 | S>=50 | <1981 | 0 | 0 | 0 | 0 |
| 4-stroke | SH3 | S>=50 | 1981-1990 | 0 | 0 | 0 | 0 |
| 4-stroke | SH3 | S>=50 | 1991-Stage I | 0 | 0 | 0 | 0 |
| 4-stroke | SH3 | S>=50 | Stage I | 0 | 0 | 0 | 0 |
| 4-stroke | SH3 | S>=50 | Stage II | 0 | 0 | 0 | 0 |

Transient factors for diesel machinery.

| Emission Level | Load | $NO_x$ | VOC | CO | TSP | Fuel |
|---|---|---|---|---|---|---|
| <1981 | High | 0.95 | 1.05 | 1.53 | 1.23 | 1.01 |
| 1981-1990 | High | 0.95 | 1.05 | 1.53 | 1.23 | 1.01 |
| 1991-Stage I | High | 0.95 | 1.05 | 1.53 | 1.23 | 1.01 |
| Stage I | High | 0.95 | 1.05 | 1.53 | 1.23 | 1.01 |
| Stage II | High | 0.95 | 1.05 | 1.53 | 1.23 | 1.01 |
| Stage IIIA | High | 0.95 | 1.05 | 1.53 | 1.23 | 1.01 |
| Stage IIIB | High | 1 | 1 | 1 | 1 | 1 |
| Stage IV | High | 1 | 1 | 1 | 1 | 1 |
| <1981 | Low | 1.1 | 2.29 | 2.57 | 1.97 | 1.18 |
| 1981-1990 | Low | 1.1 | 2.29 | 2.57 | 1.97 | 1.18 |
| 1991-Stage I | Low | 1.1 | 2.29 | 2.57 | 1.97 | 1.18 |
| Stage I | Low | 1.1 | 2.29 | 2.57 | 1.97 | 1.18 |
| Stage II | Low | 1.1 | 2.29 | 2.57 | 1.97 | 1.18 |
| Stage IIIA | Low | 1.1 | 2.29 | 2.57 | 1.97 | 1.18 |
| Stage IIIB | Low | 1 | 1 | 1 | 1 | 1 |
| Stage IV | Low | 1 | 1 | 1 | 1 | 1 |

Annual working hours, load factors and lifetimes for agricultural tractors.

| Tractor type | Annual working hours | Load factor | Lifetime (yrs) |
|---|---|---|---|
| Diesel | 500 (0-7 years)<br>500-100 (7-16 years)<br>100 (>16 years) | 0.5 | 30 |
| Gasoline (certified) | 100 | 0.4 | 37 |
| Gasoline (non certified) | 50 | 0.4 | 37 |

Annual working hours, load factors and lifetimes for harvesters.

| Annual working hours | Load factor | Lifetime (yrs) |
|---|---|---|
| 250-100 (linear decrease 0-24 years) | 0.8 | 25 |

Annual working hours, load factors and lifetime for machine pool machinery.

| Tractor type | Hours pr yr | Load factor | Lifetime (yrs) |
|---|---|---|---|
| Tractors | 750 | 0.5 | 7 |
| Harvesters | 100 | 0.8 | 11 |
| Self-propelled vehicles | 500 | 0.75 | 6 |

Operational data for other machinery types in agriculture.

| Machinery type | Fuel type | Load factor | Lifetime (yrs) | Hours | Size (kW) |
|---|---|---|---|---|---|
| ATV private | Gasoline | - | 6 | 250 | - |
| ATV professional | Gasoline | - | 8 | 400 | - |
| Bedding machines | Gasoline | 0.3 | 10 | 50 | 3 |
| Fodder trucks | Gasoline | 0.4 | 10 | 200 | 8 |
| Other (gasoline) | Gasoline | 0.4 | 10 | 50 | 5 |
| Scrapers | Gasoline | 0.3 | 10 | 50 | 3 |
| Self-propelled vehicles | Diesel | 0.75 | 15 | 150 | 60 |
| Sweepers | Gasoline | 0.3 | 10 | 50 | 3 |

Annual working hours, load factors and lifetimes for forestry machinery.

| Machinery type | Hours | Load factors | Lifetime |
|---|---|---|---|
| Chippers | 1200 | 0.5 | 6 |
| Tractors (other) | 100 (1990)<br>400 (2004) | 0.5 | 15 |
| Tractors (silvicultural) | 800 | 0.5 | 6 |
| Harvesters | 1200 | 0.5 | 8 |
| Forwarders | 1200 | 0.5 | 8 |
| Chain saws (forestry) | 800 | 0.4 | 3 |

Annual working hours, load factors and lifetime for fork lifts.

| Hours pr yr | Load factor | Lifetime (yrs) |
|---|---|---|
| 1200 (>=50 kW and <=10 years old)<br>650 (>=50 kW and >10 years old)<br>650 (<50 kW) | 0.27 | 20 |

Operational data for construction machinery.

| Machinery type | Load factor | Lifetime | Hours | Size |
|---|---|---|---|---|
| Track type dozers | 0.5 | 10 | 1100 | 140 |
| Track type loaders | 0.5 | 10 | 1100 | 100 (1990)<br>150 (2004) |
| Wheel loaders (0-5 tonnes) | 0.5 | 10 | 1200 | 20 |
| Wheel loaders (> 5,1 tonnes) | 0.5 | 10 | 1200 | 120 |
| Wheel type excavators | 0.6 | 10 | 1200 | 100 |
| Track type excavators (0-5 tonnes) | 0.6 | 10 | 1100 | 20 |
| Track type excavators (>5,1 tonnes) | 0.6 | 10 | 1100 | 120 |
| Excavators/Loaders | 0.45 | 10 | 700 | 50 |
| Dump trucks | 0.4 | 10 | 900 (1990)<br>1200 (2004) | 60 (1990)<br>180 (2004) |
| Mini loaders | 0.5 | 14 | 700 | 30 |
| Telescopic loaders | 0.5 | 14 | 1000 | 35 |

Stock and operational data for other machinery types in industry.

| Sector | Fuel type | Machinery type | Size (kW) | No | Load Factor | Hours |
|---|---|---|---|---|---|---|
| Construction machinery | Diesel | Tampers/Land rollers | 30 | 2800 | 0.45 | 600 |
| Construction machinery | Diesel | Generators (diesel) | 45 | 5000 | 0.5 | 200 |
| Construction machinery | Diesel | Kompressors (diesel) | 45 | 5000 | 0.5 | 500 |
| Construction machinery | Diesel | Pumps (diesel) | 75 | 1000 | 0.5 | 5 |
| Construction machinery | Diesel | Asphalt pavers | 80 | 300 | 0.35 | 700 |
| Construction machinery | Diesel | Motor graders | 100 | 100 | 0.4 | 700 |
| Construction machinery | Diesel | Refuse compressors | 160 | 100 | 0.25 | 1300 |
| Construction machinery | Gasoline | Generators (gasoline) | 2.5 | 11000 | 0.4 | 80 |
| Construction machinery | Gasoline | Pumps (gasoline) | 4 | 10000 | 0.4 | 300 |
| Construction machinery | Gasoline | Kompressors (gasoline) | 4 | 500 | 0.35 | 15 |
| Industry | Diesel | Refrigerating units (distribution) | 8 | 3000 | 0.5 | 1250 |
| Industry | Diesel | Refrigerating units (long distance) | 15 | 3500 | 0.5 | 200 |
| Industry | Diesel | Tractors (transport, industry) | 50 | 3000 | 0.4 | 500 |
| Airport GSE and other | Diesel | Airport GSE and other (light duty) | 100 | 500 | 0.5 | 400 |
| Airport GSE and other | Diesel | Airport GSE and other (medium duty) | 125 | 350 | 0.5 | 300 |
| Airport GSE and other | Diesel | Airport GSE and other (Heavy duty) | 175 | 650 | 0.5 | 200 |
| Building and construction | Diesel | Vibratory plates | 6 | 3500 | 0.6 | 300 |
| Building and construction | Diesel | Aereal lifts (diesel) | 30 | 150 | 0.4 | 400 |
| Building and construction | Diesel | Sweepers (diesel) | 30 | 200 | 0.4 | 300 |
| Building and construction | Diesel | High pressure cleaners (diesel) | 30 | 50 | 0.8 | 500 |
| Building and construction | Gasoline | Rammers | 2.5 | 3000 | 0.4 | 80 |
| Building and construction | Gasoline | Drills | 3 | 100 | 0.4 | 10 |
| Building and construction | Gasoline | Vibratory plates (gasoline) | 4 | 2500 | 0.5 | 200 |
| Building and construction | Gasoline | Cutters | 4 | 800 | 0.5 | 50 |
| Building and construction | Gasoline | Other (gasoline) | 5 | 1000 | 0.5 | 40 |
| Building and construction | Gasoline | High pressure cleaners (gasoline) | 5 | 500 | 0.6 | 200 |
| Building and construction | Gasoline | Sweepers (gasoline) | 10 | 500 | 0.4 | 150 |
| Building and construction | Gasoline | Slicers | 10 | 100 | 0.7 | 150 |
| Building and construction | Gasoline | Aereal lifts (gasoline) | 20 | 50 | 0.4 | 400 |

Operational data for the most important types of household and gardening machinery.

| Machinery type | Engine | Size (kW) | Hours | Load factor | Lifetime (yrs) |
|---|---|---|---|---|---|
| Chain saws (private) | 2-stroke | 2 | 5 | 0.3 | 10 |
| Chain saws (professional) | 2-stroke | 3 | 270 | 0.4 | 3 |
| Cultivators (private-large) | 4-stroke | 3.7 | 5 | 0.6 | 5 |
| Cultivators (private-small) | 4-stroke | 1 | 5 | 0.6 | 15 |
| Cultivators (professional) | 4-stroke | 7 | 360 | 0.6 | 8 |
| Hedge cutters (private) | 2-stroke | 0.9 | 10 | 0.5 | 10 |
| Hedge cutters (professional) | 2-stroke | 2 | 300 | 0.5 | 4 |
| Lawn movers (private) | 4-stroke | 2.5 (2000)<br>3.5 (2004) | 25 | 0.4 | 8 |
| Lawn movers (professional) | 4-stroke | 2.5 (2000)<br>3.5 (2004) | 250 | 0.4 | 4 |
| Riders (private) | 4-stroke | 11 | 50 | 0.5 | 12 |
| Riders (professional) | 4-stroke | 13 | 330 | 0.5 | 5 |
| Shrub clearers (private) | 2-stroke | 1 | 15 | 0.6 | 10 |
| Shrub clearers (professional) | 2-stroke | 2 | 300 | 0.6 | 4 |
| Trimmers (private) | 2-stroke | 0.9 | 20 | 0.5 | 10 |
| Trimmers (professional) | 2-stroke | 0.9 | 200 | 0.5 | 4 |

Stock and operational data for other machines in household and gardening.

| Machinery type | Engine | No. | Size (kW) | Hours | Load factor | Lifetime (yrs) |
|---|---|---|---|---|---|---|
| Chippers | 2-stroke | 200 | 10 | 100 | 0.7 | 10 |
| Garden shredders | 2-stroke | 500 | 3 | 20 | 0.7 | 10 |
| Other (gasoline) | 2-stroke | 200 | 2 | 20 | 0.5 | 10 |
| Suction machines | 2-stroke | 300 | 4 | 80 | 0.5 | 10 |
| Wood cutters | 4-stroke | 100 | 4 | 15 | 0.5 | 10 |

Operational data for recreational craft.

| Fuel type | Vessel type | Engine type | Stroke | Hours | Lifetime | Load factor |
|---|---|---|---|---|---|---|
| Gasoline | Other boats (<20 ft) | Out board engine | 2-stroke | 30 | 10 | 0.5 |
| Gasoline | Other boats (<20 ft) | Out board engine | 4-stroke | 30 | 10 | 0.5 |
| Gasoline | Yawls and cabin boats | Out board engine | 2-stroke | 50 | 10 | 0.5 |
| Gasoline | Yawls and cabin boats | Out board engine | 4-stroke | 50 | 10 | 0.5 |
| Gasoline | Sailing boats (<26ft) | Out board engine | 2-stroke | 5 | 10 | 0.5 |
| Gasoline | Sailing boats (<26ft) | Out board engine | 4-stroke | 5 | 10 | 0.5 |
| Gasoline | Speed boats | In board engine | 4-stroke | 75 | 10 | 0.5 |
| Gasoline | Speed boats | Out board engine | 2-stroke | 50 | 10 | 0.5 |
| Gasoline | Speed boats | Out board engine | 4-stroke | 50 | 10 | 0.5 |
| Gasoline | Water scooters | Built in | 2-stroke | 10 | 10 | 0.5 |
| Gasoline | Water scooters | Built in | 4-stroke | 10 | 10 | 0.5 |
| Diesel | Motor boats (27-34 ft) | In board engine | | 150 | 15 | 0.5 |
| Diesel | Motor boats (>34 ft) | In board engine | | 100 | 15 | 0.5 |
| Diesel | Motor boats (<27 ft) | In board engine | | 75 | 15 | 0.5 |
| Diesel | Motor sailors | In board engine | | 75 | 15 | 0.5 |
| Diesel | Sailing boats (<26ft) | In board engine | | 25 | 15 | 0.5 |

# Annex 2B-10 Stock data for non-road working machinery and equipment

Stock data for diesel tractors 1985-2008.

| Size (kW) | Emission Level | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 37 | <1981 | 3882 | 3792 | 3542 | 3543 | 3403 | 3234 | 3106 | 2922 | 2861 | 2610 | 2605 | 2273 | 2193 | 1918 | 1796 |
| 37 | 1981-1990 | 635 | 731 | 760 | 835 | 855 | 879 | 889 | 883 | 915 | 887 | 945 | 883 | 918 | 869 | 888 |
| 37 | 1991-Stage I | | | | | | | 25 | 107 | 153 | 201 | 278 | 354 | 445 | 496 | 554 |
| 37 | Stage I | | | | | | | | | | | | | | | |
| 37 | Stage II | | | | | | | | | | | | | | | |
| 37 | Stage IIIA | | | | | | | | | | | | | | | |
| 45 | <1981 | 25988 | 25387 | 23709 | 23718 | 22781 | 21650 | 20796 | 19563 | 19154 | 17475 | 17441 | 15219 | 14684 | 12840 | 12025 |
| 45 | 1981-1990 | 5740 | 6808 | 7263 | 8075 | 8476 | 8770 | 8867 | 8805 | 9128 | 8848 | 9419 | 8807 | 9151 | 8668 | 8856 |
| 45 | 1991-Stage I | | | | | | | 203 | 202 | 209 | 203 | 216 | 202 | 210 | 199 | 203 |
| 49 | 1991-Stage I | | | | | | | | 154 | 281 | 485 | 602 | 618 | 702 | 749 | 765 |
| 52 | 1991-Stage I | | | | | | | | | | | | | | | 247 |
| 52 | Stage I | | | | | | | | | | | | | | | |
| 52 | Stage II | | | | | | | | | | | | | | | |
| 52 | Stage IIIA | | | | | | | | | | | | | | | |
| 56 | 1991-Stage I | | | | | | | | 201 | 338 | 428 | 747 | 943 | 1181 | 1280 | 1307 |
| 60 | <1981 | 54651 | 53387 | 49857 | 49877 | 47907 | 45529 | 43732 | 41140 | 40278 | 36747 | 36676 | 32004 | 30879 | 27001 | 25287 |
| 60 | 1981-1990 | 11751 | 14613 | 15795 | 17797 | 19395 | 20542 | 20770 | 20624 | 21380 | 20725 | 22063 | 20628 | 21434 | 20304 | 20744 |
| 60 | 1991-Stage I | | | | | | | 863 | 857 | 888 | 861 | 917 | 857 | 891 | 844 | 862 |
| 63 | 1991-Stage I | | | | | | | | 468 | 855 | 1325 | 2014 | 2384 | 2837 | 3011 | 3076 |
| 67 | 1991-Stage I | | | | | | | | | | | | | | | 671 |
| 67 | Stage I | | | | | | | | | | | | | | | |
| 67 | Stage II | | | | | | | | | | | | | | | |
| 67 | Stage IIIA | | | | | | | | | | | | | | | |
| 71 | 1991-Stage I | | | | | | | | 411 | 715 | 1179 | 1949 | 2507 | 3344 | 3594 | 3672 |
| 78 | <1981 | 14558 | 14221 | 13281 | 13286 | 12761 | 12128 | 11649 | 10959 | 10729 | 9789 | 9770 | 8525 | 8226 | 7192 | 6736 |
| 78 | 1981-1990 | 4592 | 6152 | 7196 | 8559 | 10026 | 11323 | 11448 | 11368 | 11785 | 11424 | 12162 | 11371 | 11815 | 11192 | 11434 |
| 78 | 1991-Stage I | | | | | | | 1233 | 1503 | 1713 | 1945 | 2429 | 2561 | 2946 | 2994 | 3287 |
| 78 | Stage I | | | | | | | | | | | | | | | |
| 78 | Stage II | | | | | | | | | | | | | | | |
| 78 | Stage IIIA | | | | | | | | | | | | | | | |
| 86 | 1991-Stage I | | | | | | | | 108 | 193 | 333 | 589 | 880 | 1364 | 1532 | 1718 |
| 86 | Stage I | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | | | | | | | | | | |
| 86 | Stage II | | | | | | | | | | | | | | | |
| 86 | Stage IIIA | | | | | | | | | | | | | | | |
| 93 | 1991-Stage I | | | | | | | | | | | | | | | 149 |
| 93 | Stage I | | | | | | | | | | | | | | | |
| 93 | Stage II | | | | | | | | | | | | | | | |
| 93 | Stage IIIA | | | | | | | | | | | | | | | |
| 97 | 1991-Stage I | | | | | | | | 71 | 175 | 443 | 962 | 1556 | 2327 | 2638 | 2695 |
| 101 | <1981 | 4659 | 4551 | 4250 | 4252 | 4084 | 3881 | 3728 | 3507 | 3433 | 3132 | 3126 | 2728 | 2632 | 2302 | 2156 |
| 101 | 1981-1990 | 1158 | 1434 | 1618 | 1921 | 2156 | 2377 | 2403 | 2387 | 2474 | 2398 | 2553 | 2387 | 2480 | 2350 | 2400 |
| 101 | 1991-Stage I | | | | | | | 266 | 264 | 274 | 266 | 283 | 264 | 275 | 260 | 696 |
| 101 | Stage I | | | | | | | | | | | | | | | |
| 101 | Stage II | | | | | | | | | | | | | | | |
| 101 | Stage IIIA | | | | | | | | | | | | | | | |
| 112 | 1991-Stage I | | | | | | | | 63 | 114 | 166 | 252 | 422 | 690 | 790 | 978 |
| 112 | Stage I | | | | | | | | | | | | | | | |
| 112 | Stage II | | | | | | | | | | | | | | | |
| 112 | Stage IIIA | | | | | | | | | | | | | | | |
| 127 | 1991-Stage I | | | | | | | | 12 | 36 | 81 | 193 | 279 | 408 | 457 | 590 |
| 127 | Stage I | | | | | | | | | | | | | | | |
| 127 | Stage II | | | | | | | | | | | | | | | |
| 127 | Stage IIIA | | | | | | | | | | | | | | | |
| 131 | <1981 | 798 | 780 | 728 | 728 | 700 | 665 | 639 | 601 | 588 | 537 | 536 | 467 | 451 | 394 | 369 |
| 131 | 1981-1990 | 288 | 421 | 500 | 651 | 753 | 887 | 897 | 890 | 923 | 895 | 952 | 890 | 925 | 876 | 895 |
| 131 | 1991-Stage I | | | | | | | 97 | 97 | 100 | 97 | 103 | 97 | 100 | 95 | 97 |
| 157 | 1981-1990 | | 2 | 3 | 6 | 11 | 15 | 15 | 15 | 16 | 15 | 16 | 15 | 16 | 15 | 15 |
| 157 | 1991-Stage I | | | | | | | 9 | 23 | 39 | 102 | 232 | 357 | 545 | 648 | 784 |
| 157 | Stage I | | | | | | | | | | | | | | | |
| 157 | Stage II | | | | | | | | | | | | | | | |
| 157 | Stage IIIA | | | | | | | | | | | | | | | |
| 186 | 1991-Stage I | | | | | | | | | | | | | | | 23 |
| 186 | Stage I | | | | | | | | | | | | | | | |
| 186 | Stage II | | | | | | | | | | | | | | | |
| 186 | Stage IIIA | | | | | | | | | | | | | | | |

| Size (kW) | Emission Level | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| 37 | <1981 | 1601 | 1449 | 1298 | 1148 | 993 | 833 | 664 | 504 | 342 |
| 37 | 1981-1990 | 871 | 876 | 882 | 892 | 900 | 906 | 903 | 914 | 930 |

| *Continued* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 37 | 1991-Stage I | 568 | 572 | 576 | 582 | 587 | 592 | 590 | 597 | 607 |
| 37 | Stage I | | 33 | 56 | 83 | 84 | 84 | 84 | 85 | 86 |
| 37 | Stage II | | | | | 23 | 53 | 162 | 324 | 330 |
| 37 | Stage IIIA | | | | | | | | | 109 |
| 45 | <1981 | 10715 | 9700 | 8690 | 7685 | 6646 | 5577 | 4447 | 3376 | 2290 |
| 45 | 1981-1990 | 8681 | 8731 | 8800 | 8894 | 8974 | 9037 | 9006 | 9116 | 9274 |
| 45 | 1991-Stage I | 199 | 200 | 202 | 204 | 206 | 207 | 207 | 209 | 213 |
| 49 | 1991-Stage I | 750 | 754 | 760 | 768 | 775 | 780 | 778 | 787 | 801 |
| 52 | 1991-Stage I | 358 | 360 | 363 | 367 | 370 | 373 | 372 | 376 | 383 |
| 52 | Stage I | | 132 | 242 | 377 | 381 | 383 | 382 | 387 | 393 |
| 52 | Stage II | | | | | 68 | 147 | 241 | 347 | 353 |
| 52 | Stage IIIA | | | | | | | | | 86 |
| 56 | 1991-Stage I | 1281 | 1289 | 1299 | 1313 | 1325 | 1334 | 1329 | 1346 | 1369 |
| 60 | <1981 | 22533 | 20397 | 18273 | 16162 | 13976 | 11729 | 9351 | 7099 | 4815 |
| 60 | 1981-1990 | 20333 | 20451 | 20612 | 20834 | 21019 | 21167 | 21096 | 21353 | 21723 |
| 60 | 1991-Stage I | 845 | 850 | 856 | 866 | 873 | 879 | 876 | 887 | 903 |
| 63 | 1991-Stage I | 3015 | 3033 | 3057 | 3090 | 3117 | 3139 | 3128 | 3167 | 3221 |
| 67 | 1991-Stage I | 1343 | 1351 | 1361 | 1376 | 1388 | 1398 | 1393 | 1410 | 1435 |
| 67 | Stage I | | 533 | 835 | 1113 | 1123 | 1131 | 1127 | 1141 | 1161 |
| 67 | Stage II | | | | | 375 | 729 | 1144 | 1524 | 1550 |
| 67 | Stage IIIA | | | | | | | | | 303 |
| 71 | 1991-Stage I | 3600 | 3620 | 3649 | 3688 | 3721 | 3747 | 3735 | 3780 | 3846 |
| 78 | <1981 | 6002 | 5433 | 4868 | 4305 | 3723 | 3124 | 2491 | 1891 | 1283 |
| 78 | 1981-1990 | 11208 | 11273 | 11361 | 11484 | 11586 | 11668 | 11628 | 11770 | 11974 |
| 78 | 1991-Stage I | 3436 | 3727 | 3756 | 3797 | 3830 | 3857 | 3844 | 3891 | 3959 |
| 78 | Stage I | | | 325 | 329 | 332 | 334 | 333 | 337 | 343 |
| 78 | Stage II | | | | 227 | 310 | 400 | 463 | 469 | 477 |
| 78 | Stage IIIA | | | | | | | | 63 | 121 |
| 86 | 1991-Stage I | 1876 | 2023 | 2039 | 2061 | 2079 | 2094 | 2087 | 2112 | 2149 |
| 86 | Stage I | | | 134 | 136 | 137 | 138 | 137 | 139 | 142 |
| 86 | Stage II | | | | 91 | 343 | 530 | 760 | 769 | 783 |
| 86 | Stage IIIA | | | | | | | | 226 | 434 |
| 93 | 1991-Stage I | 245 | 325 | 327 | 331 | 334 | 336 | 335 | 339 | 345 |
| 93 | Stage I | | | 114 | 115 | 116 | 117 | 116 | 118 | 120 |
| 93 | Stage II | | | | 107 | 186 | 313 | 512 | 518 | 527 |
| 93 | Stage IIIA | | | | | | | | 264 | 470 |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 97 | 1991-Stage I | 2642 | 2657 | 2678 | 2707 | 2731 | 2750 | 2741 | 2774 | 2822 |
| 101 | <1981 | 1921 | 1739 | 1558 | 1378 | 1191 | 1000 | 797 | 605 | 410 |
| 101 | 1981-1990 | 2353 | 2367 | 2385 | 2411 | 2432 | 2449 | 2441 | 2471 | 2514 |
| 101 | 1991-Stage I | 1116 | 1567 | 1579 | 1596 | 1611 | 1622 | 1616 | 1636 | 1664 |
| 101 | Stage I | | | 232 | 234 | 236 | 238 | 237 | 240 | 244 |
| 101 | Stage II | | | | 136 | 357 | 635 | 776 | 785 | 799 |
| 101 | Stage IIIA | | | | | | | | 188 | 336 |
| 112 | 1991-Stage I | 1265 | 1626 | 1639 | 1656 | 1671 | 1683 | 1677 | 1698 | 1727 |
| 112 | Stage I | | | 465 | 470 | 474 | 478 | 476 | 482 | 490 |
| 112 | Stage II | | | | 337 | 732 | 1170 | 1763 | 1785 | 1815 |
| 112 | Stage IIIA | | | | | | | | 378 | 663 |
| 127 | 1991-Stage I | 707 | 847 | 854 | 863 | 871 | 877 | 874 | 884 | 900 |
| 127 | Stage I | | | 152 | 154 | 155 | 156 | 156 | 158 | 161 |
| 127 | Stage II | | | | 78 | 268 | 453 | 591 | 599 | 609 |
| 127 | Stage IIIA | | | | | | | | 292 | 675 |
| 131 | <1981 | 329 | 298 | 267 | 236 | 204 | 171 | 137 | 104 | 70 |
| 131 | 1981-1990 | 878 | 883 | 890 | 899 | 907 | 914 | 911 | 922 | 938 |
| 131 | 1991-Stage I | 95 | 96 | 96 | 97 | 98 | 99 | 99 | 100 | 102 |
| 157 | 1981-1990 | 15 | 15 | 15 | 15 | 16 | 16 | 16 | 16 | 16 |
| 157 | 1991-Stage I | 900 | 905 | 912 | 922 | 930 | 937 | 934 | 945 | 961 |
| 157 | Stage I | | 89 | 89 | 90 | 91 | 92 | 91 | 92 | 94 |
| 157 | Stage II | | | 149 | 415 | 695 | 1089 | 1085 | 1098 | 1117 |
| 157 | Stage IIIA | | | | | | | 623 | 1453 | 2140 |
| 186 | 1991-Stage I | 53 | 54 | 54 | 55 | 55 | 56 | 55 | 56 | 57 |
| 186 | Stage I | | 47 | 48 | 48 | 49 | 49 | 49 | 49 | 50 |
| 186 | Stage II | | | 68 | 207 | 320 | 481 | 480 | 486 | 494 |
| 186 | Stage IIIA | | | | | | | 272 | 685 | 1103 |

Stock data for gasoline tractors 1985-2005.

| Size (kW) | Emission Level | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Certified | <1981 | 13176 | 12541 | 11906 | 11270 | 10635 | 10000 | 9053 | 8148 | 7285 | 6465 | 5687 | 4951 | 4258 | 3607 | 2998 |
| Non certified | <1981 | 26352 | 25082 | 23811 | 22541 | 21270 | 20000 | 19042 | 18041 | 16998 | 15913 | 14785 | 13616 | 12403 | 11149 | 9852 |

*Continued*

| Size (kW) | Emission Level | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|
| Certified | <1981 | 2432 | 1908 | 1427 | 987 | 591 | 236 |
| Non certified | <1981 | 8512 | 7131 | 5707 | 4240 | 2732 | 1180 |

Stock data for harvesters 1985-2008.

| Size Group | Emission Level | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0<S<=50 | <1981 | 26601 | 24394 | 22599 | 22144 | 19842 | 18915 | 17241 | 15607 | 14575 | 12673 | 10700 | 9491 | 6966 | 5446 | 3589 |
| 0<S<=50 | 1981-1990 | 519 | 534 | 550 | 582 | 566 | 591 | 594 | 601 | 635 | 636 | 633 | 683 | 641 | 686 | 672 |
| 50<S<=60 | <1981 | 2703 | 2648 | 2634 | 2785 | 2711 | 2828 | 2847 | 2876 | 3040 | 3044 | 3029 | 3271 | 3068 | 2930 | 2235 |
| 50<S<=60 | 1981-1990 | 853 | 1102 | 1164 | 1275 | 1258 | 1333 | 1341 | 1355 | 1432 | 1434 | 1427 | 1541 | 1446 | 1548 | 1516 |
| 50<S<=60 | 1991-Stage I | | | | | | | 8 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 9 |
| 60<S<=70 | <1981 | 1786 | 1750 | 1741 | 1841 | 1792 | 1869 | 1881 | 1901 | 2009 | 2012 | 2002 | 2162 | 2028 | 2171 | 2127 |
| 60<S<=70 | 1981-1990 | 1138 | 1679 | 1943 | 2237 | 2213 | 2348 | 2363 | 2388 | 2524 | 2527 | 2515 | 2716 | 2547 | 2727 | 2671 |
| 60<S<=70 | 1991-Stage I | | | | | | | 8 | 16 | 18 | 21 | 22 | 24 | 23 | 24 | 24 |
| 70<S<=80 | <1981 | 929 | 910 | 905 | 958 | 932 | 972 | 979 | 989 | 1045 | 1046 | 1041 | 1125 | 1055 | 1129 | 1106 |
| 70<S<=80 | 1981-1990 | 383 | 699 | 1026 | 1165 | 1318 | 1493 | 1502 | 1518 | 1604 | 1606 | 1598 | 1726 | 1619 | 1733 | 1698 |
| 70<S<=80 | 1991-Stage I | | | | | | | 72 | 77 | 83 | 86 | 87 | 96 | 91 | 98 | 96 |
| 70<S<=80 | Stage I | | | | | | | | | | | | | | | 1 |
| 80<S<=90 | <1981 | 323 | 317 | 315 | 333 | 324 | 338 | 340 | 344 | 363 | 364 | 362 | 391 | 367 | 393 | 385 |
| 80<S<=90 | 1981-1990 | 383 | 562 | 645 | 967 | 1107 | 1466 | 1475 | 1491 | 1575 | 1577 | 1570 | 1695 | 1590 | 1702 | 1667 |
| 80<S<=90 | 1991-Stage I | | | | | | | 61 | 158 | 181 | 200 | 200 | 217 | 207 | 222 | 217 |
| 80<S<=90 | Stage I | | | | | | | | | | | | | | | 1 |
| 90<S<=100 | 1981-1990 | 89 | 175 | 235 | 387 | 515 | 670 | 674 | 681 | 720 | 721 | 717 | 775 | 726 | 778 | 762 |
| 90<S<=100 | 1991-Stage I | | | | | | | 180 | 257 | 320 | 329 | 351 | 382 | 367 | 393 | 385 |
| 90<S<=100 | Stage I | | | | | | | | | | | | | | | 1 |
| 100<S<=120 | 1981-1990 | | 54 | 106 | 219 | 334 | 589 | 592 | 599 | 633 | 634 | 630 | 681 | 639 | 684 | 670 |
| 100<S<=120 | 1991-Stage I | | | | | | | 129 | 253 | 316 | 375 | 440 | 567 | 586 | 673 | 660 |
| 100<S<=120 | Stage I | | | | | | | | | | | | | | | 2 |
| 120<S<=140 | 1981-1990 | | | | 4 | 69 | 183 | 184 | 186 | 197 | 197 | 196 | 212 | 199 | 213 | 208 |
| 120<S<=140 | 1991-Stage I | | | | | | | 70 | 148 | 189 | 215 | 319 | 484 | 626 | 804 | 860 |
| 120<S<=140 | Stage I | | | | | | | | | | | | | | | 21 |

| Continued | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 120<S<=140 | Stage II | | | | | | | | |
| 120<S<=140 | Stage IIIA | | | | | | | | |
| 140<S<=160 | 1991-Stage I | 8 | 36 | 69 | 112 | 271 | 354 | 554 | 632 |
| 140<S<=160 | Stage II | | | | | | | | |
| 140<S<=160 | Stage IIIA | | | | | | | | |
| 160<S<=180 | 1991-Stage I | | | | 26 | 69 | 200 | 374 | 440 |
| 160<S<=180 | Stage II | | | | | | | | |
| 160<S<=180 | Stage IIIA | | | | | | | | |
| 180<S<=200 | 1991-Stage I | | | | | 20 | 67 | 117 | 193 |
| 180<S<=200 | Stage II | | | | | | | | |
| 180<S<=200 | Stage IIIA | | | | | | | | |
| 200<S<=220 | 1991-Stage I | | | | | | | 45 | 92 |
| 200<S<=220 | Stage II | | | | | | | | |
| 200<S<=220 | Stage IIIA | | | | | | | | |
| 220<S<=240 | 1991-Stage I | | | | | | | | 3 |
| 220<S<=240 | Stage II | | | | | | | | |
| 220<S<=240 | Stage IIIA | | | | | | | | |
| 240<S<=260 | 1991-Stage I | | | | | | | | 3 |
| 240<S<=260 | Stage II | | | | | | | | |
| 240<S<=260 | Stage IIIA | | | | | | | | |
| 260<S<=280 | 1991-Stage I | | | | | | | | 14 |
| 260<S<=280 | Stage II | | | | | | | | |
| 260<S<=280 | Stage IIIA | | | | | | | | |
| 280<S<=300 | 1991-Stage I | | | | | | | | |
| 280<S<=300 | Stage II | | | | | | | | |
| 280<S<=300 | Stage IIIA | | | | | | | | |
| 300<S<=320 | Stage II | | | | | | | | |
| 300<S<=320 | Stage IIIA | | | | | | | | |

| Size Group | Emission Level | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0<S<=50 | <1981 | 2873 | 1828 | 1236 | 718 | 251 | | | | |
| 0<S<=50 | 1981-1990 | 715 | 748 | 754 | 777 | 826 | 840 | 703 | 580 | 423 |
| 50<S<=60 | <1981 | 1999 | 1549 | 1222 | 854 | 366 | | | | |
| 50<S<=60 | 1981-1990 | 1612 | 1687 | 1702 | 1752 | 1863 | 1894 | 1675 | 1519 | 1261 |
| 50<S<=60 | 1991-Stage I | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 11 |
| 60<S<=70 | <1981 | 2073 | 1626 | 1299 | 934 | 451 | | | | |
| 60<S<=70 | 1981-1990 | 2841 | 2973 | 2999 | 3087 | 3282 | 3338 | 3018 | 2827 | 2513 |

| Continued | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 60<S<=70 | 1991-Stage I | 25 | 26 | 27 | 27 | 29 | 30 | 29 | 29 | 30 |
| 70<S<=80 | <1981 | 1176 | 1231 | 1071 | 699 | 202 | | | | |
| 70<S<=80 | 1981-1990 | 1806 | 1890 | 1906 | 1963 | 2086 | 2122 | 1953 | 1886 | 1832 |
| 70<S<=80 | 1991-Stage I | 102 | 107 | 108 | 111 | 118 | 120 | 118 | 119 | 124 |
| 70<S<=80 | Stage I | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 80<S<=90 | <1981 | 409 | 428 | 432 | 445 | 202 | | | | |
| 80<S<=90 | 1981-1990 | 1773 | 1856 | 1872 | 1927 | 2049 | 2083 | 1916 | 1848 | 1792 |
| 80<S<=90 | 1991-Stage I | 231 | 242 | 244 | 251 | 267 | 272 | 265 | 270 | 279 |
| 80<S<=90 | Stage I | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 90<S<=100 | 1981-1990 | 810 | 848 | 855 | 881 | 936 | 952 | 930 | 945 | 932 |
| 90<S<=100 | 1991-Stage I | 410 | 429 | 433 | 445 | 473 | 481 | 471 | 478 | 494 |
| 90<S<=100 | Stage I | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 100<S<=120 | 1981-1990 | 712 | 745 | 752 | 774 | 823 | 837 | 818 | 830 | 859 |
| 100<S<=120 | 1991-Stage I | 702 | 734 | 740 | 762 | 811 | 824 | 805 | 818 | 846 |
| 100<S<=120 | Stage I | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 120<S<=140 | 1981-1990 | 222 | 232 | 234 | 241 | 256 | 260 | 255 | 258 | 267 |
| 120<S<=140 | 1991-Stage I | 918 | 964 | 972 | 1001 | 1064 | 1082 | 1057 | 1074 | 1111 |
| 120<S<=140 | Stage I | 26 | 30 | 31 | 32 | 34 | 34 | 33 | 34 | 35 |
| 120<S<=140 | Stage II | | | | | 3 | 3 | 3 | 3 | 3 |
| 120<S<=140 | Stage IIIA | | | | | | | 1 | 1 | 1 |
| 140<S<=160 | 1991-Stage I | 715 | 784 | 791 | 814 | 866 | 880 | 860 | 874 | 904 |
| 140<S<=160 | Stage II | | | 22 | 38 | 50 | 57 | 56 | 56 | 58 |
| 140<S<=160 | Stage IIIA | | | | | | | 5 | 8 | 11 |
| 160<S<=180 | 1991-Stage I | 533 | 594 | 599 | 617 | 655 | 666 | 651 | 661 | 684 |
| 160<S<=180 | Stage II | | | 44 | 76 | 95 | 107 | 105 | 106 | 110 |
| 160<S<=180 | Stage IIIA | | | | | | | 8 | 13 | 19 |
| 180<S<=200 | 1991-Stage I | 249 | 296 | 299 | 308 | 327 | 333 | 325 | 330 | 341 |
| 180<S<=200 | Stage II | | | 66 | 99 | 120 | 132 | 129 | 131 | 135 |
| 180<S<=200 | Stage IIIA | | | | | | | 8 | 13 | 19 |
| 200<S<=220 | 1991-Stage I | 142 | 185 | 186 | 192 | 204 | 207 | 203 | 206 | 213 |
| 200<S<=220 | Stage II | | | 44 | 76 | 95 | 107 | 105 | 106 | 110 |
| 200<S<=220 | Stage IIIA | | | | | | | 8 | 13 | 19 |
| 220<S<=240 | 1991-Stage I | 48 | 149 | 150 | 154 | 164 | 167 | 163 | 166 | 171 |
| 220<S<=240 | Stage II | | | 78 | 124 | 170 | 220 | 215 | 218 | 226 |
| 220<S<=240 | Stage IIIA | | | | | | | 55 | 113 | 185 |
| 240<S<=260 | 1991-Stage I | 71 | 140 | 141 | 145 | 154 | 157 | 153 | 156 | 161 |

| *Continued* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 240<S<=260 | Stage II | | | 78 | 137 | 207 | 295 | 289 | 293 | 303 |
| 240<S<=260 | Stage IIIA | | | | | | | 102 | 214 | 350 |
| 260<S<=280 | 1991-Stage I | 61 | 129 | 130 | 134 | 142 | 145 | 141 | 143 | 148 |
| 260<S<=280 | Stage II | | | 78 | 137 | 207 | 295 | 289 | 293 | 303 |
| 260<S<=280 | Stage IIIA | | | | | | | 102 | 214 | 350 |
| 280<S<=300 | 1991-Stage I | | 33 | 33 | 34 | 36 | 37 | 36 | 36 | 38 |
| 280<S<=300 | Stage II | | | 78 | 137 | 207 | 295 | 289 | 293 | 303 |
| 280<S<=300 | Stage IIIA | | | | | | | 102 | 214 | 350 |
| 300<S<=320 | Stage II | | | | 28 | 61 | 104 | 102 | 103 | 107 |
| 300<S<=320 | Stage IIIA | | | | | | | 51 | 107 | 175 |

Stock data for fork lifts 1985-2008.

| FuelCode | Size (kW) | Emission Level | 1985 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 205B | 35 | <1981 | 387 | 260 | 234 | 209 | 183 | 158 | 133 | 107 | 84 | 58 | 30 |
| 205B | 35 | 1981-1990 | 120 | 297 | 297 | 297 | 297 | 297 | 297 | 297 | 297 | 297 | 297 |
| 205B | 35 | 1991-Stage I | | | 26 | 49 | 65 | 93 | 131 | 168 | 218 | 247 | 275 |
| 205B | 35 | Stage II | | | | | | | | | | | |
| 205B | 35 | Stage IIIA | | | | | | | | | | | |
| 205B | 45 | <1981 | 1612 | 1082 | 976 | 870 | 764 | 658 | 552 | 446 | 349 | 243 | 126 |
| 205B | 45 | 1981-1990 | 499 | 1233 | 1233 | 1233 | 1233 | 1233 | 1233 | 1233 | 1233 | 1233 | 1233 |
| 205B | 45 | 1991-Stage I | | | 108 | 203 | 270 | 386 | 544 | 699 | 905 | 1063 | 1063 |
| 205B | 45 | Stage I | | | | | | | | | | | 151 |
| 205B | 45 | Stage II | | | | | | | | | | | |
| 205B | 45 | Stage IIIA | | | | | | | | | | | |
| 205B | 50 | <1981 | 2173 | 1459 | 1316 | 1174 | 1031 | 888 | 745 | 602 | 471 | 328 | 170 |
| 205B | 50 | 1981-1990 | 673 | 1662 | 1662 | 1662 | 1662 | 1662 | 1662 | 1662 | 1662 | 1662 | 1662 |
| 205B | 50 | 1991-Stage I | | | 145 | 273 | 363 | 519 | 732 | 940 | 1217 | 1469 | 1469 |
| 205B | 50 | Stage I | | | | | | | | | | | 240 |
| 205B | 50 | Stage II | | | | | | | | | | | |
| 205B | 50 | Stage IIIA | | | | | | | | | | | |
| 205B | 75 | <1981 | 497 | 334 | 301 | 269 | 236 | 203 | 170 | 138 | 108 | 75 | 39 |
| 205B | 75 | 1981-1990 | 154 | 382 | 382 | 382 | 382 | 382 | 382 | 382 | 382 | 382 | 382 |
| 205B | 75 | 1991-Stage I | | | 33 | 63 | 84 | 120 | 169 | 217 | 281 | 354 | 354 |
| 205B | 75 | Stage I | | | | | | | | | | | 70 |
| 205B | 75 | Stage II | | | | | | | | | | | |
| 205B | 75 | Stage IIIA | | | | | | | | | | | |
| 205B | 120 | <1981 | 111 | 74 | 67 | 60 | 52 | 45 | 38 | 31 | 24 | 17 | 9 |
| 205B | 120 | 1981-1990 | 34 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| 205B | 120 | 1991-Stage I | | | 7 | 14 | 19 | 27 | 38 | 49 | 63 | 97 | 97 |
| 205B | 120 | Stage I | | | | | | | | | | | 32 |
| 205B | 120 | Stage II | | | | | | | | | | | |
| 205B | 120 | Stage IIIA | | | | | | | | | | | |
| 3030 | 33 | | 5420 | 5215 | 5156 | 5068 | 4947 | 4863 | 4835 | 4792 | 4732 | 4765 | 4712 |
| 3030 | 40 | | 4917 | 4730 | 4676 | 4596 | 4486 | 4410 | 4384 | 4344 | 4289 | 4295 | 4223 |
| 3030 | 50 | | 2149 | 2067 | 2044 | 2008 | 1960 | 1926 | 1915 | 1897 | 1874 | 1926 | 1941 |
| 3030 | 78 | | 97 | 93 | 92 | 91 | 89 | 88 | 88 | 87 | 86 | 90 | 92 |
| 3030 | 120 | | | | | | | | | | | 1 | 2 |

| *Continued* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FuelCode | Size (kW) | Emission Level | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| 205B | 35 | <1981 | | | | | | | | | |
| 205B | 35 | 1981-1990 | 297 | 277 | 249 | 232 | 198 | 177 | 135 | 95 | 58 |
| 205B | 35 | 1991-Stage I | 304 | 304 | 304 | 304 | 304 | 304 | 304 | 304 | 304 |
| 205B | 35 | Stage II | | 23 | 53 | 75 | 89 | 117 | 152 | 152 | 152 |
| 205B | 35 | Stage IIIA | | | | | | | | 41 | 76 |
| 205B | 45 | <1981 | | | | | | | | | |
| 205B | 45 | 1981-1990 | 1233 | 1151 | 1036 | 964 | 820 | 734 | 559 | 394 | 239 |
| 205B | 45 | 1991-Stage I | 1063 | 1063 | 1063 | 1063 | 1063 | 1063 | 1063 | 1063 | 1063 |
| 205B | 45 | Stage I | 303 | 422 | 524 | 664 | 664 | 664 | 664 | 664 | 664 |
| 205B | 45 | Stage II | | | | | 104 | 232 | 452 | 612 | 612 |
| 205B | 45 | Stage IIIA | | | | | | | | | 126 |
| 205B | 50 | <1981 | | | | | | | | | |
| 205B | 50 | 1981-1990 | 1662 | 1551 | 1396 | 1299 | 1105 | 989 | 753 | 531 | 322 |
| 205B | 50 | 1991-Stage I | 1469 | 1469 | 1469 | 1469 | 1469 | 1469 | 1469 | 1469 | 1469 |
| 205B | 50 | Stage I | 461 | 682 | 897 | 1135 | 1135 | 1135 | 1135 | 1135 | 1135 |
| 205B | 50 | Stage II | | | | | 187 | 447 | 818 | 1134 | 1134 |
| 205B | 50 | Stage IIIA | | | | | | | | | 181 |
| 205B | 75 | <1981 | | | | | | | | | |
| 205B | 75 | 1981-1990 | 382 | 357 | 321 | 299 | 255 | 228 | 174 | 123 | 75 |
| 205B | 75 | 1991-Stage I | 354 | 354 | 354 | 354 | 354 | 354 | 354 | 354 | 354 |
| 205B | 75 | Stage I | 162 | 234 | 311 | 311 | 311 | 311 | 311 | 311 | 311 |
| 205B | 75 | Stage II | | | | 58 | 129 | 208 | 326 | 326 | 326 |
| 205B | 75 | Stage IIIA | | | | | | | | 142 | 213 |
| 205B | 120 | <1981 | | | | | | | | | |
| 205B | 120 | 1981-1990 | 85 | 80 | 72 | 67 | 57 | 51 | 39 | 28 | 17 |
| 205B | 120 | 1991-Stage I | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| 205B | 120 | Stage I | 71 | 89 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 205B | 120 | Stage II | | | | 16 | 38 | 58 | 112 | 112 | 112 |
| 205B | 120 | Stage IIIA | | | | | | | | 58 | 70 |
| 3030 | 33 | | 4718 | 4677 | 4655 | 4595 | 4494 | 4345 | 4220 | 4154 | 4043 |
| 3030 | 40 | | 4218 | 4214 | 4244 | 4224 | 4166 | 4116 | 4048 | 4005 | 3951 |
| 3030 | 50 | | 1897 | 1938 | 2003 | 2020 | 2018 | 2029 | 2061 | 2136 | 2198 |
| 3030 | 78 | | 88 | 95 | 98 | 99 | 104 | 104 | 114 | 123 | 147 |
| 3030 | 120 | | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

Stock data for construction machinery 1985-2008.

| EquipmentName (Eng) | Emission Level | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Track type dozers | <1981 | 125 | 100 | 75 | 50 | 25 | | | | | | | | | | |
| Track type dozers | 1981-1990 | 125 | 150 | 175 | 200 | 225 | 250 | 221 | 193 | 166 | 139 | 114 | 89 | 66 | 43 | 21 |
| Track type dozers | 1991-Stage I | | | | | | | 25 | 48 | 71 | 93 | 114 | 134 | 153 | 172 | 189 |
| Track type dozers | Stage II | | | | | | | | | | | | | | | |
| Track type dozers | Stage IIIA | | | | | | | | | | | | | | | |
| Track type loaders | <1981 | 50 | 40 | 30 | 20 | 10 | | | | | | | | | | |
| Track type loaders | 1981-1990 | 50 | 60 | 70 | 80 | 90 | 100 | 89 | 79 | 68 | 58 | 48 | 38 | 28 | 19 | 9 |
| Track type loaders | 1991-Stage I | | | | | | | 10 | 20 | 29 | 39 | 48 | 57 | 66 | 75 | 83 |
| Track type loaders | Stage II | | | | | | | | | | | | | | | |
| Track type loaders | Stage IIIA | | | | | | | | | | | | | | | |
| Wheel loaders (0-5 tonnes) | 1981-1990 | | | | | | | 186 | 331 | 434 | 496 | 517 | 496 | 434 | 331 | 186 |
| Wheel loaders (0-5 tonnes) | 1991-Stage I | | | | | | | 21 | 83 | 186 | 331 | 517 | 744 | 1013 | 1323 | 1674 |
| Wheel loaders (0-5 tonnes) | Stage II | | | | | | | | | | | | | | | |
| Wheel loaders (0-5 tonnes) | Stage IIIA | | | | | | | | | | | | | | | |
| Wheel loaders (> 5,1 tonnes) | <1981 | 1250 | 1000 | 750 | 500 | 250 | | | | | | | | | | |
| Wheel loaders (> 5,1 tonnes) | 1981-1990 | 1250 | 1500 | 1750 | 2000 | 2250 | 2500 | 2228 | 1960 | 1698 | 1441 | 1188 | 941 | 698 | 460 | 228 |
| Wheel loaders (> 5,1 tonnes) | 1991-Stage I | | | | | | | 248 | 490 | 728 | 960 | 1188 | 1411 | 1629 | 1841 | 1822 |
| Wheel loaders (> 5,1 tonnes) | Stage I | | | | | | | | | | | | | | | 228 |
| Wheel loaders (> 5,1 tonnes) | Stage II | | | | | | | | | | | | | | | |
| Wheel loaders (> 5,1 tonnes) | Stage IIIA | | | | | | | | | | | | | | | |
| Wheel type excavators | <1981 | 500 | 400 | 300 | 200 | 100 | | | | | | | | | | |
| Wheel type excavators | 1981-1990 | 500 | 600 | 700 | 800 | 900 | 1000 | 862 | 732 | 611 | 498 | 394 | 298 | 211 | 132 | 62 |
| Wheel type excavators | 1991-Stage I | | | | | | | 96 | 183 | 262 | 332 | 394 | 447 | 491 | 528 | 493 |
| Wheel type excavators | Stage I | | | | | | | | | | | | | | | 62 |
| Wheel type excavators | Stage II | | | | | | | | | | | | | | | |
| Wheel type excavators | Stage IIIA | | | | | | | | | | | | | | | |
| Track type excavators (0-5 tonnes) | 1981-1990 | | | | | | | 459 | 816 | 1071 | 1224 | 1275 | 1224 | 1071 | 816 | 459 |
| Track type excavators (0-5 tonnes) | 1991-Stage I | | | | | | | 51 | 204 | 459 | 816 | 1275 | 1837 | 2500 | 3265 | 4132 |
| Track type excavators (0-5 tonnes) | Stage II | | | | | | | | | | | | | | | |
| Track type excavators (0-5 tonnes) | Stage IIIA | | | | | | | | | | | | | | | |
| Track type excavators (>5,1 tonnes) | <1981 | 1000 | 800 | 600 | 400 | 200 | | | | | | | | | | |
| Track type excavators (>5,1 tonnes) | 1981-1990 | 1000 | 1200 | 1400 | 1600 | 1800 | 2000 | 1798 | 1596 | 1394 | 1194 | 993 | 794 | 594 | 396 | 198 |
| Track type excavators (>5,1 tonnes) | 1991-Stage I | | | | | | | 200 | 399 | 598 | 796 | 993 | 1190 | 1387 | 1583 | 1581 |
| Track type excavators (>5,1 tonnes) | Stage I | | | | | | | | | | | | | | | 198 |
| Track type excavators (>5,1 tonnes) | Stage II | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Track type excavators (>5,1 tonnes) | Stage IIIA | | | | | | | | | | | | | | | |
| Excavators/Loaders | <1981 | 2100 | 1680 | 1260 | 840 | 420 | | | | | | | | | | |
| Excavators/Loaders | 1981-1990 | 2100 | 2520 | 2940 | 3360 | 3780 | 4200 | 3807 | 3408 | 3003 | 2592 | 2175 | 1752 | 1323 | 888 | 447 |
| Excavators/Loaders | 1991-Stage I | | | | | | | 423 | 852 | 1287 | 1728 | 2175 | 2628 | 3087 | 3552 | 3575 |
| Excavators/Loaders | Stage I | | | | | | | | | | | | | | | 447 |
| Excavators/Loaders | Stage II | | | | | | | | | | | | | | | |
| Excavators/Loaders | Stage IIIA | | | | | | | | | | | | | | | |
| Dump trucks | <1981 | 250 | 200 | 150 | 100 | 50 | | | | | | | | | | |
| Dump trucks | 1981-1990 | 250 | 300 | 350 | 400 | 450 | 500 | 489 | 469 | 441 | 404 | 358 | 304 | 241 | 169 | 89 |
| Dump trucks | 1991-Stage I | | | | | | | 54 | 117 | 189 | 269 | 358 | 455 | 561 | 676 | 711 |
| Dump trucks | Stage I | | | | | | | | | | | | | | | 89 |
| Dump trucks | Stage II | | | | | | | | | | | | | | | |
| Dump trucks | Stage IIIA | | | | | | | | | | | | | | | |
| Mini loaders | <1981 | 1800 | 1600 | 1400 | 1200 | 1000 | 800 | 635 | 447 | 235 | | | | | | |
| Mini loaders | 1981-1990 | 1000 | 1200 | 1400 | 1600 | 1800 | 2000 | 2118 | 2237 | 2355 | 2473 | 2332 | 2168 | 1980 | 1768 | 1532 |
| Mini loaders | 1991-Stage I | | | | | | | 212 | 447 | 706 | 989 | 1296 | 1626 | 1980 | 2357 | 2758 |
| Mini loaders | Stage II | | | | | | | | | | | | | | | |
| Mini loaders | Stage IIIA | | | | | | | | | | | | | | | |
| Telescopic loaders | 1981-1990 | | | | | | | | | | | 149 | 265 | 348 | 398 | 414 |
| Telescopic loaders | 1991-Stage I | | | | | | | | | | | 83 | 199 | 348 | 530 | 746 |
| Telescopic loaders | Stage II | | | | | | | | | | | | | | | |
| Telescopic loaders | Stage IIIA | | | | | | | | | | | | | | | |

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| EquipmentName (Eng) | Emission Level | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| Track type dozers | <1981 | | | | | | | | | |
| Track type dozers | 1981-1990 | | | | | | | | | |
| Track type dozers | 1991-Stage I | 206 | 201 | 177 | 154 | 132 | 128 | 125 | 116 | 95 |
| Track type dozers | Stage II | | | 20 | 38 | 56 | 86 | 100 | 116 | 126 |
| Track type dozers | Stage IIIA | | | | | | | 25 | 58 | 95 |
| Track type loaders | <1981 | | | | | | | | | |
| Track type loaders | 1981-1990 | | | | | | | | | |
| Track type loaders | 1991-Stage I | 91 | 91 | 81 | 71 | 62 | 61 | 71 | 68 | 55 |
| Track type loaders | Stage II | | | 9 | 18 | 26 | 40 | 56 | 68 | 73 |
| Track type loaders | Stage IIIA | | | | | | | 14 | 34 | 55 |
| Wheel loaders (0-5 tonnes) | 1981-1990 | | | | | | | | | |
| Wheel loaders (0-5 tonnes) | 1991-Stage I | 2067 | 2046 | 1984 | 1881 | 1736 | 1444 | 1269 | 1045 | 726 |
| Wheel loaders (0-5 tonnes) | Stage II | | 227 | 496 | 806 | 1158 | 1444 | 1903 | 2090 | 2177 |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wheel loaders (0-5 tonnes) | Stage IIIA | | | | | | | | 348 | 726 |
| Wheel loaders (> 5,1 tonnes) | <1981 | | | | | | | | | |
| Wheel loaders (> 5,1 tonnes) | 1981-1990 | | | | | | | | | |
| Wheel loaders (> 5,1 tonnes) | 1991-Stage I | 1802 | 1559 | 1322 | 1089 | 861 | 677 | 485 | 273 | |
| Wheel loaders (> 5,1 tonnes) | Stage I | 450 | 668 | 881 | 871 | 861 | 902 | 969 | 1092 | 1174 |
| Wheel loaders (> 5,1 tonnes) | Stage II | | | | 218 | 431 | 677 | 969 | 1092 | 1174 |
| Wheel loaders (> 5,1 tonnes) | Stage IIIA | | | | | | | | 273 | 587 |
| Wheel type excavators | <1981 | | | | | | | | | |
| Wheel type excavators | 1981-1990 | | | | | | | | | |
| Wheel type excavators | 1991-Stage I | 459 | 372 | 293 | 223 | 162 | 118 | 74 | 38 | |
| Wheel type excavators | Stage I | 115 | 160 | 196 | 179 | 162 | 157 | 148 | 152 | 146 |
| Wheel type excavators | Stage II | | | | 45 | 81 | 118 | 148 | 152 | 146 |
| Wheel type excavators | Stage IIIA | | | | | | | | 38 | 73 |
| Track type excavators (0-5 tonnes) | 1981-1990 | | | | | | | | | |
| Track type excavators (0-5 tonnes) | 1991-Stage I | 5101 | 5050 | 4897 | 4642 | 4285 | 3889 | 3599 | 3027 | 2073 |
| Track type excavators (0-5 tonnes) | Stage II | | 561 | 1224 | 1990 | 2857 | 3889 | 5399 | 6054 | 6220 |
| Track type excavators (0-5 tonnes) | Stage IIIA | | | | | | | | 1009 | 2073 |
| Track type excavators (>5,1 tonnes) | <1981 | | | | | | | | | |
| Track type excavators (>5,1 tonnes) | 1981-1990 | | | | | | | | | |
| Track type excavators (>5,1 tonnes) | 1991-Stage I | 1579 | 1380 | 1181 | 983 | 785 | 683 | 536 | 313 | |
| Track type excavators (>5,1 tonnes) | Stage I | 395 | 591 | 787 | 786 | 785 | 910 | 1073 | 1251 | 1338 |
| Track type excavators (>5,1 tonnes) | Stage II | | | | 197 | 393 | 683 | 1073 | 1251 | 1338 |
| Track type excavators (>5,1 tonnes) | Stage IIIA | | | | | | | | 313 | 669 |
| Excavators/Loaders | <1981 | | | | | | | | | |
| Excavators/Loaders | 1981-1990 | | | | | | | | | |
| Excavators/Loaders | 1991-Stage I | 3599 | 3170 | 2735 | 2295 | 1848 | 1370 | 938 | 481 | |
| Excavators/Loaders | Stage I | 900 | 1359 | 1824 | 2295 | 2310 | 2283 | 2344 | 2403 | 2314 |
| Excavators/Loaders | Stage II | | | | | 462 | 913 | 1406 | 1922 | 1851 |
| Excavators/Loaders | Stage IIIA | | | | | | | | | 463 |
| Dump trucks | <1981 | | | | | | | | | |
| Dump trucks | 1981-1990 | | | | | | | | | |
| Dump trucks | 1991-Stage I | 745 | 682 | 611 | 530 | 442 | 385 | 301 | 176 | |
| Dump trucks | Stage I | 186 | 292 | 407 | 530 | 552 | 642 | 752 | 880 | 943 |
| Dump trucks | Stage II | | | | | 110 | 257 | 451 | 704 | 754 |
| Dump trucks | Stage IIIA | | | | | | | | | 189 |
| Mini loaders | <1981 | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Mini loaders | 1981-1990 | 1273 | 990 | 684 | 354 | | | | | |
| Mini loaders | 1991-Stage I | 3183 | 3301 | 3419 | 3537 | 3656 | 2756 | 2294 | 1077 | 715 |
| Mini loaders | Stage II | | 330 | 684 | 1061 | 1462 | 1531 | 1720 | 923 | 715 |
| Mini loaders | Stage IIIA | | | | | | | | 154 | 238 |
| Telescopic loaders | 1981-1990 | 398 | 348 | 265 | 149 | | | | | |
| Telescopic loaders | 1991-Stage I | 994 | 1160 | 1326 | 1491 | 1657 | 1740 | 1837 | 1846 | 1687 |
| Telescopic loaders | Stage II | | 116 | 265 | 447 | 663 | 966 | 1378 | 1582 | 1687 |
| Telescopic loaders | Stage IIIA | | | | | | | | 264 | 562 |

Stock data for machine pools 1985-2008.

| EquipmentName (Eng) | Emission Level | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tractors (machine pools) | <1981 | 1236 | 627 | | | | | | | | | | | | | |
| Tractors (machine pools) | 1981-1990 | 3091 | 3763 | 4575 | 4515 | 4370 | 4100 | 3643 | 2808 | 2368 | 1786 | 1214 | 604 | | | |
| Tractors (machine pools) | 1991-Stage I | | | | | | | 607 | 1123 | 1776 | 2382 | 3035 | 3624 | 4324 | 4210 | 4336 |
| Tractors (machine pools) | Stage I | | | | | | | | | | | | | | | |
| Tractors (machine pools) | Stage II | | | | | | | | | | | | | | | |
| Tractors (machine pools) | Stage IIIA | | | | | | | | | | | | | | | |
| Harvesters (machine pools) | <1981 | 969 | 776 | 661 | 472 | 287 | 139 | | | | | | | | | |
| Harvesters (machine pools) | 1981-1990 | 807 | 932 | 1157 | 1257 | 1294 | 1385 | 1385 | 1197 | 927 | 794 | 712 | 512 | 421 | 282 | 162 |
| Harvesters (machine pools) | 1991-Stage I | | | | | | | 139 | 266 | 348 | 454 | 593 | 615 | 737 | 751 | 729 |
| Harvesters (machine pools) | Stage II | | | | | | | | | | | | | | | |
| Harvesters (machine pools) | Stage IIIA | | | | | | | | | | | | | | | |
| Self-propelled vehicles (machine pools) | 1981-1990 | | | | | | | | | 72 | 61 | 38 | | | | |
| Self-propelled vehicles (machine pools) | 1991-Stage I | | | | | | | | | 72 | 122 | 190 | 263 | 278 | 277 | 295 |
| Self-propelled vehicles (machine pools) | Stage II | | | | | | | | | | | | | | | |
| Self-propelled vehicles (machine pools) | Stage IIIA | | | | | | | | | | | | | | | |

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| EquipmentName (Eng) | Emission Level | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| Tractors (machine pools) | <1981 | | | | | | | | | |
| Tractors (machine pools) | 1981-1990 | | | | | | | | | |
| Tractors (machine pools) | 1991-Stage I | 3956 | 4069 | 3323 | 2566 | 2066 | 1421 | 927 | 487 | |
| Tractors (machine pools) | Stage I | | | 554 | 513 | 517 | 474 | 464 | 487 | 487 |
| Tractors (machine pools) | Stage II | | | | 513 | 1033 | 1421 | 1855 | 1946 | 1946 |
| Tractors (machine pools) | Stage IIIA | | | | | | | | 487 | 973 |
| Harvesters (machine pools) | <1981 | | | | | | | | | |
| Harvesters (machine pools) | 1981-1990 | 78 | | | | | | | | |
| Harvesters (machine pools) | 1991-Stage I | 778 | 779 | 651 | 531 | 472 | 300 | 257 | 211 | 169 |
| Harvesters (machine pools) | Stage II | | | 65 | 118 | 177 | 171 | 172 | 169 | 169 |
| Harvesters (machine pools) | Stage IIIA | | | | | | | 43 | 85 | 127 |
| Self-propelled vehicles (machine pools) | 1981-1990 | | | | | | | | | |
| Self-propelled vehicles (machine pools) | 1991-Stage I | 289 | 314 | 237 | 203 | 153 | 99 | 49 | | |
| Self-propelled vehicles (machine pools) | Stage II | | | 47 | 102 | 153 | 199 | 194 | 189 | 142 |
| Self-propelled vehicles (machine pools) | Stage IIIA | | | | | | | 49 | 94 | 142 |

Stock data for household and gardening 1985-2008.

| EquipmentName (Eng) | Emission Level | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lawn movers (private) | <1981 | 253125 | 168750 | 84375 | | | | | | | | | | | | |
| Lawn movers (private) | 1981-1990 | 421875 | 506250 | 590625 | 675000 | 675000 | 675000 | 590625 | 506250 | 421875 | 337500 | 253125 | 168750 | 84375 | | |
| Lawn movers (private) | 1991-Stage I | | | | | | | 84375 | 168750 | 253125 | 337500 | 421875 | 506250 | 590625 | 675000 | 675000 |
| Lawn movers (private) | Stage I | | | | | | | | | | | | | | | |
| Lawn movers (private) | Stage II | | | | | | | | | | | | | | | |
| Lawn movers (professional) | 1981-1990 | 25000 | 25000 | 25000 | 25000 | 25000 | 25000 | 18750 | 12500 | 6250 | | | | | | |
| Lawn movers (professional) | 1991-Stage I | | | | | | | 6250 | 12500 | 18750 | 25000 | 25000 | 25000 | 25000 | 25000 | 25000 |
| Lawn movers (professional) | Stage I | | | | | | | | | | | | | | | |
| Lawn movers (professional) | Stage II | | | | | | | | | | | | | | | |
| Cultivators (private-large) | <1981 | 73333 | 66000 | 58667 | 51333 | 44000 | 36667 | 29333 | 22000 | 14667 | 7333 | | | | | |
| Cultivators (private-large) | 1981-1990 | 36667 | 44000 | 51333 | 58667 | 66000 | 73333 | 73333 | 73333 | 73333 | 73333 | 73333 | 66000 | 58667 | 51333 | 44000 |
| Cultivators (private-large) | 1991-Stage I | | | | | | | 7333 | 14667 | 22000 | 29333 | 36667 | 44000 | 51333 | 58667 | 66000 |
| Cultivators (private-large) | Stage II | | | | | | | | | | | | | | | |
| Cultivators (private-small) | 1981-1990 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 8000 | 6000 | 4000 | 2000 | | | | | |
| Cultivators (private-small) | 1991-Stage I | | | | | | | 2000 | 4000 | 6000 | 8000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| Cultivators (private-small) | Stage II | | | | | | | | | | | | | | | |
| Cultivators (professional) | <1981 | 3750 | 2500 | 1250 | | | | | | | | | | | | |
| Cultivators (professional) | 1981-1990 | 6250 | 7500 | 8750 | 10000 | 10000 | 10000 | 8750 | 7500 | 6250 | 5000 | 3750 | 2500 | 1250 | | |
| Cultivators (professional) | 1991-Stage I | | | | | | | 1250 | 2500 | 3750 | 5000 | 6250 | 7500 | 8750 | 10000 | 10000 |
| Cultivators (professional) | Stage I | | | | | | | | | | | | | | | |
| Cultivators (professional) | Stage II | | | | | | | | | | | | | | | |
| Chain saws (private) | <1981 | 125000 | 100000 | 75000 | 50000 | 25000 | | | | | | | | | | |
| Chain saws (private) | 1981-1990 | 125000 | 150000 | 175000 | 200000 | 225000 | 250000 | 227250 | 204000 | 180250 | 156000 | 131250 | 106000 | 80250 | 54000 | 27250 |
| Chain saws (private) | 1991-Stage I | | | | | | | 25250 | 51000 | 77250 | 104000 | 131250 | 159000 | 187250 | 216000 | 245250 |
| Chain saws (private) | Stage I | | | | | | | | | | | | | | | |
| Chain saws (private) | Stage II | | | | | | | | | | | | | | | |
| Chain saws (professional) | 1981-1990 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 7333 | 4000 | | | | | | | |
| Chain saws (professional) | 1991-Stage I | | | | | | | 3667 | 8000 | 13000 | 14000 | 15000 | 16000 | 17000 | 18000 | 19000 |
| Chain saws (professional) | Stage I | | | | | | | | | | | | | | | |
| Riders (private) | <1981 | 40950 | 35100 | 29250 | 23400 | 17550 | 11700 | 5880 | | | | | | | | |
| Riders (private) | 1981-1990 | 29250 | 35100 | 40950 | 46800 | 52650 | 58500 | 58796 | 59388 | 54248 | 49167 | 44056 | 38828 | 33392 | 27660 | 21544 |
| Riders (private) | 1991-Stage I | | | | | | | 5880 | 11878 | 18083 | 24583 | 31469 | 38828 | 46748 | 55320 | 64631 |
| Riders (private) | Stage I | | | | | | | | | | | | | | | |
| Riders (private) | Stage II | | | | | | | | | | | | | | | |
| Riders (professional) | 1981-1990 | 4800 | 4800 | 4800 | 4800 | 4800 | 4800 | 3878 | 2966 | 2035 | 1056 | | | | | |
| Riders (professional) | 1991-Stage I | | | | | | | 970 | 1978 | 3053 | 4224 | 5520 | 5760 | 6000 | 6240 | 6480 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Riders (professional) | Stage I | | | | | | | | | | | | | | | |
| Riders (professional) | Stage II | | | | | | | | | | | | | | | |
| Shrub clearers (private) | <1981 | 24000 | 19200 | 14400 | 9600 | 4800 | | | | | | | | | | |
| Shrub clearers (private) | 1981-1990 | 24000 | 28800 | 33600 | 38400 | 43200 | 48000 | 47520 | 46080 | 43680 | 40320 | 36000 | 30720 | 24480 | 17280 | 9120 |
| Shrub clearers (private) | 1991-Stage I | | | | | | | 5280 | 11520 | 18720 | 26880 | 36000 | 46080 | 57120 | 69120 | 82080 |
| Shrub clearers (private) | Stage I | | | | | | | | | | | | | | | |
| Shrub clearers (private) | Stage II | | | | | | | | | | | | | | | |
| Shrub clearers (professional) | 1981-1990 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 1650 | 1200 | 650 | | | | | | |
| Shrub clearers (professional) | 1991-Stage I | | | | | | | 550 | 1200 | 1950 | 2800 | 3000 | 3200 | 3400 | 3600 | 3800 |
| Shrub clearers (professional) | Stage I | | | | | | | | | | | | | | | |
| Shrub clearers (professional) | Stage II | | | | | | | | | | | | | | | |
| Hedge cutters (private) | <1981 | 6850 | 5480 | 4110 | 2740 | 1370 | | | | | | | | | | |
| Hedge cutters (private) | 1981-1990 | 6850 | 8220 | 9590 | 10960 | 12330 | 13700 | 15237 | 16128 | 16373 | 15972 | 14925 | 13232 | 10893 | 7908 | 4277 |
| Hedge cutters (private) | 1991-Stage I | | | | | | | 1693 | 4032 | 7017 | 10648 | 14925 | 19848 | 25417 | 31632 | 38493 |
| Hedge cutters (private) | Stage I | | | | | | | | | | | | | | | |
| Hedge cutters (private) | Stage II | | | | | | | | | | | | | | | |
| Hedge cutters (professional) | 1981-1990 | 1300 | 1300 | 1300 | 1300 | 1300 | 1300 | 1178 | 920 | 528 | | | | | | |
| Hedge cutters (professional) | 1991-Stage I | | | | | | | 393 | 920 | 1583 | 2380 | 2650 | 2920 | 3190 | 3460 | 3730 |
| Hedge cutters (professional) | Stage I | | | | | | | | | | | | | | | |
| Hedge cutters (professional) | Stage II | | | | | | | | | | | | | | | |
| Trimmers (private) | <1981 | 25500 | 20400 | 15300 | 10200 | 5100 | | | | | | | | | | |
| Trimmers (private) | 1981-1990 | 25500 | 30600 | 35700 | 40800 | 45900 | 51000 | 48086 | 44686 | 40800 | 36429 | 31571 | 26229 | 20400 | 14086 | 7286 |
| Trimmers (private) | 1991-Stage I | | | | | | | 5343 | 11171 | 17486 | 24286 | 31571 | 39343 | 47600 | 56343 | 65571 |
| Trimmers (private) | Stage I | | | | | | | | | | | | | | | |
| Trimmers (private) | Stage II | | | | | | | | | | | | | | | |
| Trimmers (professional) | 1981-1990 | 9000 | 9000 | 9000 | 9000 | 9000 | 9000 | 7071 | 4929 | 2571 | | | | | | |
| Trimmers (professional) | 1991-Stage I | | | | | | | 2357 | 4929 | 7714 | 10714 | 11143 | 11571 | 12000 | 12429 | 12857 |
| Trimmers (professional) | Stage I | | | | | | | | | | | | | | | |
| Trimmers (professional) | Stage II | | | | | | | | | | | | | | | |

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| EquipmentName (Eng) | Emission Level | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| Lawn movers (private) | <1981 | | | | | | | | | |
| Lawn movers (private) | 1981-1990 | | | | | | | | | |
| Lawn movers (private) | 1991-Stage I | 675000 | 675000 | 675000 | 675000 | 675000 | 595000 | 513750 | 428125 | 342500 |
| Lawn movers (private) | Stage I | | | | | | 85000 | 171250 | 256875 | 256875 |
| Lawn movers (private) | Stage II | | | | | | | | | 85625 |
| Lawn movers (professional) | 1981-1990 | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Lawn movers (professional) | 1991-Stage I | 25000 | 25000 | 25000 | 25000 | 25000 | 18750 | 12500 | 6250 | |
| Lawn movers (professional) | Stage I | | | | | | 6250 | 12500 | 18750 | 18750 |
| Lawn movers (professional) | Stage II | | | | | | | | | 6250 |
| Cultivators (private-large) | <1981 | | | | | | | | | |
| Cultivators (private-large) | 1981-1990 | 36667 | 29333 | 22000 | 14667 | 7333 | | | | |
| Cultivators (private-large) | 1991-Stage I | 73333 | 80667 | 88000 | 95333 | 102667 | 102667 | 95333 | 88000 | 80667 |
| Cultivators (private-large) | Stage II | | | | | | 7333 | 14667 | 22000 | 29333 |
| Cultivators (private-small) | 1981-1990 | | | | | | | | | |
| Cultivators (private-small) | 1991-Stage I | 10000 | 10000 | 10000 | 10000 | 10000 | 8000 | 6000 | 4000 | 2000 |
| Cultivators (private-small) | Stage II | | | | | | 2000 | 4000 | 6000 | 8000 |
| Cultivators (professional) | <1981 | | | | | | | | | |
| Cultivators (professional) | 1981-1990 | | | | | | | | | |
| Cultivators (professional) | 1991-Stage I | 10000 | 10000 | 10000 | 10000 | 10000 | 8750 | 7500 | 6250 | 5000 |
| Cultivators (professional) | Stage I | | | | | | 1250 | 2500 | 3750 | 3750 |
| Cultivators (professional) | Stage II | | | | | | | | | 1250 |
| Chain saws (private) | <1981 | | | | | | | | | |
| Chain saws (private) | 1981-1990 | | | | | | | | | |
| Chain saws (private) | 1991-Stage I | 275000 | 280750 | 286500 | 292250 | 298000 | 268200 | 238400 | 208600 | 178800 |
| Chain saws (private) | Stage I | | | | | | 29800 | 59600 | 89400 | 89400 |
| Chain saws (private) | Stage II | | | | | | | | | 29800 |
| Chain saws (professional) | 1981-1990 | | | | | | | | | |
| Chain saws (professional) | 1991-Stage I | 20000 | 27500 | 35000 | 42500 | 50000 | 33333 | 16667 | | |
| Chain saws (professional) | Stage I | | | | | | 16667 | 33333 | 50000 | 50000 |
| Riders (private) | <1981 | | | | | | | | | |
| Riders (private) | 1981-1990 | 14954 | 7910 | | | | | | | |
| Riders (private) | 1991-Stage I | 74771 | 87015 | 101775 | 109920 | 119360 | 117741 | 114313 | 107663 | 99047 |
| Riders (private) | Stage I | | | | | | 10704 | 22863 | 23925 | 24762 |
| Riders (private) | Stage II | | | | | | | | 11963 | 24762 |
| Riders (professional) | 1981-1990 | | | | | | | | | |
| Riders (professional) | 1991-Stage I | 6720 | 7802 | 9726 | 12492 | 16100 | 15728 | 13398 | 9444 | 4800 |
| Riders (professional) | Stage I | | | | | | 3932 | 8932 | 9444 | 9600 |
| Riders (professional) | Stage II | | | | | | | | 4722 | 9600 |
| Shrub clearers (private) | <1981 | | | | | | | | | |
| Shrub clearers (private) | 1981-1990 | | | | | | | | | |
| Shrub clearers (private) | 1991-Stage I | 96000 | 107000 | 118000 | 129000 | 140000 | 126000 | 112000 | 98000 | 84000 |
| Shrub clearers (private) | Stage I | | | | | | 14000 | 28000 | 42000 | 42000 |
| Shrub clearers (private) | Stage II | | | | | | | | | 14000 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | | | | |
| Shrub clearers (professional) | 1981-1990 | | | | | | | | | |
| Shrub clearers (professional) | 1991-Stage I | 4000 | 5500 | 7000 | 8500 | 10000 | 7500 | 5000 | 2500 | |
| Shrub clearers (professional) | Stage I | | | | | | 2500 | 5000 | 7500 | 7500 |
| Shrub clearers (professional) | Stage II | | | | | | | | | 2500 |
| Hedge cutters (private) | <1981 | | | | | | | | | |
| Hedge cutters (private) | 1981-1990 | | | | | | | | | |
| Hedge cutters (private) | 1991-Stage I | 46000 | 52900 | 59800 | 66700 | 73600 | 66240 | 58880 | 51520 | 44160 |
| Hedge cutters (private) | Stage I | | | | | | 7360 | 14720 | 22080 | 22080 |
| Hedge cutters (private) | Stage II | | | | | | | | | 7360 |
| Hedge cutters (professional) | 1981-1990 | | | | | | | | | |
| Hedge cutters (professional) | 1991-Stage I | 4000 | 4600 | 5200 | 5800 | 6400 | 4800 | 3200 | 1600 | |
| Hedge cutters (professional) | Stage I | | | | | | 1600 | 3200 | 4800 | 4800 |
| Hedge cutters (professional) | Stage II | | | | | | | | | 1600 |
| Trimmers (private) | <1981 | | | | | | | | | |
| Trimmers (private) | 1981-1990 | | | | | | | | | |
| Trimmers (private) | 1991-Stage I | 75286 | 77714 | 80143 | 82571 | 85000 | 76500 | 68000 | 59500 | 51000 |
| Trimmers (private) | Stage I | | | | | | 8500 | 17000 | 25500 | 25500 |
| Trimmers (private) | Stage II | | | | | | | | | 8500 |
| Trimmers (professional) | 1981-1990 | | | | | | | | | |
| Trimmers (professional) | 1991-Stage I | 13286 | 13714 | 14143 | 14571 | 15000 | 11250 | 7500 | 3750 | |
| Trimmers (professional) | Stage I | | | | | | 3750 | 7500 | 11250 | 11250 |
| Trimmers (professional) | Stage II | | | | | | | | | 3750 |

Stock data for small boats and pleasure crafts 1985-2008.

| Fuel | Engine | Boat type | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diesel | | Motor boats (27-34 ft) | 1550 | 1550 | 1719 | 1889 | 2058 | 2228 | 2397 | 2567 | 2736 | 2906 | 3075 | 3244 | 3414 | 3583 | 3753 |
| Diesel | | Motor boats (> 34 ft) | 450 | 450 | 503 | 556 | 608 | 661 | 714 | 767 | 819 | 872 | 925 | 978 | 1031 | 1083 | 1136 |
| Diesel | | Motor boats <(27 ft) | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Diesel | | Motor sailors | 3500 | 3500 | 3583 | 3667 | 3750 | 3833 | 3917 | 4000 | 4083 | 4167 | 4250 | 4333 | 4417 | 4500 | 4583 |
| Diesel | | Sailing boats (> 26 ft) | 7500 | 7500 | 7917 | 8333 | 8750 | 9167 | 9583 | 10000 | 10417 | 10833 | 11250 | 11667 | 12083 | 12500 | 12917 |
| Benzin | 2-stroke | Other boats (< 20 ft) | 4000 | 4000 | 4056 | 4111 | 4167 | 4222 | 4278 | 4333 | 4389 | 4444 | 4500 | 4556 | 4565 | 4527 | 4439 |
| Benzin | 2-stroke | Yawls and cabin boats | 4000 | 4000 | 4056 | 4111 | 4167 | 4222 | 4278 | 4333 | 4389 | 4444 | 4500 | 4556 | 4565 | 4527 | 4439 |
| Benzin | 2-stroke | Sailing boats (< 26 ft) | 19000 | 19000 | 18778 | 18556 | 18333 | 18111 | 17889 | 17667 | 17444 | 17222 | 17000 | 16778 | 16390 | 15843 | 15144 |
| Benzin | 2-stroke | Speed boats | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 2970 | 2910 | 2820 |
| Benzin | 2-stroke | Water scooters | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 990 | 970 | 940 |
| Benzin | 4-stroke | Other boats (< 20 ft) | | | | | | | | | | | | | 46 | 140 | 283 |
| Benzin | 4-stroke | Yawls and cabin boats | | | | | | | | | | | | | 46 | 140 | 283 |
| Benzin | 4-stroke | Sailing boats (< 26 ft) | | | | | | | | | | | | | 166 | 490 | 967 |
| Benzin | 4-stroke | Speed boats | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Benzin | 4-stroke | Speed boats | | | | | | | | | | | | | 30 | 90 | 180 |
| Benzin | 4-stroke | Water scooters | | | | | | | | | | | | | 10 | 30 | 60 |

*Continued*

| Fuel | Engine | Boat type | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Diesel | | Motor boats (27-34 ft) | 3922 | 4092 | 4261 | 4431 | 4600 | 4600 | 4600 | 4600 | 4600 |
| Diesel | | Motor boats (> 34 ft) | 1189 | 1242 | 1294 | 1347 | 1400 | 1400 | 1400 | 1400 | 1400 |
| Diesel | | Motor boats <(27 ft) | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Diesel | | Motor sailors | 4667 | 4750 | 4833 | 4917 | 5000 | 5000 | 5000 | 5000 | 5000 |
| Diesel | | Sailing boats (> 26 ft) | 13333 | 13750 | 14167 | 14583 | 15000 | 15000 | 15000 | 15000 | 15000 |
| Benzin | 2-stroke | Other boats (< 20 ft) | 4300 | 4108 | 3862 | 3560 | 3200 | 2750 | 2250 | 1800 | 1400 |
| Benzin | 2-stroke | Yawls and cabin boats | 4300 | 4108 | 3862 | 3560 | 3200 | 2750 | 2250 | 1800 | 1400 |
| Benzin | 2-stroke | Sailing boats (< 26 ft) | 14300 | 13317 | 12201 | 10960 | 9600 | 8250 | 6750 | 5400 | 4200 |
| Benzin | 2-stroke | Speed boats | 2700 | 2550 | 2370 | 2160 | 1920 | 1650 | 1350 | 1080 | 840 |
| Benzin | 2-stroke | Water scooters | 900 | 850 | 790 | 720 | 640 | 550 | 450 | 360 | 280 |
| Benzin | 4-stroke | Other boats (< 20 ft) | 478 | 725 | 1027 | 1384 | 1800 | 2250 | 2750 | 3200 | 3600 |
| Benzin | 4-stroke | Yawls and cabin boats | 478 | 725 | 1027 | 1384 | 1800 | 2250 | 2750 | 3200 | 3600 |
| Benzin | 4-stroke | Sailing boats (< 26 ft) | 1589 | 2350 | 3243 | 4262 | 5400 | 6750 | 8250 | 9600 | 10800 |
| Benzin | 4-stroke | Speed boats | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Benzin | 4-stroke | Speed boats | 300 | 450 | 630 | 840 | 1080 | 1350 | 1650 | 1920 | 2160 |
| Benzin | 4-stroke | Water scooters | 100 | 150 | 210 | 280 | 360 | 450 | 550 | 640 | 720 |

Engine sizes (kW) for recreational craft 1985-2008.

| Engine | Boat type | 1985 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004-2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-stroke | Other boats (< 20 ft) | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 2-stroke | Yawls and cabin boats | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| 2-stroke | Sailing boats (< 26 ft) | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 2-stroke | Speed boats | 25 | 31 | 32 | 33 | 35 | 36 | 38 | 39 | 40 | 42 | 43 | 44 | 46 | 47 | 49 | 50 |
| 2-stroke | Water scooters | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| 4-stroke | Other boats (< 20 ft) | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 4-stroke | Yawls and cabin boats | | | | | | | | | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| 4-stroke | Sailing boats (< 26 ft) | | | | | | | | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 4-stroke | Speed boats (in board eng.) | 45 | 55 | 58 | 60 | 63 | 65 | 68 | 70 | 73 | 75 | 78 | 80 | 83 | 85 | 88 | 90 |
| 4-stroke | Speed boats (out board eng.) | | | | | | | | | 40 | 42 | 43 | 44 | 46 | 47 | 49 | 50 |
| 4-stroke | Water scooters | | | | | | | | | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| Diesel | Motor boats (27-34 ft) | 70 | 88 | 92 | 97 | 101 | 106 | 110 | 114 | 119 | 123 | 128 | 132 | 137 | 141 | 146 | 150 |
| Diesel | Motor boats (> 34 ft) | 120 | 149 | 156 | 163 | 171 | 178 | 185 | 192 | 199 | 207 | 214 | 221 | 228 | 236 | 243 | 250 |
| Diesel | Motor boats <(27 ft) | 20 | 24 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 36 | 37 | 38 | 39 | 40 |
| Diesel | Motor sailors | 20 | 22 | 23 | 23 | 24 | 24 | 25 | 26 | 26 | 27 | 27 | 28 | 28 | 29 | 29 | 30 |
| Diesel | Sailing boats (> 26 ft) | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |

## Annex 3B-11 Traffic data and different technical and operational data for Danish domestic ferries

Annual traffic data for ferries (no. of round trips) for Danish domestic ferries (1990-2008).

| Domestic ferries | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| Korsør-Nyborg, DSB | 9305 | 9167 | 9237 | 8959 | 8813 | 8789 | 8746 | 3258 | 0 | 0 |
| Korsør-Nyborg, Vognmandsruten | 7512 | 7363 | 7468 | 7496 | 7502 | 7828 | 7917 | 8302 | 3576 | 0 |
| Halsskov-Knudshoved | 10601 | 10582 | 11701 | 11767 | 12420 | 12970 | 13539 | 13612 | 5732 | 0 |
| Kalundborg-Juelsminde | 0 | 1326 | 1733 | 1542 | 1541 | 1508 | 856 | 0 | 0 | 0 |
| Kalundborg-Århus | 1907 | 2400 | 3162 | 2921 | 2913 | 3540 | 4962 | 4888 | 4483 | 1454 |
| Sjællands Odde-Ebeltoft | 3908 | 3978 | 4008 | 3988 | 4325 | 4569 | 5712 | 8153 | 7851 | 7720 |
| Sjællands Odde-Århus | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2339 |
| Hundested-Grenaa | 1026 | 1025 | 1032 | 1030 | 718 | 602 | 67 | 0 | 0 | 0 |
| København-Rønne | 558 | 545 | 484 | 412 | 427 | 426 | 437 | 465 | 458 | 506 |
| Køge-Rønne | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kalundborg-Samsø | 873 | 873 | 860 | 881 | 826 | 811 | 813 | 823 | 824 | 850 |
| Tårs-Spodsbjerg | 7656 | 8835 | 9488 | 9535 | 9402 | 9562 | 9000 | 9129 | 7052 | 6442 |
| Local ferries | 176891 | 179850 | 181834 | 178419 | 202445 | 209129 | 182750 | 197489 | 200027 | 202054 |

*Continued*

| Domestic ferries | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| Korsør-Nyborg, DSB | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Korsør-Nyborg, Vognmandsruten | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Halsskov-Knudshoved | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kalundborg-Juelsminde | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kalundborg-Århus | 1870 | 1804 | 2037 | 1800 | 1750 | 1725 | 1724 | 1695 | 1694 |
| Sjællands Odde-Ebeltoft | 4775 | 4226 | 3597 | 3191 | 2906 | 2889 | 2690 | 2670 | 2577 |
| Sjællands Odde-Århus | 1799 | 1817 | 1825 | 2359 | 2863 | 2795 | 2853 | 2810 | 2814 |
| Hundested-Grenaa | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| København-Rønne | 491 | 430 | 413 | 397 | 293 | 0 | 0 | 0 | 0 |
| Køge-Rønne | 0 | 0 | 0 | 0 | 154 | 488 | 436 | 399 | 428 |
| Kalundborg-Samsø | 828 | 817 | 833 | 831 | 841 | 867 | 862 | 887 | 921 |
| Tårs-Spodsbjerg | 6477 | 6498 | 6468 | 6516 | 6497 | 6494 | 6460 | 6493 | 6504 |
| Local ferries | 201833 | 200130 | 208396 | 208501 | 206297 | 205564 | 203413 | 205260 | 210089 |

Ferry data: Service, name, engine year, main engine MCR (kW), engine type, specific fuel consumption (sfc), aux. engine (kW).

| Ferry service | Ferry name | Engine year | Main engine MCR (kW) | Engine type | Sfc (g/kWh) | Fuel type | Aux engine (kW) |
|---|---|---|---|---|---|---|---|
| Halsskov-Knudshoved | ARVEPRINS KNUD | 1963 | 8238 | Slow speed (2-stroke) | 220 | Fuel | 1666 |
| Halsskov-Knudshoved | DRONNING MARGRETHE II | 1973 | 8826 | Medium speed (4-stroke) | 230 | Diesel | 1692 |
| Halsskov-Knudshoved | HEIMDAL | 1983 | 8309 | Medium speed (4-stroke) | 220 | Diesel | 740 |
| Halsskov-Knudshoved | KNUDSHOVED | 1961 | 6400 | Slow speed (2-stroke) | 220 | Fuel | 1840 |
| Halsskov-Knudshoved | KONG FREDERIK IX | 1954 | 6767 | Slow speed (2-stroke) | 225 | Fuel | 1426 |
| Halsskov-Knudshoved | KRAKA | 1982 | 8309 | Medium speed (4-stroke) | 220 | Diesel | 740 |
| Halsskov-Knudshoved | LODBROG | 1982 | 8309 | Medium speed (4-stroke) | 220 | Diesel | 740 |
| Halsskov-Knudshoved | PRINSESSE ANNE-MARIE | 1960 | 8238 | Slow speed (2-stroke) | 220 | Fuel | 1360 |
| Halsskov-Knudshoved | PRINSESSE ELISABETH | 1964 | 8238 | Slow speed (2-stroke) | 220 | Fuel | 1360 |
| Halsskov-Knudshoved | ROMSØ | 1973 | 8826 | Medium speed (4-stroke) | 230 | Diesel | 1728 |
| Halsskov-Knudshoved | SPROGØ | 1962 | 6400 | Slow speed (2-stroke) | 220 | Fuel | 1840 |
| Hundested-Grenaa | DJURSLAND | 1974 | 9856 | Medium speed (4-stroke) | 230 | Diesel | 900 |
| Hundested-Grenaa | KATTEGAT | 1995 | 23200 | High speed (4-stroke) | 205 | Diesel | 1223 |
| Hundested-Grenaa | KONG FREDERIK IX | 1954 | 6767 | Slow speed (2-stroke) | 235 | Fuel | 1375 |
| Hundested-Grenaa | PRINSESSE ANNE-MARIE | 1960 | 8238 | Slow speed (2-stroke) | 220 | Fuel | 1360 |
| Kalundborg-Juelsminde | Mercandia I | 1989 | 2950 | High speed (4-stroke) | 220 | Diesel | 0 |
| Kalundborg-Juelsminde | Mercandia II | 1989 | 2950 | High speed (4-stroke) | 220 | Diesel | 0 |
| Kalundborg-Juelsminde | Mercandia III | 1989 | 2950 | High speed (4-stroke) | 220 | Diesel | 0 |
| Kalundborg-Juelsminde | Mercandia IV | 1989 | 2950 | High speed (4-stroke) | 220 | Diesel | 0 |
| Kalundborg-Samsø | HOLGER DANSKE | 1976 | 2354 | High speed (4-stroke) | 225 | Diesel | 600 |
| Kalundborg-Samsø | KALUNDBORG | 1952 | 3825 | Slow speed (2-stroke) | 235 | Fuel | 570 |
| Kalundborg-Samsø | KYHOLM | 1998 | 2940 | High speed (4-stroke) | 195 | Diesel | 864 |
| Kalundborg-Samsø | VESBORG | 1995 | 1770 | High speed (4-stroke) | 200 | Diesel | 494 |
| Kalundborg-Århus | ASK | 1984 | 8826 | Medium speed (4-stroke) | 215 | Diesel | 2220 |
| Kalundborg-Århus | ASK | 1984 | 8826 | Medium speed (4-stroke) | 215 | Diesel | 3000 |
| Kalundborg-Århus | ASK | 1984 | 9840 | Medium speed (4-stroke) | 215 | Diesel | 3000 |
| Kalundborg-Århus | CAT-LINK I | 1995 | 17280 | High speed (4-stroke) | 205 | Diesel | 1160 |
| Kalundborg-Århus | CAT-LINK I | 1995 | 17280 | High speed (4-stroke) | 205 | Diesel | 1160 |
| Kalundborg-Århus | CAT-LINK I | 1995 | 17280 | High speed (4-stroke) | 205 | Diesel | 1160 |
| Kalundborg-Århus | CAT-LINK I | 1995 | 17280 | High speed (4-stroke) | 205 | Diesel | 1160 |
| Kalundborg-Århus | CAT-LINK II | 1995 | 17280 | High speed (4-stroke) | 205 | Diesel | 1160 |
| Kalundborg-Århus | CAT-LINK II | 1995 | 17280 | High speed (4-stroke) | 205 | Diesel | 1160 |
| Kalundborg-Århus | CAT-LINK II | 1995 | 17280 | High speed (4-stroke) | 205 | Diesel | 1160 |
| Kalundborg-Århus | CAT-LINK II | 1995 | 17280 | High speed (4-stroke) | 205 | Diesel | 1160 |
| Kalundborg-Århus | CAT-LINK III | 1995 | 22000 | High speed (4-stroke) | 205 | Diesel | 800 |
| Kalundborg-Århus | CAT-LINK III | 1995 | 22000 | High speed (4-stroke) | 205 | Diesel | 801 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | |
| Kalundborg-Århus | CAT-LINK III | 1995 | 22000 | High speed (4-stroke) | 205 | Diesel | 802 |
| Kalundborg-Århus | CAT-LINK IV | 1998 | 28320 | High speed (4-stroke) | 205 | Diesel | 920 |
| Kalundborg-Århus | CAT-LINK V | 1998 | 28320 | High speed (4-stroke) | 205 | Diesel | 920 |
| Kalundborg-Århus | KATTEGAT SYD | 1979 | 7650 | Medium speed (4-stroke) | 225 | Diesel | 1366 |
| Kalundborg-Århus | KNUDSHOVED | 1961 | 6400 | Slow speed (2-stroke) | 220 | Fuel | 1840 |
| Kalundborg-Århus | KONG FREDERIK IX | 1954 | 6767 | Slow speed (2-stroke) | 225 | Fuel | 1426 |
| Kalundborg-Århus | KRAKA | 1982 | 8309 | Medium speed (4-stroke) | 220 | Diesel | 740 |
| Kalundborg-Århus | MAREN MOLS | 1996 | 11700 | Slow speed (2-stroke) | 180 | Diesel | 2530 |
| Kalundborg-Århus | MAREN MOLS | 1996 | 11700 | Slow speed (2-stroke) | 180 | Diesel | 2530 |
| Kalundborg-Århus | MAREN MOLS | 1996 | 11700 | Slow speed (2-stroke) | 180 | Diesel | 2530 |
| Kalundborg-Århus | MAREN MOLS | 1996 | 11700 | Slow speed (2-stroke) | 180 | Diesel | 2530 |
| Kalundborg-Århus | METTE MOLS | 1996 | 11700 | Slow speed (2-stroke) | 180 | Diesel | 2530 |
| Kalundborg-Århus | METTE MOLS | 1996 | 11700 | Slow speed (2-stroke) | 180 | Diesel | 2530 |
| Kalundborg-Århus | METTE MOLS | 1996 | 11700 | Slow speed (2-stroke) | 180 | Diesel | 2530 |
| Kalundborg-Århus | METTE MOLS | 1996 | 11700 | Slow speed (2-stroke) | 180 | Diesel | 2530 |
| Kalundborg-Århus | NIELS KLIM | 1986 | 12474 | Slow speed (2-stroke) | 215 | Fuel | 4440 |
| Kalundborg-Århus | PEDER PAARS | 1985 | 12474 | Slow speed (2-stroke) | 215 | Fuel | 4440 |
| Kalundborg-Århus | PRINSESSE ELISABETH | 1964 | 8238 | Slow speed (2-stroke) | 220 | Fuel | 1360 |
| Kalundborg-Århus | ROSTOCK LINK | 1975 | 8385 | Medium speed (4-stroke) | 230 | Diesel | 2500 |
| Kalundborg-Århus | SØLØVEN/SØBJØRNEN | 1992 | 4000 | High speed (4-stroke) | 210 | Diesel | 272 |
| Kalundborg-Århus | URD | 1981 | 8826 | Medium speed (4-stroke) | 215 | Diesel | 2220 |
| Kalundborg-Århus | URD | 1981 | 8826 | Medium speed (4-stroke) | 215 | Diesel | 3000 |
| Kalundborg-Århus | URD | 1981 | 9840 | Medium speed (4-stroke) | 215 | Diesel | 3000 |
| Korsør-Nyborg, DSB | ASA-THOR | 1965 | 6472 | Slow speed (2-stroke) | 220 | Fuel | 1305 |
| Korsør-Nyborg, DSB | DRONNING INGRID | 1980 | 18720 | Medium speed (4-stroke) | 220 | Diesel | 2932 |
| Korsør-Nyborg, DSB | DRONNING MARGRETHE II | 1973 | 8826 | Medium speed (4-stroke) | 230 | Diesel | 1692 |
| Korsør-Nyborg, DSB | KONG FREDERIK IX | 1954 | 6767 | Slow speed (2-stroke) | 225 | Fuel | 1426 |
| Korsør-Nyborg, DSB | KRONPRINS FREDERIK | 1981 | 18720 | Medium speed (4-stroke) | 220 | Diesel | 2932 |
| Korsør-Nyborg, DSB | PRINS JOACHIM | 1980 | 18720 | Medium speed (4-stroke) | 220 | Diesel | 2932 |
| Korsør-Nyborg, DSB | SPROGØ/KNUDSHOVED | 1962 | 6400 | Slow speed (2-stroke) | 220 | Fuel | 1840 |
| Korsør-Nyborg, Vognmandsruten | Superflex Alfa | 1989 | 2950 | High speed (4-stroke) | 220 | Diesel | 0 |
| Korsør-Nyborg, Vognmandsruten | Superflex Bravo | 1989 | 2950 | High speed (4-stroke) | 220 | Diesel | 0 |
| Korsør-Nyborg, Vognmandsruten | Superflex Charlie | 1988 | 2950 | High speed (4-stroke) | 220 | Diesel | 0 |
| København-Rønne | JENS KOFOED | 1979 | 12950 | Medium speed (4-stroke) | 232,58 | Fuel | 2889 |
| København-Rønne | POVL ANKER | 1979 | 12950 | Medium speed (4-stroke) | 232,58 | Fuel | 2889 |
| Køge-Rønne | DUEODDE | 2005 | 8640 | Medium speed (4-stroke) | 189,9 | Fuel | 1545 |
| Køge-Rønne | DUEODDE | 2005 | 8640 | Medium speed (4-stroke) | 189,9 | Fuel | 1545 |

*Continued*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Køge-Rønne | HAMMERODDE | 2005 | 8640 | Medium speed (4-stroke) | 189,9 | Fuel | 1545 |
| Køge-Rønne | HAMMERODDE | 2005 | 8640 | Medium speed (4-stroke) | 189,9 | Fuel | 1545 |
| Køge-Rønne | HAMMERODDE | 2005 | 8640 | Medium speed (4-stroke) | 189,9 | Fuel | 1545 |
| Køge-Rønne | JENS KOFOED | 1979 | 12950 | Medium speed (4-stroke) | 232,58 | Fuel | 2889 |
| Køge-Rønne | POVL ANKER | 1979 | 12950 | Medium speed (4-stroke) | 232,58 | Fuel | 2889 |
| Køge-Rønne | POVL ANKER | 1979 | 12950 | Medium speed (4-stroke) | 232,58 | Fuel | 2889 |
| Køge-Rønne | POVL ANKER | 1979 | 12950 | Medium speed (4-stroke) | 232,58 | Fuel | 2889 |
| Sjællands Odde-Ebeltoft | MAI MOLS | 1996 | 24800 | Gas turbine | 240 | Diesel | 752 |
| Sjællands Odde-Ebeltoft | MAI MOLS | 1996 | 24800 | Gas turbine | 240 | Diesel | 752 |
| Sjællands Odde-Ebeltoft | MAI MOLS | 1996 | 24800 | Gas turbine | 240 | Diesel | 752 |
| Sjællands Odde-Ebeltoft | MAREN MOLS | 1975 | 12062 | Medium speed (4-stroke) | 230 | Fuel | 1986 |
| Sjællands Odde-Ebeltoft | MAREN MOLS 2 | 1996 | 11700 | Slow speed (2-stroke) | 180 | Diesel | 2530 |
| Sjællands Odde-Ebeltoft | MAREN MOLS 2 | 1996 | 11700 | Slow speed (2-stroke) | 180 | Diesel | 2530 |
| Sjællands Odde-Ebeltoft | METTE MOLS | 1975 | 12062 | Medium speed (4-stroke) | 230 | Fuel | 1986 |
| Sjællands Odde-Ebeltoft | METTE MOLS 2 | 1996 | 11700 | Slow speed (2-stroke) | 180 | Diesel | 2530 |
| Sjællands Odde-Ebeltoft | METTE MOLS 2 | 1996 | 11700 | Slow speed (2-stroke) | 180 | Diesel | 2530 |
| Sjællands Odde-Ebeltoft | MIE MOLS | 1971 | 5884 | Medium speed (4-stroke) | 230 | Diesel | |
| Sjællands Odde-Ebeltoft | MIE MOLS 2 | 1996 | 24800 | Gas turbine | 240 | Diesel | 752 |
| Sjællands Odde-Ebeltoft | MIE MOLS 2 | 1996 | 24800 | Gas turbine | 240 | Diesel | 752 |
| Sjællands Odde-Ebeltoft | MIE MOLS 2 | 1996 | 24800 | Gas turbine | 240 | Diesel | 752 |
| Sjællands Odde-Århus | MADS MOLS | 1998 | 28320 | High speed (4-stroke) | 205 | Diesel | 920 |
| Sjællands Odde-Århus | MADS MOLS | 1998 | 28320 | High speed (4-stroke) | 205 | Diesel | 920 |
| Sjællands Odde-Århus | MADS MOLS | 1998 | 28320 | High speed (4-stroke) | 205 | Diesel | 920 |
| Sjællands Odde-Århus | MAI MOLS | 1996 | 24800 | Gas turbine | 240 | Diesel | 752 |
| Sjællands Odde-Århus | MAI MOLS | 1996 | 24800 | Gas turbine | 240 | Diesel | 752 |
| Sjællands Odde-Århus | MAX MOLS | 1998 | 28320 | High speed (4-stroke) | 205 | Diesel | 920 |
| Sjællands Odde-Århus | MAX MOLS | 1998 | 28320 | High speed (4-stroke) | 205 | Diesel | 920 |
| Sjællands Odde-Århus | MAX MOLS | 1998 | 28320 | High speed (4-stroke) | 205 | Diesel | 920 |
| Sjællands Odde-Århus | MIE MOLS | 1996 | 24800 | Gas turbine | 240 | Diesel | 752 |
| Sjællands Odde-Århus | MIE MOLS | 1996 | 24800 | Gas turbine | 240 | Diesel | 752 |
| Tårs-Spodsbjerg | FRIGG SYDFYEN | 1984 | 1300 | Medium speed (4-stroke) | 220 | Diesel | 780 |
| Tårs-Spodsbjerg | ODIN SYDFYEN | 1982 | 1180 | Medium speed (4-stroke) | 220 | Diesel | 780 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1530 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1531 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1532 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1533 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1534 | Medium speed (4-stroke) | 225 | Diesel | 300 |

| *Continued* | | | | | | | |
|---|---|---|---|---|---|---|---|
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1535 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1536 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1537 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1538 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1539 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1540 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1541 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1542 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1543 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1544 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 1972 | 1545 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | SPODSBJERG | 2006 | 1545 | Medium speed (4-stroke) | 189,9038 | Diesel | 300 |
| Tårs-Spodsbjerg | THOR SYDFYEN | 1978 | 1176 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | THOR SYDFYEN | 1978 | 1176 | Medium speed (4-stroke) | 225 | Diesel | 300 |
| Tårs-Spodsbjerg | THOR SYDFYEN | 2008 | 1176 | Medium speed (4-stroke) | 189,9038 | Diesel | 300 |

Ferry data: Sailing time (single trip) 1990 to 1999.

| Ferry service | Ferry name | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Halsskov-Knudshoved | ARVEPRINS KNUD | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | |
| Halsskov-Knudshoved | DRONNING MARGRETHE II | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | |
| Halsskov-Knudshoved | HEIMDAL | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | |
| Halsskov-Knudshoved | KNUDSHOVED | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | |
| Halsskov-Knudshoved | KONG FREDERIK IX | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | |
| Halsskov-Knudshoved | KRAKA | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | |
| Halsskov-Knudshoved | LODBROG | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | |
| Halsskov-Knudshoved | PRINSESSE ANNE-MARIE | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | |
| Halsskov-Knudshoved | PRINSESSE ELISABETH | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | |
| Halsskov-Knudshoved | ROMSØ | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | |
| Halsskov-Knudshoved | SPROGØ | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | |
| Hundested-Grenaa | DJURSLAND | 160 | 160 | 160 | 160 | 160 | | | | | |
| Hundested-Grenaa | KATTEGAT | | | | | | 90 | 90 | | | |
| Hundested-Grenaa | KONG FREDERIK IX | | | | | 170 | | | | | |
| Hundested-Grenaa | PRINSESSE ANNE-MARIE | | | | | 165 | | | | | |
| Kalundborg-Juelsminde | Mercandia I | 160 | 160 | 160 | 160 | 160 | 160 | 160 | | | |
| Kalundborg-Juelsminde | Mercandia II | 160 | 160 | 160 | 160 | 160 | 160 | 160 | | | |
| Kalundborg-Juelsminde | Mercandia III | 160 | 160 | 160 | 160 | 160 | 160 | 160 | | | |
| Kalundborg-Juelsminde | Mercandia IV | 160 | 160 | 160 | 160 | 160 | 160 | 160 | | | |
| Kalundborg-Samsø | HOLGER DANSKE | | | 120 | 120 | 120 | 120 | 120 | 120 | 120 | |
| Kalundborg-Samsø | KALUNDBORG | 120 | 120 | 120 | | | | | | | |
| Kalundborg-Samsø | KYHOLM | | | | | | | | | 110 | 110 |
| Kalundborg-Samsø | VESBORG | | | | | | | | | 120 | |
| Kalundborg-Århus | ASK | | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 |
| Kalundborg-Århus | CAT-LINK I | | | | | | 80 | 85 | 90 | 95 | |
| Kalundborg-Århus | CAT-LINK II | | | | | | 80 | 85 | 90 | 95 | |
| Kalundborg-Århus | CAT-LINK III | | | | | | | 85 | 90 | 95 | |
| Kalundborg-Århus | CAT-LINK IV | | | | | | | | | 80 | 80 |
| Kalundborg-Århus | CAT-LINK V | | | | | | | | | 80 | 80 |
| Kalundborg-Århus | KATTEGAT SYD | | | | | | | | | | 195 |
| Kalundborg-Århus | KNUDSHOVED | | 190 | | | | | | | | |
| Kalundborg-Århus | KONG FREDERIK IX | | 190 | 190 | 190 | 190 | 190 | 190 | | | |
| Kalundborg-Århus | KRAKA | | | | | | | | | 195 | |
| Kalundborg-Århus | MAREN MOLS | | | | | | | | | | |
| Kalundborg-Århus | METTE MOLS | | | | | | | | | | |
| Kalundborg-Århus | NIELS KLIM | 185 | 185 | | | | | | | | |

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| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kalundborg-Århus | PEDER PAARS | 185 | 185 | | | | | | | | |
| Kalundborg-Århus | PRINSESSE ELISABETH | | 185 | | | | | | | | |
| Kalundborg-Århus | ROSTOCK LINK | | | | | | | | | | 195 |
| Kalundborg-Århus | SØLØVEN/SØBJØRNEN | | 90 | 90 | 90 | 90 | 90 | 90 | | | |
| Kalundborg-Århus | URD | | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 |
| Korsør-Nyborg, DSB | ASA-THOR | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | | |
| Korsør-Nyborg, DSB | DRONNING INGRID | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | | |
| Korsør-Nyborg, DSB | DRONNING MARGRETHE II | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | | |
| Korsør-Nyborg, DSB | KONG FREDERIK IX | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | | |
| Korsør-Nyborg, DSB | KRONPRINS FREDERIK | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | | |
| Korsør-Nyborg, DSB | PRINS JOACHIM | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | | |
| Korsør-Nyborg, DSB | SPROGØ/KNUDSHOVED | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | | |
| Korsør-Nyborg, Vognmandsruten | Superflex Alfa | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | |
| Korsør-Nyborg, Vognmandsruten | Superflex Bravo | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | |
| Korsør-Nyborg, Vognmandsruten | Superflex Charlie | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | |
| København-Rønne | JENS KOFOED | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 |
| København-Rønne | POVL ANKER | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 |
| Køge-Rønne | DUEODDE | | | | | | | | | | |
| Køge-Rønne | HAMMERODDE | | | | | | | | | | |
| Køge-Rønne | JENS KOFOED | | | | | | | | | | |
| Køge-Rønne | POVL ANKER | | | | | | | | | | |
| Sjællands Odde-Ebeltoft | MAI MOLS | | | | | | | 45 | 45 | 45 | 45 |
| Sjællands Odde-Ebeltoft | MAREN MOLS | 100 | 100 | 100 | 100 | 100 | 100 | 100 | | | |
| Sjællands Odde-Ebeltoft | MAREN MOLS 2 | | | | | | | 100 | 100 | 100 | 95 |
| Sjællands Odde-Ebeltoft | METTE MOLS | 100 | 100 | 100 | 100 | 100 | 100 | 100 | | | |
| Sjællands Odde-Ebeltoft | METTE MOLS 2 | | | | | | | 100 | 100 | 100 | 95 |
| Sjællands Odde-Ebeltoft | MIE MOLS | 105 | 105 | 105 | 105 | 105 | 105 | 105 | | | |
| Sjællands Odde-Ebeltoft | MIE MOLS 2 | | | | | | | 45 | 45 | 45 | 45 |
| Sjællands Odde-Århus | MADS MOLS | | | | | | | | | | 60 |
| Sjællands Odde-Århus | MAI MOLS | | | | | | | | | | |
| Sjællands Odde-Århus | MAX MOLS | | | | | | | | | | 60 |
| Sjællands Odde-Århus | MIE MOLS | | | | | | | | | | |
| Tårs-Spodsbjerg | FRIGG SYDFYEN | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| Tårs-Spodsbjerg | ODIN SYDFYEN | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| Tårs-Spodsbjerg | SPODSBJERG | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| Tårs-Spodsbjerg | THOR SYDFYEN | 45 | 45 | 45 | 45 | 45 | 17 | 45 | 45 | 45 | 45 |

Ferry data: Sailing time (single trip) 2000 to 2008.

| Ferry service | Ferry name | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| Halsskov-Knudshoved | ARVEPRINS KNUD | | | | | | | | | |
| Halsskov-Knudshoved | DRONNING MARGRETHE II | | | | | | | | | |
| Halsskov-Knudshoved | HEIMDAL | | | | | | | | | |
| Halsskov-Knudshoved | KNUDSHOVED | | | | | | | | | |
| Halsskov-Knudshoved | KONG FREDERIK IX | | | | | | | | | |
| Halsskov-Knudshoved | KRAKA | | | | | | | | | |
| Halsskov-Knudshoved | LODBROG | | | | | | | | | |
| Halsskov-Knudshoved | PRINSESSE ANNE-MARIE | | | | | | | | | |
| Halsskov-Knudshoved | PRINSESSE ELISABETH | | | | | | | | | |
| Halsskov-Knudshoved | ROMSØ | | | | | | | | | |
| Halsskov-Knudshoved | SPROGØ | | | | | | | | | |
| Hundested-Grenaa | DJURSLAND | | | | | | | | | |
| Hundested-Grenaa | KATTEGAT | | | | | | | | | |
| Hundested-Grenaa | KONG FREDERIK IX | | | | | | | | | |
| Hundested-Grenaa | PRINSESSE ANNE-MARIE | | | | | | | | | |
| Kalundborg-Juelsminde | Mercandia I | | | | | | | | | |
| Kalundborg-Juelsminde | Mercandia II | | | | | | | | | |
| Kalundborg-Juelsminde | Mercandia III | | | | | | | | | |
| Kalundborg-Juelsminde | Mercandia IV | | | | | | | | | |
| Kalundborg-Samsø | HOLGER DANSKE | | | | | | | | | |
| Kalundborg-Samsø | KALUNDBORG | | | | | | | | | |
| Kalundborg-Samsø | KYHOLM | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| Kalundborg-Samsø | VESBORG | | | | | | | | | |
| Kalundborg-Århus | ASK | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK I | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK II | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK III | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK IV | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK V | | | | | | | | | |
| Kalundborg-Århus | KATTEGAT SYD | | | | | | | | | |
| Kalundborg-Århus | KNUDSHOVED | | | | | | | | | |
| Kalundborg-Århus | KONG FREDERIK IX | | | | | | | | | |
| Kalundborg-Århus | KRAKA | | | | | | | | | |
| Kalundborg-Århus | MAREN MOLS | 160 | 160 | 155 | 155 | 155 | 155 | 165 | 165 | 165 |
| Kalundborg-Århus | METTE MOLS | 160 | 160 | 155 | 155 | 155 | 155 | 165 | 165 | 165 |
| Kalundborg-Århus | NIELS KLIM | | | | | | | | | |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Kalundborg-Århus | PEDER PAARS | | | | | | | | | |
| Kalundborg-Århus | PRINSESSE ELISABETH | | | | | | | | | |
| Kalundborg-Århus | ROSTOCK LINK | | | | | | | | | |
| Kalundborg-Århus | SØLØVEN/SØBJØRNEN | | | | | | | | | |
| Kalundborg-Århus | URD | | | | | | | | | |
| Korsør-Nyborg, DSB | ASA-THOR | | | | | | | | | |
| Korsør-Nyborg, DSB | DRONNING INGRID | | | | | | | | | |
| Korsør-Nyborg, DSB | DRONNING MARGRETHE II | | | | | | | | | |
| Korsør-Nyborg, DSB | KONG FREDERIK IX | | | | | | | | | |
| Korsør-Nyborg, DSB | KRONPRINS FREDERIK | | | | | | | | | |
| Korsør-Nyborg, DSB | PRINS JOACHIM | | | | | | | | | |
| Korsør-Nyborg, DSB | SPROGØ/KNUDSHOVED | | | | | | | | | |
| Korsør-Nyborg, Vognmandsruten | Superflex Alfa | | | | | | | | | |
| Korsør-Nyborg, Vognmandsruten | Superflex Bravo | | | | | | | | | |
| Korsør-Nyborg, Vognmandsruten | Superflex Charlie | | | | | | | | | |
| København-Rønne | JENS KOFOED | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 |
| København-Rønne | POVL ANKER | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 |
| Køge-Rønne | DUEODDE | | | | | | 375 | 375 | 375 | 375 |
| Køge-Rønne | HAMMERODDE | | | | | | 375 | 375 | 375 | 375 |
| Køge-Rønne | JENS KOFOED | | | | | 375 | 375 | | | |
| Køge-Rønne | POVL ANKER | | | | | 375 | 375 | 375 | 375 | 375 |
| Sjællands Odde-Ebeltoft | MAI MOLS | 45 | 45 | 45 | 45 | 45 | 45 | 50 | 50 | 50 |
| Sjællands Odde-Ebeltoft | MAREN MOLS | | | | | | | | | |
| Sjællands Odde-Ebeltoft | MAREN MOLS 2 | | | | | | | | | |
| Sjællands Odde-Ebeltoft | METTE MOLS | | | | | | | | | |
| Sjællands Odde-Ebeltoft | METTE MOLS 2 | | | | | | | | | |
| Sjællands Odde-Ebeltoft | MIE MOLS | | | | | | | | | |
| Sjællands Odde-Ebeltoft | MIE MOLS 2 | 45 | 45 | 45 | 45 | 45 | 45 | 50 | 50 | 50 |
| Sjællands Odde-Århus | MADS MOLS | 65 | 65 | 65 | 65 | 65 | 65 | 70 | 70 | 70 |
| Sjællands Odde-Århus | MAI MOLS | | | 65 | 65 | 65 | 65 | 68 | 68 | 68 |
| Sjællands Odde-Århus | MAX MOLS | 65 | 65 | 65 | 65 | 65 | 65 | 70 | 70 | 70 |
| Sjællands Odde-Århus | MIE MOLS | | | 65 | 65 | 65 | 65 | 68 | 68 | 68 |
| Tårs-Spodsbjerg | FRIGG SYDFYEN | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| Tårs-Spodsbjerg | ODIN SYDFYEN | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| Tårs-Spodsbjerg | SPODSBJERG | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| Tårs-Spodsbjerg | THOR SYDFYEN | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |

Ferry data: Load factor (% MCR) 1990 to 1999.

| Ferry service | Ferry name | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Halsskov-Knudshoved | ARVEPRINS KNUD | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | |
| Halsskov-Knudshoved | DRONNING MARGRETHE II | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | |
| Halsskov-Knudshoved | HEIMDAL | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | |
| Halsskov-Knudshoved | KNUDSHOVED | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | |
| Halsskov-Knudshoved | KONG FREDERIK IX | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | |
| Halsskov-Knudshoved | KRAKA | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | |
| Halsskov-Knudshoved | LODBROG | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | |
| Halsskov-Knudshoved | PRINSESSE ANNE-MARIE | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | |
| Halsskov-Knudshoved | PRINSESSE ELISABETH | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | |
| Halsskov-Knudshoved | ROMSØ | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | |
| Halsskov-Knudshoved | SPROGØ | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | |
| Hundested-Grenaa | DJURSLAND | 80 | 80 | 80 | 80 | 80 | | | | | |
| Hundested-Grenaa | KATTEGAT | | | | | | 85 | 85 | | | |
| Hundested-Grenaa | KONG FREDERIK IX | | | | | 65 | | | | | |
| Hundested-Grenaa | PRINSESSE ANNE-MARIE | | | | | 85 | | | | | |
| Kalundborg-Juelsminde | Mercandia I | 75 | 75 | 75 | 75 | 75 | 75 | 75 | | | |
| Kalundborg-Juelsminde | Mercandia II | 70 | 70 | 70 | 70 | 70 | 70 | 70 | | | |
| Kalundborg-Juelsminde | Mercandia III | 70 | 70 | 70 | 70 | 70 | 70 | 70 | | | |
| Kalundborg-Juelsminde | Mercandia IV | 70 | 70 | 70 | 70 | 70 | 70 | 70 | | | |
| Kalundborg-Samsø | HOLGER DANSKE | | | 85 | 85 | 85 | 85 | 85 | 85 | 85 | |
| Kalundborg-Samsø | KALUNDBORG | 80 | 80 | 80 | | | | | | | |
| Kalundborg-Samsø | KYHOLM | | | | | | | | | 85 | 85 |
| Kalundborg-Samsø | VESBORG | | | | | | | | | 95 | |
| Kalundborg-Århus | ASK | | 85 | 85 | 85 | 80 | 80 | 80 | 80 | 80 | 80 |
| Kalundborg-Århus | CAT-LINK I | | | | | | 95 | 90 | 90 | 85 | |
| Kalundborg-Århus | CAT-LINK II | | | | | | 95 | 90 | 90 | 85 | |
| Kalundborg-Århus | CAT-LINK III | | | | | | | 95 | 95 | 90 | |
| Kalundborg-Århus | CAT-LINK IV | | | | | | | | | 95 | 95 |
| Kalundborg-Århus | CAT-LINK V | | | | | | | | | 95 | 95 |
| Kalundborg-Århus | KATTEGAT SYD | | | | | | | | | | 85 |
| Kalundborg-Århus | KNUDSHOVED | | 85 | | | | | | | | |
| Kalundborg-Århus | KONG FREDERIK IX | | 85 | 85 | 85 | 85 | 85 | 85 | | | |
| Kalundborg-Århus | KRAKA | | | | | | | | | 85 | |
| Kalundborg-Århus | MAREN MOLS | | | | | | | | | | |
| Kalundborg-Århus | METTE MOLS | | | | | | | | | | |
| Kalundborg-Århus | NIELS KLIM | 85 | 85 | | | | | | | | |

| *Continued* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kalundborg-Århus | PEDER PAARS | 85 | 85 | | | | | | | | |
| Kalundborg-Århus | PRINSESSE ELISABETH | | 80 | | | | | | | | |
| Kalundborg-Århus | ROSTOCK LINK | | | | | | | | | | 80 |
| Kalundborg-Århus | SØLØVEN/SØBJØRNEN | | 90 | 90 | 90 | 90 | 90 | 90 | | | |
| Kalundborg-Århus | URD | | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 80 | 80 |
| Korsør-Nyborg, DSB | ASA-THOR | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | | |
| Korsør-Nyborg, DSB | DRONNING INGRID | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | | |
| Korsør-Nyborg, DSB | DRONNING MARGRETHE II | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | | |
| Korsør-Nyborg, DSB | KONG FREDERIK IX | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | | |
| Korsør-Nyborg, DSB | KRONPRINS FREDERIK | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | | |
| Korsør-Nyborg, DSB | PRINS JOACHIM | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | | |
| Korsør-Nyborg, DSB | SPROGØ/KNUDSHOVED | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | | |
| Korsør-Nyborg, Vognmandsruten | Superflex Alfa | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | |
| Korsør-Nyborg, Vognmandsruten | Superflex Bravo | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | |
| Korsør-Nyborg, Vognmandsruten | Superflex Charlie | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | |
| København-Rønne | JENS KOFOED | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 |
| København-Rønne | POVL ANKER | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 |
| Køge-Rønne | DUEODDE | | | | | | | | | | |
| Køge-Rønne | HAMMERODDE | | | | | | | | | | |
| Køge-Rønne | JENS KOFOED | | | | | | | | | | |
| Køge-Rønne | POVL ANKER | | | | | | | | | | |
| Sjællands Odde-Ebeltoft | MAI MOLS | | | | | | | 80 | 80 | 80 | 80 |
| Sjællands Odde-Ebeltoft | MAREN MOLS | 75 | 75 | 75 | 75 | 75 | 75 | 75 | | | |
| Sjællands Odde-Ebeltoft | MAREN MOLS 2 | | | | | | | 80 | 80 | 80 | 85 |
| Sjællands Odde-Ebeltoft | METTE MOLS | 75 | 75 | 75 | 75 | 75 | 75 | 75 | | | |
| Sjællands Odde-Ebeltoft | METTE MOLS 2 | | | | | | | 80 | 80 | 80 | 85 |
| Sjællands Odde-Ebeltoft | MIE MOLS | 85 | 85 | 85 | 85 | 85 | 85 | 85 | | | |
| Sjællands Odde-Ebeltoft | MIE MOLS 2 | | | | | | | 80 | 80 | 80 | 80 |
| Sjællands Odde-Århus | MADS MOLS | | | | | | | | | | 90 |
| Sjællands Odde-Århus | MAI MOLS | | | | | | | | | | |
| Sjællands Odde-Århus | MAX MOLS | | | | | | | | | | 90 |
| Sjællands Odde-Århus | MIE MOLS | | | | | | | | | | |
| Tårs-Spodsbjerg | FRIGG SYDFYEN | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Tårs-Spodsbjerg | ODIN SYDFYEN | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Tårs-Spodsbjerg | SPODSBJERG | 75 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Tårs-Spodsbjerg | THOR SYDFYEN | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |

Ferry data: Load factor (% MCR) 2000 to 2008.

| Ferry service | Ferry name | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| Halsskov-Knudshoved | ARVEPRINS KNUD | | | | | | | | | |
| Halsskov-Knudshoved | DRONNING MARGRETHE II | | | | | | | | | |
| Halsskov-Knudshoved | HEIMDAL | | | | | | | | | |
| Halsskov-Knudshoved | KNUDSHOVED | | | | | | | | | |
| Halsskov-Knudshoved | KONG FREDERIK IX | | | | | | | | | |
| Halsskov-Knudshoved | KRAKA | | | | | | | | | |
| Halsskov-Knudshoved | LODBROG | | | | | | | | | |
| Halsskov-Knudshoved | PRINSESSE ANNE-MARIE | | | | | | | | | |
| Halsskov-Knudshoved | PRINSESSE ELISABETH | | | | | | | | | |
| Halsskov-Knudshoved | ROMSØ | | | | | | | | | |
| Halsskov-Knudshoved | SPROGØ | | | | | | | | | |
| Hundested-Grenaa | DJURSLAND | | | | | | | | | |
| Hundested-Grenaa | KATTEGAT | | | | | | | | | |
| Hundested-Grenaa | KONG FREDERIK IX | | | | | | | | | |
| Hundested-Grenaa | PRINSESSE ANNE-MARIE | | | | | | | | | |
| Kalundborg-Juelsminde | Mercandia I | | | | | | | | | |
| Kalundborg-Juelsminde | Mercandia II | | | | | | | | | |
| Kalundborg-Juelsminde | Mercandia III | | | | | | | | | |
| Kalundborg-Juelsminde | Mercandia IV | | | | | | | | | |
| Kalundborg-Samsø | HOLGER DANSKE | | | | | | | | | |
| Kalundborg-Samsø | KALUNDBORG | | | | | | | | | |
| Kalundborg-Samsø | KYHOLM | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| Kalundborg-Samsø | VESBORG | | | | | | | | | |
| Kalundborg-Århus | ASK | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK I | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK II | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK III | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK IV | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK V | | | | | | | | | |
| Kalundborg-Århus | KATTEGAT SYD | | | | | | | | | |
| Kalundborg-Århus | KNUDSHOVED | | | | | | | | | |
| Kalundborg-Århus | KONG FREDERIK IX | | | | | | | | | |
| Kalundborg-Århus | KRAKA | | | | | | | | | |
| Kalundborg-Århus | MAREN MOLS | 85 | 85 | 85 | 85 | 85 | 85 | 82 | 80 | 80 |
| Kalundborg-Århus | METTE MOLS | 85 | 85 | 85 | 85 | 85 | 85 | 82 | 80 | 80 |
| Kalundborg-Århus | NIELS KLIM | | | | | | | | | |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Kalundborg-Århus | PEDER PAARS | | | | | | | | | |
| Kalundborg-Århus | PRINSESSE ELISABETH | | | | | | | | | |
| Kalundborg-Århus | ROSTOCK LINK | | | | | | | | | |
| Kalundborg-Århus | SØLØVEN/SØBJØRNEN | | | | | | | | | |
| Kalundborg-Århus | URD | | | | | | | | | |
| Korsør-Nyborg, DSB | ASA-THOR | | | | | | | | | |
| Korsør-Nyborg, DSB | DRONNING INGRID | | | | | | | | | |
| Korsør-Nyborg, DSB | DRONNING MARGRETHE II | | | | | | | | | |
| Korsør-Nyborg, DSB | KONG FREDERIK IX | | | | | | | | | |
| Korsør-Nyborg, DSB | KRONPRINS FREDERIK | | | | | | | | | |
| Korsør-Nyborg, DSB | PRINS JOACHIM | | | | | | | | | |
| Korsør-Nyborg, DSB | SPROGØ/KNUDSHOVED | | | | | | | | | |
| Korsør-Nyborg, Vognmandsruten | Superflex Alfa | | | | | | | | | |
| Korsør-Nyborg, Vognmandsruten | Superflex Bravo | | | | | | | | | |
| Korsør-Nyborg, Vognmandsruten | Superflex Charlie | | | | | | | | | |
| København-Rønne | JENS KOFOED | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 |
| København-Rønne | POVL ANKER | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 | 30,8 |
| Køge-Rønne | DUEODDE | | | | | | 69,1 | 65 | 65 | 65 |
| Køge-Rønne | HAMMERODDE | | | | | | 69,1 | 65 | 66 | 66 |
| Køge-Rønne | JENS KOFOED | | | | | 31,3 | 31,3 | | | |
| Køge-Rønne | POVL ANKER | | | | | 31,3 | 31,3 | 45 | 49 | 49 |
| Sjællands Odde-Ebeltoft | MAI MOLS | 80 | 80 | 80 | 80 | 80 | 80 | 79 | 78 | 78 |
| Sjællands Odde-Ebeltoft | MAREN MOLS | | | | | | | | | |
| Sjællands Odde-Ebeltoft | MAREN MOLS 2 | | | | | | | | | |
| Sjællands Odde-Ebeltoft | METTE MOLS | | | | | | | | | |
| Sjællands Odde-Ebeltoft | METTE MOLS 2 | | | | | | | | | |
| Sjællands Odde-Ebeltoft | MIE MOLS | | | | | | | | | |
| Sjællands Odde-Ebeltoft | MIE MOLS 2 | 80 | 80 | 80 | 80 | 80 | 80 | 79 | 78 | 78 |
| Sjællands Odde-Århus | MADS MOLS | 85 | 85 | 85 | 85 | 85 | 85 | 67 | 67 | 67 |
| Sjællands Odde-Århus | MAI MOLS | | | 75 | 75 | 75 | 75 | 69 | 69 | 69 |
| Sjællands Odde-Århus | MAX MOLS | 85 | 85 | 85 | 85 | 85 | 85 | 67 | 67 | 67 |
| Sjællands Odde-Århus | MIE MOLS | | | 75 | 75 | 75 | 75 | 69 | 69 | 69 |
| Tårs-Spodsbjerg | FRIGG SYDFYEN | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Tårs-Spodsbjerg | ODIN SYDFYEN | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Tårs-Spodsbjerg | SPODSBJERG | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Tårs-Spodsbjerg | THOR SYDFYEN | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |

Ferry data: Round trip shares (%) 1990 to 1999.

| Ferry service | Ferry name | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Halsskov-Knudshoved | ARVEPRINS KNUD | 21,1 | 20,2 | 19,7 | 19,8 | 20,6 | 18,6 | 18,8 | 17,6 | 20,0 | |
| Halsskov-Knudshoved | DRONNING MARGRETHE II | 2,4 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | |
| Halsskov-Knudshoved | HEIMDAL | 22,5 | 23,8 | 22,3 | 24,3 | 23,4 | 21,3 | 21,1 | 19,3 | 21,5 | |
| Halsskov-Knudshoved | KNUDSHOVED | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 2,4 | 4,6 | 0,0 | |
| Halsskov-Knudshoved | KONG FREDERIK IX | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,3 | 0,0 | 0,0 | 0,0 | |
| Halsskov-Knudshoved | KRAKA | 24,3 | 25,4 | 22,7 | 23,4 | 21,1 | 20,4 | 20,3 | 19,9 | 21,0 | |
| Halsskov-Knudshoved | LODBROG | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 7,1 | 14,0 | |
| Halsskov-Knudshoved | PRINSESSE ANNE-MARIE | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 5,5 | 2,4 | 0,0 | 0,0 | |
| Halsskov-Knudshoved | PRINSESSE ELISABETH | 0,0 | 0,0 | 0,0 | 2,5 | 0,1 | 0,0 | 0,0 | 0,0 | 0,0 | |
| Halsskov-Knudshoved | ROMSØ | 20,6 | 21,6 | 20,5 | 16,2 | 20,1 | 19,0 | 21,1 | 20,5 | 22,9 | |
| Halsskov-Knudshoved | SPROGØ | 9,1 | 9,0 | 14,8 | 13,8 | 14,7 | 14,9 | 13,9 | 11,0 | 0,6 | |
| Hundested-Grenaa | DJURSLAND | 100,0 | 100,0 | 100,0 | 100,0 | 50,0 | | | | | |
| Hundested-Grenaa | KATTEGAT | | | | | | 100,0 | 100,0 | | | |
| Hundested-Grenaa | KONG FREDERIK IX | | | | | 5,0 | | | | | |
| Hundested-Grenaa | PRINSESSE ANNE-MARIE | | | | | 45,0 | | | | | |
| Kalundborg-Juelsminde | Mercandia I | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | | | |
| Kalundborg-Juelsminde | Mercandia II | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | | | |
| Kalundborg-Juelsminde | Mercandia III | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | | | |
| Kalundborg-Juelsminde | Mercandia IV | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | | | |
| Kalundborg-Samsø | HOLGER DANSKE | | | 95,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 92,0 | |
| Kalundborg-Samsø | KALUNDBORG | 100,0 | 100,0 | 5,0 | | | | | | | |
| Kalundborg-Samsø | KYHOLM | | | | | | | | | 6,0 | 100,0 |
| Kalundborg-Samsø | VESBORG | | | | | | | | | 2,0 | |
| Kalundborg-Århus | ASK | | 15,8 | 31,8 | 26,3 | 32,8 | 26,8 | 18,5 | 10,7 | 11,8 | 2,4 |
| Kalundborg-Århus | CAT-LINK I | | | | | | 17,2 | 25,4 | 27,5 | 11,4 | |
| Kalundborg-Århus | CAT-LINK II | | | | | | 0,9 | 22,6 | 27,5 | 7,6 | |
| Kalundborg-Århus | CAT-LINK III | | | | | | | 8,5 | 23,6 | 19,1 | |
| Kalundborg-Århus | CAT-LINK IV | | | | | | | | | 22,9 | 25,8 |
| Kalundborg-Århus | CAT-LINK V | | | | | | | | | 15,3 | 25,8 |
| Kalundborg-Århus | KATTEGAT SYD | | | | | | | | | | 2,4 |
| Kalundborg-Århus | KNUDSHOVED | | 4,0 | | | | | | | | |
| Kalundborg-Århus | KONG FREDERIK IX | | 4,0 | 0,0 | 6,6 | 0,0 | 0,0 | 1,5 | | | |
| Kalundborg-Århus | KRAKA | | | | | | | | | 2,4 | |
| Kalundborg-Århus | MAREN MOLS | | | | | | | | | | |
| Kalundborg-Århus | METTE MOLS | | | | | | | | | | |
| Kalundborg-Århus | NIELS KLIM | 50,0 | 19,8 | | | | | | | | |

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| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kalundborg-Århus | PEDER PAARS | 50,0 | 15,8 | | | | | | | | |
| Kalundborg-Århus | PRINSESSE ELISABETH | | 4,0 | | | | | | | | |
| Kalundborg-Århus | ROSTOCK LINK | | | | | | | | | | 21,8 |
| Kalundborg-Århus | SØLØVEN/SØBJØRNEN | | 20,8 | 36,4 | 34,2 | 34,3 | 28,2 | 5,0 | | | |
| Kalundborg-Århus | URD | | 15,8 | 31,8 | 32,9 | 32,8 | 26,8 | 18,5 | 10,7 | 9,5 | 21,8 |
| Korsør-Nyborg, DSB | ASA-THOR | 12,6 | 13,4 | 13,1 | 11,1 | 9,3 | 8,9 | 9,2 | 6,3 | | |
| Korsør-Nyborg, DSB | DRONNING INGRID | 26,2 | 27,6 | 25,9 | 28,3 | 28,0 | 28,8 | 28,2 | 31,0 | | |
| Korsør-Nyborg, DSB | DRONNING MARGRETHE II | 3,0 | 0,0 | 3,4 | 0,9 | 2,8 | 0,5 | 2,3 | 0,0 | | |
| Korsør-Nyborg, DSB | KONG FREDERIK IX | 0,1 | 0,0 | 0,0 | 0,2 | 3,4 | 4,4 | 0,7 | 0,0 | | |
| Korsør-Nyborg, DSB | KRONPRINS FREDERIK | 26,8 | 28,1 | 26,9 | 28,8 | 28,2 | 29,3 | 28,6 | 31,9 | | |
| Korsør-Nyborg, DSB | PRINS JOACHIM | 25,2 | 26,6 | 25,4 | 26,9 | 26,9 | 27,4 | 27,1 | 27,8 | | |
| Korsør-Nyborg, DSB | SPROGØ/KNUDSHOVED | 6,1 | 4,3 | 5,3 | 3,8 | 1,4 | 0,7 | 3,9 | 3,0 | | |
| Korsør-Nyborg, Vognmandsruten | Superflex Alfa | 33,0 | 33,0 | 33,0 | 33,0 | 33,0 | 33,0 | 33,0 | 33,0 | 33,0 | |
| Korsør-Nyborg, Vognmandsruten | Superflex Bravo | 33,0 | 33,0 | 33,0 | 33,0 | 33,0 | 33,0 | 33,0 | 33,0 | 33,0 | |
| Korsør-Nyborg, Vognmandsruten | Superflex Charlie | 34,0 | 34,0 | 34,0 | 34,0 | 34,0 | 34,0 | 34,0 | 34,0 | 34,0 | |
| København-Rønne | JENS KOFOED | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 |
| København-Rønne | POVL ANKER | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 |
| Køge-Rønne | DUEODDE | | | | | | | | | | |
| Køge-Rønne | HAMMERODDE | | | | | | | | | | |
| Køge-Rønne | JENS KOFOED | | | | | | | | | | |
| Køge-Rønne | POVL ANKER | | | | | | | | | | |
| Sjællands Odde-Ebeltoft | MAI MOLS | | | | | | | 21,0 | 35,0 | 35,0 | 35,0 |
| Sjællands Odde-Ebeltoft | MAREN MOLS | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 15,0 | | | |
| Sjællands Odde-Ebeltoft | MAREN MOLS 2 | | | | | | | 18,0 | 15,0 | 15,0 | 15,0 |
| Sjællands Odde-Ebeltoft | METTE MOLS | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 17,0 | | | |
| Sjællands Odde-Ebeltoft | METTE MOLS 2 | | | | | | | 15,0 | 15,0 | 15,0 | 15,0 |
| Sjællands Odde-Ebeltoft | MIE MOLS | 20,0 | 20,0 | 20,0 | 20,0 | 20,0 | 20,0 | 5,0 | | | |
| Sjællands Odde-Ebeltoft | MIE MOLS 2 | | | | | | | 9,0 | 35,0 | 35,0 | 35,0 |
| Sjællands Odde-Århus | MADS MOLS | | | | | | | | | | 50,0 |
| Sjællands Odde-Århus | MAI MOLS | | | | | | | | | | |
| Sjællands Odde-Århus | MAX MOLS | | | | | | | | | | 50,0 |
| Sjællands Odde-Århus | MIE MOLS | | | | | | | | | | |
| Tårs-Spodsbjerg | FRIGG SYDFYEN | 41,0 | 40,0 | 39,0 | 38,0 | 36,0 | 36,0 | 36,0 | 32,0 | 33,0 | 45,0 |
| Tårs-Spodsbjerg | ODIN SYDFYEN | 41,0 | 40,0 | 39,0 | 38,0 | 36,0 | 36,0 | 36,0 | 32,0 | 33,0 | 45,0 |
| Tårs-Spodsbjerg | SPODSBJERG | 4,0 | 2,0 | 8,0 | 8,0 | 9,0 | 8,0 | 8,0 | 19,0 | 20,0 | 10,0 |
| Tårs-Spodsbjerg | THOR SYDFYEN | 14,0 | 18,0 | 14,0 | 16,0 | 19,0 | 20,0 | 20,0 | 17,0 | 14,0 | 0,0 |

Ferry data: Round trip shares (%) 2000 to 2008.

| Ferry service | Ferry name | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| Halsskov-Knudshoved | ARVEPRINS KNUD | | | | | | | | | |
| Halsskov-Knudshoved | DRONNING MARGRETHE II | | | | | | | | | |
| Halsskov-Knudshoved | HEIMDAL | | | | | | | | | |
| Halsskov-Knudshoved | KNUDSHOVED | | | | | | | | | |
| Halsskov-Knudshoved | KONG FREDERIK IX | | | | | | | | | |
| Halsskov-Knudshoved | KRAKA | | | | | | | | | |
| Halsskov-Knudshoved | LODBROG | | | | | | | | | |
| Halsskov-Knudshoved | PRINSESSE ANNE-MARIE | | | | | | | | | |
| Halsskov-Knudshoved | PRINSESSE ELISABETH | | | | | | | | | |
| Halsskov-Knudshoved | ROMSØ | | | | | | | | | |
| Halsskov-Knudshoved | SPROGØ | | | | | | | | | |
| Hundested-Grenaa | DJURSLAND | | | | | | | | | |
| Hundested-Grenaa | KATTEGAT | | | | | | | | | |
| Hundested-Grenaa | KONG FREDERIK IX | | | | | | | | | |
| Hundested-Grenaa | PRINSESSE ANNE-MARIE | | | | | | | | | |
| Kalundborg-Juelsminde | Mercandia I | | | | | | | | | |
| Kalundborg-Juelsminde | Mercandia II | | | | | | | | | |
| Kalundborg-Juelsminde | Mercandia III | | | | | | | | | |
| Kalundborg-Juelsminde | Mercandia IV | | | | | | | | | |
| Kalundborg-Samsø | HOLGER DANSKE | | | | | | | | | |
| Kalundborg-Samsø | KALUNDBORG | | | | | | | | | |
| Kalundborg-Samsø | KYHOLM | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 |
| Kalundborg-Samsø | VESBORG | | | | | | | | | |
| Kalundborg-Århus | ASK | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK I | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK II | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK III | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK IV | | | | | | | | | |
| Kalundborg-Århus | CAT-LINK V | | | | | | | | | |
| Kalundborg-Århus | KATTEGAT SYD | | | | | | | | | |
| Kalundborg-Århus | KNUDSHOVED | | | | | | | | | |
| Kalundborg-Århus | KONG FREDERIK IX | | | | | | | | | |
| Kalundborg-Århus | KRAKA | | | | | | | | | |
| Kalundborg-Århus | MAREN MOLS | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 |
| Kalundborg-Århus | METTE MOLS | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 |
| Kalundborg-Århus | NIELS KLIM | | | | | | | | | |

| *Continued* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Kalundborg-Århus | PEDER PAARS | | | | | | | | | |
| Kalundborg-Århus | PRINSESSE ELISABETH | | | | | | | | | |
| Kalundborg-Århus | ROSTOCK LINK | | | | | | | | | |
| Kalundborg-Århus | SØLØVEN/SØBJØRNEN | | | | | | | | | |
| Kalundborg-Århus | URD | | | | | | | | | |
| Korsør-Nyborg, DSB | ASA-THOR | | | | | | | | | |
| Korsør-Nyborg, DSB | DRONNING INGRID | | | | | | | | | |
| Korsør-Nyborg, DSB | DRONNING MARGRETHE II | | | | | | | | | |
| Korsør-Nyborg, DSB | KONG FREDERIK IX | | | | | | | | | |
| Korsør-Nyborg, DSB | KRONPRINS FREDERIK | | | | | | | | | |
| Korsør-Nyborg, DSB | PRINS JOACHIM | | | | | | | | | |
| Korsør-Nyborg, DSB | SPROGØ/KNUDSHOVED | | | | | | | | | |
| Korsør-Nyborg, Vognmandsruten | Superflex Alfa | | | | | | | | | |
| Korsør-Nyborg, Vognmandsruten | Superflex Bravo | | | | | | | | | |
| Korsør-Nyborg, Vognmandsruten | Superflex Charlie | | | | | | | | | |
| København-Rønne | JENS KOFOED | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 |
| København-Rønne | POVL ANKER | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 |
| Køge-Rønne | DUEODDE | | | | | | 25,0 | 48,7 | 46,9 | 46,9 |
| Køge-Rønne | HAMMERODDE | | | | | | 35,0 | 48,5 | 52,6 | 52,6 |
| Køge-Rønne | JENS KOFOED | | | | | 50,0 | 20,0 | | | |
| Køge-Rønne | POVL ANKER | | | | | 50,0 | 20,0 | 2,7 | 0,5 | 0,5 |
| Sjællands Odde-Ebeltoft | MAI MOLS | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 |
| Sjællands Odde-Ebeltoft | MAREN MOLS | | | | | | | | | |
| Sjællands Odde-Ebeltoft | MAREN MOLS 2 | | | | | | | | | |
| Sjællands Odde-Ebeltoft | METTE MOLS | | | | | | | | | |
| Sjællands Odde-Ebeltoft | METTE MOLS 2 | | | | | | | | | |
| Sjællands Odde-Ebeltoft | MIE MOLS | | | | | | | | | |
| Sjællands Odde-Ebeltoft | MIE MOLS 2 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 | 50,0 |
| Sjællands Odde-Århus | MADS MOLS | 95,0 | 90,0 | 95,0 | 60,0 | 60,0 | 35,0 | 30,0 | 31,0 | 31,0 |
| Sjællands Odde-Århus | MAI MOLS | | | 1,0 | 10,0 | 15,0 | 15,0 | 20,0 | 19,0 | 19,0 |
| Sjællands Odde-Århus | MAX MOLS | 5,0 | 10,0 | 3,0 | 20,0 | 10,0 | 35,0 | 30,0 | 31,0 | 31,0 |
| Sjællands Odde-Århus | MIE MOLS | | | 1,0 | 10,0 | 15,0 | 15,0 | 20,0 | 19,0 | 19,0 |
| Tårs-Spodsbjerg | FRIGG SYDFYEN | 45,0 | 45,0 | 45,0 | 45,0 | 45,0 | 45,0 | 45,0 | 45,0 | 45,0 |
| Tårs-Spodsbjerg | ODIN SYDFYEN | 45,0 | 45,0 | 45,0 | 45,0 | 45,0 | 45,0 | 45,0 | 45,0 | 45,0 |
| Tårs-Spodsbjerg | SPODSBJERG | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 |
| Tårs-Spodsbjerg | THOR SYDFYEN | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |

## Annex 2B-12 Fuel consumption and emission factors, engine specific ($NO_x$, CO, VOC (NMVOC and $CH_4$)), and fuel type specific (S-%, $SO_2$, PM) for ship engines

Specific fuel consumption and $NO_x$ emission factors (g pr kWh) per engine year for diesel ship engines.

| Year | High speed 4-stroke sfc (g pr kWh) | Medium speed 4-stroke sfc (g pr kWh) | Slow speed 2-stroke sfc (g pr kWh) | High speed 4-stroke $NO_X$ (g pr kWh) | Medium speed 4-stroke $NO_X$ (g pr kWh) | Slow speed 2-stroke $NO_X$ (g pr kWh) |
|---|---|---|---|---|---|---|
| 1949 | 265.5 | 255.5 | 235.5 | 7.3 | 8.0 | 14.5 |
| 1950 | 265.0 | 255.0 | 235.0 | 7.3 | 8.0 | 14.5 |
| 1951 | 264.5 | 254.5 | 234.5 | 7.3 | 8.0 | 14.5 |
| 1952 | 264.0 | 254.0 | 234.0 | 7.3 | 8.0 | 14.5 |
| 1953 | 263.5 | 253.5 | 233.5 | 7.3 | 8.0 | 14.5 |
| 1954 | 263.0 | 253.0 | 233.0 | 7.3 | 8.0 | 14.5 |
| 1955 | 262.4 | 252.4 | 232.4 | 7.3 | 8.0 | 14.5 |
| 1956 | 261.9 | 251.9 | 231.9 | 7.4 | 8.1 | 14.6 |
| 1957 | 261.3 | 251.3 | 231.3 | 7.5 | 8.2 | 14.7 |
| 1958 | 260.7 | 250.7 | 230.7 | 7.6 | 8.3 | 14.8 |
| 1959 | 260.1 | 250.1 | 230.1 | 7.7 | 8.4 | 14.9 |
| 1960 | 259.5 | 249.5 | 229.5 | 7.8 | 8.5 | 15.0 |
| 1961 | 258.9 | 248.9 | 228.9 | 7.9 | 8.6 | 15.1 |
| 1962 | 258.2 | 248.2 | 228.2 | 8.0 | 8.7 | 15.1 |
| 1963 | 257.6 | 247.6 | 227.6 | 8.1 | 8.8 | 15.2 |
| 1964 | 256.9 | 246.9 | 226.9 | 8.2 | 8.9 | 15.3 |
| 1965 | 256.1 | 246.1 | 226.1 | 8.3 | 9.0 | 15.4 |
| 1966 | 255.4 | 245.4 | 225.4 | 8.3 | 9.1 | 15.5 |
| 1967 | 254.6 | 244.6 | 224.6 | 8.4 | 9.2 | 15.6 |
| 1968 | 253.8 | 243.8 | 223.8 | 8.5 | 9.3 | 15.7 |
| 1969 | 253.0 | 243.0 | 223.0 | 8.6 | 9.4 | 15.8 |
| 1970 | 252.1 | 242.1 | 222.1 | 8.7 | 9.5 | 15.9 |
| 1971 | 251.2 | 241.2 | 221.2 | 8.8 | 9.6 | 16.0 |
| 1972 | 250.3 | 240.3 | 220.3 | 8.9 | 9.7 | 16.1 |
| 1973 | 249.3 | 239.3 | 219.3 | 9.0 | 9.8 | 16.2 |
| 1974 | 248.3 | 238.3 | 218.3 | 9.1 | 9.9 | 16.3 |
| 1975 | 247.3 | 237.3 | 217.3 | 9.2 | 10.0 | 16.4 |
| 1976 | 246.2 | 236.2 | 216.2 | 9.3 | 10.1 | 16.4 |
| 1977 | 245.0 | 235.0 | 215.0 | 9.3 | 10.2 | 16.5 |
| 1978 | 243.8 | 233.8 | 213.8 | 9.4 | 10.3 | 16.6 |
| 1979 | 242.6 | 232.6 | 212.6 | 9.5 | 10.4 | 16.7 |
| 1980 | 241.3 | 231.3 | 211.3 | 9.6 | 10.5 | 16.8 |
| 1981 | 239.9 | 229.9 | 209.9 | 9.7 | 10.6 | 16.9 |
| 1982 | 238.5 | 228.5 | 208.5 | 9.8 | 10.7 | 17.0 |
| 1983 | 237.0 | 227.0 | 207.0 | 9.9 | 10.8 | 17.4 |
| 1984 | 235.5 | 225.5 | 205.5 | 10.0 | 10.9 | 17.8 |
| 1985 | 233.9 | 223.9 | 203.9 | 10.1 | 11.0 | 18.2 |
| 1986 | 232.2 | 222.2 | 202.2 | 10.2 | 11.1 | 18.6 |
| 1987 | 230.5 | 220.5 | 200.5 | 10.3 | 11.3 | 19.0 |
| 1988 | 228.6 | 218.6 | 198.6 | 10.5 | 11.4 | 19.3 |
| 1989 | 226.7 | 216.7 | 196.7 | 10.6 | 11.6 | 19.5 |
| 1990 | 224.8 | 214.8 | 194.8 | 10.7 | 11.7 | 19.8 |
| 1991 | 222.7 | 212.7 | 192.7 | 10.9 | 11.9 | 20.0 |
| 1992 | 220.5 | 210.5 | 190.5 | 11.0 | 12.0 | 19.8 |
| 1993 | 218.3 | 208.3 | 188.3 | 11.1 | 12.1 | 19.6 |
| 1994 | 216.0 | 206.0 | 186.0 | 11.3 | 12.3 | 19.4 |
| 1995 | 213.6 | 203.6 | 183.6 | 11.4 | 12.4 | 19.3 |
| 1996 | 211.0 | 201.0 | 181.0 | 11.5 | 12.6 | 19.1 |
| 1997 | 208.4 | 198.4 | 178.4 | 11.7 | 12.7 | 18.9 |

*Continued*

| Year | High speed 4-stroke sfc (g pr kWh) | Medium speed 4-stroke sfc (g pr kWh) | Slow speed 2-stroke sfc (g pr kWh) | High speed 4-stroke $NO_X$ (g pr kWh) | Medium speed 4-stroke $NO_X$ (g pr kWh) | Slow speed 2-stroke $NO_X$ (g pr kWh) |
|---|---|---|---|---|---|---|
| 1998 | 205.7 | 195.7 | 175.7 | 11.8 | 12.9 | 18.7 |
| 1999 | 202.9 | 192.9 | 172.9 | 11.9 | 13.0 | 18.5 |
| 2000 | 199.9 | 189.9 | 169.9 | 11.0 | 12.0 | 16.0 |

CO and VOC emission factors (g pr kg fuel) for ship engines.

| Year | High speed 4-stroke CO | Medium speed 4-stroke CO | Slow speed 2-stroke CO | High speed 4-stroke VOC | Medium speed 4-stroke VOC | Slow speed 2-stroke VOC |
|---|---|---|---|---|---|---|
| 1949 | 6.03 | 6.26 | 6.79 | 1.88 | 1.96 | 2.12 |
| 1950 | 6.04 | 6.27 | 6.81 | 1.89 | 1.96 | 2.13 |
| 1951 | 6.05 | 6.29 | 6.82 | 1.89 | 1.96 | 2.13 |
| 1952 | 6.06 | 6.30 | 6.84 | 1.89 | 1.97 | 2.14 |
| 1953 | 6.07 | 6.31 | 6.85 | 1.90 | 1.97 | 2.14 |
| 1954 | 6.08 | 6.33 | 6.87 | 1.90 | 1.98 | 2.15 |
| 1955 | 6.10 | 6.34 | 6.88 | 1.91 | 1.98 | 2.15 |
| 1956 | 6.11 | 6.35 | 6.90 | 1.91 | 1.99 | 2.16 |
| 1957 | 6.12 | 6.37 | 6.92 | 1.91 | 1.99 | 2.16 |
| 1958 | 6.14 | 6.38 | 6.93 | 1.92 | 1.99 | 2.17 |
| 1959 | 6.15 | 6.40 | 6.95 | 1.92 | 2.00 | 2.17 |
| 1960 | 6.17 | 6.41 | 6.97 | 1.93 | 2.00 | 2.18 |
| 1961 | 6.18 | 6.43 | 6.99 | 1.93 | 2.01 | 2.18 |
| 1962 | 6.20 | 6.45 | 7.01 | 1.94 | 2.01 | 2.19 |
| 1963 | 6.21 | 6.46 | 7.03 | 1.94 | 2.02 | 2.20 |
| 1964 | 6.23 | 6.48 | 7.05 | 1.95 | 2.03 | 2.20 |
| 1965 | 6.25 | 6.50 | 7.08 | 1.95 | 2.03 | 2.21 |
| 1966 | 6.26 | 6.52 | 7.10 | 1.96 | 2.04 | 2.22 |
| 1967 | 6.28 | 6.54 | 7.12 | 1.96 | 2.04 | 2.23 |
| 1968 | 6.30 | 6.56 | 7.15 | 1.97 | 2.05 | 2.23 |
| 1969 | 6.32 | 6.58 | 7.17 | 1.98 | 2.06 | 2.24 |
| 1970 | 6.35 | 6.61 | 7.20 | 1.98 | 2.06 | 2.25 |
| 1971 | 6.37 | 6.63 | 7.23 | 1.99 | 2.07 | 2.26 |
| 1972 | 6.39 | 6.66 | 7.26 | 2.00 | 2.08 | 2.27 |
| 1973 | 6.42 | 6.69 | 7.29 | 2.01 | 2.09 | 2.28 |
| 1974 | 6.44 | 6.71 | 7.33 | 2.01 | 2.10 | 2.29 |
| 1975 | 6.47 | 6.74 | 7.36 | 2.02 | 2.11 | 2.30 |
| 1976 | 6.50 | 6.77 | 7.40 | 2.03 | 2.12 | 2.31 |
| 1977 | 6.53 | 6.81 | 7.44 | 2.04 | 2.13 | 2.33 |
| 1978 | 6.56 | 6.84 | 7.48 | 2.05 | 2.14 | 2.34 |
| 1979 | 6.60 | 6.88 | 7.53 | 2.06 | 2.15 | 2.35 |
| 1980 | 6.63 | 6.92 | 7.57 | 2.07 | 2.16 | 2.37 |
| 1981 | 6.67 | 6.96 | 7.62 | 2.08 | 2.17 | 2.38 |
| 1982 | 6.71 | 7.00 | 7.67 | 2.10 | 2.19 | 2.40 |
| 1983 | 6.75 | 7.05 | 7.73 | 2.11 | 2.20 | 2.42 |
| 1984 | 6.79 | 7.10 | 7.79 | 2.12 | 2.22 | 2.43 |
| 1985 | 6.84 | 7.15 | 7.85 | 2.14 | 2.23 | 2.45 |
| 1986 | 6.89 | 7.20 | 7.91 | 2.15 | 2.25 | 2.47 |
| 1987 | 6.94 | 7.26 | 7.98 | 2.17 | 2.27 | 2.49 |
| 1988 | 7.00 | 7.32 | 8.05 | 2.19 | 2.29 | 2.52 |
| 1989 | 7.06 | 7.38 | 8.13 | 2.21 | 2.31 | 2.54 |
| 1990 | 7.12 | 7.45 | 8.22 | 2.22 | 2.33 | 2.57 |
| 1991 | 7.18 | 7.52 | 8.30 | 2.25 | 2.35 | 2.59 |
| 1992 | 7.25 | 7.60 | 8.40 | 2.27 | 2.37 | 2.62 |
| 1993 | 7.33 | 7.68 | 8.50 | 2.29 | 2.40 | 2.66 |
| 1994 | 7.41 | 7.77 | 8.60 | 2.31 | 2.43 | 2.69 |
| 1995 | 7.49 | 7.86 | 8.72 | 2.34 | 2.46 | 2.72 |
| 1996 | 7.58 | 7.96 | 8.84 | 2.37 | 2.49 | 2.76 |
| 1997 | 7.68 | 8.06 | 8.97 | 2.40 | 2.52 | 2.80 |
| 1998 | 7.78 | 8.18 | 9.11 | 2.43 | 2.56 | 2.85 |
| 1999 | 7.89 | 8.30 | 9.26 | 2.46 | 2.59 | 2.89 |
| 2000 | 8.00 | 8.43 | 9.42 | 2.50 | 2.63 | 2.94 |

NMVOC and $CH_4$ emission factors (g pr kg fuel) for ship engines.

| Year | High speed 4-stroke NMVOC | Medium speed 4-stroke NMVOC | Slow speed 2-stroke NMVOC | High speed 4-stroke $CH_4$ | Medium speed 4-stroke $CH_4$ | Slow speed 2-stroke $CH_4$ |
|---|---|---|---|---|---|---|
| 1949 | 1.83 | 1.90 | 2.06 | 0.06 | 0.06 | 0.06 |
| 1950 | 1.83 | 1.90 | 2.06 | 0.06 | 0.06 | 0.06 |
| 1951 | 1.83 | 1.91 | 2.07 | 0.06 | 0.06 | 0.06 |
| 1952 | 1.84 | 1.91 | 2.07 | 0.06 | 0.06 | 0.06 |
| 1953 | 1.84 | 1.91 | 2.08 | 0.06 | 0.06 | 0.06 |
| 1954 | 1.84 | 1.92 | 2.08 | 0.06 | 0.06 | 0.06 |
| 1955 | 1.85 | 1.92 | 2.09 | 0.06 | 0.06 | 0.06 |
| 1956 | 1.85 | 1.93 | 2.09 | 0.06 | 0.06 | 0.06 |
| 1957 | 1.86 | 1.93 | 2.10 | 0.06 | 0.06 | 0.06 |
| 1958 | 1.86 | 1.93 | 2.10 | 0.06 | 0.06 | 0.07 |
| 1959 | 1.86 | 1.94 | 2.11 | 0.06 | 0.06 | 0.07 |
| 1960 | 1.87 | 1.94 | 2.11 | 0.06 | 0.06 | 0.07 |
| 1961 | 1.87 | 1.95 | 2.12 | 0.06 | 0.06 | 0.07 |
| 1962 | 1.88 | 1.95 | 2.13 | 0.06 | 0.06 | 0.07 |
| 1963 | 1.88 | 1.96 | 2.13 | 0.06 | 0.06 | 0.07 |
| 1964 | 1.89 | 1.96 | 2.14 | 0.06 | 0.06 | 0.07 |
| 1965 | 1.89 | 1.97 | 2.14 | 0.06 | 0.06 | 0.07 |
| 1966 | 1.90 | 1.98 | 2.15 | 0.06 | 0.06 | 0.07 |
| 1967 | 1.90 | 1.98 | 2.16 | 0.06 | 0.06 | 0.07 |
| 1968 | 1.91 | 1.99 | 2.17 | 0.06 | 0.06 | 0.07 |
| 1969 | 1.92 | 2.00 | 2.17 | 0.06 | 0.06 | 0.07 |
| 1970 | 1.92 | 2.00 | 2.18 | 0.06 | 0.06 | 0.07 |
| 1971 | 1.93 | 2.01 | 2.19 | 0.06 | 0.06 | 0.07 |
| 1972 | 1.94 | 2.02 | 2.20 | 0.06 | 0.06 | 0.07 |
| 1973 | 1.95 | 2.03 | 2.21 | 0.06 | 0.06 | 0.07 |
| 1974 | 1.95 | 2.04 | 2.22 | 0.06 | 0.06 | 0.07 |
| 1975 | 1.96 | 2.04 | 2.23 | 0.06 | 0.06 | 0.07 |
| 1976 | 1.97 | 2.05 | 2.24 | 0.06 | 0.06 | 0.07 |
| 1977 | 1.98 | 2.06 | 2.26 | 0.06 | 0.06 | 0.07 |
| 1978 | 1.99 | 2.07 | 2.27 | 0.06 | 0.06 | 0.07 |
| 1979 | 2.00 | 2.09 | 2.28 | 0.06 | 0.06 | 0.07 |
| 1980 | 2.01 | 2.10 | 2.30 | 0.06 | 0.06 | 0.07 |
| 1981 | 2.02 | 2.11 | 2.31 | 0.06 | 0.07 | 0.07 |
| 1982 | 2.03 | 2.12 | 2.33 | 0.06 | 0.07 | 0.07 |
| 1983 | 2.05 | 2.14 | 2.34 | 0.06 | 0.07 | 0.07 |
| 1984 | 2.06 | 2.15 | 2.36 | 0.06 | 0.07 | 0.07 |
| 1985 | 2.07 | 2.17 | 2.38 | 0.06 | 0.07 | 0.07 |
| 1986 | 2.09 | 2.18 | 2.40 | 0.06 | 0.07 | 0.07 |
| 1987 | 2.10 | 2.20 | 2.42 | 0.07 | 0.07 | 0.07 |
| 1988 | 2.12 | 2.22 | 2.44 | 0.07 | 0.07 | 0.08 |
| 1989 | 2.14 | 2.24 | 2.47 | 0.07 | 0.07 | 0.08 |
| 1990 | 2.16 | 2.26 | 2.49 | 0.07 | 0.07 | 0.08 |
| 1991 | 2.18 | 2.28 | 2.52 | 0.07 | 0.07 | 0.08 |
| 1992 | 2.20 | 2.30 | 2.55 | 0.07 | 0.07 | 0.08 |
| 1993 | 2.22 | 2.33 | 2.58 | 0.07 | 0.07 | 0.08 |
| 1994 | 2.25 | 2.35 | 2.61 | 0.07 | 0.07 | 0.08 |
| 1995 | 2.27 | 2.38 | 2.64 | 0.07 | 0.07 | 0.08 |
| 1996 | 2.30 | 2.41 | 2.68 | 0.07 | 0.07 | 0.08 |
| 1997 | 2.33 | 2.44 | 2.72 | 0.07 | 0.08 | 0.08 |
| 1998 | 2.36 | 2.48 | 2.76 | 0.07 | 0.08 | 0.09 |
| 1999 | 2.39 | 2.51 | 2.81 | 0.07 | 0.08 | 0.09 |
| 2000 | 2.43 | 2.55 | 2.85 | 0.08 | 0.08 | 0.09 |

S-%, $SO_2$ and PM emission factors (g/kg fuel and g/GJ) per fuel type for diesel ship engines

| Fuel type | SNAPCode | Year | S % | $SO_2$ (g/kg) | TSP (g/kg) | $PM_{10}$ (g/kg) | $PM_{2,5}$ (g/kg) | $SO_2$ (g/GJ) | TSP (g/GJ) | $PM_{10}$ (g/GJ) | $PM_{2,5}$ (g/GJ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fuel | National sea | 1990 | 2.64 | 52.8 | 6.1 | 6.0 | 6.0 | 1291.0 | 149.2 | 147.8 | 147.0 |
| Fuel | National sea | 1991 | 2.35 | 47 | 4.9 | 4.9 | 4.8 | 1149.1 | 120.2 | 119.0 | 118.4 |
| Fuel | National sea | 1992 | 1.8 | 36 | 3.3 | 3.2 | 3.2 | 880.2 | 79.8 | 79.0 | 78.6 |
| Fuel | National sea | 1993 | 2.39 | 47.8 | 5.1 | 5.0 | 5.0 | 1168.7 | 123.9 | 122.6 | 122.0 |
| Fuel | National sea | 1994 | 2.62 | 52.4 | 6.0 | 6.0 | 5.9 | 1281.2 | 147.0 | 145.6 | 144.8 |
| Fuel | National sea | 1995 | 2.95 | 59 | 7.7 | 7.6 | 7.6 | 1442.5 | 188.0 | 186.1 | 185.2 |
| Fuel | National sea | 1996 | 2.57 | 51.4 | 5.8 | 5.7 | 5.7 | 1256.7 | 141.7 | 140.2 | 139.5 |
| Fuel | National sea | 1997 | 2.74 | 54.8 | 6.6 | 6.5 | 6.5 | 1339.9 | 160.8 | 159.2 | 158.4 |
| Fuel | National sea | 1998 | 1.97 | 39.4 | 3.7 | 3.7 | 3.6 | 963.3 | 90.6 | 89.7 | 89.2 |
| Fuel | National sea | 1999 | 1.97 | 39.4 | 3.7 | 3.7 | 3.6 | 963.3 | 90.6 | 89.7 | 89.2 |
| Fuel | National sea | 2000 | 1.81 | 36.2 | 3.3 | 3.3 | 3.2 | 885.1 | 80.4 | 79.6 | 79.2 |
| Fuel | National sea | 2001 | 1.7 | 34 | 3.0 | 3.0 | 3.0 | 831.3 | 74.1 | 73.4 | 73.0 |
| Fuel | National sea | 2002 | 1.51 | 30.2 | 2.6 | 2.6 | 2.6 | 738.4 | 64.3 | 63.7 | 63.3 |
| Fuel | National sea | 2003 | 1.62 | 32.4 | 2.9 | 2.8 | 2.8 | 792.2 | 69.8 | 69.1 | 68.8 |
| Fuel | National sea | 2004 | 1.98 | 39.6 | 3.7 | 3.7 | 3.7 | 968.2 | 91.3 | 90.4 | 89.9 |
| Fuel | National sea | 2005 | 2 | 40 | 3.8 | 3.8 | 3.7 | 978.0 | 92.6 | 91.7 | 91.3 |
| Fuel | National sea | 2006 | 1.94 | 38.8 | 3.6 | 3.6 | 3.6 | 948.7 | 88.6 | 87.7 | 87.3 |
| Fuel | National sea | 2007 | 1.2 | 24 | 2.1 | 2.1 | 2.1 | 586.8 | 51.0 | 50.5 | 50.3 |
| Fuel | National sea | 2008 | 1.2 | 24 | 2.1 | 2.1 | 2.1 | 586.8 | 51.0 | 50.5 | 50.3 |
| Fuel | International sea | 1990 | 2.96 | 59.2 | 7.7 | 7.7 | 7.6 | 1447.4 | 189.4 | 187.5 | 186.6 |
| Fuel | International sea | 1991 | 2.89 | 57.8 | 7.4 | 7.3 | 7.2 | 1413.2 | 179.8 | 178.0 | 177.1 |
| Fuel | International sea | 1992 | 2.88 | 57.6 | 7.3 | 7.2 | 7.2 | 1408.3 | 178.5 | 176.7 | 175.8 |
| Fuel | International sea | 1993 | 3.2 | 64 | 9.3 | 9.2 | 9.1 | 1564.8 | 226.5 | 224.2 | 223.1 |
| Fuel | International sea | 1994 | 3.03 | 60.6 | 8.2 | 8.1 | 8.0 | 1481.7 | 199.6 | 197.6 | 196.6 |
| Fuel | International sea | 1995 | 3.3 | 66 | 10.0 | 9.9 | 9.8 | 1613.7 | 244.0 | 241.6 | 240.4 |
| Fuel | International sea | 1996 | 3.42 | 68.4 | 10.9 | 10.8 | 10.8 | 1672.4 | 266.9 | 264.2 | 262.9 |
| Fuel | International sea | 1997 | 3.45 | 69 | 11.2 | 11.0 | 11.0 | 1687.0 | 272.9 | 270.2 | 268.8 |
| Fuel | International sea | 1998 | 3.42 | 68.4 | 10.9 | 10.8 | 10.8 | 1672.4 | 266.9 | 264.2 | 262.9 |
| Fuel | International sea | 1999 | 3.45 | 69 | 11.2 | 11.0 | 11.0 | 1687.0 | 272.9 | 270.2 | 268.8 |
| Fuel | International sea | 2000 | 3.36 | 67.2 | 10.4 | 10.3 | 10.3 | 1643.0 | 255.2 | 252.6 | 251.4 |
| Fuel | International sea | 2001 | 3.42 | 68.4 | 10.9 | 10.8 | 10.8 | 1672.4 | 266.9 | 264.2 | 262.9 |
| Fuel | International sea | 2002 | 3.44 | 68.8 | 11.1 | 11.0 | 10.9 | 1682.2 | 270.9 | 268.2 | 266.8 |
| Fuel | International sea | 2003 | 3.11 | 62.2 | 8.7 | 8.6 | 8.5 | 1520.8 | 211.8 | 209.7 | 208.6 |
| Fuel | International sea | 2004 | 3.2 | 64 | 9.3 | 9.2 | 9.1 | 1564.8 | 226.5 | 224.2 | 223.1 |
| Fuel | International sea | 2005 | 3.5 | 70 | 11.6 | 11.5 | 11.4 | 1711.5 | 283.2 | 280.4 | 279.0 |
| Fuel | International sea | 2006 | 3.35 | 67 | 10.4 | 10.3 | 10.2 | 1638.1 | 253.3 | 250.8 | 249.5 |
| Fuel | International sea | 2007 | 1.5 | 30 | 2.6 | 2.6 | 2.6 | 733.5 | 63.8 | 63.2 | 62.9 |
| Fuel | International sea | 2008 | 1.5 | 30 | 2.6 | 2.6 | 2.6 | 733.5 | 63.8 | 63.2 | 62.9 |
| Diesel | - | 1990 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 1991 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 1992 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 1993 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 1994 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 1995 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 1996 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 1997 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 1998 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 1999 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 2000 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 2001 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 2002 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 2003 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 2004 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 2005 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |

*Continued*

| Fuel type | SNAPCode | Year | S % | $SO_2$ (g/kg) | TSP (g/kg) | $PM_{10}$ (g/kg) | $PM_{2,5}$ (g/kg) | $SO_2$ (g/GJ) | TSP (g/GJ) | $PM_{10}$ (g/GJ) | $PM_{2,5}$ (g/GJ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Diesel | - | 2006 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 2007 | 0.2 | 4.0 | 1.0 | 1.0 | 1.0 | 93.7 | 23.2 | 23.0 | 22.9 |
| Diesel | - | 2008 | 0.1 | 2.0 | 0.9 | 0.9 | 0.9 | 46.8 | 21.5 | 21.3 | 21.2 |

## Annex 2B-13Fuel sales figures from DEA, and further processed fuel consumption data suited for the Danish inventory

| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Agriculture and forestry, DEA statistics** | | | | | | | | | | | | | | | |
| - LPG | 88 | 84 | 354 | 311 | 457 | 438 | 412 | 359 | 234 | 205 | 204 | 212 | 184 | 219 | 162 |
| - gasoline | 425 | 184 | 315 | 317 | 304 | 274 | 251 | 240 | 208 | 166 | 161 | 191 | 70 | 61 | 56 |
| - gas/diesel oil | 9199 | 9634 | 9498 | 9520 | 10605 | 10528 | 10700 | 11028 | 11423 | 11494 | 11585 | 13088 | 13875 | 13310 | 13909 |
| **Gartneri, DEA statistics** | | | | | | | | | | | | | | | |
| - LPG | 8 | 5 | 47 | 47 | 53 | 50 | 47 | 39 | 26 | 23 | 23 | 22 | 20 | 24 | 17 |
| - gasoline | 10 | 3 | 6 | 6 | 11 | 10 | 10 | 12 | 23 | 18 | 18 | 19 | 7 | 6 | 6 |
| - gas/diesel oil | 1705 | 1270 | 1405 | 1383 | 1231 | 1409 | 1687 | 1887 | 1205 | 963 | 1138 | 487 | 356 | 341 | 347 |
| **Fishery, DEA statistics** | | | | | | | | | | | | | | | |
| - LPG | 0 | 0 | 34 | 29 | 50 | 42 | 34 | 30 | 12 | 18 | 16 | 36 | 5 | 1 | 16 |
| - gasoline | 0 | 1 | 2 | 2 | 9 | 9 | 10 | 8 | 7 | 7 | 8 | 7 | 6 | 6 | 60 |
| - kerosene | 7 | 2 | 9 | 5 | 12 | 26 | 9 | 5 | 4 | 3 | 4 | 3 | 3 | 2 | 0 |
| - gas/diesel oil | 9152 | 10248 | 8390 | 9499 | 10038 | 10422 | 10809 | 10868 | 8843 | 8796 | 8277 | 8750 | 8748 | 9186 | 9282 |
| - fuel oil | 27 | 5 | 82 | 68 | 251 | 285 | 113 | 231 | 146 | 8 | 19 | 219 | 260 | 27 | 0 |
| **Manufacturing industry, DEA statistics** | | | | | | | | | | | | | | | |
| - LPG | 2860 | 2839 | 2688 | 2553 | 2080 | 2032 | 2076 | 1827 | 1858 | 2029 | 2234 | 2404 | 2106 | 2017 | 1917 |
| - gasoline | 262 | 273 | 453 | 326 | 136 | 177 | 161 | 158 | 145 | 138 | 110 | 86 | 82 | 137 | 80 |
| - gas/diesel oil | 15576 | 15441 | 14743 | 13346 | 12670 | 12259 | 12934 | 11901 | 11323 | 10154 | 10401 | 10184 | 8921 | 8720 | 8852 |
| - fuel oil | 29465 | 29451 | 21518 | 19056 | 16741 | 15989 | 17133 | 16694 | 14600 | 15438 | 14000 | 12632 | 11009 | 10943 | 8704 |
| **Building and construction, DEA statistics** | | | | | | | | | | | | | | | |
| - LPG | 305 | 343 | 500 | 451 | 575 | 500 | 573 | 708 | 579 | 522 | 501 | 509 | 471 | 575 | 422 |
| - gasoline | 19 | 85 | 52 | 48 | 36 | 34 | 26 | 24 | 20 | 23 | 25 | 34 | 27 | 23 | 27 |
| - gas/diesel oil | 5313 | 4962 | 4378 | 4220 | 3945 | 3548 | 3797 | 3839 | 3871 | 4145 | 5317 | 5572 | 6079 | 5947 | 6556 |
| **Housing, DEA statistics** | | | | | | | | | | | | | | | |
| - gasoline | 1006 | 1046 | 1073 | 1114 | 1128 | 1131 | 1146 | 1158 | 1168 | 1194 | 1233 | 1258 | 1299 | 1317 | 1357 |
| | | | | | | | | | | | | | | | |
| **Road transport, DEA statistics** | | | | | | | | | | | | | | | |
| - gasoline | 66 037 | 68 670 | 70 502 | 73 151 | 74 152 | 74 326 | 75 290 | 76 084 | 76 697 | 78 425 | 80 998 | 82 656 | 85 341 | 86 520 | 89 129 |
| - gas/diesel oil | 45 609 | 49 738 | 49 626 | 49 686 | 51 854 | 54 746 | 58 427 | 57 511 | 56 796 | 58 755 | 58 561 | 59 851 | 60 528 | 61 072 | 63 619 |
| - bioethanol | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| - biodiesel | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Non-road, DEA statistics** | | | | | | | | | | | | | | | |
| - LPG | 2 955 | 2 929 | 3 089 | 2 911 | 2 590 | 2 520 | 2 535 | 2 224 | 2 118 | 2 257 | 2 461 | 2 638 | 2 310 | 2 260 | 2 097 |
| - gasoline | 1 722 | 1 590 | 1 898 | 1 810 | 1 616 | 1 626 | 1 595 | 1 592 | 1 563 | 1 540 | 1 547 | 1 589 | 1 485 | 1 545 | 1 526 |

*Continued*

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| - gas/diesel oil | 31 793 | 31 307 | 30 025 | 28 469 | 28 451 | 27 744 | 29 118 | 28 655 | 27 822 | 26 755 | 28 441 | 29 331 | 29 231 | 28 319 | 29 665 |
| **Non-road, NERI model** | | | | | | | | | | | | | | | |
| - LPG | 1232 | 1233 | 1225 | 1209 | 1196 | 1185 | 1172 | 1151 | 1124 | 1105 | 1099 | 1088 | 1075 | 1086 | 1077 |
| - gasoline | 2998 | 2950 | 2903 | 2856 | 2813 | 2770 | 2702 | 2641 | 2587 | 2550 | 2521 | 2499 | 2479 | 2463 | 2456 |
| - gas/diesel oil | 26357 | 26895 | 26577 | 27075 | 26940 | 26800 | 26734 | 26046 | 26073 | 25235 | 25798 | 25139 | 25536 | 24844 | 24885 |
| **Recreational craft, NERI model** | | | | | | | | | | | | | | | |
| - gasoline | 270 | 270 | 279 | 289 | 299 | 309 | 319 | 329 | 339 | 348 | 358 | 368 | 377 | 385 | 391 |
| - gas/diesel oil | 219 | 219 | 247 | 277 | 309 | 343 | 378 | 415 | 454 | 495 | 537 | 581 | 628 | 676 | 726 |
| **Non-road, added 0203 and 0301** | | | | | | | | | | | | | | | |
| - gas/diesel oil | 5436 | 4412 | 3448 | 1395 | 1510 | 944 | 2384 | 2609 | 1748 | 1521 | 2642 | 4192 | 3695 | 3475 | 4780 |
| - LPG | 1724 | 1696 | 1864 | 1701 | 1393 | 1335 | 1363 | 1073 | 994 | 1152 | 1362 | 1549 | 1235 | 1175 | 1020 |
| **Non-road, added 0203** | | | | | | | | | | | | | | | |
| - gas/diesel oil | 1864 | 1537 | 1252 | 534 | 628 | 406 | 1014 | 1176 | 794 | 708 | 1182 | 1940 | 1799 | 1675 | 2297 |
| - LPG | 56 | 52 | 242 | 209 | 274 | 259 | 247 | 192 | 122 | 116 | 125 | 137 | 109 | 126 | 87 |
| **Non-road, added 0301** | | | | | | | | | | | | | | | |
| - gas/diesel oil | 3572 | 2875 | 2196 | 860 | 882 | 538 | 1370 | 1433 | 955 | 813 | 1460 | 2252 | 1896 | 1800 | 2483 |
| - LPG | 1668 | 1644 | 1622 | 1492 | 1119 | 1076 | 1116 | 881 | 872 | 1036 | 1237 | 1412 | 1126 | 1048 | 933 |
| **Non-road, added road transport** | | | | | | | | | | | | | | | |
| - gasoline | -1276 | -1360 | -1005 | -1046 | -1197 | -1145 | -1107 | -1049 | -1023 | -1010 | -975 | -909 | -994 | -918 | -931 |
| **Fisheries, added national sea transport** | | | | | | | | | | | | | | | |
| - fuel oil | 27 | 5 | 82 | 68 | 251 | 285 | 113 | 231 | 146 | 8 | 19 | 219 | 260 | 27 | 0 |
| **Fisheries, consumed by recreational craft** | | | | | | | | | | | | | | | |
| - gasoline | 0 | 1 | 2 | 2 | 9 | 9 | 10 | 8 | 7 | 7 | 8 | 7 | 6 | 6 | 60 |
| **National sea transport, input NERI model** | | | | | | | | | | | | | | | |
| - LPG | 3 | 1 | 3 | - | 2 | 2 | 2 | 3 | 16 | 1 | 2 | 1 | 2 | 3 | 1 |
| - kerosene | 5 | - | 5 | 3 | 1 | 0 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| - gas/diesel oil | 3 074 | 3 045 | 3 032 | 3 230 | 2 669 | 2 782 | 3 313 | 3 501 | 4 971 | 5 035 | 6 049 | 6 764 | 5 899 | 4 113 | 3 409 |
| - fuel oil | 2 541 | 3 424 | 3 922 | 2 795 | 4 228 | 3 845 | 4 429 | 3 646 | 2 797 | 2 160 | 1 592 | 1 379 | 1 210 | 1 367 | 1 435 |
| **Fisheries, input NERI model** | | | | | | | | | | | | | | | |
| - LPG | - | - | 34 | 29 | 50 | 42 | 34 | 30 | 12 | 18 | 16 | 36 | 5 | 1 | 16 |
| - gasoline | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| - kerosene | 7 | 2 | 9 | 5 | 12 | 26 | 9 | 5 | 4 | 3 | 4 | 3 | 3 | 2 | 0 |
| - gas/diesel oil | 8 932 | 10 029 | 8 143 | 9 222 | 9 729 | 10 080 | 10 431 | 10 453 | 8 389 | 8 301 | 7 740 | 8 169 | 8 120 | 8 510 | 8 556 |
| **International sea transport, input NERI model** | | | | | | | | | | | | | | | |
| - gas/diesel oil | 7 171 | 7 867 | 8 547 | 9 743 | 10 514 | 11 633 | 12 590 | 16 881 | 19 114 | 24 123 | 26 743 | 27 231 | 25 325 | 31 243 | 26 085 |
| - fuel oil | 10 123 | 12 236 | 20 883 | 27 532 | 27 667 | 28 543 | 23 470 | 20 998 | 36 988 | 39 024 | 39 509 | 35 739 | 32 427 | 26 952 | 28 526 |
| **National sea transport, output NERI model** | | | | | | | | | | | | | | | |

| Continued | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| - gas/diesel oil | 4942 | 4942 | 4942 | 4942 | 4942 | 4942 | 5575 | 6472 | 6285 | 6238 | 6655 | 8189 | 8691 | 7057 | 5590 |
| - fuel oil | 3843 | 3843 | 3843 | 3843 | 3843 | 3843 | 3197 | 2473 | 2473 | 2633 | 2653 | 2097 | 1324 | 862 | 726 |
| - kerosene | 5 | 0 | 5 | 3 | 1 | 0 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| - LPG | 3 | 1 | 3 | 0 | 2 | 2 | 2 | 3 | 16 | 1 | 2 | 1 | 2 | 3 | 1 |
| **Fisheries, output NERI model** | | | | | | | | | | | | | | | |
| - gas/diesel oil | 7064 | 8131 | 6233 | 7509 | 7455 | 7920 | 8170 | 7482 | 7075 | 7097 | 7134 | 6744 | 5328 | 5566 | 6375 |
| - kerosene | 7 | 2 | 9 | 5 | 12 | 26 | 9 | 5 | 4 | 3 | 4 | 3 | 3 | 2 | 0 |
| - LPG | 0 | 0 | 34 | 29 | 50 | 42 | 34 | 30 | 12 | 18 | 16 | 36 | 5 | 1 | 16 |
| **National sea transport, added 0301** | | | | | | | | | | | | | | | |
| - fuel oil | -1 302 | - 419 | 80 | -1 048 | 386 | 3 | 1 233 | 1 174 | 325 | - 473 | -1 061 | - 718 | - 113 | 506 | 709 |
| **Road transport, NERI excl. traded fuels** | | | | | | | | | | | | | | | |
| - gasoline | 64 492 | 67 041 | 69 220 | 71 819 | 72 664 | 72 882 | 73 874 | 74 714 | 75 342 | 77 074 | 79 674 | 81 385 | 83 976 | 85 223 | 87 867 |
| - gas/diesel oil | 45 609 | 49 738 | 49 626 | 49 686 | 51 854 | 54 746 | 58 427 | 57 511 | 56 796 | 58 755 | 58 561 | 59 851 | 60 528 | 61 072 | 63 619 |
| - bioethanol | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| - biodiesel | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Road transport, input NERI model incl. traded fuels** | | | | | | | | | | | | | | | |
| - gasoline | 62 077 | 62 442 | 62 716 | 63 442 | 62 546 | 66 279 | 70 589 | 74 320 | 76 459 | 79 209 | 80 101 | 80 958 | 83 089 | 84 832 | 84 506 |
| - gas/diesel oil | 49 016 | 54 939 | 54 827 | 54 887 | 57 055 | 59 947 | 61 296 | 59 950 | 59 522 | 63 561 | 64 013 | 65 590 | 66 374 | 67 206 | 69 501 |
| - bioethanol | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| - biodiesel | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

| Continued | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| **Agriculture and forestry, DEA statistics** | | | | | | | | | |
| - LPG | 179 | 190 | 159 | 153 | 138 | 121 | 116 | 110 | 103 |
| - gasoline | 38 | 39 | 28 | 42 | 51 | 52 | 20 | 21 | 20 |
| - gas/diesel oil | 13689 | 13437 | 13706 | 13463 | 12934 | 12464 | 13047 | 12590 | 13803 |
| **Gartneri, DEA statistics** | | | | | | | | | |
| - LPG | 19 | 20 | 17 | 16 | 14 | 12 | 12 | 11 | 10 |
| - gasoline | 4 | 4 | 3 | 5 | 6 | 6 | 2 | 2 | 2 |
| - gas/diesel oil | 698 | 581 | 529 | 556 | 488 | 407 | 391 | 309 | 338 |
| **Fishery, DEA statistics** | | | | | | | | | |
| - LPG | 13 | 19 | 21 | 20 | 18 | 20 | 20 | 18 | 12 |
| - gasoline | 67 | 3 | 3 | 0 | 0 | 0 | 1 | 1 | 1 |
| - kerosene | 25 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| - gas/diesel oil | 9347 | 8908 | 8888 | 8428 | 7337 | 7340 | 7362 | 6854 | 6501 |
| - fuel oil | 0 | 0 | 4 | 84 | 35 | 126 | 86 | 13 | 14 |
| **Manufacturing industry, DEA statistics** | | | | | | | | | |
| - LPG | 1819 | 1526 | 1405 | 1472 | 1488 | 1478 | 1482 | 1216 | 1178 |

| Continued | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| - gasoline | 97 | 69 | 42 | 26 | 30 | 21 | 32 | 16 | 15 |
| - gas/diesel oil | 8635 | 10099 | 9155 | 9964 | 10515 | 10022 | 9132 | 8168 | 7986 |
| - fuel oil | 8221 | 7395 | 7818 | 6916 | 6940 | 6055 | 8527 | 6422 | 5664 |
| **Building and construction, DEA statistics** | | | | | | | | | |
| - LPG | 165 | 179 | 236 | 226 | 228 | 224 | 248 | 222 | 172 |
| - gasoline | 33 | 24 | 26 | 27 | 27 | 27 | 27 | 28 | 26 |
| - gas/diesel oil | 5950 | 6356 | 6226 | 6226 | 6227 | 6338 | 6187 | 6410 | 6518 |
| **Housing, DEA statistics** | | | | | | | | | |
| - gasoline | 1355 | 1317 | 1313 | 1303 | 1288 | 1250 | 1216 | 1193 | 1148 |
| **Road transport, DEA statistics** | | | | | | | | | |
| - gasoline | 88 975 | 86 474 | 86 247 | 85 611 | 84 629 | 82 118 | 79 822 | 78 325 | 75 361 |
| - gas/diesel oil | 64 282 | 66 254 | 66 814 | 70 875 | 75 422 | 79 476 | 86 223 | 95 084 | 94 846 |
| - bioethanol | - | - | - | - | - | - | 151 | 252 | 210 |
| - biodiesel | - | - | - | - | - | - | - | - | 10 |
| **Non-road, DEA statistics** | | | | | | | | | |
| - LPG | 2 018 | 1 736 | 1 581 | 1 641 | 1 640 | 1 612 | 1 610 | 1 337 | 1 292 |
| - gasoline | 1 525 | 1 453 | 1 412 | 1 404 | 1 402 | 1 356 | 1 296 | 1 259 | 1 211 |
| - gas/diesel oil | 28 972 | 30 473 | 29 616 | 30 209 | 30 164 | 29 232 | 28 757 | 27 478 | 28 645 |
| **Non-road, NERI model** | | | | | | | | | |
| - LPG | 1071 | 1073 | 1084 | 1079 | 1065 | 1049 | 1038 | 1040 | 1037 |
| - gasoline | 2458 | 2622 | 2833 | 3090 | 3391 | 3604 | 3807 | 3873 | 3889 |
| - gas/diesel oil | 24630 | 24893 | 25053 | 25233 | 25558 | 26199 | 27518 | 29329 | 30454 |
| **Recreational craft, NERI model** | | | | | | | | | |
| - gasoline | 396 | 400 | 403 | 404 | 404 | 393 | 382 | 371 | 361 |
| - gas/diesel oil | 777 | 831 | 886 | 944 | 1002 | 1002 | 1002 | 1002 | 1002 |
| **Non-road, added 0203 and 0301** | | | | | | | | | |
| - gas/diesel oil | 4342 | 5580 | 4563 | 4976 | 4606 | 3033 | 1239 | -1852 | -1809 |
| - LPG | 947 | 662 | 497 | 563 | 575 | 562 | 572 | 298 | 255 |
| **Non-road, added 0203** | | | | | | | | | |
| - gas/diesel oil | 2156 | 2567 | 2193 | 2309 | 2050 | 1335 | 579 | -869 | -893 |
| - LPG | 93 | 80 | 55 | 58 | 53 | 46 | 46 | 27 | 22 |
| **Non-road, added 0301** | | | | | | | | | |
| - gas/diesel oil | 2186 | 3013 | 2370 | 2667 | 2557 | 1697 | 660 | -982 | -916 |
| - LPG | 854 | 582 | 442 | 505 | 522 | 516 | 526 | 271 | 232 |
| **Non-road, added road transport** | | | | | | | | | |
| - gasoline | -932 | -1169 | -1421 | -1686 | -1990 | -2248 | -2511 | -2613 | -2678 |
| **Fisheries, added national sea transport** | | | | | | | | | |

| *Continued* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| - fuel oil | 0 | 0 | 4 | 84 | 35 | 126 | 86 | 13 | 14 |
| **Fisheries, consumed by recreational craft** | | | | | | | | | |
| - gasoline | 67 | 3 | 3 | 0 | 0 | 0 | 1 | 1 | 1 |
| **National sea transport, input NERI model** | | | | | | | | | |
| - LPG | 0 | - | - | 0 | 0 | 0 | 0 | 0 | - |
| - kerosene | 1 | 1 | 1 | 1 | 1 | 1 | 0 | - | - |
| - gas/diesel oil | 3 367 | 3 240 | 3 780 | 3 828 | 3 463 | 4 358 | 3 699 | 3 411 | 4 667 |
| - fuel oil | 1 509 | 1 513 | 2 068 | 1 907 | 1 704 | 1 506 | 1 367 | 1 110 | 1 174 |
| **Fisheries, input NERI model** | | | | | | | | | |
| - LPG | 13 | 19 | 21 | 20 | 18 | 20 | 20 | 18 | 12 |
| - gasoline | - | - | - | - | - | - | - | - | - |
| - kerosene | 25 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| - gas/diesel oil | 8 570 | 8 077 | 8 001 | 7 484 | 6 335 | 6 338 | 6 360 | 5 852 | 5 499 |
| **International sea transport, input NERI model** | | | | | | | | | |
| - gas/diesel oil | 22 872 | 21 389 | 21 579 | 20 730 | 16 152 | 13 917 | 13 116 | 10 947 | 13 504 |
| - fuel oil | 33 165 | 25 924 | 17 547 | 20 462 | 17 298 | 20 591 | 31 565 | 35 243 | 27 164 |
| **National sea transport, output NERI model** | | | | | | | | | |
| - gas/diesel oil | 4515 | 4301 | 4192 | 4199 | 4308 | 4260 | 4180 | 4119 | 4103 |
| - fuel oil | 715 | 671 | 659 | 647 | 673 | 679 | 633 | 610 | 628 |
| - kerosene | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| - LPG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Fisheries, output NERI model** | | | | | | | | | |
| - gas/diesel oil | 7422 | 7016 | 7590 | 7113 | 5490 | 6437 | 5879 | 5144 | 6063 |
| - kerosene | 25 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| - LPG | 13 | 19 | 21 | 20 | 18 | 20 | 20 | 18 | 12 |
| **National sea transport, added 0301** | | | | | | | | | |
| - fuel oil | 794 | 842 | 1 409 | 1 260 | 1 032 | 826 | 734 | 500 | 546 |
| **Road transport, NERI excl. traded fuels** | | | | | | | | | |
| - gasoline | 87 713 | 84 907 | 84 426 | 83 521 | 82 235 | 79 477 | 76 930 | 75 342 | 72 323 |
| - gas/diesel oil | 64 282 | 66 254 | 66 814 | 70 875 | 75 422 | 79 476 | 86 223 | 95 084 | 94 846 |
| - bioethanol | - | - | - | - | - | - | 151 | 252 | 210 |
| - biodiesel | - | - | - | - | - | - | - | - | 10 |
| **Road transport, input NERI model incl. traded fuels** | | | | | | | | | |
| - gasoline | 83 312 | 81 852 | 81 963 | 81 878 | 80 593 | 77 835 | 76 109 | 75 342 | 72 323 |
| - gas/diesel oil | 69 196 | 70 916 | 72 552 | 78 766 | 84 209 | 88 264 | 95 010 | 103 871 | 103 633 |
| - bioethanol | - | - | - | - | - | - | 151 | 252 | 210 |
| - biodiesel | - | - | - | - | - | - | - | - | 10 |

## Annex 2B-14 Emission factors and total emissions in CollectER format

1990 emission factors for $CO_2$, $CH_4$, $N_2O$, $SO_2$, $NO_x$; NMVOC, $NH_3$ and TSP.

| Year | SNAP ID | Category | | Fuel type | $SO_2$ | $NO_x$ | NMVOC | $CH_4$ | CO | $CO_2$ | $N_2O$ | $NH_3$ | TSP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | g pr GJ | g pr GJ | g pr GJ | g pr GJ | g pr GJ | g pr GJ | g pr GJ | g pr GJ | g pr GJ |
| 1990 | 070101 | Passenger cars | Highway | Diesel | 93,68 | 254,03 | 25,07 | 3,74 | 179,70 | 74,00 | 0,00 | 0,47 | 79,48 |
| 1990 | 070101 | Passenger cars | Highway | Gasoline | 2,28 | 1313,15 | 372,27 | 11,08 | 3460,04 | 73,00 | 2,77 | 0,85 | 12,23 |
| 1990 | 070101 | Passenger cars | Highway | LPG | 0,00 | 1151,70 | 187,09 | 10,06 | 3914,25 | 65,00 | 0,00 | 0,00 | 10,06 |
| 1990 | 070102 | Passenger cars | Rural | Diesel | 93,68 | 253,60 | 42,09 | 6,82 | 268,08 | 74,00 | 0,00 | 0,57 | 75,13 |
| 1990 | 070102 | Passenger cars | Rural | Gasoline | 2,28 | 1136,14 | 493,47 | 13,92 | 3985,27 | 73,00 | 3,11 | 0,96 | 14,07 |
| 1990 | 070102 | Passenger cars | Rural | LPG | 0,00 | 1248,46 | 305,18 | 16,91 | 1146,38 | 65,00 | 0,00 | 0,00 | 14,49 |
| 1990 | 070103 | Passenger cars | Urban | Diesel | 93,68 | 208,50 | 79,41 | 8,78 | 310,69 | 74,00 | 0,00 | 0,36 | 117,16 |
| 1990 | 070103 | Passenger cars | Urban | Gasoline | 2,28 | 630,07 | 914,35 | 48,81 | 9356,56 | 73,00 | 3,22 | 0,64 | 13,76 |
| 1990 | 070103 | Passenger cars | Urban | LPG | 0,00 | 642,80 | 431,03 | 24,31 | 1249,98 | 65,00 | 0,00 | 0,00 | 12,16 |
| 1990 | 070201 | Light duty vehicles | Highway | Diesel | 93,68 | 270,67 | 30,19 | 2,60 | 344,14 | 74,00 | 0,00 | 0,32 | 104,48 |
| 1990 | 070201 | Light duty vehicles | Highway | Gasoline | 2,28 | 1369,26 | 170,29 | 10,11 | 2987,40 | 73,00 | 2,63 | 0,81 | 16,17 |
| 1990 | 070202 | Light duty vehicles | Rural | Diesel | 93,68 | 299,25 | 33,22 | 4,26 | 358,42 | 74,00 | 0,00 | 0,36 | 107,73 |
| 1990 | 070202 | Light duty vehicles | Rural | Gasoline | 2,28 | 1188,86 | 262,59 | 15,25 | 2316,18 | 73,00 | 2,48 | 0,76 | 15,25 |
| 1990 | 070203 | Light duty vehicles | Urban | Diesel | 93,68 | 489,77 | 53,27 | 6,54 | 403,83 | 74,00 | 0,00 | 0,27 | 126,74 |
| 1990 | 070203 | Light duty vehicles | Urban | Gasoline | 2,28 | 638,11 | 689,36 | 40,67 | 7008,46 | 73,00 | 2,28 | 0,46 | 9,12 |
| 1990 | 070301 | Heavy duty vehicles | Highway | Diesel | 93,68 | 1029,48 | 47,87 | 6,11 | 188,44 | 74,00 | 2,86 | 0,29 | 38,21 |
| 1990 | 070301 | Heavy duty vehicles | Highway | Gasoline | 2,28 | 1037,78 | 474,61 | 9,69 | 7610,35 | 73,00 | 0,83 | 0,28 | 55,35 |
| 1990 | 070302 | Heavy duty vehicles | Rural | Diesel | 93,68 | 1050,89 | 63,23 | 6,84 | 209,56 | 74,00 | 3,01 | 0,30 | 40,60 |
| 1990 | 070302 | Heavy duty vehicles | Rural | Gasoline | 2,28 | 1141,55 | 820,40 | 16,74 | 8371,39 | 73,00 | 0,91 | 0,30 | 60,88 |
| 1990 | 070303 | Heavy duty vehicles | Urban | Diesel | 93,68 | 1009,50 | 84,32 | 12,48 | 257,98 | 74,00 | 2,45 | 0,24 | 47,07 |
| 1990 | 070303 | Heavy duty vehicles | Urban | Gasoline | 2,28 | 456,62 | 696,09 | 14,21 | 7102,99 | 73,00 | 0,61 | 0,20 | 40,59 |
| 1990 | 070400 | Mopeds | Urban | Gasoline | 2,28 | 18,26 | 12503,20 | 200,00 | 12602,74 | 73,00 | 0,91 | 0,91 | 171,69 |
| 1990 | 070501 | Motorcycles | Highway | Gasoline | 2,28 | 215,28 | 1274,65 | 122,02 | 17695,34 | 73,00 | 1,27 | 1,27 | 29,79 |
| 1990 | 070502 | Motorcycles | Rural | Gasoline | 2,28 | 173,21 | 1528,99 | 146,11 | 16838,71 | 73,00 | 1,52 | 1,52 | 35,67 |
| 1990 | 070503 | Motorcycles | Urban | Gasoline | 2,28 | 93,24 | 2017,69 | 147,20 | 15315,93 | 73,00 | 1,53 | 1,53 | 35,94 |
| 1990 | 080100 | Military | | Diesel | 93,68 | 790,81 | 60,12 | 7,64 | 264,47 | 74,00 | 1,82 | 0,30 | 65,87 |
| 1990 | 080100 | Military | | Jet fuel | 22,99 | 250,57 | 24,94 | 2,65 | 229,89 | 72,00 | 2,30 | 0,00 | 1,16 |
| 1990 | 080100 | Military | | Gasoline | 2,28 | 890,75 | 1175,82 | 32,66 | 6684,91 | 73,00 | 3,08 | 0,78 | 14,48 |
| 1990 | 080100 | Military | | AvGas | 22,83 | 859,00 | 1242,60 | 21,90 | 6972,00 | 73,00 | 2,00 | 1,60 | 10,00 |
| 1990 | 080200 | Railways | | Diesel | 93,68 | 1225,13 | 79,94 | 3,07 | 223,21 | 74,00 | 2,04 | 0,20 | 50,26 |
| 1990 | 080200 | Railways | | Kerosene | 5,00 | 50,00 | 3,00 | 7,00 | 20,00 | 72,00 | 2,00 | 0,00 | 121,95 |
| 1990 | 080300 | Inland waterways | | Diesel | 93,68 | 983,64 | 171,79 | 2,79 | 453,65 | 74,00 | 2,96 | 0,17 | 106,93 |

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 080300 | Inland waterways | | Gasoline | 2,28 | 291,33 | 3606,55 | 50,38 | 13853,27 | 73,00 | 0,78 | 0,08 | 182,44 |
| 1990 | 080402 | National sea traffic | | Residual oil | 1290,95 | 1601,17 | 53,33 | 1,65 | 175,95 | 78,00 | 4,89 | 0,00 | 149,25 |
| 1990 | 080402 | National sea traffic | | Diesel | 93,68 | 1100,31 | 50,67 | 1,57 | 167,17 | 74,00 | 4,68 | 0,00 | 23,21 |
| 1990 | 080402 | National sea traffic | | Kerosene | 2,30 | 50,00 | 3,00 | 7,00 | 20,00 | 72,00 | 0,00 | 0,00 | 5,00 |
| 1990 | 080402 | National sea traffic | | LPG | 0,00 | 1249,00 | 384,94 | 20,26 | 443,00 | 65,00 | 0,00 | 0,00 | 0,20 |
| 1990 | 080403 | Fishing | | Diesel | 93,68 | 1052,12 | 49,13 | 1,52 | 162,08 | 74,00 | 4,68 | 0,00 | 23,21 |
| 1990 | 080403 | Fishing | | Kerosene | 2,30 | 50,00 | 3,00 | 7,00 | 20,00 | 72,00 | 0,00 | 0,00 | 5,00 |
| 1990 | 080403 | Fishing | | LPG | 0,00 | 1249,00 | 384,94 | 20,26 | 443,00 | 65,00 | 0,00 | 0,00 | 0,20 |
| 1990 | 080404 | International sea traffic | | Residual oil | 1447,43 | 1689,57 | 53,98 | 1,67 | 178,09 | 78,00 | 4,89 | 0,00 | 189,43 |
| 1990 | 080404 | International sea traffic | | Diesel | 93,68 | 1208,60 | 49,46 | 1,53 | 163,17 | 74,00 | 4,68 | 0,00 | 23,21 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | Jet fuel | 22,99 | 314,51 | 14,93 | 1,59 | 90,41 | 72,00 | 5,70 | 0,00 | 1,16 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | AvGas | 22,83 | 859,00 | 1242,60 | 21,90 | 6972,00 | 73,00 | 2,00 | 1,60 | 10,00 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | Jet fuel | 22,99 | 309,25 | 16,47 | 1,75 | 168,98 | 72,00 | 7,10 | 0,00 | 1,16 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | AvGas | 22,83 | 859,00 | 1242,60 | 21,90 | 6972,00 | 73,00 | 2,00 | 1,60 | 10,00 |
| 1990 | 080503 | Air traffic, Dom. > 3000 ft. | Other airports | Jet fuel | 22,99 | 330,11 | 12,36 | 1,31 | 90,75 | 72,00 | 2,30 | 0,00 | 1,16 |
| 1990 | 080504 | Air traffic, Int. > 3000 ft. | Other airports | Jet fuel | 22,99 | 244,20 | 6,48 | 0,69 | 54,10 | 72,00 | 2,30 | 0,00 | 1,16 |
| 1990 | 080600 | Agriculture | | Diesel | 93,68 | 758,87 | 156,85 | 2,55 | 635,53 | 74,00 | 2,93 | 0,17 | 144,45 |
| 1990 | 080600 | Agriculture | | Gasoline | 2,28 | 31,60 | 949,55 | 88,42 | 47524,17 | 73,00 | 1,28 | 0,09 | 6,56 |
| 1990 | 080700 | Forestry | | Diesel | 93,68 | 857,48 | 156,47 | 2,54 | 645,65 | 74,00 | 2,97 | 0,17 | 149,05 |
| 1990 | 080700 | Forestry | | Gasoline | 2,28 | 40,39 | 7206,91 | 60,42 | 18057,40 | 73,00 | 0,37 | 0,07 | 101,22 |
| 1990 | 080800 | Industry | | Diesel | 93,68 | 933,58 | 178,23 | 2,90 | 655,80 | 74,00 | 2,94 | 0,17 | 154,50 |
| 1990 | 080800 | Industry | | Gasoline | 2,28 | 136,27 | 1610,77 | 120,61 | 14797,46 | 73,00 | 1,33 | 0,09 | 12,40 |
| 1990 | 080800 | Industry | | LPG | 0,00 | 1328,11 | 146,09 | 7,69 | 104,85 | 65,00 | 3,50 | 0,21 | 4,89 |
| 1990 | 080900 | Household and gardening | | Gasoline | 2,28 | 67,15 | 2656,60 | 96,95 | 30931,24 | 73,00 | 1,11 | 0,08 | 22,88 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | Jet fuel | 22,99 | 283,87 | 20,73 | 2,20 | 129,70 | 72,00 | 4,58 | 0,00 | 1,16 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | AvGas | 22,83 | 859,00 | 1242,60 | 21,90 | 6972,00 | 73,00 | 2,00 | 1,60 | 10,00 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | Jet fuel | 22,99 | 324,87 | 34,25 | 3,64 | 157,15 | 72,00 | 3,79 | 0,00 | 1,16 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | AvGas | 22,83 | 859,00 | 1242,60 | 21,90 | 6972,00 | 73,00 | 2,00 | 1,60 | 10,00 |
| 1990 | 080503 | Air traffic, Dom. > 3000 ft. | Copenhagen | Jet fuel | 22,99 | 314,86 | 11,78 | 1,25 | 84,05 | 72,00 | 2,30 | 0,00 | 1,16 |
| 1990 | 080504 | Air traffic, Int. > 3000 ft. | Copenhagen | Jet fuel | 22,99 | 290,20 | 10,08 | 1,07 | 37,65 | 72,00 | 2,30 | 0,00 | 1,16 |

2008 emission factors for $CO_2$, $CH_4$, $N_2O$, $SO_2$, $NO_x$; NMVOC, $NH_3$ and TSP.

| Year | SNAP ID | Category | | Fuel type | $SO_2$ | $NO_x$ | NMVOC | $CH_4$ | CO | $CO_2$ | $N_2O$ | $NH_3$ | TSP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | g pr GJ | g pr GJ | g pr GJ | g pr GJ | g pr GJ | g pr GJ | g pr GJ | g pr GJ | g pr GJ |
| 2008 | 070101 | Passenger cars | Highway | Diesel | 0,47 | 302,40 | 7,32 | 0,45 | 28,01 | 73,99 | 1,93 | 0,49 | 22,84 |
| 2008 | 070101 | Passenger cars | Highway | Gasoline | 0,46 | 174,91 | 41,80 | 3,24 | 791,07 | 72,79 | 0,75 | 29,46 | 1,27 |
| 2008 | 070101 | Passenger cars | Highway | LPG | 0,00 | 1151,70 | 187,09 | 10,06 | 3914,25 | 65,00 | 0,00 | 0,00 | 10,06 |
| 2008 | 070102 | Passenger cars | Rural | Diesel | 0,47 | 258,76 | 10,42 | 0,93 | 43,68 | 73,99 | 2,08 | 0,52 | 18,89 |
| 2008 | 070102 | Passenger cars | Rural | Gasoline | 0,46 | 143,76 | 48,85 | 3,70 | 643,60 | 72,79 | 1,30 | 31,60 | 1,25 |
| 2008 | 070102 | Passenger cars | Rural | LPG | 0,00 | 1248,46 | 305,18 | 16,91 | 1146,38 | 65,00 | 0,00 | 0,00 | 14,49 |
| 2008 | 070103 | Passenger cars | Urban | Diesel | 0,47 | 257,64 | 29,19 | 1,52 | 97,20 | 73,99 | 3,99 | 0,39 | 30,93 |
| 2008 | 070103 | Passenger cars | Urban | Gasoline | 0,46 | 143,62 | 232,30 | 10,85 | 2602,34 | 72,79 | 2,32 | 10,51 | 1,31 |
| 2008 | 070103 | Passenger cars | Urban | LPG | 0,00 | 613,63 | 451,14 | 23,33 | 1361,56 | 65,00 | 0,00 | 0,00 | 11,66 |
| 2008 | 070201 | Light duty vehicles | Highway | Diesel | 0,47 | 265,54 | 25,42 | 0,53 | 150,05 | 73,99 | 1,48 | 0,36 | 30,78 |
| 2008 | 070201 | Light duty vehicles | Highway | Gasoline | 0,46 | 165,58 | 19,58 | 2,68 | 549,69 | 72,79 | 1,46 | 22,64 | 1,48 |
| 2008 | 070202 | Light duty vehicles | Rural | Diesel | 0,47 | 278,53 | 28,50 | 1,17 | 132,75 | 73,99 | 1,62 | 0,40 | 26,53 |
| 2008 | 070202 | Light duty vehicles | Rural | Gasoline | 0,46 | 144,76 | 28,98 | 2,98 | 416,66 | 72,79 | 2,23 | 21,62 | 1,33 |
| 2008 | 070203 | Light duty vehicles | Urban | Diesel | 0,47 | 278,93 | 48,38 | 1,91 | 160,87 | 73,99 | 2,41 | 0,29 | 36,05 |
| 2008 | 070203 | Light duty vehicles | Urban | Gasoline | 0,46 | 120,86 | 147,59 | 7,09 | 2844,03 | 72,79 | 3,80 | 5,79 | 0,91 |
| 2008 | 070301 | Heavy duty vehicles | Highway | Diesel | 0,47 | 668,12 | 20,93 | 5,22 | 126,84 | 73,99 | 3,15 | 0,31 | 15,28 |
| 2008 | 070301 | Heavy duty vehicles | Highway | Gasoline | 0,46 | 1037,78 | 474,61 | 9,69 | 7610,35 | 72,79 | 0,83 | 0,28 | 55,35 |
| 2008 | 070302 | Heavy duty vehicles | Rural | Diesel | 0,47 | 691,61 | 25,39 | 5,75 | 131,55 | 73,99 | 3,16 | 0,32 | 15,55 |
| 2008 | 070302 | Heavy duty vehicles | Rural | Gasoline | 0,46 | 1141,55 | 820,40 | 16,74 | 8371,39 | 72,79 | 0,91 | 0,30 | 60,88 |
| 2008 | 070303 | Heavy duty vehicles | Urban | Diesel | 0,47 | 697,71 | 33,17 | 8,14 | 154,48 | 73,99 | 2,60 | 0,26 | 18,98 |
| 2008 | 070303 | Heavy duty vehicles | Urban | Gasoline | 0,46 | 456,62 | 696,09 | 14,21 | 7102,99 | 72,79 | 0,61 | 0,20 | 40,59 |
| 2008 | 070400 | Mopeds | Urban | Gasoline | 0,46 | 113,84 | 9177,91 | 146,85 | 9905,34 | 72,79 | 1,21 | 1,21 | 142,17 |
| 2008 | 070501 | Motorcycles | Highway | Gasoline | 0,46 | 239,44 | 938,89 | 97,21 | 13244,99 | 72,79 | 1,19 | 1,19 | 21,83 |
| 2008 | 070502 | Motorcycles | Rural | Gasoline | 0,46 | 183,54 | 1175,67 | 121,25 | 13028,29 | 72,79 | 1,50 | 1,50 | 27,44 |
| 2008 | 070503 | Motorcycles | Urban | Gasoline | 0,46 | 106,67 | 1594,63 | 126,87 | 12062,59 | 72,79 | 1,50 | 1,50 | 27,47 |
| 2008 | 080100 | Military | | Diesel | 0,47 | 486,62 | 26,51 | 3,84 | 120,80 | 74,00 | 2,71 | 0,35 | 21,90 |
| 2008 | 080100 | Military | | Jet fuel | 22,99 | 250,57 | 24,94 | 2,65 | 229,89 | 72,00 | 2,30 | 0,00 | 1,16 |
| 2008 | 080100 | Military | | Gasoline | 0,46 | 149,10 | 206,88 | 8,94 | 1747,51 | 73,00 | 1,71 | 21,17 | 2,10 |
| 2008 | 080100 | Military | | AvGas | 22,99 | 859,00 | 1242,60 | 21,90 | 6972,00 | 73,00 | 2,00 | 1,60 | 10,00 |
| 2008 | 080200 | Railways | | Diesel | 0,47 | 912,90 | 63,95 | 2,46 | 164,49 | 74,00 | 2,04 | 0,20 | 31,64 |
| 2008 | 080300 | Inland waterways | | Diesel | 93,68 | 851,39 | 164,23 | 2,67 | 446,96 | 74,00 | 2,97 | 0,17 | 100,90 |
| 2008 | 080300 | Inland waterways | | Gasoline | 0,46 | 495,52 | 1576,18 | 60,27 | 14675,43 | 73,00 | 1,34 | 0,10 | 61,17 |
| 2008 | 080402 | National sea traffic | | Residual oil | 586,80 | 1853,24 | 61,96 | 1,92 | 204,41 | 78,00 | 4,89 | 0,00 | 51,05 |
| 2008 | 080402 | National sea traffic | | Diesel | 46,84 | 923,31 | 51,92 | 1,49 | 79,00 | 74,00 | 4,68 | 0,00 | 21,55 |
| 2008 | 080403 | Fishing | | Diesel | 46,84 | 1365,96 | 56,98 | 1,76 | 187,98 | 74,00 | 4,68 | 0,00 | 21,55 |

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | 080403 | Fishing | | Kerosene | 2,30 | 50,00 | 3,00 | 7,00 | 20,00 | 72,00 | 0,00 | 0,00 | 5,00 |
| 2008 | 080403 | Fishing | | LPG | 0,00 | 1249,00 | 384,94 | 20,26 | 443,00 | 65,00 | 0,00 | 0,00 | 0,20 |
| 2008 | 080404 | International sea traffic | | Residual oil | 733,50 | 2085,30 | 61,67 | 1,91 | 203,45 | 78,00 | 4,89 | 0,00 | 63,83 |
| 2008 | 080404 | International sea traffic | | Diesel | 46,84 | 1547,73 | 56,16 | 1,74 | 185,25 | 74,00 | 4,68 | 0,00 | 21,55 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | Jet fuel | 22,99 | 307,88 | 22,64 | 2,40 | 139,67 | 72,00 | 11,93 | 0,00 | 1,16 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | AvGas | 22,83 | 859,00 | 1242,60 | 21,90 | 6972,00 | 73,00 | 2,00 | 1,60 | 10,00 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | Jet fuel | 22,99 | 294,41 | 28,63 | 3,04 | 179,88 | 72,00 | 7,97 | 0,00 | 1,16 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | AvGas | 22,83 | 859,00 | 1242,60 | 21,90 | 6972,00 | 73,00 | 2,00 | 1,60 | 10,00 |
| 2008 | 080503 | Air traffic, Dom. > 3000 ft. | Other airports | Jet fuel | 22,99 | 283,13 | 15,67 | 1,66 | 116,30 | 72,00 | 2,30 | 0,00 | 1,16 |
| 2008 | 080504 | Air traffic, Int. > 3000 ft. | Other airports | Jet fuel | 22,99 | 238,25 | 7,21 | 0,77 | 52,58 | 72,00 | 2,30 | 0,00 | 1,16 |
| 2008 | 080600 | Agriculture | | Diesel | 2,34 | 659,21 | 66,65 | 1,08 | 365,48 | 74,00 | 3,16 | 0,18 | 51,55 |
| 2008 | 080600 | Agriculture | | Gasoline | 0,46 | 107,65 | 1143,24 | 152,40 | 22029,44 | 73,00 | 1,68 | 1,41 | 29,26 |
| 2008 | 080700 | Forestry | | Diesel | 2,34 | 510,08 | 38,83 | 0,63 | 261,75 | 74,00 | 3,21 | 0,18 | 29,45 |
| 2008 | 080700 | Forestry | | Gasoline | 0,46 | 86,32 | 6899,22 | 57,62 | 16933,82 | 73,00 | 0,43 | 0,09 | 77,69 |
| 2008 | 080800 | Industry | | Diesel | 2,34 | 618,51 | 69,85 | 1,14 | 341,87 | 74,00 | 3,10 | 0,18 | 60,74 |
| 2008 | 080800 | Industry | | Gasoline | 0,46 | 204,01 | 1523,99 | 107,34 | 13519,54 | 73,00 | 1,46 | 0,10 | 15,48 |
| 2008 | 080800 | Industry | | LPG | 0,00 | 1328,11 | 146,09 | 7,69 | 104,85 | 65,00 | 3,50 | 0,21 | 4,89 |
| 2008 | 080900 | Household and gardening | | Gasoline | 0,46 | 92,92 | 2429,63 | 73,44 | 29136,13 | 73,00 | 1,14 | 0,09 | 24,64 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | Jet fuel | 22,99 | 296,09 | 28,55 | 3,03 | 181,39 | 72,00 | 7,10 | 0,00 | 1,16 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | AvGas | 22,83 | 859,00 | 1242,60 | 21,90 | 6972,00 | 73,00 | 2,00 | 1,60 | 10,00 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | Jet fuel | 22,99 | 338,31 | 42,63 | 4,53 | 239,83 | 72,00 | 3,82 | 0,00 | 1,16 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | AvGas | 22,83 | 859,00 | 1242,60 | 21,90 | 6972,00 | 73,00 | 2,00 | 1,60 | 10,00 |
| 2008 | 080503 | Air traffic, Dom. > 3000 ft. | Copenhagen | Jet fuel | 22,99 | 283,56 | 15,44 | 1,64 | 61,39 | 72,00 | 2,30 | 0,00 | 1,16 |
| 2008 | 080504 | Air traffic, Int. > 3000 ft. | Copenhagen | Jet fuel | 22,99 | 313,19 | 10,58 | 1,12 | 33,66 | 72,00 | 2,30 | 0,00 | 1,16 |

1990 emissions for $CO_2$, $CH_4$, $N_2O$, $SO_2$, $NO_x$; NMVOC, $NH_3$ and TSP.

| Year | SNAP ID | Category | | Fuel type | Fuel PJ | $SO_2$ tonnes | $NO_x$ tonnes | NMVOC tonnes | $CH_4$ tonnes | CO tonnes | $CO_2$ ktonnes | $N_2O$ tonnes | $NH_3$ tonnes | TSP tonnes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 070101 | Passenger cars | Highway | Diesel | 0,819 | 77 | 208 | 21 | 3 | 147 | 61 | 0 | 0 | 65 |
| 1990 | 070101 | Passenger cars | Highway | Gasoline | 7,544 | 17 | 9907 | 2808 | 84 | 26103 | 551 | 21 | 6 | 92 |
| 1990 | 070101 | Passenger cars | Highway | LPG | 0,002 | 0 | 2 | 0 | 0 | 6 | 0 | 0 | 0 | 0 |
| 1990 | 070102 | Passenger cars | Rural | Diesel | 2,332 | 218 | 591 | 98 | 16 | 625 | 173 | 0 | 1 | 175 |
| 1990 | 070102 | Passenger cars | Rural | Gasoline | 23,293 | 53 | 26465 | 11495 | 324 | 92831 | 1700 | 72 | 22 | 328 |
| 1990 | 070102 | Passenger cars | Rural | LPG | 0,004 | 0 | 6 | 1 | 0 | 5 | 0 | 0 | 0 | 0 |
| 1990 | 070103 | Passenger cars | Urban | Diesel | 3,484 | 326 | 726 | 277 | 31 | 1082 | 258 | 0 | 1 | 408 |
| 1990 | 070103 | Passenger cars | Urban | Gasoline | 32,220 | 74 | 20301 | 29461 | 1573 | 301473 | 2352 | 104 | 21 | 443 |
| 1990 | 070103 | Passenger cars | Urban | LPG | 0,007 | 0 | 4 | 3 | 0 | 8 | 0 | 0 | 0 | 0 |
| 1990 | 070201 | Light duty vehicles | Highway | Diesel | 1,615 | 151 | 437 | 49 | 4 | 556 | 120 | 0 | 1 | 169 |
| 1990 | 070201 | Light duty vehicles | Highway | Gasoline | 0,220 | 1 | 302 | 38 | 2 | 659 | 16 | 1 | 0 | 4 |
| 1990 | 070202 | Light duty vehicles | Rural | Diesel | 5,782 | 542 | 1730 | 192 | 25 | 2073 | 428 | 0 | 2 | 623 |
| 1990 | 070202 | Light duty vehicles | Rural | Gasoline | 0,916 | 2 | 1088 | 240 | 14 | 2121 | 67 | 2 | 1 | 14 |
| 1990 | 070203 | Light duty vehicles | Urban | Diesel | 6,750 | 632 | 3306 | 360 | 44 | 2726 | 500 | 0 | 2 | 856 |
| 1990 | 070203 | Light duty vehicles | Urban | Gasoline | 1,336 | 3 | 853 | 921 | 54 | 9364 | 98 | 3 | 1 | 12 |
| 1990 | 070301 | Heavy duty vehicles | Highway | Diesel | 9,522 | 892 | 9802 | 456 | 58 | 1794 | 705 | 27 | 3 | 364 |
| 1990 | 070301 | Heavy duty vehicles | Highway | Gasoline | 0,010 | 0 | 11 | 5 | 0 | 78 | 1 | 0 | 0 | 1 |
| 1990 | 070302 | Heavy duty vehicles | Rural | Diesel | 16,444 | 1540 | 17280 | 1040 | 112 | 3446 | 1217 | 49 | 5 | 668 |
| 1990 | 070302 | Heavy duty vehicles | Rural | Gasoline | 0,030 | 0 | 34 | 24 | 0 | 250 | 2 | 0 | 0 | 2 |
| 1990 | 070303 | Heavy duty vehicles | Urban | Diesel | 13,199 | 1236 | 13325 | 1113 | 165 | 3405 | 977 | 32 | 3 | 621 |
| 1990 | 070303 | Heavy duty vehicles | Urban | Gasoline | 0,035 | 0 | 16 | 24 | 0 | 245 | 3 | 0 | 0 | 1 |
| 1990 | 070400 | Mopeds | Urban | Gasoline | 0,287 | 1 | 5 | 3584 | 57 | 3613 | 21 | 0 | 0 | 49 |
| 1990 | 070501 | Motorcycles | Highway | Gasoline | 0,077 | 0 | 16 | 98 | 9 | 1355 | 6 | 0 | 0 | 2 |
| 1990 | 070502 | Motorcycles | Rural | Gasoline | 0,143 | 0 | 25 | 218 | 21 | 2406 | 10 | 0 | 0 | 5 |
| 1990 | 070503 | Motorcycles | Urban | Gasoline | 0,168 | 0 | 16 | 339 | 25 | 2573 | 12 | 0 | 0 | 6 |
| 1990 | 080100 | Military | | Diesel | 0,146 | 14 | 116 | 9 | 1 | 39 | 11 | 0 | 0 | 10 |
| 1990 | 080100 | Military | | Jet fuel | 1,497 | 34 | 375 | 37 | 4 | 344 | 108 | 3 | | 2 |
| 1990 | 080100 | Military | | Gasoline | 0,001 | 0 | 1 | 1 | 0 | 7 | 0 | 0 | 0 | 0 |
| 1990 | 080100 | Military | | AvGas | 0,005 | 0 | 4 | 6 | 0 | 34 | 0 | 0 | 0 | 0 |
| 1990 | 080200 | Railways | | Diesel | 4,010 | 376 | 4913 | 321 | 12 | 895 | 297 | 8 | 1 | 202 |
| 1990 | 080200 | Railways | | Kerosene | 0,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 1990 | 080300 | Inland waterways | | Diesel | 0,343 | 32 | 337 | 59 | 1 | 155 | 25 | 1 | 0 | 37 |
| 1990 | 080300 | Inland waterways | | Gasoline | 0,309 | 1 | 90 | 1115 | 16 | 4283 | 23 | 0 | 0 | 56 |
| 1990 | 080402 | National sea traffic | | Residual oil | 3,843 | 4961 | 6153 | 205 | 6 | 676 | 300 | 19 | | 573 |
| 1990 | 080402 | National sea traffic | | Diesel | 4,942 | 463 | 5438 | 250 | 8 | 826 | 366 | 23 | | 115 |

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| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 080402 | National sea traffic | | Kerosene | 0,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 1990 | 080402 | National sea traffic | | LPG | 0,002 | | 2 | 1 | 0 | 1 | 0 | 0 | | 0 |
| 1990 | 080403 | Fishing | | Diesel | 7,920 | 742 | 8333 | 389 | 12 | 1284 | 586 | 37 | | 184 |
| 1990 | 080403 | Fishing | | Kerosene | 0,026 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | | 0 |
| 1990 | 080403 | Fishing | | LPG | 0,042 | | 53 | 16 | 1 | 19 | 3 | 0 | | 0 |
| 1990 | 080404 | International sea traffic | | Residual oil | 28,543 | 41315 | 48226 | 1541 | 48 | 5083 | 2226 | 140 | | 5407 |
| 1990 | 080404 | International sea traffic | | Diesel | 11,633 | 1090 | 14059 | 575 | 18 | 1898 | 861 | 54 | | 270 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | Jet fuel | 0,422 | 10 | 133 | 6 | 1 | 38 | 30 | 2 | | 0 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | AvGas | 0,105 | 2 | 90 | 130 | 2 | 732 | 8 | 0 | 0 | 1 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | Jet fuel | 0,132 | 3 | 41 | 2 | 0 | 22 | 10 | 1 | | 0 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | AvGas | 0,031 | 1 | 26 | 38 | 1 | 214 | 2 | 0 | 0 | 0 |
| 1990 | 080503 | Air traffic, Dom. > 3000 ft. | Other airports | Jet fuel | 1,026 | 24 | 339 | 13 | 1 | 93 | 74 | 2 | | 1 |
| 1990 | 080504 | Air traffic, Int. > 3000 ft. | Other airports | Jet fuel | 1,612 | 37 | 394 | 10 | 1 | 87 | 116 | 4 | | 2 |
| 1990 | 080600 | Agriculture | | Diesel | 16,496 | 1545 | 12518 | 2587 | 42 | 10484 | 1221 | 48 | 3 | 2383 |
| 1990 | 080600 | Agriculture | | Gasoline | 0,709 | 2 | 22 | 673 | 63 | 33688 | 52 | 1 | 0 | 5 |
| 1990 | 080700 | Forestry | | Diesel | 0,145 | 14 | 125 | 23 | 0 | 94 | 11 | 0 | 0 | 22 |
| 1990 | 080700 | Forestry | | Gasoline | 0,341 | 1 | 14 | 2461 | 21 | 6165 | 25 | 0 | 0 | 35 |
| 1990 | 080800 | Industry | | Diesel | 10,158 | 952 | 9484 | 1811 | 29 | 6662 | 752 | 30 | 2 | 1569 |
| 1990 | 080800 | Industry | | Gasoline | 0,175 | 0 | 24 | 282 | 21 | 2593 | 13 | 0 | 0 | 2 |
| 1990 | 080800 | Industry | | LPG | 1,185 | 0 | 1574 | 173 | 9 | 124 | 77 | 4 | 0 | 6 |
| 1990 | 080900 | Household and gardening | | Gasoline | 1,545 | 4 | 104 | 4104 | 150 | 47787 | 113 | 2 | 0 | 35 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | Jet fuel | 0,502 | 12 | 143 | 10 | 1 | 65 | 36 | 2 | | 1 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | AvGas | 0,009 | 0 | 7 | 11 | 0 | 60 | 1 | 0 | 0 | 0 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | Jet fuel | 2,001 | 46 | 650 | 69 | 7 | 314 | 144 | 8 | | 2 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | AvGas | 0,006 | 0 | 5 | 7 | 0 | 39 | 0 | 0 | 0 | 0 |
| 1990 | 080503 | Air traffic, Dom. > 3000 ft. | Copenhagen | Jet fuel | 1,305 | 30 | 411 | 15 | 2 | 110 | 94 | 3 | | 2 |
| 1990 | 080504 | Air traffic, Int. > 3000 ft. | Copenhagen | Jet fuel | 20,330 | 467 | 5900 | 205 | 22 | 765 | 1464 | 47 | | 24 |

2008 emissions for $CO_2$, $CH_4$, $N_2O$, $SO_2$, $NO_x$; NMVOC, $NH_3$ and TSP.

| Year | SNAP ID | Category | | Fuel type | Fuel | $SO_2$ | $NO_x$ | NMVOC | $CH_4$ | CO | $CO_2$ | $N_2O$ | $NH_3$ | TSP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | PJ | tonnes | tonnes | tonnes | tonnes | tonnes | ktonnes | tonnes | tonnes | tonnes |
| 2008 | 070101 | Passenger cars | Highway | Diesel | 4,635 | 2 | 1402 | 34 | 2 | 130 | 343 | 9 | 2 | 106 |
| 2008 | 070101 | Passenger cars | Highway | Gasoline | 11,495 | 5 | 2011 | 480 | 37 | 9093 | 837 | 9 | 339 | 15 |
| 2008 | 070101 | Passenger cars | Highway | LPG | 0,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 070102 | Passenger cars | Rural | Diesel | 10,422 | 5 | 2697 | 109 | 10 | 455 | 771 | 22 | 5 | 197 |
| 2008 | 070102 | Passenger cars | Rural | Gasoline | 26,383 | 12 | 3793 | 1289 | 98 | 16980 | 1920 | 34 | 834 | 33 |
| 2008 | 070102 | Passenger cars | Rural | LPG | 0,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 070103 | Passenger cars | Urban | Diesel | 10,695 | 5 | 2755 | 312 | 16 | 1040 | 791 | 43 | 4 | 331 |
| 2008 | 070103 | Passenger cars | Urban | Gasoline | 29,732 | 14 | 4270 | 6907 | 323 | 77373 | 2164 | 69 | 312 | 39 |
| 2008 | 070103 | Passenger cars | Urban | LPG | 0,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 070201 | Light duty vehicles | Highway | Diesel | 3,435 | 2 | 912 | 87 | 2 | 515 | 254 | 5 | 1 | 106 |
| 2008 | 070201 | Light duty vehicles | Highway | Gasoline | 0,392 | 0 | 65 | 8 | 1 | 215 | 29 | 1 | 9 | 1 |
| 2008 | 070202 | Light duty vehicles | Rural | Diesel | 10,465 | 5 | 2915 | 298 | 12 | 1389 | 774 | 17 | 4 | 278 |
| 2008 | 070202 | Light duty vehicles | Rural | Gasoline | 1,383 | 1 | 200 | 40 | 4 | 576 | 101 | 3 | 30 | 2 |
| 2008 | 070203 | Light duty vehicles | Urban | Diesel | 10,240 | 5 | 2856 | 495 | 20 | 1647 | 758 | 25 | 3 | 369 |
| 2008 | 070203 | Light duty vehicles | Urban | Gasoline | 1,676 | 1 | 203 | 247 | 12 | 4767 | 122 | 6 | 10 | 2 |
| 2008 | 070301 | Heavy duty vehicles | Highway | Diesel | 15,748 | 7 | 10522 | 330 | 82 | 1998 | 1165 | 50 | 5 | 241 |
| 2008 | 070301 | Heavy duty vehicles | Highway | Gasoline | 0,014 | 0 | 15 | 7 | 0 | 107 | 1 | 0 | 0 | 1 |
| 2008 | 070302 | Heavy duty vehicles | Rural | Diesel | 22,894 | 11 | 15834 | 581 | 132 | 3012 | 1694 | 72 | 7 | 356 |
| 2008 | 070302 | Heavy duty vehicles | Rural | Gasoline | 0,029 | 0 | 33 | 23 | 0 | 239 | 2 | 0 | 0 | 2 |
| 2008 | 070303 | Heavy duty vehicles | Urban | Diesel | 15,111 | 7 | 10543 | 501 | 123 | 2334 | 1118 | 39 | 4 | 287 |
| 2008 | 070303 | Heavy duty vehicles | Urban | Gasoline | 0,029 | 0 | 13 | 20 | 0 | 207 | 2 | 0 | 0 | 1 |
| 2008 | 070400 | Mopeds | Urban | Gasoline | 0,180 | 0 | 20 | 1650 | 26 | 1780 | 13 | 0 | 0 | 26 |
| 2008 | 070501 | Motorcycles | Highway | Gasoline | 0,207 | 0 | 50 | 195 | 20 | 2748 | 15 | 0 | 0 | 5 |
| 2008 | 070502 | Motorcycles | Rural | Gasoline | 0,460 | 0 | 84 | 540 | 56 | 5989 | 33 | 1 | 1 | 13 |
| 2008 | 070503 | Motorcycles | Urban | Gasoline | 0,553 | 0 | 59 | 883 | 70 | 6677 | 40 | 1 | 1 | 15 |
| 2008 | 080100 | Military | | Diesel | 0,630 | 0 | 307 | 17 | 2 | 76 | 47 | 2 | 0 | 14 |
| 2008 | 080100 | Military | | Jet fuel | 0,832 | 19 | 208 | 21 | 2 | 191 | 60 | 2 | 0 | 1 |
| 2008 | 080100 | Military | | Gasoline | 0,012 | 0 | 2 | 2 | 0 | 20 | 1 | 0 | 0 | 0 |
| 2008 | 080100 | Military | | AvGas | 0,003 | 0 | 3 | 4 | 0 | 21 | 0 | 0 | 0 | 0 |
| 2008 | 080200 | Railways | | Diesel | 3,199 | 1 | 2920 | 205 | 8 | 526 | 237 | 7 | 1 | 101 |
| 2008 | 080300 | Inland waterways | | Diesel | 1,002 | 94 | 853 | 165 | 3 | 448 | 74 | 3 | 0 | 101 |
| 2008 | 080300 | Inland waterways | | Gasoline | 0,361 | 0 | 179 | 569 | 22 | 5302 | 26 | 0 | 0 | 22 |
| 2008 | 080402 | National sea traffic | | Residual oil | 0,628 | 369 | 1164 | 39 | 1 | 128 | 49 | 3 | | 32 |
| 2008 | 080402 | National sea traffic | | Diesel | 4,103 | 192 | 3789 | 213 | 6 | 324 | 304 | 19 | 0 | 88 |
| 2008 | 080403 | Fishing | | Diesel | 6,063 | 284 | 8282 | 345 | 11 | 1140 | 449 | 28 | 0 | 131 |

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| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | 080403 | Fishing | | Kerosene | 0,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 2008 | 080403 | Fishing | | LPG | 0,012 | 0 | 15 | 5 | 0 | 5 | 1 | 0 | 0 | 0 |
| 2008 | 080404 | International sea traffic | | Residual oil | 27,164 | 19924 | 56644 | 1675 | 52 | 5526 | 2119 | 133 | | 1734 |
| 2008 | 080404 | International sea traffic | | Diesel | 13,504 | 633 | 20901 | 758 | 23 | 2502 | 999 | 63 | | 291 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | Jet fuel | 0,221 | 5 | 68 | 5 | 1 | 31 | 16 | 3 | | 0 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | AvGas | 0,087 | 2 | 75 | 108 | 2 | 605 | 6 | 0 | 0 | 1 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | Jet fuel | 0,303 | 7 | 89 | 9 | 1 | 55 | 22 | 2 | | 0 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | AvGas | 0,007 | 0 | 6 | 9 | 0 | 51 | 1 | 0 | 0 | 0 |
| 2008 | 080503 | Air traffic, Dom. > 3000 ft. | Other airports | Jet fuel | 0,605 | 14 | 171 | 9 | 1 | 70 | 44 | 1 | | 1 |
| 2008 | 080504 | Air traffic, Int. > 3000 ft. | Other airports | Jet fuel | 3,529 | 81 | 841 | 25 | 3 | 186 | 254 | 8 | | 4 |
| 2008 | 080600 | Agriculture | | Diesel | 16,246 | 38 | 10710 | 1083 | 18 | 5938 | 1202 | 51 | 3 | 837 |
| 2008 | 080600 | Agriculture | | Gasoline | 0,382 | 0 | 41 | 437 | 58 | 8422 | 28 | 1 | 1 | 11 |
| 2008 | 080700 | Forestry | | Diesel | 0,159 | 0 | 81 | 6 | 0 | 42 | 12 | 1 | 0 | 5 |
| 2008 | 080700 | Forestry | | Gasoline | 0,074 | 0 | 6 | 512 | 4 | 1256 | 5 | 0 | 0 | 6 |
| 2008 | 080800 | Industry | | Diesel | 14,049 | 33 | 8689 | 981 | 16 | 4803 | 1040 | 43 | 2 | 853 |
| 2008 | 080800 | Industry | | Gasoline | 0,159 | 0 | 32 | 242 | 17 | 2149 | 12 | 0 | 0 | 2 |
| 2008 | 080800 | Industry | | LPG | 1,037 | 0 | 1378 | 152 | 8 | 109 | 67 | 4 | 0 | 5 |
| 2008 | 080900 | Household and gardening | | Gasoline | 3,274 | 1 | 304 | 7954 | 240 | 95382 | 239 | 4 | 0 | 81 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | Jet fuel | 0,277 | 6 | 82 | 8 | 1 | 50 | 20 | 2 | | 0 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | AvGas | 0,001 | 0 | 1 | 1 | 0 | 5 | 0 | 0 | 0 | 0 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | Jet fuel | 2,905 | 67 | 983 | 124 | 13 | 697 | 209 | 11 | 0 | 3 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | AvGas | 0,001 | 0 | 1 | 1 | 0 | 7 | 0 | 0 | 0 | 0 |
| 2008 | 080503 | Air traffic, Dom. > 3000 ft. | Copenhagen | Jet fuel | 1,084 | 25 | 307 | 17 | 2 | 67 | 78 | 2 | 0 | 1 |
| 2008 | 080504 | Air traffic, Int. > 3000 ft. | Copenhagen | Jet fuel | 29,948 | 688 | 9379 | 317 | 34 | 1008 | 2156 | 69 | 0 | 35 |

Non-exhaust emission factors, activity data and total non-exhaust emissions of TSP, $PM_{10}$ and $PM_{2.5}$ in 2008.

| Year | Source | Category | Mileage kmkveh | TSP mg pr km | $PM_{10}$ mg pr km | $PM_{2.5}$ mg pr km | TSP tonnes | $PM_{10}$ tonnes | $PM_{2.5}$ tonnes |
|---|---|---|---|---|---|---|---|---|---|
| 2008 | Brake wear | 1 | 38696576 | 7.6 | 7.5 | 3.0 | 295 | 289 | 115 |
| 2008 | Brake wear | 2 | 9249795 | 13.7 | 13.4 | 5.3 | 127 | 124 | 49 |
| 2008 | Brake wear | 3 | 4463993 | 34.5 | 33.9 | 13.5 | 154 | 151 | 60 |
| 2008 | Brake wear | 4 | 917786 | 47.4 | 46.4 | 18.5 | 43 | 43 | 17 |
| 2008 | Brake wear | 5 | 217400 | 6.2 | 6.1 | 2.4 | 1 | 1 | 1 |
| 2008 | Brake wear | 6 | 884995 | 4.2 | 4.2 | 1.7 | 4 | 4 | 1 |
| 2008 | Road abrasion | 1 | 38696576 | 15.0 | 7.5 | 4.1 | 580 | 290 | 157 |
| 2008 | Road abrasion | 2 | 9249795 | 15.0 | 7.5 | 4.1 | 139 | 69 | 37 |
| 2008 | Road abrasion | 3 | 4463993 | 76.0 | 38.0 | 20.5 | 339 | 170 | 92 |
| 2008 | Road abrasion | 4 | 917786 | 76.0 | 38.0 | 20.5 | 70 | 35 | 19 |
| 2008 | Road abrasion | 5 | 217400 | 6.0 | 3.0 | 1.6 | 1 | 1 | 0 |
| 2008 | Road abrasion | 6 | 884995 | 6.0 | 3.0 | 1.6 | 5 | 3 | 1 |
| 2008 | Tyre wear | 1 | 38696576 | 12.4 | 7.5 | 5.2 | 482 | 289 | 202 |
| 2008 | Tyre wear | 2 | 9249795 | 20.5 | 12.3 | 8.6 | 189 | 114 | 79 |
| 2008 | Tyre wear | 3 | 4463993 | 62.9 | 37.8 | 26.4 | 281 | 169 | 118 |
| 2008 | Tyre wear | 4 | 917786 | 29.4 | 17.7 | 12.4 | 27 | 16 | 11 |
| 2008 | Tyre wear | 5 | 217400 | 6.4 | 3.8 | 2.7 | 1 | 1 | 1 |
| 2008 | Tyre wear | 6 | 884995 | 5.6 | 3.3 | 2.3 | 5 | 3 | 2 |
| 2008 | Total | 1 | 38696576 | 35.1 | 22.4 | 12.2 | 1357 | 868 | 474 |
| 2008 | Total | 2 | 9249795 | 49.1 | 33.2 | 18.0 | 455 | 307 | 166 |
| 2008 | Total | 3 | 4463993 | 173.5 | 109.6 | 60.4 | 774 | 489 | 270 |
| 2008 | Total | 4 | 917786 | 152.8 | 102.1 | 51.4 | 140 | 94 | 47 |
| 2008 | Total | 5 | 217400 | 18.6 | 12.9 | 6.7 | 4 | 3 | 1 |
| 2008 | Total | 6 | 884995 | 15.8 | 10.5 | 5.6 | 14 | 9 | 5 |

Heavy metal emission factors for 1990 and 2008 in CollectER format.

| Year | SNAP ID | Category | | Fuel type | Arsenic | Cadmium | Chromium | Copper | Mercury | Nickel | Lead | Selenium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | mg pr GJ | mg pr GJ | mg pr GJ | mg pr GJ | mg pr GJ | mg pr GJ | mg pr GJ | mg pr GJ | mg pr GJ |
| 1990 | 070101 | Passenger cars | Highway | Diesel | 0,000 | 0,234 | 1,171 | 39,812 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 070101 | Passenger cars | Highway | Gasoline | 0,000 | 0,225 | 1,125 | 38,263 | 0,000 | 1,575 | 1471,201 | 0,225 | 22,508 |
| 1990 | 070101 | Passenger cars | Highway | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 070102 | Passenger cars | Rural | Diesel | 0,000 | 0,234 | 1,171 | 39,812 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 070102 | Passenger cars | Rural | Gasoline | 0,000 | 0,225 | 1,124 | 38,207 | 0,000 | 1,573 | 1471,201 | 0,225 | 22,475 |
| 1990 | 070102 | Passenger cars | Rural | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 070103 | Passenger cars | Urban | Diesel | 0,000 | 0,234 | 1,171 | 39,812 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 070103 | Passenger cars | Urban | Gasoline | 0,000 | 0,226 | 1,129 | 38,405 | 0,000 | 1,581 | 1471,201 | 0,226 | 22,591 |
| 1990 | 070103 | Passenger cars | Urban | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 070201 | Light duty vehicles | Highway | Diesel | 0,000 | 0,234 | 1,171 | 39,812 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 070201 | Light duty vehicles | Highway | Gasoline | 0,000 | 0,297 | 1,486 | 50,529 | 0,000 | 2,081 | 1471,201 | 0,297 | 29,723 |
| 1990 | 070202 | Light duty vehicles | Rural | Diesel | 0,000 | 0,234 | 1,171 | 39,812 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 070202 | Light duty vehicles | Rural | Gasoline | 0,000 | 0,297 | 1,486 | 50,529 | 0,000 | 2,081 | 1471,201 | 0,297 | 29,723 |
| 1990 | 070203 | Light duty vehicles | Urban | Diesel | 0,000 | 0,234 | 1,171 | 39,812 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 070203 | Light duty vehicles | Urban | Gasoline | 0,000 | 0,297 | 1,486 | 50,529 | 0,000 | 2,081 | 1471,201 | 0,297 | 29,723 |
| 1990 | 070301 | Heavy duty vehicles | Highway | Diesel | 0,000 | 0,234 | 1,171 | 39,812 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 070301 | Heavy duty vehicles | Highway | Gasoline | 0,000 | 0,297 | 1,486 | 50,529 | 0,000 | 2,081 | 1471,201 | 0,297 | 29,723 |
| 1990 | 070302 | Heavy duty vehicles | Rural | Diesel | 0,000 | 0,234 | 1,171 | 39,812 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 070302 | Heavy duty vehicles | Rural | Gasoline | 0,000 | 0,297 | 1,486 | 50,529 | 0,000 | 2,081 | 1471,201 | 0,297 | 29,723 |
| 1990 | 070303 | Heavy duty vehicles | Urban | Diesel | 0,000 | 0,234 | 1,171 | 39,812 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 070303 | Heavy duty vehicles | Urban | Gasoline | 0,000 | 0,297 | 1,486 | 50,529 | 0,000 | 2,081 | 1471,201 | 0,297 | 29,723 |
| 1990 | 070400 | Mopeds | Urban | Gasoline | 0,000 | 0,297 | 1,486 | 50,529 | 0,000 | 2,081 | 1471,201 | 0,297 | 29,723 |
| 1990 | 070501 | Motorcycles | Highway | Gasoline | 0,000 | 0,297 | 1,486 | 50,529 | 0,000 | 2,081 | 1471,201 | 0,297 | 29,723 |
| 1990 | 070502 | Motorcycles | Rural | Gasoline | 0,000 | 0,297 | 1,486 | 50,529 | 0,000 | 2,081 | 1471,201 | 0,297 | 29,723 |
| 1990 | 070503 | Motorcycles | Urban | Gasoline | 0,000 | 0,297 | 1,486 | 50,529 | 0,000 | 2,081 | 1471,201 | 0,297 | 29,723 |
| 1990 | 080100 | Military | | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 080100 | Military | | Jet fuel | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,000 | 0,228 | 22,831 |
| 1990 | 080100 | Military | | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 1471,201 | 0,228 | 22,831 |
| 1990 | 080100 | Military | | AvGas | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 12785,388 | 0,228 | 22,831 |
| 1990 | 080200 | Railways | | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 080200 | Railways | | Kerosene | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080300 | Inland waterways | | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 080300 | Inland waterways | | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 1471,201 | 0,228 | 22,831 |
| 1990 | 080402 | National sea traffic | | Residual oil | 12,225 | 0,733 | 4,890 | 12,225 | 0,490 | 733,496 | 4,890 | 9,780 | 22,005 |
| 1990 | 080402 | National sea traffic | | Diesel | 1,171 | 0,234 | 0,937 | 1,171 | 1,170 | 1,639 | 2,340 | 4,684 | 11,710 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 080402 | National sea traffic | | Kerosene | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080402 | National sea traffic | | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080403 | Fishing | | Diesel | 1,171 | 0,234 | 0,937 | 1,171 | 1,170 | 1,639 | 2,340 | 4,684 | 11,710 |
| 1990 | 080403 | Fishing | | Kerosene | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080403 | Fishing | | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080404 | International sea traffic | | Residual oil | 12,225 | 0,733 | 4,890 | 12,225 | 0,490 | 733,496 | 4,890 | 9,780 | 22,005 |
| 1990 | 080404 | International sea traffic | | Diesel | 1,171 | 0,234 | 0,937 | 1,171 | 1,170 | 1,639 | 2,340 | 4,684 | 11,710 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | Jet fuel | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,000 | 0,228 | 22,831 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | AvGas | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 13505,692 | 0,228 | 22,831 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | Jet fuel | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,000 | 0,228 | 22,831 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | AvGas | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 13505,692 | 0,228 | 22,831 |
| 1990 | 080503 | Air traffic, Dom. > 3000 ft. | Other airports | Jet fuel | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,000 | 0,228 | 22,831 |
| 1990 | 080504 | Air traffic, Int. > 3000 ft. | Other airports | Jet fuel | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,000 | 0,228 | 22,831 |
| 1990 | 080600 | Agriculture | | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 080600 | Agriculture | | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 1471,201 | 0,228 | 22,831 |
| 1990 | 080700 | Forestry | | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 080700 | Forestry | | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 1471,201 | 0,228 | 22,831 |
| 1990 | 080800 | Industry | | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 1990 | 080800 | Industry | | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 1471,201 | 0,228 | 22,831 |
| 1990 | 080800 | Industry | | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080900 | Household and gardening | | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 1471,201 | 0,228 | 22,831 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,000 | 0,228 | 22,831 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | AvGas | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 13505,692 | 0,228 | 22,831 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,000 | 0,228 | 22,831 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | AvGas | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 13505,692 | 0,228 | 22,831 |
| 1990 | 080503 | Air traffic, Dom. > 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,000 | 0,228 | 22,831 |
| 1990 | 080504 | Air traffic, Int. > 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,000 | 0,228 | 22,831 |

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| Year | SNAP ID | Category | | Fuel type | Arsenic | Cadmium | Chromium | Copper | Mercury | Nickel | Lead | Selenium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | mg pr GJ | mg pr GJ | mg pr GJ | mg pr GJ | mg pr GJ | mg pr GJ | mg pr GJ | mg pr GJ | mg pr GJ |
| 2008 | 070101 | Passenger cars | Highway | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 2008 | 070101 | Passenger cars | Highway | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,685 | 0,228 | 22,831 |
| 2008 | 070101 | Passenger cars | Highway | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 070102 | Passenger cars | Rural | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 2008 | 070102 | Passenger cars | Rural | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,685 | 0,228 | 22,831 |
| 2008 | 070102 | Passenger cars | Rural | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 070103 | Passenger cars | Urban | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | 070103 | Passenger cars | Urban | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,685 | 0,228 | 22,831 |
| 2008 | 070103 | Passenger cars | Urban | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 070201 | Light duty vehicles | Highway | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 2008 | 070201 | Light duty vehicles | Highway | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,685 | 0,228 | 22,831 |
| 2008 | 070202 | Light duty vehicles | Rural | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 2008 | 070202 | Light duty vehicles | Rural | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,685 | 0,228 | 22,831 |
| 2008 | 070203 | Light duty vehicles | Urban | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 2008 | 070203 | Light duty vehicles | Urban | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,685 | 0,228 | 22,831 |
| 2008 | 070301 | Heavy duty vehicles | Highway | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 2008 | 070301 | Heavy duty vehicles | Highway | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,685 | 0,228 | 22,831 |
| 2008 | 070302 | Heavy duty vehicles | Rural | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 2008 | 070302 | Heavy duty vehicles | Rural | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,685 | 0,228 | 22,831 |
| 2008 | 070303 | Heavy duty vehicles | Urban | Diesel | 0,000 | 0,234 | 1,171 | 39,813 | 0,000 | 1,639 | 0,000 | 0,234 | 23,419 |
| 2008 | 070303 | Heavy duty vehicles | Urban | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,685 | 0,228 | 22,831 |
| 2008 | 070400 | Mopeds | Urban | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,685 | 0,228 | 22,831 |
| 2008 | 070501 | Motorcycles | Highway | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,685 | 0,228 | 22,831 |
| 2008 | 070502 | Motorcycles | Rural | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,685 | 0,228 | 22,831 |
| 2008 | 070503 | Motorcycles | Urban | Gasoline | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,685 | 0,228 | 22,831 |
| 2008 | 080100 | Military | | Diesel | 0,000 | 0,230 | 1,170 | 39,810 | 0,000 | 1,640 | 0,000 | 0,230 | 23,420 |
| 2008 | 080100 | Military | | Jet fuel | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 0,000 | 0,230 | 22,830 |
| 2008 | 080100 | Military | | Gasoline | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 0,680 | 0,230 | 22,830 |
| 2008 | 080100 | Military | | AvGas | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 12785,390 | 0,230 | 22,830 |
| 2008 | 080200 | Railways | | Diesel | 0,000 | 0,230 | 1,170 | 39,810 | 0,000 | 1,640 | 0,000 | 0,230 | 23,420 |
| 2008 | 080300 | Inland waterways | | Diesel | 0,000 | 0,230 | 1,170 | 39,810 | 0,000 | 1,640 | 0,000 | 0,230 | 23,420 |
| 2008 | 080300 | Inland waterways | | Gasoline | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 0,685 | 0,230 | 22,830 |
| 2008 | 080402 | National sea traffic | | Residual oil | 12,220 | 0,730 | 4,890 | 12,220 | 0,490 | 733,500 | 4,890 | 9,780 | 22,000 |
| 2008 | 080402 | National sea traffic | | Diesel | 1,170 | 0,230 | 0,940 | 1,170 | 1,170 | 1,640 | 2,340 | 4,680 | 11,710 |
| 2008 | 080403 | Fishing | | Diesel | 1,170 | 0,230 | 0,940 | 1,170 | 1,170 | 1,640 | 2,340 | 4,680 | 11,710 |
| 2008 | 080403 | Fishing | | Kerosene | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 080403 | Fishing | | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 080404 | International sea traffic | | Residual oil | 12,220 | 0,730 | 4,890 | 12,220 | 0,490 | 733,500 | 4,890 | 9,780 | 22,000 |
| 2008 | 080404 | International sea traffic | | Diesel | 1,170 | 0,230 | 0,940 | 1,170 | 1,170 | 1,640 | 2,340 | 4,680 | 11,710 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | Jet fuel | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 0,000 | 0,230 | 22,830 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | AvGas | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 13505,692 | 0,230 | 22,830 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | Jet fuel | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 0,000 | 0,230 | 22,830 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | AvGas | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 13505,692 | 0,230 | 22,830 |

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | 080503 | Air traffic, Dom. > 3000 ft. | Other airports | Jet fuel | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 0,000 | 0,230 | 22,830 |
| 2008 | 080504 | Air traffic, Int. > 3000 ft. | Other airports | Jet fuel | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 0,000 | 0,230 | 22,830 |
| 2008 | 080600 | Agriculture | | Diesel | 0,000 | 0,230 | 1,170 | 39,810 | 0,000 | 1,640 | 0,000 | 0,230 | 23,420 |
| 2008 | 080600 | Agriculture | | Gasoline | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 0,685 | 0,230 | 22,830 |
| 2008 | 080700 | Forestry | | Diesel | 0,000 | 0,230 | 1,170 | 39,810 | 0,000 | 1,640 | 0,000 | 0,230 | 23,420 |
| 2008 | 080700 | Forestry | | Gasoline | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 0,685 | 0,230 | 22,830 |
| 2008 | 080800 | Industry | | Diesel | 0,000 | 0,230 | 1,170 | 39,810 | 0,000 | 1,640 | 0,000 | 0,230 | 23,420 |
| 2008 | 080800 | Industry | | Gasoline | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 0,685 | 0,230 | 22,830 |
| 2008 | 080800 | Industry | | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 080900 | Household and gardening | | Gasoline | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 0,685 | 0,230 | 22,830 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 0,000 | 0,228 | 22,831 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | AvGas | 0,000 | 0,228 | 1,142 | 38,813 | 0,000 | 1,598 | 13505,692 | 0,228 | 22,831 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 0,000 | 0,230 | 22,830 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | AvGas | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 13505,692 | 0,230 | 22,830 |
| 2008 | 080503 | Air traffic, Dom. > 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 0,000 | 0,230 | 22,830 |
| 2008 | 080504 | Air traffic, Int. > 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,230 | 1,140 | 38,810 | 0,000 | 1,600 | 0,000 | 0,230 | 22,830 |

Heavy metal emissions for 1990 and 2008 in CollectER format.

| Year | SNAP ID | Category | | Fuel type | Arsenic | Cadmium | Chromium | Copper | Mercury | Nickel | Lead | Selenium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | kg | kg | kg | kg | kg | kg | kg | kg | kg |
| 1990 | 070101 | Passenger cars | Highway | Diesel | | 0 | 1 | 33 | | 1 | 0 | 0 | 19 |
| 1990 | 070101 | Passenger cars | Highway | Gasoline | | 2 | 8 | 289 | | 12 | 11099 | 2 | 170 |
| 1990 | 070101 | Passenger cars | Highway | LPG | | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| 1990 | 070102 | Passenger cars | Rural | Diesel | | 1 | 3 | 93 | | 4 | 0 | 1 | 55 |
| 1990 | 070102 | Passenger cars | Rural | Gasoline | | 5 | 26 | 890 | | 37 | 34269 | 5 | 524 |
| 1990 | 070102 | Passenger cars | Rural | LPG | | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| 1990 | 070103 | Passenger cars | Urban | Diesel | | 1 | 4 | 139 | | 6 | 0 | 1 | 82 |
| 1990 | 070103 | Passenger cars | Urban | Gasoline | | 7 | 36 | 1237 | | 51 | 47403 | 7 | 728 |
| 1990 | 070103 | Passenger cars | Urban | LPG | | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| 1990 | 070201 | Light duty vehicles | Highway | Diesel | | 0 | 2 | 64 | | 3 | 0 | 0 | 38 |
| 1990 | 070201 | Light duty vehicles | Highway | Gasoline | | 0 | 0 | 11 | | 0 | 324 | 0 | 7 |
| 1990 | 070202 | Light duty vehicles | Rural | Diesel | | 1 | 7 | 230 | | 9 | 0 | 1 | 135 |
| 1990 | 070202 | Light duty vehicles | Rural | Gasoline | | 0 | 1 | 46 | | 2 | 1347 | 0 | 27 |
| 1990 | 070203 | Light duty vehicles | Urban | Diesel | | 2 | 8 | 269 | | 11 | 0 | 2 | 158 |
| 1990 | 070203 | Light duty vehicles | Urban | Gasoline | | 0 | 2 | 68 | | 3 | 1966 | 0 | 40 |
| 1990 | 070301 | Heavy duty vehicles | Highway | Diesel | | 2 | 11 | 379 | | 16 | 0 | 2 | 223 |
| 1990 | 070301 | Heavy duty vehicles | Highway | Gasoline | | 0 | 0 | 1 | | 0 | 15 | 0 | 0 |
| 1990 | 070302 | Heavy duty vehicles | Rural | Diesel | | 4 | 19 | 655 | | 27 | 0 | 4 | 385 |
| 1990 | 070302 | Heavy duty vehicles | Rural | Gasoline | | 0 | 0 | 2 | | 0 | 44 | 0 | 1 |
| 1990 | 070303 | Heavy duty vehicles | Urban | Diesel | | 3 | 15 | 525 | | 22 | 0 | 3 | 309 |
| 1990 | 070303 | Heavy duty vehicles | Urban | Gasoline | | 0 | 0 | 2 | | 0 | 51 | 0 | 1 |
| 1990 | 070400 | Mopeds | Urban | Gasoline | | 0 | 0 | 14 | | 1 | 422 | 0 | 9 |
| 1990 | 070501 | Motorcycles | Highway | Gasoline | | 0 | 0 | 4 | | 0 | 113 | 0 | 2 |
| 1990 | 070502 | Motorcycles | Rural | Gasoline | | 0 | 0 | 7 | | 0 | 210 | 0 | 4 |
| 1990 | 070503 | Motorcycles | Urban | Gasoline | | 0 | 0 | 8 | | 0 | 247 | 0 | 5 |
| 1990 | 080100 | Military | | Diesel | | 0 | 0 | 6 | | 0 | | 0 | 3 |
| 1990 | 080100 | Military | | Jet fuel | | 0 | 2 | 58 | | 2 | | 0 | 34 |
| 1990 | 080100 | Military | | Gasoline | | 0 | 0 | 0 | | 0 | 1 | 0 | 0 |
| 1990 | 080100 | Military | | AvGas | | 0 | 0 | 0 | | 0 | 63 | 0 | 0 |
| 1990 | 080200 | Railways | | Diesel | | 1 | 5 | 160 | | 7 | | 1 | 94 |
| 1990 | 080200 | Railways | | Kerosene | | | | | | | | | |
| 1990 | 080300 | Inland waterways | | Diesel | | 0 | 0 | 14 | | 1 | | 0 | 8 |
| 1990 | 080300 | Inland waterways | | Gasoline | | 0 | 0 | 12 | | 0 | 455 | 0 | 7 |
| 1990 | 080402 | National sea traffic | | Residual oil | 47 | 3 | 19 | 47 | 2 | 2818 | 19 | 38 | 85 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 080402 | National sea traffic | | Diesel | 6 | 1 | 5 | 6 | 6 | 8 | 12 | 23 | 58 |
| 1990 | 080402 | National sea traffic | | Kerosene | | | | | | | | | |
| 1990 | 080402 | National sea traffic | | LPG | | | | | | | | | |
| 1990 | 080403 | Fishing | | Diesel | 9 | 2 | 7 | 9 | 9 | 13 | 19 | 37 | 93 |
| 1990 | 080403 | Fishing | | Kerosene | | | | | | | | | |
| 1990 | 080403 | Fishing | | LPG | | | | | | | | | |
| 1990 | 080404 | International sea traffic | | Residual oil | 349 | 21 | 140 | 349 | 14 | 20936 | 140 | 279 | 628 |
| 1990 | 080404 | International sea traffic | | Diesel | 14 | 3 | 11 | 14 | 14 | 19 | 27 | 54 | 136 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | Jet fuel | | 0 | 0 | 16 | | 1 | | 0 | 10 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | AvGas | | 0 | 0 | 4 | | 0 | 1417 | 0 | 2 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | Jet fuel | | 0 | 0 | 5 | | 0 | | 0 | 3 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | AvGas | | 0 | 0 | 1 | | 0 | 414 | 0 | 1 |
| 1990 | 080503 | Air traffic, Dom. > 3000 ft. | Other airports | Jet fuel | | 0 | 1 | 40 | | 2 | | 0 | 23 |
| 1990 | 080504 | Air traffic, Int. > 3000 ft. | Other airports | Jet fuel | | 0 | 2 | 63 | | 3 | | 0 | 37 |
| 1990 | 080600 | Agriculture | | Diesel | | 4 | 19 | 657 | | 27 | | 4 | 386 |
| 1990 | 080600 | Agriculture | | Gasoline | | 0 | 1 | 28 | | 1 | 1043 | 0 | 16 |
| 1990 | 080700 | Forestry | | Diesel | | 0 | 0 | 6 | | 0 | | 0 | 3 |
| 1990 | 080700 | Forestry | | Gasoline | | 0 | 0 | 13 | | 1 | 502 | 0 | 8 |
| 1990 | 080800 | Industry | | Diesel | | 2 | 12 | 404 | | 17 | | 2 | 238 |
| 1990 | 080800 | Industry | | Gasoline | | 0 | 0 | 7 | | 0 | 258 | 0 | 4 |
| 1990 | 080800 | Industry | | LPG | | | | | | | | | |
| 1990 | 080900 | Household and gardening | | Gasoline | | 0 | 2 | 60 | | 2 | 2273 | 0 | 35 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | Jet fuel | | 0 | 1 | 19 | | 1 | | 0 | 11 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | AvGas | | 0 | 0 | 0 | | 0 | 117 | 0 | 0 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | Jet fuel | | 0 | 2 | 78 | | 3 | | 0 | 46 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | AvGas | | 0 | 0 | 0 | | 0 | 76 | 0 | 0 |
| 1990 | 080503 | Air traffic, Dom. > 3000 ft. | Copenhagen | Jet fuel | | 0 | 1 | 51 | | 2 | | 0 | 30 |
| 1990 | 080504 | Air traffic, Int. > 3000 ft. | Copenhagen | Jet fuel | | 5 | 23 | 789 | | 32 | | 5 | 464 |

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| Year | SNAP ID | Category | | Fuel type | Arsenic kg | Cadmium kg | Chromium kg | Copper kg | Mercury kg | Nickel kg | Lead kg | Selenium kg | Zinc kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | 070101 | Passenger cars | Highway | Diesel | | 1 | 5 | 185 | | 8 | 0 | 1 | 109 |
| 2008 | 070101 | Passenger cars | Highway | Gasoline | | 3 | 13 | 446 | | 18 | 8 | 3 | 262 |
| 2008 | 070101 | Passenger cars | Highway | LPG | | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| 2008 | 070102 | Passenger cars | Rural | Diesel | | 2 | 12 | 415 | | 17 | 0 | 2 | 244 |
| 2008 | 070102 | Passenger cars | Rural | Gasoline | | 6 | 30 | 1024 | | 42 | 18 | 6 | 602 |
| 2008 | 070102 | Passenger cars | Rural | LPG | | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | | | | | | | |
| 2008 | 070103 | Passenger cars | Urban | Diesel | | 3 | 13 | 426 | | 18 | 0 | 3 | 250 |
| 2008 | 070103 | Passenger cars | Urban | Gasoline | | 7 | 34 | 1154 | | 48 | 20 | 7 | 679 |
| 2008 | 070103 | Passenger cars | Urban | LPG | | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| 2008 | 070201 | Light duty vehicles | Highway | Diesel | | 1 | 4 | 137 | | 6 | 0 | 1 | 80 |
| 2008 | 070201 | Light duty vehicles | Highway | Gasoline | | 0 | 0 | 15 | | 1 | 0 | 0 | 9 |
| 2008 | 070202 | Light duty vehicles | Rural | Diesel | | 2 | 12 | 417 | | 17 | 0 | 2 | 245 |
| 2008 | 070202 | Light duty vehicles | Rural | Gasoline | | 0 | 2 | 54 | | 2 | 1 | 0 | 32 |
| 2008 | 070203 | Light duty vehicles | Urban | Diesel | | 2 | 12 | 408 | | 17 | 0 | 2 | 240 |
| 2008 | 070203 | Light duty vehicles | Urban | Gasoline | | 0 | 2 | 65 | | 3 | 1 | 0 | 38 |
| 2008 | 070301 | Heavy duty vehicles | Highway | Diesel | | 4 | 18 | 627 | | 26 | 0 | 4 | 369 |
| 2008 | 070301 | Heavy duty vehicles | Highway | Gasoline | | 0 | 0 | 1 | | 0 | 0 | 0 | 0 |
| 2008 | 070302 | Heavy duty vehicles | Rural | Diesel | | 5 | 27 | 911 | | 38 | 0 | 5 | 536 |
| 2008 | 070302 | Heavy duty vehicles | Rural | Gasoline | | 0 | 0 | 1 | | 0 | 0 | 0 | 1 |
| 2008 | 070303 | Heavy duty vehicles | Urban | Diesel | | 4 | 18 | 602 | | 25 | 0 | 4 | 354 |
| 2008 | 070303 | Heavy duty vehicles | Urban | Gasoline | | 0 | 0 | 1 | | 0 | 0 | 0 | 1 |
| 2008 | 070400 | Mopeds | Urban | Gasoline | | 0 | 0 | 7 | | 0 | 0 | 0 | 4 |
| 2008 | 070501 | Motorcycles | Highway | Gasoline | | 0 | 0 | 8 | | 0 | 0 | 0 | 5 |
| 2008 | 070502 | Motorcycles | Rural | Gasoline | | 0 | 1 | 18 | | 1 | 0 | 0 | 10 |
| 2008 | 070503 | Motorcycles | Urban | Gasoline | | 0 | 1 | 21 | | 1 | 0 | 0 | 13 |
| 2008 | 080100 | Military | | Diesel | | 0 | 1 | 25 | | 1 | | 0 | 15 |
| 2008 | 080100 | Military | | Jet fuel | 0 | 0 | 1 | 32 | 0 | 1 | 0 | 0 | 19 |
| 2008 | 080100 | Military | | Gasoline | | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| 2008 | 080100 | Military | | AvGas | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 0 |
| 2008 | 080200 | Railways | | Diesel | | 1 | 4 | 127 | | 5 | | 1 | 75 |
| 2008 | 080300 | Inland waterways | | Diesel | | 0 | 1 | 40 | | 2 | | 0 | 23 |
| 2008 | 080300 | Inland waterways | | Gasoline | | 0 | 0 | 14 | | 1 | 0 | 0 | 8 |
| 2008 | 080402 | National sea traffic | | Residual oil | 8 | 0 | 3 | 8 | 0 | 461 | 3 | 6 | 14 |
| 2008 | 080402 | National sea traffic | | Diesel | 5 | 1 | 4 | 5 | 5 | 7 | 10 | 19 | 48 |
| 2008 | 080403 | Fishing | | Diesel | 7 | 1 | 6 | 7 | 7 | 10 | 14 | 28 | 71 |
| 2008 | 080403 | Fishing | | Kerosene | | | | | | | | | |
| 2008 | 080403 | Fishing | | LPG | | | | | | | | | |
| 2008 | 080404 | International sea traffic | | Residual oil | 332 | 20 | 133 | 332 | 13 | 19924 | 133 | 266 | 598 |
| 2008 | 080404 | International sea traffic | | Diesel | 16 | 3 | 13 | 16 | 16 | 22 | 32 | 63 | 158 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | Jet fuel | | 0 | 0 | 9 | | 0 | 0 | 0 | 5 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | AvGas | | 0 | 0 | 3 | | 0 | 1172 | 0 | 2 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | Jet fuel | | 0 | 0 | 12 | | 0 | 0 | 0 | 7 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | | | | | | | |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | AvGas | | 0 | 0 | 0 | | 0 | 99 | 0 | 0 |
| 2008 | 080503 | Air traffic, Dom. > 3000 ft. | Other airports | Jet fuel | | 0 | 1 | 23 | | 1 | 0 | 0 | 14 |
| 2008 | 080504 | Air traffic, Int. > 3000 ft. | Other airports | Jet fuel | | 1 | 4 | 137 | | 6 | 0 | 1 | 81 |
| 2008 | 080600 | Agriculture | | Diesel | | 4 | 19 | 647 | | 27 | | 4 | 380 |
| 2008 | 080600 | Agriculture | | Gasoline | | 0 | 0 | 15 | | 1 | 0 | 0 | 9 |
| 2008 | 080700 | Forestry | | Diesel | | 0 | 0 | 6 | | 0 | | 0 | 4 |
| 2008 | 080700 | Forestry | | Gasoline | | 0 | 0 | 3 | | 0 | 0 | 0 | 2 |
| 2008 | 080800 | Industry | | Diesel | | 3 | 16 | 559 | | 23 | | 3 | 329 |
| 2008 | 080800 | Industry | | Gasoline | | 0 | 0 | 6 | | 0 | 0 | 0 | 4 |
| 2008 | 080800 | Industry | | LPG | | | | | | | | | |
| 2008 | 080900 | Household and gardening | | Gasoline | | 1 | 4 | 127 | | 5 | 2 | 1 | 75 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | Jet fuel | | 0 | 0 | 11 | | 0 | | 0 | 6 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | AvGas | | 0 | 0 | 0 | | 0 | 9 | 0 | 0 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | Jet fuel | 0 | 1 | 3 | 113 | 0 | 5 | 0 | 1 | 66 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | AvGas | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 0 |
| 2008 | 080503 | Air traffic, Dom. > 3000 ft. | Copenhagen | Jet fuel | 0 | 0 | 1 | 42 | 0 | 2 | 0 | 0 | 25 |
| 2008 | 080504 | Air traffic, Int. > 3000 ft. | Copenhagen | Jet fuel | 0 | 7 | 34 | 1162 | 0 | 48 | 0 | 7 | 684 |

PAH emission factors for 1990 and 2008 in CollectER format.

| Year | SNAP ID | Category | | Fuel type | Dioxins/ Furans | Flouranthene | Benzo(b) flouranthene | Benzo(k) flouranthene | Benzo(a) pyrene | Benzo(g,h,i) perylene | indeno(1,2,3-c,d) pyrene |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 070101 | Passenger cars | Highway | Diesel | 0,001 | 12,250 | 0,748 | 0,678 | 0,818 | 1,589 | 0,771 |
| 1990 | 070101 | Passenger cars | Highway | Gasoline | 0,013 | 8,503 | 0,553 | 0,425 | 0,468 | 1,105 | 0,425 |
| 1990 | 070101 | Passenger cars | Highway | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 070102 | Passenger cars | Rural | Diesel | 0,001 | 14,889 | 0,909 | 0,824 | 0,994 | 1,932 | 0,937 |
| 1990 | 070102 | Passenger cars | Rural | Gasoline | 0,015 | 9,536 | 0,620 | 0,477 | 0,524 | 1,240 | 0,477 |
| 1990 | 070102 | Passenger cars | Rural | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 070103 | Passenger cars | Urban | Diesel | 0,001 | 9,303 | 0,568 | 0,515 | 0,621 | 1,207 | 0,586 |
| 1990 | 070103 | Passenger cars | Urban | Gasoline | 0,010 | 6,423 | 0,417 | 0,321 | 0,353 | 0,835 | 0,321 |
| 1990 | 070103 | Passenger cars | Urban | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 070201 | Light duty vehicles | Highway | Diesel | 0,000 | 8,505 | 0,519 | 0,470 | 0,568 | 1,104 | 0,536 |
| 1990 | 070201 | Light duty vehicles | Highway | Gasoline | 0,013 | 8,086 | 0,526 | 0,404 | 0,445 | 1,051 | 0,404 |
| 1990 | 070202 | Light duty vehicles | Rural | Diesel | 0,001 | 9,306 | 0,568 | 0,515 | 0,622 | 1,207 | 0,586 |
| 1990 | 070202 | Light duty vehicles | Rural | Gasoline | 0,012 | 7,625 | 0,495 | 0,381 | 0,419 | 0,991 | 0,381 |
| 1990 | 070203 | Light duty vehicles | Urban | Diesel | 0,000 | 6,954 | 0,425 | 0,385 | 0,464 | 0,902 | 0,438 |
| 1990 | 070203 | Light duty vehicles | Urban | Gasoline | 0,007 | 4,558 | 0,296 | 0,228 | 0,251 | 0,592 | 0,228 |
| 1990 | 070301 | Heavy duty vehicles | Highway | Diesel | 0,001 | 2,086 | 0,526 | 0,780 | 0,097 | 0,078 | 0,136 |
| 1990 | 070301 | Heavy duty vehicles | Highway | Gasoline | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 070302 | Heavy duty vehicles | Rural | Diesel | 0,001 | 2,208 | 0,557 | 0,825 | 0,103 | 0,082 | 0,144 |
| 1990 | 070302 | Heavy duty vehicles | Rural | Gasoline | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 070303 | Heavy duty vehicles | Urban | Diesel | 0,001 | 1,788 | 0,451 | 0,668 | 0,083 | 0,067 | 0,117 |
| 1990 | 070303 | Heavy duty vehicles | Urban | Gasoline | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 070400 | Mopeds | Urban | Gasoline | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 070501 | Motorcycles | Highway | Gasoline | 0,020 | 12,673 | 0,824 | 0,634 | 0,697 | 1,647 | 0,634 |
| 1990 | 070502 | Motorcycles | Rural | Gasoline | 0,024 | 15,176 | 0,986 | 0,759 | 0,834 | 1,973 | 0,759 |
| 1990 | 070503 | Motorcycles | Urban | Gasoline | 0,024 | 15,300 | 0,994 | 0,765 | 0,841 | 1,989 | 0,765 |
| 1990 | 080100 | Military | | Diesel | 0,001 | 4,391 | 0,571 | 0,568 | 0,290 | 0,550 | 0,290 |
| 1990 | 080100 | Military | | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080100 | Military | | Gasoline | 0,006 | 5,257 | 0,277 | 0,116 | 0,142 | 0,825 | 0,300 |
| 1990 | 080100 | Military | | AvGas | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 1990 | 080200 | Railways | | Diesel | 0,001 | 1,366 | 0,348 | 0,389 | 0,057 | 0,049 | 0,089 |
| 1990 | 080200 | Railways | | Kerosene | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080300 | Inland waterways | | Diesel | 0,001 | 4,391 | 0,571 | 0,568 | 0,290 | 0,550 | 0,290 |
| 1990 | 080300 | Inland waterways | | Gasoline | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 1990 | 080402 | National sea traffic | | Residual oil | 0,013 | 5,190 | 0,270 | 0,050 | 0,020 | 0,070 | 0,030 |
| 1990 | 080402 | National sea traffic | | Diesel | 0,012 | 7,420 | 0,640 | 0,300 | 0,150 | 1,430 | 1,180 |

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| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 080402 | National sea traffic | | Kerosene | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080402 | National sea traffic | | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080403 | Fishing | | Diesel | 0,012 | 7,420 | 0,640 | 0,300 | 0,150 | 1,430 | 1,180 |
| 1990 | 080403 | Fishing | | Kerosene | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080403 | Fishing | | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080404 | International sea traffic | | Residual oil | 0,013 | 4,120 | 0,200 | 0,090 | 0,070 | 0,260 | 0,200 |
| 1990 | 080404 | International sea traffic | | Diesel | 0,012 | 7,420 | 0,640 | 0,300 | 0,150 | 1,430 | 1,180 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | AvGas | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | AvGas | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 1990 | 080503 | Air traffic, Dom. > 3000 ft. | Other airports | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080504 | Air traffic, Int. > 3000 ft. | Other airports | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080600 | Agriculture | | Diesel | 0,001 | 4,391 | 0,571 | 0,568 | 0,290 | 0,550 | 0,290 |
| 1990 | 080600 | Agriculture | | Gasoline | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 1990 | 080700 | Forestry | | Diesel | 0,001 | 4,391 | 0,571 | 0,568 | 0,290 | 0,550 | 0,290 |
| 1990 | 080700 | Forestry | | Gasoline | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 1990 | 080800 | Industry | | Diesel | 0,001 | 4,391 | 0,571 | 0,568 | 0,290 | 0,550 | 0,290 |
| 1990 | 080800 | Industry | | Gasoline | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 1990 | 080800 | Industry | | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080900 | Household and gardening | | Gasoline | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | AvGas | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | AvGas | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 1990 | 080503 | Air traffic, Dom. > 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 1990 | 080504 | Air traffic, Int. > 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |

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| Year | SNAP ID | Category | | Fuel type | Dioxins/ | Flouranthene | Benzo(b) | Benzo(k) | Benzo(a) | Benzo(g,h,i) | indeno(1,2,3-c,d) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Furans | | flouranthene | flouranthene | pyrene |
| 2008 | 070101 | Passenger cars | Highway | Diesel | 0,000 | 12,815 | 0,782 | 0,709 | 0,856 | 1,663 | 0,807 |
| 2008 | 070101 | Passenger cars | Highway | Gasoline | 0,001 | 1,373 | 0,220 | 0,257 | 0,214 | 0,439 | 0,304 |
| 2008 | 070101 | Passenger cars | Highway | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 070102 | Passenger cars | Rural | Diesel | 0,001 | 14,593 | 0,891 | 0,807 | 0,975 | 1,894 | 0,919 |
| 2008 | 070102 | Passenger cars | Rural | Gasoline | 0,001 | 1,502 | 0,244 | 0,287 | 0,238 | 0,487 | 0,338 |
| 2008 | 070102 | Passenger cars | Rural | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 070103 | Passenger cars | Urban | Diesel | 0,001 | 9,684 | 0,591 | 0,536 | 0,647 | 1,257 | 0,610 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | | | | | |
| 2008 | 070103 | Passenger cars | Urban | Gasoline | 0,001 | 0,895 | 0,137 | 0,160 | 0,134 | 0,275 | 0,188 |
| 2008 | 070103 | Passenger cars | Urban | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 070201 | Light duty vehicles | Highway | Diesel | 0,001 | 9,234 | 0,564 | 0,511 | 0,617 | 1,198 | 0,581 |
| 2008 | 070201 | Light duty vehicles | Highway | Gasoline | 0,001 | 1,087 | 0,162 | 0,186 | 0,157 | 0,323 | 0,218 |
| 2008 | 070202 | Light duty vehicles | Rural | Diesel | 0,001 | 10,103 | 0,617 | 0,559 | 0,675 | 1,311 | 0,636 |
| 2008 | 070202 | Light duty vehicles | Rural | Gasoline | 0,001 | 1,026 | 0,153 | 0,176 | 0,148 | 0,305 | 0,206 |
| 2008 | 070203 | Light duty vehicles | Urban | Diesel | 0,000 | 7,261 | 0,443 | 0,402 | 0,485 | 0,942 | 0,457 |
| 2008 | 070203 | Light duty vehicles | Urban | Gasoline | 0,000 | 0,593 | 0,088 | 0,102 | 0,085 | 0,176 | 0,119 |
| 2008 | 070301 | Heavy duty vehicles | Highway | Diesel | 0,001 | 2,030 | 0,512 | 0,759 | 0,095 | 0,076 | 0,133 |
| 2008 | 070301 | Heavy duty vehicles | Highway | Gasoline | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 070302 | Heavy duty vehicles | Rural | Diesel | 0,001 | 2,066 | 0,521 | 0,772 | 0,096 | 0,077 | 0,135 |
| 2008 | 070302 | Heavy duty vehicles | Rural | Gasoline | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 070303 | Heavy duty vehicles | Urban | Diesel | 0,001 | 1,676 | 0,423 | 0,626 | 0,078 | 0,063 | 0,110 |
| 2008 | 070303 | Heavy duty vehicles | Urban | Gasoline | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 070400 | Mopeds | Urban | Gasoline | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 070501 | Motorcycles | Highway | Gasoline | 0,020 | 12,799 | 0,832 | 0,640 | 0,704 | 1,664 | 0,640 |
| 2008 | 070502 | Motorcycles | Rural | Gasoline | 0,024 | 15,331 | 0,996 | 0,766 | 0,843 | 1,993 | 0,766 |
| 2008 | 070503 | Motorcycles | Urban | Gasoline | 0,024 | 15,500 | 1,007 | 0,775 | 0,852 | 2,015 | 0,775 |
| 2008 | 080100 | Military | | Diesel | 0,001 | 4,350 | 0,510 | 0,496 | 0,256 | 0,464 | 0,264 |
| 2008 | 080100 | Military | | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 080100 | Military | | Gasoline | 0,007 | 2,152 | 0,180 | 0,115 | 0,118 | 0,358 | 0,179 |
| 2008 | 080100 | Military | | AvGas | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 2008 | 080200 | Railways | | Diesel | 0,001 | 1,411 | 0,360 | 0,402 | 0,059 | 0,051 | 0,092 |
| 2008 | 080300 | Inland waterways | | Diesel | 0,001 | 4,350 | 0,510 | 0,496 | 0,256 | 0,464 | 0,264 |
| 2008 | 080300 | Inland waterways | | Gasoline | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 2008 | 080402 | National sea traffic | | Residual oil | 0,013 | 5,190 | 0,270 | 0,050 | 0,020 | 0,070 | 0,030 |
| 2008 | 080402 | National sea traffic | | Diesel | 0,012 | 7,420 | 0,640 | 0,300 | 0,150 | 1,430 | 1,180 |
| 2008 | 080403 | Fishing | | Diesel | 0,012 | 7,420 | 0,640 | 0,300 | 0,150 | 1,430 | 1,180 |
| 2008 | 080403 | Fishing | | Kerosene | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 080403 | Fishing | | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 080404 | International sea traffic | | Residual oil | 0,013 | 4,120 | 0,200 | 0,090 | 0,070 | 0,260 | 0,200 |
| 2008 | 080404 | International sea traffic | | Diesel | 0,012 | 7,420 | 0,640 | 0,300 | 0,150 | 1,430 | 1,180 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | AvGas | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | AvGas | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | | | | | |
| 2008 | 080503 | Air traffic, Dom. > 3000 ft. | Other airports | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 080504 | Air traffic, Int. > 3000 ft. | Other airports | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 080600 | Agriculture | | Diesel | 0,001 | 4,350 | 0,510 | 0,496 | 0,256 | 0,464 | 0,264 |
| 2008 | 080600 | Agriculture | | Gasoline | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 2008 | 080700 | Forestry | | Diesel | 0,001 | 4,350 | 0,510 | 0,496 | 0,256 | 0,464 | 0,264 |
| 2008 | 080700 | Forestry | | Gasoline | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 2008 | 080800 | Industry | | Diesel | 0,001 | 4,350 | 0,510 | 0,496 | 0,256 | 0,464 | 0,264 |
| 2008 | 080800 | Industry | | Gasoline | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 2008 | 080800 | Industry | | LPG | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 080900 | Household and gardening | | Gasoline | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | AvGas | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | AvGas | 0,005 | 4,329 | 0,209 | 0,071 | 0,114 | 0,689 | 0,245 |
| 2008 | 080503 | Air traffic, Dom. > 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| 2008 | 080504 | Air traffic, Int. > 3000 ft. | Copenhagen | Jet fuel | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |

PAH emissions for 1990 and 2008 in CollectER format.

| Year | SNAP ID | Category | | Fuel type | Dioxins/ | Flouranthene | Benzo(b) Furans | Benzo(k) | Benzo(a) flouranthene | Benzo(g,h,i) flouranthene | indeno(1,2,3-c,d) pyrene |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 070101 | Passenger cars | Highway | Diesel | 0 | 10 | 1 | 1 | 1 | 1 | 1 |
| 1990 | 070101 | Passenger cars | Highway | Gasoline | 0 | 64 | 4 | 3 | 4 | 8 | 3 |
| 1990 | 070101 | Passenger cars | Highway | LPG | | | | | | | |
| 1990 | 070102 | Passenger cars | Rural | Diesel | 0 | 35 | 2 | 2 | 2 | 5 | 2 |
| 1990 | 070102 | Passenger cars | Rural | Gasoline | 0 | 222 | 14 | 11 | 12 | 29 | 11 |
| 1990 | 070102 | Passenger cars | Rural | LPG | | | | | | | |
| 1990 | 070103 | Passenger cars | Urban | Diesel | 0 | 32 | 2 | 2 | 2 | 4 | 2 |
| 1990 | 070103 | Passenger cars | Urban | Gasoline | 0 | 207 | 13 | 10 | 11 | 27 | 10 |
| 1990 | 070103 | Passenger cars | Urban | LPG | | | | | | | |
| 1990 | 070201 | Light duty vehicles | Highway | Diesel | 0 | 14 | 1 | 1 | 1 | 2 | 1 |
| 1990 | 070201 | Light duty vehicles | Highway | Gasoline | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 070202 | Light duty vehicles | Rural | Diesel | 0 | 54 | 3 | 3 | 4 | 7 | 3 |
| 1990 | 070202 | Light duty vehicles | Rural | Gasoline | 0 | 7 | 0 | 0 | 0 | 1 | 0 |
| 1990 | 070203 | Light duty vehicles | Urban | Diesel | 0 | 47 | 3 | 3 | 3 | 6 | 3 |
| 1990 | 070203 | Light duty vehicles | Urban | Gasoline | 0 | 6 | 0 | 0 | 0 | 1 | 0 |
| 1990 | 070301 | Heavy duty vehicles | Highway | Diesel | 0 | 20 | 5 | 7 | 1 | 1 | 1 |
| 1990 | 070301 | Heavy duty vehicles | Highway | Gasoline | | | | | | | |
| 1990 | 070302 | Heavy duty vehicles | Rural | Diesel | 0 | 36 | 9 | 14 | 2 | 1 | 2 |
| 1990 | 070302 | Heavy duty vehicles | Rural | Gasoline | | | | | | | |
| 1990 | 070303 | Heavy duty vehicles | Urban | Diesel | 0 | 24 | 6 | 9 | 1 | 1 | 2 |
| 1990 | 070303 | Heavy duty vehicles | Urban | Gasoline | | | | | | | |
| 1990 | 070400 | Mopeds | Urban | Gasoline | | | | | | | |
| 1990 | 070501 | Motorcycles | Highway | Gasoline | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 070502 | Motorcycles | Rural | Gasoline | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 070503 | Motorcycles | Urban | Gasoline | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080100 | Military | | Diesel | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080100 | Military | | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080100 | Military | | Gasoline | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080100 | Military | | AvGas | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080200 | Railways | | Diesel | 0 | 5 | 1 | 2 | 0 | 0 | 0 |
| 1990 | 080200 | Railways | | Kerosene | | | | | | | |
| 1990 | 080300 | Inland waterways | | Diesel | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080300 | Inland waterways | | Gasoline | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080402 | National sea traffic | | Residual oil | 0 | 20 | 1 | 0 | 0 | 0 | 0 |

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| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 080402 | National sea traffic | | Diesel | 0 | 37 | 3 | 1 | 1 | 7 | 6 |
| 1990 | 080402 | National sea traffic | | Kerosene | | | | | | | |
| 1990 | 080402 | National sea traffic | | LPG | | | | | | | |
| 1990 | 080403 | Fishing | | Diesel | 0 | 59 | 5 | 2 | 1 | 11 | 9 |
| 1990 | 080403 | Fishing | | Kerosene | | | | | | | |
| 1990 | 080403 | Fishing | | LPG | | | | | | | |
| 1990 | 080404 | International sea traffic | | Residual oil | 0 | 118 | 6 | 3 | 2 | 7 | 6 |
| 1990 | 080404 | International sea traffic | | Diesel | 0 | 86 | 7 | 3 | 2 | 17 | 14 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | AvGas | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | AvGas | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080503 | Air traffic, Dom. > 3000 ft. | Other airports | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080504 | Air traffic, Int. > 3000 ft. | Other airports | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080600 | Agriculture | | Diesel | 0 | 72 | 9 | 9 | 5 | 9 | 5 |
| 1990 | 080600 | Agriculture | | Gasoline | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080700 | Forestry | | Diesel | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080700 | Forestry | | Gasoline | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080800 | Industry | | Diesel | 0 | 45 | 6 | 6 | 3 | 6 | 3 |
| 1990 | 080800 | Industry | | Gasoline | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080800 | Industry | | LPG | | | | | | | |
| 1990 | 080900 | Household and gardening | | Gasoline | 0 | 7 | 0 | 0 | 0 | 1 | 0 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | AvGas | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | AvGas | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080503 | Air traffic, Dom. > 3000 ft. | Copenhagen | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 080504 | Air traffic, Int. > 3000 ft. | Copenhagen | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Continued*

| Year | SNAP ID | Category | | Fuel type | Dioxins/ Furans | Flouranthene | Benzo(b) | Benzo(k) | Benzo(a) flouranthene | Benzo(g,h,i) flouranthene | indeno(1,2,3-c,d) pyrene |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | 070101 | Passenger cars | Highway | Diesel | 0 | 59 | 4 | 3 | 4 | 8 | 4 |
| 2008 | 070101 | Passenger cars | Highway | Gasoline | 0 | 16 | 3 | 3 | 2 | 5 | 3 |
| 2008 | 070101 | Passenger cars | Highway | LPG | | | | | | | |
| 2008 | 070102 | Passenger cars | Rural | Diesel | 0 | 152 | 9 | 8 | 10 | 20 | 10 |
| 2008 | 070102 | Passenger cars | Rural | Gasoline | 0 | 40 | 6 | 8 | 6 | 13 | 9 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | | | | | |
| 2008 | 070102 | Passenger cars | Rural | LPG | | | | | | | |
| 2008 | 070103 | Passenger cars | Urban | Diesel | 0 | 104 | 6 | 6 | 7 | 13 | 7 |
| 2008 | 070103 | Passenger cars | Urban | Gasoline | 0 | 27 | 4 | 5 | 4 | 8 | 6 |
| 2008 | 070103 | Passenger cars | Urban | LPG | | | | | | | |
| 2008 | 070201 | Light duty vehicles | Highway | Diesel | 0 | 32 | 2 | 2 | 2 | 4 | 2 |
| 2008 | 070201 | Light duty vehicles | Highway | Gasoline | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 070202 | Light duty vehicles | Rural | Diesel | 0 | 106 | 6 | 6 | 7 | 14 | 7 |
| 2008 | 070202 | Light duty vehicles | Rural | Gasoline | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 070203 | Light duty vehicles | Urban | Diesel | 0 | 74 | 5 | 4 | 5 | 10 | 5 |
| 2008 | 070203 | Light duty vehicles | Urban | Gasoline | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 070301 | Heavy duty vehicles | Highway | Diesel | 0 | 32 | 8 | 12 | 1 | 1 | 2 |
| 2008 | 070301 | Heavy duty vehicles | Highway | Gasoline | | | | | | | |
| 2008 | 070302 | Heavy duty vehicles | Rural | Diesel | 0 | 47 | 12 | 18 | 2 | 2 | 3 |
| 2008 | 070302 | Heavy duty vehicles | Rural | Gasoline | | | | | | | |
| 2008 | 070303 | Heavy duty vehicles | Urban | Diesel | 0 | 25 | 6 | 9 | 1 | 1 | 2 |
| 2008 | 070303 | Heavy duty vehicles | Urban | Gasoline | | | | | | | |
| 2008 | 070400 | Mopeds | Urban | Gasoline | | | | | | | |
| 2008 | 070501 | Motorcycles | Highway | Gasoline | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 070502 | Motorcycles | Rural | Gasoline | 0 | 7 | 0 | 0 | 0 | 1 | 0 |
| 2008 | 070503 | Motorcycles | Urban | Gasoline | 0 | 9 | 1 | 0 | 0 | 1 | 0 |
| 2008 | 080100 | Military | | Diesel | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080100 | Military | | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080100 | Military | | Gasoline | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080100 | Military | | AvGas | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080200 | Railways | | Diesel | 0 | 5 | 1 | 1 | 0 | 0 | 0 |
| 2008 | 080300 | Inland waterways | | Diesel | 0 | 4 | 1 | 0 | 0 | 0 | 0 |
| 2008 | 080300 | Inland waterways | | Gasoline | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080402 | National sea traffic | | Residual oil | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080402 | National sea traffic | | Diesel | 0 | 30 | 3 | 1 | 1 | 6 | 5 |
| 2008 | 080403 | Fishing | | Diesel | 0 | 45 | 4 | 2 | 1 | 9 | 7 |
| 2008 | 080403 | Fishing | | Kerosene | | | | | | | |
| 2008 | 080403 | Fishing | | LPG | | | | | | | |
| 2008 | 080404 | International sea traffic | | Residual oil | 0 | 112 | 5 | 2 | 2 | 7 | 5 |
| 2008 | 080404 | International sea traffic | | Diesel | 0 | 100 | 9 | 4 | 2 | 19 | 16 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Other airports | AvGas | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Continued* | | | | | | | | | | | |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Other airports | AvGas | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080503 | Air traffic, Dom. > 3000 ft. | Other airports | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080504 | Air traffic, Int. > 3000 ft. | Other airports | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080600 | Agriculture | | Diesel | 0 | 71 | 8 | 8 | 4 | 8 | 4 |
| 2008 | 080600 | Agriculture | | Gasoline | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080700 | Forestry | | Diesel | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080700 | Forestry | | Gasoline | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080800 | Industry | | Diesel | 0 | 61 | 7 | 7 | 4 | 7 | 4 |
| 2008 | 080800 | Industry | | Gasoline | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080800 | Industry | | LPG | | | | | | | |
| 2008 | 080900 | Household and garde-ning | | Gasoline | 0 | 14 | 1 | 0 | 0 | 2 | 1 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080501 | Air traffic, Dom. < 3000 ft. | Copenhagen | AvGas | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080502 | Air traffic, Int. < 3000 ft. | Copenhagen | AvGas | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080503 | Air traffic, Dom. > 3000 ft. | Copenhagen | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 080504 | Air traffic, Int. > 3000 ft. | Copenhagen | Jet fuel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## Annex 2B-15 Fuel consumption and emissions in CRF format

Fuel

| IPCC ID | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Industry-Other (1A2f) | 11,7 | 11,7 | 11,6 | 11,6 | 11,6 | 11,5 | 11,5 | 11,5 | 11,5 | 11,5 | 11,6 | 11,7 | 11,7 | 11,9 | 11,9 |
| Civil Aviation (1A3a) | 3,6 | 3,3 | 3,7 | 3,8 | 3,6 | 3,4 | 2,8 | 2,7 | 2,6 | 2,7 | 2,8 | 2,8 | 2,9 | 2,7 | 2,4 |
| Road (1A3b) | 111,1 | 117,4 | 117,6 | 118,3 | 119,6 | 126,2 | 131,9 | 134,3 | 136,0 | 142,8 | 144,1 | 146,6 | 149,5 | 152,0 | 154,0 |
| Railways (1A3c) | 4,9 | 4,9 | 4,4 | 4,6 | 4,2 | 4,0 | 4,1 | 4,3 | 4,5 | 4,1 | 4,1 | 4,1 | 4,0 | 3,3 | 3,1 |
| Navigation (1A3d) | 9,3 | 9,3 | 9,3 | 9,4 | 9,4 | 9,4 | 9,5 | 9,7 | 9,6 | 9,7 | 10,2 | 11,2 | 11,0 | 9,0 | 7,4 |
| Residential (1A4b) | 1,6 | 1,6 | 1,6 | 1,5 | 1,5 | 1,5 | 1,6 | 1,6 | 1,6 | 1,6 | 1,6 | 1,6 | 1,7 | 1,7 | 1,7 |
| Ag./for./fish. (1A4c) | 24,4 | 26,0 | 23,8 | 25,5 | 25,3 | 25,7 | 25,7 | 24,3 | 23,8 | 22,9 | 23,4 | 22,2 | 21,0 | 20,4 | 21,1 |
| Military (1A5) | 5,5 | 4,3 | 5,0 | 2,7 | 2,3 | 1,6 | 3,9 | 1,9 | 3,3 | 3,5 | 3,4 | 2,4 | 2,3 | 2,8 | 2,5 |
| Navigation int. (1A3d) | 17,3 | 20,1 | 29,4 | 37,3 | 38,2 | 40,2 | 36,1 | 37,9 | 56,1 | 63,1 | 66,3 | 63,0 | 57,8 | 58,2 | 54,6 |
| Civil Aviation int. (1A3a) | 19,3 | 20,9 | 22,4 | 24,0 | 25,1 | 24,1 | 22,7 | 23,5 | 23,0 | 25,2 | 25,9 | 27,4 | 27,9 | 30,0 | 31,8 |

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| IPCC ID | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| Industry-Other (1A2f) | 12,0 | 12,1 | 12,3 | 12,4 | 12,5 | 13,0 | 13,9 | 14,8 | 15,2 |
| Civil Aviation (1A3a) | 2,1 | 2,3 | 2,0 | 1,9 | 1,8 | 1,9 | 2,0 | 2,2 | 2,3 |
| Road (1A3b) | 152,5 | 152,8 | 154,5 | 160,6 | 164,8 | 166,1 | 171,3 | 179,5 | 176,2 |
| Railways (1A3c) | 3,1 | 2,9 | 2,8 | 3,0 | 2,9 | 3,1 | 3,1 | 3,1 | 3,2 |
| Navigation (1A3d) | 6,4 | 6,2 | 6,1 | 6,2 | 6,4 | 6,3 | 6,2 | 6,1 | 6,1 |
| Residential (1A4b) | 1,8 | 2,0 | 2,2 | 2,5 | 2,8 | 3,0 | 3,2 | 3,3 | 3,3 |
| Ag./for./fish. (1A4c) | 21,8 | 21,5 | 22,1 | 21,7 | 20,3 | 21,3 | 21,1 | 21,3 | 22,9 |
| Military (1A5) | 1,5 | 1,3 | 1,2 | 1,3 | 3,3 | 3,7 | 1,7 | 2,4 | 1,5 |
| Navigation int. (1A3d) | 56,0 | 47,3 | 39,1 | 41,2 | 33,5 | 34,5 | 44,7 | 46,2 | 40,7 |
| Civil Aviation int. (1A3a) | 32,6 | 33,1 | 28,6 | 29,7 | 34,0 | 35,8 | 35,9 | 36,8 | 36,7 |

Emissions

| pol_name | IPCC ID | Unit | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $SO_2$ | Industry-Other (1A2f) | [tonnes] | 2402 | 1441 | 1440 | 1438 | 956 | 952 | 955 | 957 | 957 | 959 | 968 | 244 | 246 | 249 | 251 |
| $SO_2$ | Civil Aviation (1A3a) | [tonnes] | 82 | 77 | 85 | 86 | 83 | 77 | 64 | 62 | 61 | 63 | 63 | 65 | 68 | 62 | 56 |
| $SO_2$ | Road (1A3b) | [tonnes] | 11621 | 7862 | 7847 | 7857 | 5488 | 5767 | 5903 | 3820 | 1569 | 1669 | 1682 | 1721 | 1744 | 1768 | 1088 |
| $SO_2$ | Railways (1A3c) | [tonnes] | 1152 | 695 | 618 | 641 | 393 | 376 | 382 | 263 | 105 | 95 | 96 | 95 | 93 | 78 | 40 |
| $SO_2$ | Navigation (1A3d) | [tonnes] | 6363 | 6363 | 6367 | 6127 | 6130 | 5456 | 4232 | 2822 | 3522 | 4005 | 4502 | 3458 | 2647 | 1555 | 1292 |
| $SO_2$ | Residential (1A4b) | [tonnes] | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| $SO_2$ | Ag./for./fish. (1A4c) | [tonnes] | 4766 | 3484 | 3173 | 3073 | 2269 | 2303 | 2317 | 2186 | 2150 | 2072 | 2120 | 978 | 853 | 856 | 931 |
| $SO_2$ | Military (1A5) | [tonnes] | 408 | 260 | 193 | 72 | 70 | 48 | 206 | 82 | 76 | 80 | 80 | 56 | 54 | 65 | 47 |
| $SO_2$ | Navigation int. (1A3d) | [tonnes] | 18333 | 22047 | 36943 | 48034 | 48337 | 42404 | 34348 | 31152 | 59669 | 60081 | 66260 | 62320 | 57078 | 48000 | 50568 |
| $SO_2$ | Civil Aviation int. (1A3a) | [tonnes] | 444 | 480 | 515 | 551 | 578 | 554 | 521 | 541 | 530 | 580 | 596 | 629 | 642 | 689 | 731 |
| NOx | Industry-Other (1A2f) | [tonnes] | 10903 | 10964 | 11011 | 11044 | 11065 | 11081 | 11282 | 11440 | 11558 | 11677 | 11882 | 12080 | 12248 | 12425 | 12262 |
| $NO_x$ | Civil Aviation (1A3a) | [tonnes] | 1203 | 1132 | 1237 | 1252 | 1208 | 1123 | 920 | 902 | 900 | 940 | 958 | 971 | 998 | 911 | 815 |
| $NO_x$ | Road (1A3b) | [tonnes] | 93160 | 98763 | 98895 | 99754 | 100981 | 106456 | 107926 | 107343 | 104946 | 103977 | 100389 | 97354 | 93597 | 89621 | 86441 |
| $NO_x$ | Railways (1A3c) | [tonnes] | 6025 | 6063 | 5391 | 5589 | 5145 | 4913 | 4995 | 5284 | 5485 | 4971 | 5015 | 4977 | 4846 | 4089 | 3730 |
| $NO_x$ | Navigation (1A3d) | [tonnes] | 11778 | 11798 | 11852 | 11902 | 11962 | 12020 | 11433 | 11104 | 11007 | 11236 | 11898 | 13043 | 11805 | 9411 | 6608 |
| $NO_x$ | Residential (1A4b) | [tonnes] | 96 | 99 | 101 | 103 | 103 | 104 | 111 | 118 | 125 | 130 | 136 | 140 | 144 | 149 | 151 |
| $NO_x$ | Ag./for./fish. (1A4c) | [tonnes] | 18159 | 19915 | 18153 | 20143 | 20342 | 21066 | 21722 | 20824 | 20763 | 20524 | 21442 | 21138 | 20176 | 20119 | 21495 |
| $NO_x$ | Military (1A5) | [tonnes] | 2356 | 2032 | 1632 | 982 | 876 | 496 | 1875 | 1021 | 1302 | 1279 | 1778 | 970 | 1230 | 1428 | 1103 |
| $NO_x$ | Navigation int. (1A3d) | [tonnes] | 23987 | 28474 | 43643 | 56580 | 58561 | 62285 | 55731 | 57636 | 89632 | 101094 | 106928 | 102221 | 94977 | 94125 | 91400 |
| $NO_x$ | Civil Aviation int. (1A3a) | [tonnes] | 5663 | 6129 | 6569 | 7035 | 7313 | 7016 | 6586 | 6846 | 6702 | 7317 | 7517 | 7904 | 8058 | 8662 | 9204 |
| NMVOC | Industry-Other (1A2f) | [tonnes] | 2422 | 2395 | 2368 | 2339 | 2304 | 2266 | 2231 | 2191 | 2147 | 2107 | 2088 | 2095 | 2083 | 2074 | 1997 |
| NMVOC | Civil Aviation (1A3a) | [tonnes] | 216 | 213 | 190 | 198 | 193 | 186 | 168 | 164 | 161 | 191 | 206 | 194 | 186 | 169 | 162 |
| NMVOC | Road (1A3b) | [tonnes] | 80775 | 80473 | 79843 | 79356 | 77749 | 81541 | 82416 | 81482 | 79230 | 74979 | 70204 | 65927 | 59788 | 54665 | 48751 |
| NMVOC | Railways (1A3c) | [tonnes] | 393 | 396 | 352 | 365 | 336 | 321 | 326 | 345 | 358 | 324 | 327 | 325 | 316 | 267 | 276 |
| NMVOC | Navigation (1A3d) | [tonnes] | 1505 | 1505 | 1536 | 1566 | 1598 | 1630 | 1658 | 1699 | 1727 | 1761 | 1819 | 1920 | 1913 | 1817 | 1704 |
| NMVOC | Residential (1A4b) | [tonnes] | 4191 | 4166 | 4139 | 4112 | 4108 | 4104 | 4111 | 4094 | 4054 | 4070 | 4147 | 4231 | 4314 | 4395 | 4499 |
| NMVOC | Ag./for./fish. (1A4c) | [tonnes] | 6357 | 6417 | 6216 | 6284 | 6207 | 6149 | 5777 | 5298 | 4944 | 4638 | 4516 | 4208 | 3966 | 3691 | 3563 |
| NMVOC | Military (1A5) | [tonnes] | 595 | 463 | 172 | 489 | 313 | 53 | 165 | 89 | 124 | 120 | 151 | 92 | 105 | 118 | 108 |
| NMVOC | Navigation int. (1A3d) | [tonnes] | 880 | 1029 | 1527 | 1948 | 2003 | 2116 | 1900 | 1990 | 2993 | 3378 | 3560 | 3398 | 3138 | 3158 | 3003 |
| NMVOC | Civil Aviation int. (1A3a) | [tonnes] | 261 | 288 | 313 | 342 | 361 | 331 | 309 | 316 | 309 | 308 | 343 | 360 | 365 | 386 | 395 |
| $CH_4$ | Industry-Other (1A2f) | [tonnes] | 63 | 63 | 62 | 61 | 61 | 60 | 58 | 57 | 56 | 54 | 53 | 53 | 53 | 53 | 51 |
| $CH_4$ | Civil Aviation (1A3a) | [tonnes] | 8 | 8 | 8 | 8 | 8 | 7 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 6 |
| $CH_4$ | Road (1A3b) | [tonnes] | 2381 | 2439 | 2453 | 2484 | 2475 | 2623 | 2662 | 2631 | 2596 | 2506 | 2374 | 2268 | 2179 | 2093 | 1983 |
| $CH_4$ | Railways (1A3c) | [tonnes] | 15 | 15 | 14 | 14 | 13 | 12 | 13 | 13 | 14 | 12 | 13 | 12 | 12 | 10 | 11 |
| $CH_4$ | Navigation (1A3d) | [tonnes] | 28 | 28 | 29 | 29 | 30 | 31 | 31 | 32 | 33 | 33 | 35 | 37 | 36 | 33 | 31 |
| $CH_4$ | Residential (1A4b) | [tonnes] | 158 | 156 | 153 | 150 | 150 | 150 | 147 | 144 | 140 | 138 | 136 | 135 | 134 | 134 | 135 |
| $CH_4$ | Ag./for./fish. (1A4c) | [tonnes] | 155 | 154 | 147 | 146 | 142 | 139 | 132 | 123 | 116 | 110 | 106 | 100 | 94 | 89 | 88 |
| $CH_4$ | Military (1A5) | [tonnes] | 31 | 26 | 17 | 18 | 14 | 5 | 19 | 10 | 13 | 13 | 18 | 10 | 12 | 14 | 11 |
| $CH_4$ | Navigation int. (1A3d) | [tonnes] | 27 | 32 | 47 | 60 | 62 | 65 | 59 | 62 | 93 | 104 | 110 | 105 | 97 | 98 | 93 |
| $CH_4$ | Civil Aviation int. (1A3a) | [tonnes] | 25 | 27 | 30 | 32 | 33 | 31 | 29 | 30 | 29 | 31 | 35 | 37 | 38 | 40 | 41 |
| CO | Industry-Other (1A2f) | [tonnes] | 9863 | 9784 | 9702 | 9611 | 9502 | 9379 | 9294 | 9188 | 9070 | 8956 | 8910 | 8963 | 8939 | 8907 | 8647 |

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| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO | Civil Aviation (1A3a) | [tonnes] | 1256 | 1241 | 1118 | 1167 | 1140 | 1098 | 989 | 955 | 930 | 1098 | 1180 | 1117 | 1085 | 973 | 932 |
| CO | Road (1A3b) | [tonnes] | 560836 | 540471 | 521469 | 475754 | 447890 | 458943 | 474352 | 464445 | 466072 | 434238 | 411281 | 398904 | 345574 | 324704 | 290218 |
| CO | Railways (1A3c) | [tonnes] | 1098 | 1105 | 982 | 1018 | 937 | 895 | 910 | 963 | 999 | 906 | 914 | 907 | 883 | 745 | 717 |
| CO | Navigation (1A3d) | [tonnes] | 5291 | 5291 | 5453 | 5613 | 5777 | 5941 | 6095 | 6287 | 6428 | 6610 | 6861 | 7065 | 6967 | 6799 | 6541 |
| CO | Residential (1A4b) | [tonnes] | 50434 | 49697 | 48935 | 48149 | 47970 | 47787 | 46848 | 45867 | 45027 | 44365 | 43997 | 44112 | 44229 | 44347 | 45103 |
| CO | Ag./for./fish. (1A4c) | [tonnes] | 61165 | 59707 | 57256 | 55768 | 53717 | 51734 | 48771 | 45427 | 42608 | 39735 | 37673 | 34858 | 32455 | 29823 | 27820 |
| CO | Military (1A5) | [tonnes] | 4156 | 3086 | 1309 | 3125 | 1945 | 424 | 1010 | 514 | 849 | 871 | 885 | 619 | 604 | 691 | 697 |
| CO | Navigation int. (1A3d) | [tonnes] | 2903 | 3396 | 5038 | 6427 | 6608 | 6981 | 6268 | 6566 | 9873 | 11143 | 11745 | 11211 | 10351 | 10417 | 9905 |
| CO | Civil Aviation int. (1A3a) | [tonnes] | 1103 | 1207 | 1289 | 1416 | 1564 | 1442 | 1357 | 1399 | 1388 | 1342 | 1421 | 1502 | 1564 | 1662 | 1743 |
| $CO_2$ | Industry-Other (1A2f) | [ktonnes] | 852 | 852 | 851 | 849 | 845 | 842 | 843 | 843 | 842 | 841 | 848 | 853 | 860 | 867 | 873 |
| $CO_2$ | Civil Aviation (1A3a) | [ktonnes] | 256 | 241 | 268 | 271 | 262 | 243 | 199 | 193 | 190 | 196 | 199 | 205 | 212 | 194 | 174 |
| $CO_2$ | Road (1A3b) | [ktonnes] | 8160 | 8625 | 8636 | 8694 | 8789 | 9275 | 9690 | 9863 | 9987 | 10487 | 10585 | 10764 | 10978 | 11166 | 11312 |
| $CO_2$ | Railways (1A3c) | [ktonnes] | 364 | 366 | 326 | 338 | 311 | 297 | 302 | 319 | 331 | 300 | 303 | 301 | 293 | 247 | 232 |
| $CO_2$ | Navigation (1A3d) | [ktonnes] | 702 | 701 | 705 | 707 | 710 | 714 | 713 | 727 | 717 | 729 | 766 | 840 | 820 | 668 | 553 |
| $CO_2$ | Residential (1A4b) | [ktonnes] | 114 | 114 | 113 | 113 | 113 | 113 | 113 | 114 | 115 | 116 | 118 | 120 | 122 | 124 | 127 |
| $CO_2$ | Ag./for./fish. (1A4c) | [ktonnes] | 1806 | 1922 | 1758 | 1887 | 1874 | 1899 | 1903 | 1794 | 1760 | 1695 | 1728 | 1642 | 1554 | 1510 | 1564 |
| $CO_2$ | Military (1A5) | [ktonnes] | 402 | 316 | 361 | 196 | 165 | 119 | 287 | 141 | 237 | 252 | 252 | 176 | 171 | 204 | 182 |
| $CO_2$ | Navigation int. (1A3d) | [ktonnes] | 1320 | 1537 | 2261 | 2869 | 2936 | 3087 | 2762 | 2887 | 4300 | 4829 | 5061 | 4803 | 4403 | 4414 | 4155 |
| $CO_2$ | Civil Aviation int. (1A3a) | [ktonnes] | 1391 | 1503 | 1613 | 1725 | 1809 | 1736 | 1632 | 1693 | 1659 | 1818 | 1867 | 1971 | 2010 | 2159 | 2290 |
| $N_2O$ | Industry-Other (1A2f) | [tonnes] | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 35 | 35 | 35 | 35 | 36 | 36 | 36 | 37 |
| $N_2O$ | Civil Aviation (1A3a) | [tonnes] | 10 | 10 | 11 | 11 | 11 | 10 | 9 | 9 | 9 | 9 | 10 | 11 | 11 | 9 | 9 |
| $N_2O$ | Road (1A3b) | [tonnes] | 277 | 290 | 291 | 294 | 297 | 313 | 336 | 354 | 367 | 400 | 416 | 433 | 445 | 450 | 453 |
| $N_2O$ | Railways (1A3c) | [tonnes] | 10 | 10 | 9 | 9 | 9 | 8 | 8 | 9 | 9 | 8 | 8 | 8 | 8 | 7 | 6 |
| $N_2O$ | Navigation (1A3d) | [tonnes] | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 44 | 43 | 44 | 46 | 51 | 49 | 40 | 32 |
| $N_2O$ | Residential (1A4b) | [tonnes] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| $N_2O$ | Ag./for./fish. (1A4c) | [tonnes] | 81 | 87 | 78 | 85 | 85 | 87 | 88 | 83 | 81 | 79 | 81 | 77 | 71 | 70 | 74 |
| $N_2O$ | Military (1A5) | [tonnes] | 12 | 10 | 11 | 6 | 5 | 4 | 8 | 4 | 7 | 8 | 7 | 5 | 5 | 6 | 6 |
| $N_2O$ | Navigation int. (1A3d) | [tonnes] | 83 | 97 | 142 | 180 | 185 | 194 | 174 | 182 | 270 | 304 | 318 | 302 | 277 | 278 | 262 |
| $N_2O$ | Civil Aviation int. (1A3a) | [tonnes] | 47 | 50 | 54 | 58 | 61 | 59 | 56 | 58 | 57 | 63 | 64 | 69 | 70 | 75 | 80 |
| $NH_3$ | Industry-Other (1A2f) | [tonnes] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| $NH_3$ | Civil Aviation (1A3a) | [tonnes] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $NH_3$ | Road (1A3b) | [tonnes] | 61 | 64 | 64 | 66 | 66 | 70 | 248 | 441 | 622 | 946 | 1198 | 1428 | 1862 | 2226 | 2491 |
| $NH_3$ | Railways (1A3c) | [tonnes] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| $NH_3$ | Navigation (1A3d) | [tonnes] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $NH_3$ | Residential (1A4b) | [tonnes] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $NH_3$ | Ag./for./fish. (1A4c) | [tonnes] | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| $NH_3$ | Military (1A5) | [tonnes] | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| $NH_3$ | Navigation int. (1A3d) | [tonnes] | | 0 | | | | | | 0 | 0 | | | | | | |
| $NH_3$ | Civil Aviation int. (1A3a) | [tonnes] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TSP | Industry-Other (1A2f) | [tonnes] | 1823 | 1778 | 1733 | 1686 | 1634 | 1577 | 1533 | 1484 | 1433 | 1383 | 1349 | 1317 | 1284 | 1249 | 1193 |
| TSP | Civil Aviation (1A3a) | [tonnes] | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| TSP | Road (1A3b) | [tonnes] | 4311 | 4645 | 4650 | 4587 | 4660 | 4908 | 5019 | 4854 | 4845 | 4943 | 4713 | 4606 | 4248 | 4004 | 3813 |
| TSP | Railways (1A3c) | [tonnes] | 247 | 249 | 222 | 229 | 211 | 202 | 205 | 217 | 225 | 204 | 206 | 204 | 199 | 168 | 146 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TSP | Navigation (1A3d) | [tonnes] | 948 | 948 | 953 | 948 | 953 | 781 | 612 | 451 | 561 | 646 | 773 | 613 | 546 | 378 | 337 |
| TSP | Residential (1A4b) | [tonnes] | 37 | 36 | 36 | 36 | 36 | 35 | 35 | 34 | 33 | 34 | 35 | 36 | 38 | 39 | 40 |
| TSP | Ag./for./fish. (1A4c) | [tonnes] | 2783 | 2820 | 2673 | 2723 | 2665 | 2628 | 2534 | 2362 | 2300 | 2119 | 2087 | 1892 | 1783 | 1633 | 1576 |
| TSP | Military (1A5) | [tonnes] | 100 | 100 | 49 | 17 | 26 | 11 | 112 | 66 | 63 | 54 | 114 | 46 | 74 | 80 | 50 |
| TSP | Navigation int. (1A3d) | [tonnes] | 3047 | 3663 | 6129 | 8024 | 8081 | 5677 | 4512 | 4139 | 8822 | 8348 | 10262 | 10169 | 9437 | 7917 | 8390 |
| TSP | Civil Aviation int. (1A3a) | [tonnes] | 23 | 24 | 26 | 28 | 30 | 28 | 27 | 28 | 27 | 29 | 30 | 32 | 32 | 35 | 37 |
| $PM_{10}$ | Industry-Other (1A2f) | [tonnes] | 1823 | 1778 | 1733 | 1686 | 1634 | 1577 | 1533 | 1484 | 1433 | 1383 | 1349 | 1317 | 1284 | 1249 | 1193 |
| $PM_{10}$ | Civil Aviation (1A3a) | [tonnes] | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| $PM_{10}$ | Road (1A3b) | [tonnes] | 4311 | 4645 | 4650 | 4587 | 4660 | 4908 | 5019 | 4854 | 4845 | 4943 | 4713 | 4606 | 4248 | 4004 | 3813 |
| $PM_{10}$ | Railways (1A3c) | [tonnes] | 247 | 249 | 222 | 229 | 211 | 202 | 205 | 217 | 225 | 204 | 206 | 204 | 199 | 168 | 146 |
| $PM_{10}$ | Navigation (1A3d) | [tonnes] | 940 | 939 | 944 | 939 | 944 | 774 | 607 | 447 | 556 | 641 | 767 | 608 | 542 | 376 | 335 |
| $PM_{10}$ | Residential (1A4b) | [tonnes] | 37 | 36 | 36 | 36 | 36 | 35 | 35 | 34 | 33 | 34 | 35 | 36 | 38 | 39 | 40 |
| $PM_{10}$ | Ag./for./fish. (1A4c) | [tonnes] | 2781 | 2818 | 2671 | 2721 | 2663 | 2626 | 2532 | 2360 | 2298 | 2117 | 2086 | 1891 | 1782 | 1632 | 1575 |
| $PM_{10}$ | Military (1A5) | [tonnes] | 100 | 100 | 49 | 17 | 26 | 11 | 112 | 66 | 63 | 54 | 114 | 46 | 74 | 80 | 50 |
| $PM_{10}$ | Navigation int. (1A3d) | [tonnes] | 3016 | 3626 | 6068 | 7944 | 8000 | 5620 | 4467 | 4098 | 8734 | 8264 | 10160 | 10068 | 9342 | 7838 | 8306 |
| $PM_{10}$ | Civil Aviation int. (1A3a) | [tonnes] | 23 | 24 | 26 | 28 | 30 | 28 | 27 | 28 | 27 | 29 | 30 | 32 | 32 | 35 | 37 |
| $PM_{2.5}$ | Industry-Other (1A2f) | [tonnes] | 1823 | 1778 | 1733 | 1686 | 1634 | 1577 | 1533 | 1484 | 1433 | 1383 | 1349 | 1317 | 1284 | 1249 | 1193 |
| $PM_{2.5}$ | Civil Aviation (1A3a) | [tonnes] | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| $PM_{2.5}$ | Road (1A3b) | [tonnes] | 4311 | 4645 | 4650 | 4587 | 4660 | 4908 | 5019 | 4854 | 4845 | 4943 | 4713 | 4606 | 4248 | 4004 | 3813 |
| $PM_{2.5}$ | Railways (1A3c) | [tonnes] | 247 | 249 | 222 | 229 | 211 | 202 | 205 | 217 | 225 | 204 | 206 | 204 | 199 | 168 | 146 |
| $PM_{2.5}$ | Navigation (1A3d) | [tonnes] | 935 | 935 | 939 | 935 | 940 | 771 | 604 | 446 | 554 | 638 | 764 | 606 | 540 | 375 | 334 |
| $PM_{2.5}$ | Residential (1A4b) | [tonnes] | 37 | 36 | 36 | 36 | 36 | 35 | 35 | 34 | 33 | 34 | 35 | 36 | 38 | 39 | 40 |
| $PM_{2.5}$ | Ag./for./fish. (1A4c) | [tonnes] | 2780 | 2817 | 2670 | 2720 | 2662 | 2625 | 2531 | 2359 | 2297 | 2116 | 2085 | 1890 | 1781 | 1631 | 1574 |
| $PM_{2.5}$ | Military (1A5) | [tonnes] | 100 | 100 | 49 | 17 | 26 | 11 | 112 | 66 | 63 | 54 | 114 | 46 | 74 | 80 | 50 |
| $PM_{2.5}$ | Navigation int. (1A3d) | [tonnes] | 3001 | 3608 | 6037 | 7904 | 7959 | 5592 | 4445 | 4077 | 8690 | 8223 | 10108 | 10017 | 9295 | 7799 | 8264 |
| $PM_{2.5}$ | Civil Aviation int. (1A3a) | [tonnes] | 23 | 24 | 26 | 28 | 30 | 28 | 27 | 28 | 27 | 29 | 30 | 32 | 32 | 35 | 37 |
| Arsenic | Civil Aviation (1A3a) | [kg] | | | | | | | | | | | | | | | 0 |
| Arsenic | Navigation (1A3d) | [kg] | | | | | | 53 | 46 | 38 | 38 | 39 | 40 | 35 | 26 | 19 | 15 |
| Arsenic | Ag./for./fish. (1A4c) | [kg] | | | | | | 9 | 10 | 9 | 8 | 8 | 8 | 8 | 6 | 7 | 7 |
| Arsenic | Military (1A5) | [kg] | | | | | | | | | | 0 | | | | | 0 |
| Arsenic | Navigation int. (1A3d) | [kg] | | | | | | 363 | 302 | 276 | 475 | 505 | 514 | 332 | 426 | 366 | 379 |
| Arsenic | Civil Aviation int. (1A3a) | [kg] | | | | | | | | | | | | | | | 0 |
| Cadmium | Industry-Other (1A2f) | [kg] | | | | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 |
| Cadmium | Civil Aviation (1A3a) | [kg] | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Cadmium | Road (1A3b) | [kg] | | | | | | 29 | 30 | 31 | 31 | 33 | 33 | 34 | 34 | 35 | 36 |
| Cadmium | Railways (1A3c) | [kg] | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Cadmium | Navigation (1A3d) | [kg] | | | | | | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 2 |
| Cadmium | Residential (1A4b) | [kg] | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cadmium | Ag./for./fish. (1A4c) | [kg] | | | | | | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 |
| Cadmium | Military (1A5) | [kg] | | | | | | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Cadmium | Navigation int. (1A3d) | [kg] | | | | | | 24 | 20 | 19 | 32 | 34 | 35 | 20 | 30 | 27 | 27 |
| Cadmium | Civil Aviation int. (1A3a) | [kg] | | | | | | 6 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 7 | 7 |
| Chromium | Industry-Other (1A2f) | [kg] | | | | | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 13 | 13 |

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| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chromium | Civil Aviation (1A3a) | [kg] | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Chromium | Road (1A3b) | [kg] | 146 | 152 | 155 | 157 | 165 | 166 | 169 | 173 | 176 | 178 |
| Chromium | Railways (1A3c) | [kg] | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 |
| Chromium | Navigation (1A3d) | [kg] | 24 | 22 | 19 | 19 | 20 | 20 | 19 | 16 | 12 | 10 |
| Chromium | Residential (1A4b) | [kg] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Chromium | Ag./for./fish. (1A4c) | [kg] | 28 | 28 | 27 | 26 | 25 | 26 | 24 | 23 | 23 | 23 |
| Chromium | Military (1A5) | [kg] | 2 | 5 | 2 | 4 | 4 | 4 | 3 | 3 | 3 | 3 |
| Chromium | Navigation int. (1A3d) | [kg] | 150 | 127 | 118 | 199 | 213 | 218 | 133 | 182 | 161 | 164 |
| Chromium | Civil Aviation int. (1A3a) | [kg] | 28 | 26 | 27 | 26 | 29 | 30 | 31 | 32 | 34 | 36 |
| Copper | Industry-Other (1A2f) | [kg] | 411 | 413 | 413 | 413 | 414 | 418 | 421 | 425 | 429 | 432 |
| Copper | Civil Aviation (1A3a) | [kg] | 131 | 107 | 104 | 102 | 106 | 107 | 110 | 114 | 104 | 94 |
| Copper | Road (1A3b) | [kg] | 4965 | 5184 | 5273 | 5337 | 5605 | 5657 | 5754 | 5867 | 5968 | 6047 |
| Copper | Railways (1A3c) | [kg] | 160 | 162 | 172 | 178 | 162 | 163 | 162 | 157 | 133 | 125 |
| Copper | Navigation (1A3d) | [kg] | 78 | 73 | 67 | 69 | 73 | 76 | 73 | 66 | 61 | 60 |
| Copper | Residential (1A4b) | [kg] | 60 | 60 | 61 | 61 | 62 | 63 | 64 | 65 | 66 | 67 |
| Copper | Ag./for./fish. (1A4c) | [kg] | 713 | 706 | 674 | 672 | 636 | 653 | 623 | 630 | 597 | 594 |
| Copper | Military (1A5) | [kg] | 64 | 154 | 76 | 128 | 136 | 136 | 95 | 92 | 110 | 98 |
| Copper | Navigation int. (1A3d) | [kg] | 363 | 302 | 276 | 475 | 505 | 514 | 332 | 426 | 366 | 379 |
| Copper | Civil Aviation int. (1A3a) | [kg] | 936 | 880 | 913 | 894 | 980 | 1006 | 1063 | 1084 | 1164 | 1234 |
| Mercury | Civil Aviation (1A3a) | [kg] | | | | | | | | | | 0 |
| Mercury | Navigation (1A3d) | [kg] | 8 | 8 | 9 | 9 | 9 | 9 | 11 | 11 | 9 | 7 |
| Mercury | Ag./for./fish. (1A4c) | [kg] | 9 | 10 | 9 | 8 | 8 | 8 | 8 | 6 | 7 | 7 |
| Mercury | Military (1A5) | [kg] | | | | | 0 | | | | | 0 |
| Mercury | Navigation int. (1A3d) | [kg] | 28 | 26 | 30 | 40 | 47 | 51 | 14 | 46 | 50 | 44 |
| Mercury | Civil Aviation int. (1A3a) | [kg] | | | | | | | | | | 0 |
| Nickel | Industry-Other (1A2f) | [kg] | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 18 | 18 |
| Nickel | Civil Aviation (1A3a) | [kg] | 5 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 |
| Nickel | Road (1A3b) | [kg] | 204 | 213 | 217 | 220 | 231 | 233 | 237 | 242 | 246 | 249 |
| Nickel | Railways (1A3c) | [kg] | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 5 | 5 |
| Nickel | Navigation (1A3d) | [kg] | 2828 | 2355 | 1826 | 1825 | 1943 | 1958 | 1553 | 987 | 645 | 543 |
| Nickel | Residential (1A4b) | [kg] | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Nickel | Ag./for./fish. (1A4c) | [kg] | 42 | 42 | 40 | 39 | 37 | 38 | 36 | 34 | 33 | 35 |
| Nickel | Military (1A5) | [kg] | 3 | 6 | 3 | 5 | 6 | 6 | 4 | 4 | 5 | 4 |
| Nickel | Navigation int. (1A3d) | [kg] | 20956 | 17236 | 15429 | 27162 | 28664 | 29023 | 19856 | 23826 | 19820 | 20967 |
| Nickel | Civil Aviation int. (1A3a) | [kg] | 39 | 36 | 38 | 37 | 40 | 41 | 44 | 45 | 48 | 51 |
| Lead | Industry-Other (1A2f) | [kg] | 258 | 187 | 160 | 67 | 12 | 12 | 12 | 0 | 0 | 0 |
| Lead | Civil Aviation (1A3a) | [kg] | 1534 | 1423 | 1378 | 1328 | 1639 | 1788 | 1640 | 1559 | 1399 | 1387 |
| Lead | Road (1A3b) | [kg] | 97510 | 75857 | 68775 | 29818 | 54 | 55 | 55 | 57 | 58 | 58 |
| Lead | Railways (1A3c) | [kg] | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 |
| Lead | Navigation (1A3d) | [kg] | 485 | 371 | 331 | 159 | 51 | 53 | 55 | 27 | 21 | 17 |
| Lead | Residential (1A4b) | [kg] | 2273 | 1666 | 1442 | 612 | 109 | 110 | 112 | 1 | 1 | 1 |
| Lead | Ag./for./fish. (1A4c) | [kg] | 1564 | 1069 | 859 | 346 | 71 | 67 | 63 | 13 | 13 | 15 |
| Lead | Military (1A5) | [kg] | 64 | 80 | 62 | 120 | 86 | 102 | 98 | 123 | 116 | 78 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead | Navigation int. (1A3d) | [kg] | 167 | 144 | 142 | 226 | 247 | 256 | 134 | 218 | 205 | 201 |
| Lead | Civil Aviation int. (1A3a) | [kg] | 490 | 465 | 452 | 456 | 153 | 175 | 126 | 145 | 145 | 124 |
| Selenium | Industry-Other (1A2f) | [kg] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 |
| Selenium | Civil Aviation (1A3a) | [kg] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Selenium | Road (1A3b) | [kg] | 29 | 30 | 31 | 31 | 33 | 33 | 34 | 34 | 35 | 36 |
| Selenium | Railways (1A3c) | [kg] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Selenium | Navigation (1A3d) | [kg] | 61 | 58 | 55 | 54 | 55 | 57 | 59 | 54 | 42 | 34 |
| Selenium | Residential (1A4b) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Selenium | Ag./for./fish. (1A4c) | [kg] | 41 | 42 | 39 | 37 | 37 | 37 | 35 | 29 | 30 | 33 |
| Selenium | Military (1A5) | [kg] | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Selenium | Navigation int. (1A3d) | [kg] | 334 | 289 | 284 | 451 | 495 | 512 | 269 | 436 | 410 | 401 |
| Selenium | Civil Aviation int. (1A3a) | [kg] | 6 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 7 | 7 |
| Zinc | Industry-Other (1A2f) | [kg] | 242 | 243 | 243 | 243 | 243 | 246 | 248 | 250 | 252 | 254 |
| Zinc | Civil Aviation (1A3a) | [kg] | 77 | 63 | 61 | 60 | 62 | 63 | 65 | 67 | 61 | 55 |
| Zinc | Road (1A3b) | [kg] | 2921 | 3050 | 3102 | 3140 | 3297 | 3328 | 3384 | 3451 | 3511 | 3557 |
| Zinc | Railways (1A3c) | [kg] | 94 | 95 | 101 | 105 | 95 | 96 | 95 | 93 | 78 | 73 |
| Zinc | Navigation (1A3d) | [kg] | 158 | 152 | 147 | 146 | 151 | 157 | 164 | 154 | 126 | 107 |
| Zinc | Residential (1A4b) | [kg] | 35 | 35 | 36 | 36 | 36 | 37 | 37 | 38 | 39 | 40 |
| Zinc | Ag./for./fish. (1A4c) | [kg] | 506 | 505 | 479 | 474 | 453 | 463 | 441 | 429 | 412 | 420 |
| Zinc | Military (1A5) | [kg] | 38 | 91 | 45 | 75 | 80 | 80 | 56 | 54 | 65 | 58 |
| Zinc | Navigation int. (1A3d) | [kg] | 764 | 664 | 660 | 1038 | 1141 | 1183 | 607 | 1010 | 959 | 933 |
| Zinc | Civil Aviation int. (1A3a) | [kg] | 551 | 518 | 537 | 526 | 576 | 592 | 625 | 638 | 685 | 726 |
| Dioxins/furans | Industry-Other (1A2f) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Civil Aviation (1A3a) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Road (1A3b) | [g] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Dioxins/furans | Railways (1A3c) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Navigation (1A3d) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Residential (1A4b) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Ag./for./fish. (1A4c) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Military (1A5) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Navigation int. (1A3d) | [g] | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Dioxins/furans | Civil Aviation int. (1A3a) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Flouranthene | Industry-Other (1A2f) | [kg] | 45 | 44 | 45 | 46 | 45 | 46 | 46 | 46 | 46 | 46 |
| Flouranthene | Civil Aviation (1A3a) | [kg] | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| Flouranthene | Road (1A3b) | [kg] | 785 | 792 | 784 | 766 | 755 | 715 | 680 | 647 | 617 | 596 |
| Flouranthene | Railways (1A3c) | [kg] | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 4 |
| Flouranthene | Navigation (1A3d) | [kg] | 59 | 61 | 64 | 63 | 64 | 67 | 76 | 76 | 61 | 50 |
| Flouranthene | Residential (1A4b) | [kg] | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 |
| Flouranthene | Ag./for./fish. (1A4c) | [kg] | 136 | 135 | 128 | 127 | 121 | 124 | 117 | 107 | 104 | 110 |
| Flouranthene | Military (1A5) | [kg] | 1 | 7 | 4 | 4 | 3 | 8 | 3 | 6 | 6 | 4 |
| Flouranthene | Navigation int. (1A3d) | [kg] | 204 | 190 | 212 | 294 | 340 | 361 | 349 | 322 | 343 | 311 |
| Flouranthene | Civil Aviation int. (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(b) flouranthene | Industry-Other (1A2f) | [kg] | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Benzo(b) flouranthene | Civil Aviation (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(b) flouranthene | Road (1A3b) | [kg] | 65 | 66 | 66 | 65 | 67 | 65 | 64 | 63 | 62 | 61 |
| Benzo(b) flouranthene | Railways (1A3c) | [kg] | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| Benzo(b) flouranthene | Navigation (1A3d) | [kg] | 4 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 5 | 4 |
| Benzo(b) flouranthene | Residential (1A4b) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(b) flouranthene | Ag./for./fish. (1A4c) | [kg] | 15 | 15 | 14 | 14 | 13 | 13 | 13 | 12 | 11 | 12 |
| Benzo(b) flouranthene | Military (1A5) | [kg] | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| Benzo(b) flouranthene | Navigation int. (1A3d) | [kg] | 13 | 13 | 15 | 20 | 23 | 25 | 25 | 23 | 25 | 22 |
| Benzo(b) flouranthene | Civil Aviation int. (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(k) flouranthene | Industry-Other (1A2f) | [kg] | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Benzo(k) flouranthene | Civil Aviation (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(k) flouranthene | Road (1A3b) | [kg] | 66 | 68 | 68 | 67 | 70 | 70 | 70 | 70 | 69 | 70 |
| Benzo(k) flouranthene | Railways (1A3c) | [kg] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| Benzo(k) flouranthene | Navigation (1A3d) | [kg] | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 |
| Benzo(k) flouranthene | Residential (1A4b) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(k) flouranthene | Ag./for./fish. (1A4c) | [kg] | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 10 | 9 | 9 |
| Benzo(k) flouranthene | Military (1A5) | [kg] | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| Benzo(k) flouranthene | Navigation int. (1A3d) | [kg] | 6 | 6 | 7 | 9 | 11 | 12 | 11 | 11 | 12 | 10 |
| Benzo(k) flouranthene | Civil Aviation int. (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(a) pyrene | Industry-Other (1A2f) | [kg] | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Benzo(a) pyrene | Civil Aviation (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(a) pyrene | Road (1A3b) | [kg] | 45 | 46 | 46 | 46 | 46 | 45 | 44 | 43 | 43 | 42 |
| Benzo(a) pyrene | Railways (1A3c) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(a) pyrene | Navigation (1A3d) | [kg] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 |
| Benzo(a) pyrene | Residential (1A4b) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(a) pyrene | Ag./for./fish. (1A4c) | [kg] | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 |
| Benzo(a) pyrene | Military (1A5) | [kg] | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Benzo(a) pyrene | Navigation int. (1A3d) | [kg] | 4 | 4 | 4 | 5 | 6 | 7 | 7 | 6 | 7 | 6 |
| Benzo(a) pyrene | Civil Aviation int. (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(g,h,i) perylene | Industry-Other (1A2f) | [kg] | 6 | 6 | 6 | 6 | 5 | 6 | 5 | 5 | 5 | 5 |
| Benzo(g,h,i) perylene | Civil Aviation (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(g,h,i) perylene | Road (1A3b) | [kg] | 95 | 97 | 97 | 96 | 96 | 92 | 89 | 87 | 85 | 83 |
| Benzo(g,h,i) perylene | Railways (1A3c) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(g,h,i) perylene | Navigation (1A3d) | [kg] | 8 | 9 | 10 | 10 | 10 | 10 | 12 | 13 | 11 | 9 |
| Benzo(g,h,i) perylene | Residential (1A4b) | [kg] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Benzo(g,h,i) perylene | Ag./for./fish. (1A4c) | [kg] | 21 | 21 | 20 | 19 | 19 | 19 | 18 | 16 | 15 | 16 |
| Benzo(g,h,i) perylene | Military (1A5) | [kg] | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |
| Benzo(g,h,i) perylene | Navigation int. (1A3d) | [kg] | 24 | 24 | 30 | 37 | 45 | 49 | 48 | 45 | 52 | 45 |
| Benzo(g,h,i) perylene | Civil Aviation int. (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| indeno(1,2,3-c,d) pyrene | Industry-Other (1A2f) | [kg] | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| indeno(1,2,3-c,d) pyrene | Civil Aviation (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| indeno(1,2,3-c,d) pyrene | Road (1A3b) | [kg] | 43 | 44 | 45 | 45 | 47 | 46 | 46 | 46 | 47 | 47 |
| indeno(1,2,3-c,d) pyrene | Railways (1A3c) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Continued*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| indeno(1,2,3-c,d) pyrene | Navigation (1A3d) | [kg] | 6 | 7 | 8 | 8 | 8 | 8 | 10 | 11 | 9 | 7 |
| indeno(1,2,3-c,d) pyrene | Residential (1A4b) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| indeno(1,2,3-c,d) pyrene | Ag./for./fish. (1A4c) | [kg] | 14 | 15 | 14 | 13 | 13 | 13 | 12 | 11 | 11 | 11 |
| indeno(1,2,3-c,d) pyrene | Military (1A5) | [kg] | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| indeno(1,2,3-c,d) pyrene | Navigation int. (1A3d) | [kg] | 19 | 20 | 24 | 30 | 36 | 39 | 39 | 36 | 42 | 36 |
| indeno(1,2,3-c,d) pyrene | Civil Aviation int. (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Continued*

| pol_name | IPCC ID | Unit | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $SO_2$ | Industry-Other (1A2f) | [tonnes] | 253 | 256 | 258 | 261 | 263 | 28 | 30 | 32 | 33 |
| $SO_2$ | Civil Aviation (1A3a) | [tonnes] | 49 | 52 | 45 | 44 | 41 | 43 | 46 | 51 | 52 |
| $SO_2$ | Road (1A3b) | [tonnes] | 352 | 353 | 357 | 371 | 381 | 77 | 79 | 83 | 82 |
| $SO_2$ | Railways (1A3c) | [tonnes] | 7 | 7 | 7 | 7 | 7 | 1 | 1 | 1 | 1 |
| $SO_2$ | Navigation (1A3d) | [tonnes] | 1129 | 1039 | 963 | 995 | 1150 | 1157 | 1086 | 838 | 655 |
| $SO_2$ | Residential (1A4b) | [tonnes] | 4 | 4 | 5 | 6 | 6 | 1 | 1 | 1 | 1 |
| $SO_2$ | Ag./for./fish. (1A4c) | [tonnes] | 1021 | 986 | 1041 | 997 | 851 | 637 | 585 | 519 | 323 |
| $SO_2$ | Military (1A5) | [tonnes] | 27 | 12 | 19 | 17 | 46 | 57 | 26 | 40 | 19 |
| $SO_2$ | Navigation int. (1A3d) | [tonnes] | 56634 | 45358 | 31538 | 33060 | 28581 | 36544 | 52936 | 26876 | 20557 |
| $SO_2$ | Civil Aviation int. (1A3a) | [tonnes] | 750 | 761 | 657 | 683 | 781 | 822 | 824 | 845 | 844 |
| $NO_x$ | Industry-Other (1A2f) | [tonnes] | 12096 | 11869 | 11617 | 11214 | 10744 | 10664 | 10807 | 10667 | 10100 |
| $NO_x$ | Civil Aviation (1A3a) | [tonnes] | 723 | 752 | 641 | 595 | 551 | 583 | 601 | 692 | 704 |
| $NO_x$ | Road (1A3b) | [tonnes] | 81559 | 78866 | 75136 | 74757 | 72479 | 70161 | 69240 | 67717 | 61250 |
| $NO_x$ | Railways (1A3c) | [tonnes] | 3727 | 3396 | 3396 | 3540 | 3478 | 3724 | 3542 | 3555 | 2920 |
| $NO_x$ | Navigation (1A3d) | [tonnes] | 5830 | 5741 | 5900 | 5827 | 5939 | 6026 | 5997 | 5929 | 5985 |
| $NO_x$ | Residential (1A4b) | [tonnes] | 153 | 167 | 183 | 202 | 223 | 249 | 275 | 293 | 304 |
| $NO_x$ | Ag./for./fish. (1A4c) | [tonnes] | 22807 | 22699 | 23269 | 22322 | 19933 | 20776 | 19532 | 18266 | 19135 |
| $NO_x$ | Military (1A5) | [tonnes] | 554 | 724 | 489 | 544 | 1323 | 1360 | 635 | 793 | 520 |
| $NO_x$ | Navigation int. (1A3d) | [tonnes] | 96911 | 81585 | 66095 | 71376 | 58906 | 62825 | 84716 | 89720 | 77545 |
| $NO_x$ | Civil Aviation int. (1A3a) | [tonnes] | 9446 | 9605 | 8731 | 9091 | 10475 | 11031 | 11168 | 11412 | 11299 |
| NMVOC | Industry-Other (1A2f) | [tonnes] | 1926 | 1873 | 1815 | 1754 | 1676 | 1620 | 1583 | 1498 | 1375 |
| NMVOC | Civil Aviation (1A3a) | [tonnes] | 156 | 155 | 151 | 144 | 158 | 165 | 156 | 164 | 148 |
| NMVOC | Road (1A3b) | [tonnes] | 41387 | 37635 | 34090 | 31867 | 27888 | 25766 | 22835 | 20241 | 17754 |
| NMVOC | Railways (1A3c) | [tonnes] | 253 | 248 | 243 | 223 | 217 | 235 | 230 | 231 | 205 |
| NMVOC | Navigation (1A3d) | [tonnes] | 1652 | 1614 | 1575 | 1513 | 1446 | 1334 | 1206 | 1087 | 986 |
| NMVOC | Residential (1A4b) | [tonnes] | 4602 | 5328 | 6082 | 6869 | 7685 | 7859 | 8037 | 8156 | 7954 |
| NMVOC | Ag./for./fish. (1A4c) | [tonnes] | 3414 | 3246 | 3079 | 2858 | 2586 | 2568 | 2513 | 2413 | 2388 |
| NMVOC | Military (1A5) | [tonnes] | 57 | 58 | 47 | 48 | 107 | 113 | 54 | 72 | 44 |
| NMVOC | Navigation int. (1A3d) | [tonnes] | 3126 | 2651 | 2190 | 2334 | 1914 | 2005 | 2643 | 2767 | 2433 |
| NMVOC | Civil Aviation int. (1A3a) | [tonnes] | 407 | 406 | 390 | 399 | 451 | 468 | 492 | 505 | 485 |
| $CH_4$ | Industry-Other (1A2f) | [tonnes] | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 41 |
| $CH_4$ | Civil Aviation (1A3a) | [tonnes] | 5 | 6 | 5 | 5 | 6 | 7 | 6 | 7 | 6 |
| $CH_4$ | Road (1A3b) | [tonnes] | 1865 | 1744 | 1640 | 1584 | 1484 | 1393 | 1298 | 1197 | 1046 |
| $CH_4$ | Railways (1A3c) | [tonnes] | 10 | 10 | 9 | 9 | 8 | 9 | 9 | 9 | 8 |

| Continued | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $CH_4$ | Navigation (1A3d) | [tonnes] | 30 | 31 | 31 | 32 | 32 | 32 | 32 | 32 | 32 |
| $CH_4$ | Residential (1A4b) | [tonnes] | 137 | 149 | 164 | 183 | 204 | 219 | 233 | 240 | 240 |
| $CH_4$ | Ag./for./fish. (1A4c) | [tonnes] | 88 | 86 | 86 | 85 | 82 | 86 | 93 | 91 | 91 |
| $CH_4$ | Military (1A5) | [tonnes] | 6 | 7 | 5 | 5 | 13 | 13 | 6 | 8 | 5 |
| $CH_4$ | Navigation int. (1A3d) | [tonnes] | 97 | 82 | 68 | 72 | 59 | 62 | 82 | 86 | 75 |
| $CH_4$ | Civil Aviation int. (1A3a) | [tonnes] | 42 | 42 | 41 | 42 | 47 | 49 | 52 | 54 | 51 |
| CO | Industry-Other (1A2f) | [tonnes] | 8395 | 8227 | 8030 | 7842 | 7600 | 7497 | 7515 | 7383 | 7060 |
| CO | Civil Aviation (1A3a) | [tonnes] | 895 | 891 | 863 | 835 | 858 | 861 | 842 | 901 | 828 |
| CO | Road (1A3b) | [tonnes] | 266890 | 256351 | 234964 | 226060 | 199785 | 191213 | 168936 | 152344 | 139272 |
| CO | Railways (1A3c) | [tonnes] | 694 | 637 | 627 | 611 | 599 | 648 | 626 | 629 | 526 |
| CO | Navigation (1A3d) | [tonnes] | 6572 | 6742 | 6934 | 7116 | 7312 | 7339 | 6955 | 6573 | 6202 |
| CO | Residential (1A4b) | [tonnes] | 45873 | 50280 | 56144 | 63688 | 72683 | 80610 | 87744 | 92236 | 95382 |
| CO | Ag./for./fish. (1A4c) | [tonnes] | 25842 | 24006 | 22167 | 20229 | 18183 | 17153 | 16884 | 16718 | 16802 |
| CO | Military (1A5) | [tonnes] | 404 | 322 | 319 | 312 | 727 | 816 | 387 | 541 | 309 |
| CO | Navigation int. (1A3d) | [tonnes] | 10313 | 8745 | 7225 | 7701 | 6316 | 6615 | 8719 | 9129 | 8028 |
| CO | Civil Aviation int. (1A3a) | [tonnes] | 1790 | 1796 | 1610 | 1669 | 1844 | 1914 | 1870 | 1933 | 2003 |
| $CO_2$ | Industry-Other (1A2f) | [ktonnes] | 879 | 888 | 897 | 907 | 912 | 950 | 1021 | 1089 | 1119 |
| $CO_2$ | Civil Aviation (1A3a) | [ktonnes] | 154 | 163 | 141 | 138 | 128 | 135 | 143 | 161 | 164 |
| $CO_2$ | Road (1A3b) | [ktonnes] | 11202 | 11223 | 11352 | 11806 | 12115 | 12214 | 12587 | 13186 | 12948 |
| $CO_2$ | Railways (1A3c) | [ktonnes] | 228 | 211 | 210 | 218 | 216 | 232 | 227 | 228 | 237 |
| $CO_2$ | Navigation (1A3d) | [ktonnes] | 476 | 461 | 457 | 461 | 475 | 471 | 461 | 454 | 453 |
| $CO_2$ | Residential (1A4b) | [ktonnes] | 129 | 143 | 161 | 182 | 205 | 220 | 233 | 238 | 239 |
| $CO_2$ | Ag./for./fish. (1A4c) | [ktonnes] | 1615 | 1592 | 1636 | 1602 | 1498 | 1577 | 1563 | 1576 | 1697 |
| $CO_2$ | Military (1A5) | [ktonnes] | 111 | 97 | 89 | 92 | 239 | 271 | 126 | 175 | 108 |
| $CO_2$ | Navigation int. (1A3d) | [ktonnes] | 4279 | 3605 | 2966 | 3130 | 2545 | 2636 | 3433 | 3559 | 3118 |
| $CO_2$ | Civil Aviation int. (1A3a) | [ktonnes] | 2350 | 2384 | 2058 | 2141 | 2447 | 2574 | 2582 | 2647 | 2642 |
| $N_2O$ | Industry-Other (1A2f) | [tonnes] | 37 | 38 | 38 | 38 | 39 | 40 | 43 | 46 | 47 |
| $N_2O$ | Civil Aviation (1A3a) | [tonnes] | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 9 | 9 |
| $N_2O$ | Road (1A3b) | [tonnes] | 447 | 433 | 424 | 425 | 424 | 413 | 412 | 421 | 405 |
| $N_2O$ | Railways (1A3c) | [tonnes] | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 |
| $N_2O$ | Navigation (1A3d) | [tonnes] | 27 | 26 | 26 | 26 | 27 | 27 | 26 | 26 | 26 |
| $N_2O$ | Residential (1A4b) | [tonnes] | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 |
| $N_2O$ | Ag./for./fish. (1A4c) | [tonnes] | 78 | 77 | 80 | 78 | 71 | 76 | 75 | 74 | 81 |
| $N_2O$ | Military (1A5) | [tonnes] | 3 | 3 | 3 | 3 | 8 | 9 | 4 | 6 | 4 |
| $N_2O$ | Navigation int. (1A3d) | [tonnes] | 269 | 227 | 187 | 197 | 160 | 166 | 216 | 224 | 196 |
| $N_2O$ | Civil Aviation int. (1A3a) | [tonnes] | 82 | 82 | 72 | 75 | 85 | 89 | 89 | 91 | 90 |
| $NH_3$ | Industry-Other (1A2f) | [tonnes] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| $NH_3$ | Civil Aviation (1A3a) | [tonnes] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $NH_3$ | Road (1A3b) | [tonnes] | 2656 | 2537 | 2472 | 2396 | 2282 | 2122 | 1954 | 1788 | 1572 |
| $NH_3$ | Railways (1A3c) | [tonnes] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| $NH_3$ | Navigation (1A3d) | [tonnes] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $NH_3$ | Residential (1A4b) | [tonnes] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $NH_3$ | Ag./for./fish. (1A4c) | [tonnes] | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 |

| Continued | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $NH_3$ | Military (1A5) | [tonnes] | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| $NH_3$ | Navigation int. (1A3d) | [tonnes] | | | | | | | | | |
| $NH_3$ | Civil Aviation int. (1A3a) | [tonnes] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TSP | Industry-Other (1A2f) | [tonnes] | 1135 | 1121 | 1098 | 1075 | 1037 | 1002 | 991 | 938 | 861 |
| TSP | Civil Aviation (1A3a) | [tonnes] | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| TSP | Road (1A3b) | [tonnes] | 3565 | 3430 | 3205 | 3234 | 3042 | 2948 | 2852 | 2688 | 2421 |
| TSP | Railways (1A3c) | [tonnes] | 141 | 125 | 124 | 119 | 115 | 124 | 120 | 120 | 101 |
| TSP | Navigation (1A3d) | [tonnes] | 307 | 298 | 290 | 295 | 315 | 309 | 292 | 257 | 244 |
| TSP | Residential (1A4b) | [tonnes] | 41 | 50 | 58 | 67 | 76 | 78 | 79 | 80 | 81 |
| TSP | Ag./for./fish. (1A4c) | [tonnes] | 1507 | 1440 | 1374 | 1291 | 1191 | 1146 | 1074 | 1020 | 990 |
| TSP | Military (1A5) | [tonnes] | 18 | 39 | 18 | 23 | 49 | 42 | 19 | 18 | 15 |
| TSP | Navigation int. (1A3d) | [tonnes] | 8994 | 7414 | 5254 | 4816 | 4293 | 6155 | 8300 | 2504 | 2025 |
| TSP | Civil Aviation int. (1A3a) | [tonnes] | 38 | 38 | 33 | 35 | 40 | 42 | 42 | 43 | 43 |
| $PM_{10}$ | Industry-Other (1A2f) | [tonnes] | 1135 | 1121 | 1098 | 1075 | 1037 | 1002 | 991 | 938 | 861 |
| $PM_{10}$ | Civil Aviation (1A3a) | [tonnes] | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| $PM_{10}$ | Road (1A3b) | [tonnes] | 3565 | 3430 | 3205 | 3234 | 3042 | 2948 | 2852 | 2688 | 2421 |
| $PM_{10}$ | Railways (1A3c) | [tonnes] | 141 | 125 | 124 | 119 | 115 | 124 | 120 | 120 | 101 |
| $PM_{10}$ | Navigation (1A3d) | [tonnes] | 306 | 296 | 289 | 294 | 314 | 307 | 290 | 256 | 242 |
| $PM_{10}$ | Residential (1A4b) | [tonnes] | 41 | 50 | 58 | 67 | 76 | 78 | 79 | 80 | 81 |
| $PM_{10}$ | Ag./for./fish. (1A4c) | [tonnes] | 1505 | 1439 | 1372 | 1290 | 1190 | 1145 | 1073 | 1019 | 988 |
| $PM_{10}$ | Military (1A5) | [tonnes] | 18 | 39 | 18 | 23 | 49 | 42 | 19 | 18 | 15 |
| $PM_{10}$ | Navigation int. (1A3d) | [tonnes] | 8904 | 7340 | 5201 | 4767 | 4250 | 6094 | 8217 | 2479 | 2005 |
| $PM_{10}$ | Civil Aviation int. (1A3a) | [tonnes] | 38 | 38 | 33 | 35 | 40 | 42 | 42 | 43 | 43 |
| $PM_{2.5}$ | Industry-Other (1A2f) | [tonnes] | 1135 | 1121 | 1098 | 1075 | 1037 | 1002 | 991 | 938 | 861 |
| $PM_{2.5}$ | Civil Aviation (1A3a) | [tonnes] | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| $PM_{2.5}$ | Road (1A3b) | [tonnes] | 3565 | 3430 | 3205 | 3234 | 3042 | 2948 | 2852 | 2688 | 2421 |
| $PM_{2.5}$ | Railways (1A3c) | [tonnes] | 141 | 125 | 124 | 119 | 115 | 124 | 120 | 120 | 101 |
| $PM_{2.5}$ | Navigation (1A3d) | [tonnes] | 305 | 295 | 288 | 293 | 313 | 307 | 289 | 255 | 242 |
| $PM_{2.5}$ | Residential (1A4b) | [tonnes] | 41 | 50 | 58 | 67 | 76 | 78 | 79 | 80 | 81 |
| $PM_{2.5}$ | Ag./for./fish. (1A4c) | [tonnes] | 1504 | 1438 | 1372 | 1289 | 1189 | 1144 | 1072 | 1018 | 988 |
| $PM_{2.5}$ | Military (1A5) | [tonnes] | 18 | 39 | 18 | 23 | 49 | 42 | 19 | 18 | 15 |
| $PM_{2.5}$ | Navigation int. (1A3d) | [tonnes] | 8859 | 7303 | 5175 | 4743 | 4229 | 6063 | 8175 | 2466 | 1995 |
| $PM_{2.5}$ | Civil Aviation int. (1A3a) | [tonnes] | 38 | 38 | 33 | 35 | 40 | 42 | 42 | 43 | 43 |
| Arsenic | Civil Aviation (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Arsenic | Navigation (1A3d) | [kg] | 14 | 13 | 13 | 13 | 13 | 13 | 13 | 12 | 12 |
| Arsenic | Ag./for./fish. (1A4c) | [kg] | 9 | 8 | 9 | 8 | 6 | 8 | 7 | 6 | 7 |
| Arsenic | Military (1A5) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Arsenic | Navigation int. (1A3d) | [kg] | 432 | 342 | 240 | 274 | 230 | 268 | 401 | 443 | 348 |
| Arsenic | Civil Aviation int. (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cadmium | Industry-Other (1A2f) | [kg] | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Cadmium | Civil Aviation (1A3a) | [kg] | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Cadmium | Road (1A3b) | [kg] | 35 | 35 | 36 | 37 | 38 | 38 | 40 | 42 | 41 |
| Cadmium | Railways (1A3c) | [kg] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| *Continued* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cadmium | Navigation (1A3d) | [kg] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cadmium | Residential (1A4b) | [kg] | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Cadmium | Ag./for./fish. (1A4c) | [kg] | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Cadmium | Military (1A5) | [kg] | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |
| Cadmium | Navigation int. (1A3d) | [kg] | 29 | 24 | 18 | 20 | 16 | 18 | 26 | 28 | 23 |
| Cadmium | Civil Aviation int. (1A3a) | [kg] | 8 | 8 | 7 | 7 | 8 | 8 | 8 | 8 | 8 |
| Chromium | Industry-Other (1A2f) | [kg] | 13 | 13 | 13 | 13 | 13 | 14 | 15 | 16 | 17 |
| Chromium | Civil Aviation (1A3a) | [kg] | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| Chromium | Road (1A3b) | [kg] | 176 | 176 | 179 | 186 | 191 | 192 | 198 | 208 | 204 |
| Chromium | Railways (1A3c) | [kg] | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 |
| Chromium | Navigation (1A3d) | [kg] | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 8 | 9 |
| Chromium | Residential (1A4b) | [kg] | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 4 |
| Chromium | Ag./for./fish. (1A4c) | [kg] | 24 | 24 | 24 | 24 | 22 | 23 | 23 | 24 | 25 |
| Chromium | Military (1A5) | [kg] | 2 | 2 | 1 | 1 | 4 | 4 | 2 | 3 | 2 |
| Chromium | Navigation int. (1A3d) | [kg] | 184 | 147 | 106 | 120 | 100 | 114 | 167 | 183 | 146 |
| Chromium | Civil Aviation int. (1A3a) | [kg] | 37 | 38 | 33 | 34 | 39 | 41 | 41 | 42 | 42 |
| Copper | Industry-Other (1A2f) | [kg] | 435 | 440 | 445 | 450 | 454 | 474 | 513 | 549 | 565 |
| Copper | Civil Aviation (1A3a) | [kg] | 83 | 88 | 76 | 74 | 69 | 73 | 77 | 87 | 88 |
| Copper | Road (1A3b) | [kg] | 5989 | 6001 | 6072 | 6314 | 6481 | 6535 | 6742 | 7069 | 6942 |
| Copper | Railways (1A3c) | [kg] | 123 | 114 | 113 | 117 | 116 | 125 | 122 | 122 | 127 |
| Copper | Navigation (1A3d) | [kg] | 60 | 62 | 64 | 66 | 69 | 68 | 67 | 67 | 66 |
| Copper | Residential (1A4b) | [kg] | 69 | 76 | 86 | 96 | 109 | 117 | 124 | 126 | 127 |
| Copper | Ag./for./fish. (1A4c) | [kg] | 581 | 584 | 586 | 586 | 593 | 599 | 613 | 648 | 678 |
| Copper | Military (1A5) | [kg] | 60 | 52 | 48 | 50 | 129 | 146 | 68 | 94 | 58 |
| Copper | Navigation int. (1A3d) | [kg] | 432 | 342 | 240 | 274 | 230 | 268 | 401 | 443 | 348 |
| Copper | Civil Aviation int. (1A3a) | [kg] | 1267 | 1285 | 1109 | 1154 | 1319 | 1387 | 1392 | 1427 | 1424 |
| Mercury | Civil Aviation (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mercury | Navigation (1A3d) | [kg] | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Mercury | Ag./for./fish. (1A4c) | [kg] | 9 | 8 | 9 | 8 | 6 | 8 | 7 | 6 | 7 |
| Mercury | Military (1A5) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mercury | Navigation int. (1A3d) | [kg] | 43 | 38 | 34 | 34 | 27 | 26 | 31 | 30 | 29 |
| Mercury | Civil Aviation int. (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nickel | Industry-Other (1A2f) | [kg] | 18 | 18 | 18 | 19 | 19 | 20 | 21 | 23 | 23 |
| Nickel | Civil Aviation (1A3a) | [kg] | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 4 | 4 |
| Nickel | Road (1A3b) | [kg] | 247 | 247 | 250 | 260 | 267 | 269 | 278 | 291 | 286 |
| Nickel | Railways (1A3c) | [kg] | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Nickel | Navigation (1A3d) | [kg] | 534 | 501 | 492 | 484 | 503 | 508 | 474 | 456 | 470 |
| Nickel | Residential (1A4b) | [kg] | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 5 |
| Nickel | Ag./for./fish. (1A4c) | [kg] | 36 | 35 | 36 | 35 | 33 | 35 | 35 | 35 | 38 |
| Nickel | Military (1A5) | [kg] | 2 | 2 | 2 | 2 | 5 | 6 | 3 | 4 | 2 |
| Nickel | Navigation int. (1A3d) | [kg] | 24364 | 19050 | 12906 | 15043 | 12715 | 15126 | 23174 | 25869 | 19947 |
| Nickel | Civil Aviation int. (1A3a) | [kg] | 52 | 53 | 46 | 48 | 54 | 57 | 57 | 59 | 59 |
| Lead | Industry-Other (1A2f) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| *Continued* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead | Civil Aviation (1A3a) | [kg] | 1369 | 1343 | 1328 | 1252 | 1304 | 1297 | 1245 | 1329 | 1182 |
| Lead | Road (1A3b) | [kg] | 57 | 56 | 56 | 56 | 55 | 53 | 52 | 52 | 50 |
| Lead | Railways (1A3c) | [kg] | 0 | 0 | 0 | | | | | | |
| Lead | Navigation (1A3d) | [kg] | 14 | 14 | 13 | 13 | 14 | 14 | 13 | 13 | 13 |
| Lead | Residential (1A4b) | [kg] | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Lead | Ag./for./fish. (1A4c) | [kg] | 18 | 17 | 18 | 17 | 13 | 15 | 14 | 12 | 14 |
| Lead | Military (1A5) | [kg] | 114 | 88 | 106 | 78 | 82 | 59 | 47 | 81 | 39 |
| Lead | Navigation int. (1A3d) | [kg] | 216 | 177 | 136 | 149 | 122 | 133 | 185 | 198 | 164 |
| Lead | Civil Aviation int. (1A3a) | [kg] | 118 | 114 | 113 | 106 | 111 | 117 | 22 | 10 | 113 |
| Selenium | Industry-Other (1A2f) | [kg] | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Selenium | Civil Aviation (1A3a) | [kg] | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Selenium | Road (1A3b) | [kg] | 35 | 35 | 36 | 37 | 38 | 38 | 40 | 42 | 41 |
| Selenium | Railways (1A3c) | [kg] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Selenium | Navigation (1A3d) | [kg] | 28 | 27 | 26 | 26 | 27 | 27 | 26 | 26 | 26 |
| Selenium | Residential (1A4b) | [kg] | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Selenium | Ag./for./fish. (1A4c) | [kg] | 38 | 36 | 39 | 37 | 29 | 34 | 31 | 28 | 32 |
| Selenium | Military (1A5) | [kg] | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |
| Selenium | Navigation int. (1A3d) | [kg] | 431 | 354 | 273 | 297 | 245 | 267 | 370 | 396 | 329 |
| Selenium | Civil Aviation int. (1A3a) | [kg] | 8 | 8 | 7 | 7 | 8 | 8 | 8 | 8 | 8 |
| Zinc | Industry-Other (1A2f) | [kg] | 256 | 259 | 262 | 265 | 267 | 279 | 302 | 323 | 333 |
| Zinc | Civil Aviation (1A3a) | [kg] | 49 | 52 | 45 | 44 | 41 | 43 | 45 | 51 | 52 |
| Zinc | Road (1A3b) | [kg] | 3523 | 3530 | 3572 | 3714 | 3812 | 3844 | 3966 | 4158 | 4083 |
| Zinc | Railways (1A3c) | [kg] | 72 | 67 | 67 | 69 | 68 | 73 | 72 | 72 | 75 |
| Zinc | Navigation (1A3d) | [kg] | 96 | 94 | 94 | 95 | 98 | 97 | 95 | 94 | 94 |
| Zinc | Residential (1A4b) | [kg] | 40 | 45 | 50 | 57 | 64 | 69 | 73 | 74 | 75 |
| Zinc | Ag./for./fish. (1A4c) | [kg] | 423 | 421 | 428 | 423 | 409 | 423 | 425 | 438 | 466 |
| Zinc | Military (1A5) | [kg] | 35 | 31 | 28 | 29 | 76 | 86 | 40 | 55 | 34 |
| Zinc | Navigation int. (1A3d) | [kg] | 997 | 821 | 639 | 693 | 570 | 616 | 848 | 904 | 756 |
| Zinc | Civil Aviation int. (1A3a) | [kg] | 745 | 756 | 653 | 679 | 776 | 816 | 819 | 839 | 838 |
| Dioxins/furans | Industry-Other (1A2f) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Civil Aviation (1A3a) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Road (1A3b) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Railways (1A3c) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Navigation (1A3d) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Residential (1A4b) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Ag./for./fish. (1A4c) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Military (1A5) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dioxins/furans | Navigation int. (1A3d) | [g] | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |
| Dioxins/furans | Civil Aviation int. (1A3a) | [g] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Flouranthene | Industry-Other (1A2f) | [kg] | 48 | 48 | 49 | 49 | 50 | 52 | 56 | 60 | 62 |
| Flouranthene | Civil Aviation (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Flouranthene | Road (1A3b) | [kg] | 577 | 561 | 565 | 596 | 623 | 636 | 667 | 731 | 735 |
| Flouranthene | Railways (1A3c) | [kg] | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 |

| Continued | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flouranthene | Navigation (1A3d) | [kg] | 42 | 41 | 40 | 40 | 42 | 41 | 40 | 40 | 40 |
| Flouranthene | Residential (1A4b) | [kg] | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 14 | 14 |
| Flouranthene | Ag./for./fish. (1A4c) | [kg] | 118 | 115 | 119 | 116 | 105 | 112 | 110 | 108 | 118 |
| Flouranthene | Military (1A5) | [kg] | 2 | 4 | 2 | 3 | 6 | 6 | 3 | 3 | 3 |
| Flouranthene | Navigation int. (1A3d) | [kg] | 306 | 266 | 232 | 238 | 191 | 188 | 227 | 226 | 212 |
| Flouranthene | Civil Aviation int. (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(b) flouranthene | Industry-Other (1A2f) | [kg] | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 |
| Benzo(b) flouranthene | Civil Aviation (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(b) flouranthene | Road (1A3b) | [kg] | 60 | 59 | 59 | 62 | 64 | 66 | 69 | 74 | 73 |
| Benzo(b) flouranthene | Railways (1A3c) | [kg] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Benzo(b) flouranthene | Navigation (1A3d) | [kg] | 4 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 3 |
| Benzo(b) flouranthene | Residential (1A4b) | [kg] | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| Benzo(b) flouranthene | Ag./for./fish. (1A4c) | [kg] | 12 | 12 | 12 | 12 | 11 | 12 | 11 | 11 | 12 |
| Benzo(b) flouranthene | Military (1A5) | [kg] | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Benzo(b) flouranthene | Navigation int. (1A3d) | [kg] | 21 | 19 | 17 | 17 | 14 | 13 | 15 | 14 | 14 |
| Benzo(b) flouranthene | Civil Aviation int. (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(k) flouranthene | Industry-Other (1A2f) | [kg] | 6 | 5 | 5 | 6 | 6 | 6 | 6 | 7 | 7 |
| Benzo(k) flouranthene | Civil Aviation (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(k) flouranthene | Road (1A3b) | [kg] | 68 | 68 | 69 | 72 | 75 | 76 | 80 | 86 | 85 |
| Benzo(k) flouranthene | Railways (1A3c) | [kg] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Benzo(k) flouranthene | Navigation (1A3d) | [kg] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Benzo(k) flouranthene | Residential (1A4b) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(k) flouranthene | Ag./for./fish. (1A4c) | [kg] | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 10 |
| Benzo(k) flouranthene | Military (1A5) | [kg] | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Benzo(k) flouranthene | Navigation int. (1A3d) | [kg] | 10 | 9 | 8 | 8 | 6 | 6 | 7 | 6 | 6 |
| Benzo(k) flouranthene | Civil Aviation int. (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(a) pyrene | Industry-Other (1A2f) | [kg] | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 |
| Benzo(a) pyrene | Civil Aviation (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(a) pyrene | Road (1A3b) | [kg] | 42 | 41 | 42 | 44 | 47 | 47 | 50 | 54 | 54 |
| Benzo(a) pyrene | Railways (1A3c) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(a) pyrene | Navigation (1A3d) | [kg] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Benzo(a) pyrene | Residential (1A4b) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(a) pyrene | Ag./for./fish. (1A4c) | [kg] | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Benzo(a) pyrene | Military (1A5) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(a) pyrene | Navigation int. (1A3d) | [kg] | 6 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 4 |
| Benzo(a) pyrene | Civil Aviation int. (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(g,h,i) perylene | Industry-Other (1A2f) | [kg] | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 7 |
| Benzo(g,h,i) perylene | Civil Aviation (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(g,h,i) perylene | Road (1A3b) | [kg] | 82 | 80 | 81 | 85 | 89 | 90 | 93 | 101 | 102 |
| Benzo(g,h,i) perylene | Railways (1A3c) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Benzo(g,h,i) perylene | Navigation (1A3d) | [kg] | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Benzo(g,h,i) perylene | Residential (1A4b) | [kg] | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Benzo(g,h,i) perylene | Ag./for./fish. (1A4c) | [kg] | 18 | 17 | 18 | 17 | 15 | 16 | 16 | 15 | 17 |

*Continued*

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Benzo(g,h,i) perylene | Military (1A5) | [kg] | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Benzo(g,h,i) perylene | Navigation int. (1A3d) | [kg] | 41 | 37 | 35 | 35 | 28 | 25 | 27 | 25 | 26 |
| Benzo(g,h,i) perylene | Civil Aviation int. (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| indeno(1,2,3-c,d) pyrene | Industry-Other (1A2f) | [kg] | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 |
| indeno(1,2,3-c,d) pyrene | Civil Aviation (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| indeno(1,2,3-c,d) pyrene | Road (1A3b) | [kg] | 47 | 46 | 47 | 50 | 52 | 53 | 55 | 59 | 59 |
| indeno(1,2,3-c,d) pyrene | Railways (1A3c) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| indeno(1,2,3-c,d) pyrene | Navigation (1A3d) | [kg] | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| indeno(1,2,3-c,d) pyrene | Residential (1A4b) | [kg] | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| indeno(1,2,3-c,d) pyrene | Ag./for./fish. (1A4c) | [kg] | 13 | 12 | 13 | 12 | 10 | 12 | 11 | 10 | 12 |
| indeno(1,2,3-c,d) pyrene | Military (1A5) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| indeno(1,2,3-c,d) pyrene | Navigation int. (1A3d) | [kg] | 34 | 30 | 29 | 29 | 23 | 21 | 22 | 20 | 21 |
| indeno(1,2,3-c,d) pyrene | Civil Aviation int. (1A3a) | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## Annex 2B-16 Percentage distribution of new sold heavy duty trucks into Euro classes

| 1. reg. year | Conv. | I | II | III | IV | V | VI | Total |
|---|---|---|---|---|---|---|---|---|
| 1991 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| 1992 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| 1993 | 75 | 25 | 0 | 0 | 0 | 0 | 0 | 100 |
| 1994 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 100 |
| 1995 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 100 |
| 1996 | 0 | 75 | 25 | 0 | 0 | 0 | 0 | 100 |
| 1997 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 100 |
| 1998 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 100 |
| 1999 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 100 |
| 2000 | 0 | 0 | 75 | 25 | 0 | 0 | 0 | 100 |
| 2001 | 0 | 0 | 43 | 57 | 0 | 0 | 0 | 100 |
| 2002 | 0 | 0 | 2 | 98 | 0 | 0 | 0 | 100 |
| 2003 | 0 | 0 | 1 | 99 | 0 | 0 | 0 | 100 |
| 2004 | 0 | 0 | 1 | 99 | 0 | 0 | 0 | 100 |
| 2005 | 0 | 0 | 0 | 96 | 3 | 1 | 0 | 100 |
| 2006 | 0 | 0 | 0 | 81 | 14 | 5 | 0 | 100 |
| 2007 | 0 | 0 | 0 | 2 | 71 | 27 | 0 | 100 |
| 2008 | 0 | 0 | 0 | 0 | 50 | 50 | 0 | 100 |
| 2009 | 0 | 0 | 0 | 0 | 25 | 75 | 0 | 100 |
| 2010 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 100 |
| 2011 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 100 |
| 2012 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 100 |
| 2013 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 100 |
| 2014 | 0 | 0 | 0 | 0 | 0 | 75 | 25 | 100 |
| 2015 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 |

## Annex 2B-17 Uncertainty estimates

Uncertainty estimation, $SO_2$.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data Gg $SO_2$ | Input data Gg $SO_2$ | Input data % | Input data % | % | % | % | % | % | % | % |
| Road Transportation | $SO_2$ | 5767 | 82 | 2 | 50 | 50,040 | 3,498 | -0,024431002 | 0,0054 | -1,2215501 | 0,015396936 | 1,22164714 |
| Other mobile sources | $SO_2$ | 9216 | 1085 | 10 | 50 | 50,990 | 47,425 | 0,024375101 | 0,0724 | 1,21875506 | 1,024163247 | 1,5919404 |
| Total | | 14983,405 | 1166,6516 | | | | 2261,399 | | | | | 4,02669599 |
| Total uncertainties | | | | | **Year (%):** | | **47,554** | | | **Trend (%):** | | **2,007** |

Uncertainty estimation, $NO_X$.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data Gg $NO_X$ | Input data Gg $NO_X$ | Input data % | Input data % | % | % | % | % | % | % | % |
| Road Transportation | $NO_X$ | 106456 | 61250 | 2 | 50 | 50,040 | 30,371 | -0,044630295 | 0,3895 | -2,2315147 | 1,101640212 | 2,48862797 |
| Other mobile sources | $NO_X$ | 50802 | 39667 | 10 | 100 | 100,499 | 39,503 | 0,044787734 | 0,2522 | 4,47877341 | 3,567250654 | 5,72579152 |
| Total | $NO_X$ | 157258,18 | 100917,5 | | | | 2482,854 | | | | | 38,9779577 |
| Total uncertainties | | | | | **Year (%):** | | **49,828** | | | **Trend (%):** | | **6,243** |

Uncertainty estimation, NMVOC.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data Gg NMVOC | Input data Gg NMVOC | Input data % | Input data % | % | % | % | % | % | % | % |
| Road Transportation | NMVOC | 81541 | 17754 | 2 | 50 | 50,040 | 28,795 | -0,086372485 | 0,1845 | -4,3186242 | 0,521711922 | 4,35002284 |
| Other mobile sources | NMVOC | 14709 | 13099 | 10 | 100 | 100,499 | 42,668 | 0,0869713 | 0,1361 | 8,69713003 | 1,924613227 | 8,90753652 |
| Total | NMVOC | 96249,848 | 30852,285 | | | | 2649,701 | | | | | 98,2669056 |
| Total uncertainties | | | | | **Year (%):** | | **51,475** | | | **Trend (%):** | | **9,913** |

Uncertainty estimation, CO.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data Gg CO | Input data Gg CO | Input data % | Input data % | % | % | % | % | % | % | % |
| Road Transportation | CO | 458943 | 139272 | 2 | 50 | 50,040 | 26,162 | -0,125520188 | 0,2417 | -6,2760094 | 0,683653327 | 6,31313516 |
| Other mobile sources | CO | 117258 | 127111 | 10 | 100 | 100,499 | 47,955 | 0,126263004 | 0,2206 | 12,6263004 | 3,119768935 | 13,0060148 |
| Total | CO | 576201,37 | 266383,04 | | | | 2984,168 | | | | | 209,012096 |
| Total uncertainties | | | | | **Year (%):** | | **54,628** | | | **Trend (%):** | | **14,457** |

Uncertainty estimation, $NH_3$.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data<br>Gg $NH_3$ | Input data<br>Gg $NH_3$ | Input data<br>% | Input data<br>% | % | % | % | % | % | % | % |
| Road Transportation | $NH_3$ | 70 | 1572 | 2 | 1000 | 1000,002 | 994,953 | 1,54409902 | 20,6421 | 1544,09902 | 58,38468994 | 1545,20243 |
| Other mobile sources | $NH_3$ | 6 | 8 | 10 | 1000 | 1000,050 | 5,049 | -1,557054143 | 0,1048 | -1557,0541 | 1,481453291 | 1557,05485 |
| Total | $NH_3$ | 76,133495 | 1579,5309 | | | | 989956,597 | | | | | 4812070,36 |
| Total uncertainties | | | | | **Year (%):** | | **994,966** | | | **Trend (%):** | | **2194** |

Uncertainty estimation, TSP.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data<br>Gg TSP | Input data<br>Gg TSP | Input data<br>% | Input data<br>% | % | % | % | % | % | % | % |
| Road Transportation | TSP | 6779 | 5166 | 2 | 50 | 50,040 | 34,650 | 0,079252823 | 0,4298 | 3,96264115 | 1,215632854 | 4,14491111 |
| Other mobile sources | TSP | 5240 | 2294 | 10 | 100 | 100,499 | 30,909 | -0,079353885 | 0,1909 | -7,9353885 | 2,69968805 | 8,38204671 |
| Total | TSP | 12018,727 | 7459,8782 | | | | 2155,983 | | | | | 87,4389951 |
| Total uncertainties | | | | | **Year (%):** | | **46,433** | | | **Trend (%):** | | **9,351** |

Uncertainty estimation, Arsenic.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | Arsenic | 0 | 0 | 2 | 1000 | 1000,002 | 0,000 | 0 | 0,0000 | 0 | 0 | 0 |
| Other mobile sources | Arsenic | 62 | 20 | 10 | 1000 | 1000,050 | 1000,050 | 0 | 0,3154 | 0 | 4,461082366 | 4,46108237 |
| Total | Arsenic | 62,035802 | 19,568955 | | | | 1000100,000 | | | | | 19,9012559 |
| Total uncertainties | | | | | **Year (%):** | | **1000,050** | | | **Trend (%):** | | **4,461** |

Uncertainty estimation, Cadmium.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | Cadmium | 29 | 41 | 2 | 1000 | 1000,002 | 763,982 | 0,12387662 | 0,9241 | 123,87662 | 2,613634772 | 123,904189 |
| Other mobile sources | Cadmium | 15 | 13 | 10 | 1000 | 1000,050 | 236,032 | -0,124273874 | 0,2855 | -124,27387 | 4,037210179 | 124,339434 |
| Total | Cadmium | 44,162276 | 53,415744 | | | | 639378,944 | | | | | 30812,5429 |
| Total uncertainties | | | | | **Year (%):** | | **799,612** | | | **Trend (%):** | | **175,535** |

Uncertainty estimation, Chromium.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | Chromium | 146 | 204 | 2 | 1000 | 1000,002 | 766,136 | 0,130950204 | 0,9171 | 130,950204 | 2,593991346 | 130,975894 |
| Other mobile sources | Chromium | 77 | 62 | 10 | 1000 | 1000,050 | 233,877 | -0,131357432 | 0,2800 | -131,35743 | 3,9591245 | 131,417083 |
| Total | Chromium | 222,5897 | 266,45474 | | | | 641663,184 | | | | | 34425,1345 |
| Total uncertainties | | | | | **Year (%):** | | **801,039** | | | **Trend (%):** | | **185,540** |

Uncertainty estimation, Copper.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | Copper | 4965 | 6942 | 2 | 1000 | 1000,002 | 802,317 | 0,062541589 | 1,0546 | 62,5415886 | 2,982850913 | 62,6126801 |
| Other mobile sources | Copper | 1617 | 1710 | 10 | 1000 | 1000,050 | 197,695 | -0,062858991 | 0,2598 | -62,858991 | 3,674765077 | 62,9663132 |
| Total | Copper | 6582,1835 | 8651,8997 | | | | 682795,544 | | | | | 7885,10431 |
| Total uncertainties | | | | | **Year (%):** | | **826,314** | | | **Trend (%):** | | **88,798** |

Uncertainty estimation, Mercury.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | Mercury | 0 | 0 | 2 | 1000 | 1000,002 | 0,000 | 0 | 0,0000 | 0 | 0 | 0 |
| Other mobile sources | Mercury | 17 | 12 | 10 | 1000 | 1000,050 | 1000,050 | 0 | 0,7207 | 0 | 10,19189852 | 10,1918985 |
| Total | Mercury | 16,931552 | 12,202164 | | | | 1000100,000 | | | | | 103,874795 |
| Total uncertainties | | | | | **Year (%):** | | **1000,050** | | | **Trend (%):** | | **10,192** |

Uncertainty estimation, Nickel.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | Nickel | 204 | 286 | 2 | 1000 | 1000,002 | 343,186 | 0,074282429 | 0,0920 | 74,2824287 | 0,260092577 | 74,282884 |
| Other mobile sources | Nickel | 2904 | 547 | 10 | 1000 | 1000,050 | 656,848 | -0,073643299 | 0,1760 | -73,643299 | 2,488927719 | 73,685346 |
| Total | Nickel | 3108,0281 | 832,7973 | | | | 549225,356 | | | | | 10947,4771 |
| Total uncertainties | | | | | **Year (%):** | | **741,097** | | | **Trend (%):** | | **104,630** |

Uncertainty estimation, Lead.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | Lead | 97510 | 50 | 2 | 1000 | 1000,002 | 38,207 | -0,011208835 | 0,0005 | -11,208835 | 0,001355191 | 11,2088354 |
| Other mobile sources | Lead | 6178 | 1251 | 10 | 1000 | 1000,050 | 961,842 | 0,011307508 | 0,0121 | 11,3075078 | 0,170574616 | 11,3087943 |
| Total | Lead | 103687,72 | 1300,3041 | | | | 926598,884 | | | | | 253,526818 |
| Total uncertainties | | | | | **Year (%):** | | **962,600** | | | **Trend (%):** | | **15,923** |

Uncertainty estimation, Selenium.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | Selenium | 29 | 41 | 2 | 1000 | 1000,002 | 391,116 | 0,135162131 | 0,2997 | 135,162131 | 0,847736324 | 135,16479 |
| Other mobile sources | Selenium | 107 | 64 | 10 | 1000 | 1000,050 | 608,915 | -0,134395995 | 0,4666 | -134,39599 | 6,598734386 | 134,557893 |
| Total | Selenium | 136,15561 | 104,33891 | | | | 523749,345 | | | | | 36375,3471 |
| Total uncertainties | | | | | **Year (%):** | | **723,705** | | | **Trend (%):** | | **190,723** |

Uncertainty estimation, Zinc.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | Zinc | 2921 | 4083 | 2 | 1000 | 1000,002 | 783,618 | 0,083962682 | 1,0031 | 83,9626819 | 2,837258016 | 84,0106064 |
| Other mobile sources | Zinc | 1150 | 1128 | 10 | 1000 | 1000,050 | 216,395 | -0,084326984 | 0,2770 | -84,326984 | 3,917332359 | 84,4179232 |
| Total | Zinc | 4070,5314 | 5210,7663 | | | | 660883,327 | | | | | 14184,1678 |
| Total uncertainties | | | | | **Year (%):** | | **812,947** | | | **Trend (%):** | | **119,097** |

Uncertainty estimation, Dioxins.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | g dioxins | g dioxins | % | % | % | % | % | % | % | % | % |
| Road Transportation | Dioxins | 1 | 0 | 2 | 1000 | 1000,002 | 477,917 | -0,092027886 | 0,1473 | -92,027886 | 0,416679042 | 92,0288298 |
| Other mobile sources | Dioxins | 0 | 0 | 10 | 1000 | 1000,050 | 522,110 | 0,092539883 | 0,1609 | 92,5398827 | 2,275934696 | 92,5678657 |
| Total | Dioxins | 1,1053423 | 0,3407231 | | | | 501003,542 | | | | | 17038,1153 |
| Total uncertainties | | | | | **Year (%):** | | **707,816** | | | **Trend (%):** | | **130,530** |

Uncertainty estimation, Flouranthene.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | Flouranthene | 785 | 735 | 2 | 1000 | 1000,002 | 752,508 | -0,002498291 | 0,7065 | -2,4982907 | 1,99826313 | 3,19914238 |
| Other mobile sources | Flouranthene | 255 | 242 | 10 | 1000 | 1000,050 | 247,506 | 0,00251101 | 0,2324 | 2,51101022 | 3,286066983 | 4,13562674 |
| Total | Flouranthene | 1039,743 | 976,16557 | | | | 627527,373 | | | | | 27,3379205 |
| Total uncertainties | | | | | **Year (%):** | | **792,166** | | | **Trend (%):** | | **5,229** |

Uncertainty estimation, Benzo(b) flouranthene.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | Benzo(b) flouranthene | 65 | 73 | 2 | 1000 | 1000,002 | 744,546 | 0,038796111 | 0,7946 | 38,7961107 | 2,247448048 | 38,8611532 |
| Other mobile sources | Benzo(b) flouranthene | 27 | 25 | 10 | 1000 | 1000,050 | 255,468 | -0,038956982 | 0,2726 | -38,956982 | 3,855529022 | 39,1473059 |
| Total | Benzo(b) flouranthene | 92,122538 | 98,31501 | | | | 619612,891 | | | | | 3042,70079 |
| Total uncertainties | | | | | **Year (%):** | | **787,155** | | | **Trend (%):** | | **55,161** |

Uncertainty estimation, Benzo(k) flouranthene.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | Benzo(k) flouranthene | 66 | 85 | 2 | 1000 | 1000,002 | 804,847 | 0,058627338 | 0,9711 | 58,6273382 | 2,746549763 | 58,6916376 |
| Other mobile sources | Benzo(k) flouranthene | 21 | 21 | 10 | 1000 | 1000,050 | 195,165 | -0,058926645 | 0,2355 | -58,926645 | 3,329851082 | 59,0206522 |
| Total | Benzo(k) flouranthene | 87,445276 | 105,50343 | | | | 685867,391 | | | | | 6928,14571 |
| Total uncertainties | | | | | **Year (%):** | | **828,171** | | | **Trend (%):** | | **83,235** |

Uncertainty estimation, Benzo(a) pyrene.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | Benzo(a) pyrene | 45 | 54 | 2 | 1000 | 1000,002 | 838,603 | 0,033257852 | 0,9802 | 33,2578515 | 2,772359729 | 33,3732028 |
| Other mobile sources | Benzo(a) pyrene | 11 | 10 | 10 | 1000 | 1000,050 | 161,407 | -0,033463604 | 0,1886 | -33,463604 | 2,667869945 | 33,5697825 |
| Total | Benzo(a) pyrene | 55,283486 | 64,616669 | | | | 729306,859 | | | | | 2240,70097 |
| Total uncertainties | | | | | **Year (%):** | | **853,995** | | | **Trend (%):** | | **47,336** |

Uncertainty estimation, Benzo(g,h,i) perylene.

| | Gas | Base year emission | Year t emission | Activity Data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | Benzo(g,h,i) perylene | 95 | 102 | 2 | 1000 | 1000,002 | 756,793 | 0,033416225 | 0,7771 | 33,4162249 | 2,198024105 | 33,4884367 |
| Other mobile sources | Benzo(g,h,i) perylene | 36 | 33 | 10 | 1000 | 1000,050 | 243,220 | -0,033565527 | 0,2497 | -33,565527 | 3,531868291 | 33,7508323 |
| Total | Benzo(g,h,i) perylene | 130,7031 | 134,21374 | | | | 631892,155 | | | | | 2260,59408 |
| Total uncertainties | | | | | **Year (%):** | | **794,916** | | | **Trend (%):** | | **47,546** |

Uncertainty estimation, indeno(1,2,3-c,d) pyrene.

| | Gas | Base year emission | Year t emission | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in year t | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor uncertainty | Uncertainty in trend in national emissions introduced by activity data uncertainty | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Input data | Input data | Input data | Input data | | | | | | | |
| | | kg | kg | % | % | % | % | % | % | % | % | % |
| Road Transportation | indeno(1,2,3-c,d) pyr. | 43 | 59 | 2 | 1000 | 1000,002 | 731,326 | 0,111782192 | 0,8838 | 111,782192 | 2,499712828 | 111,810139 |
| Other mobile sources | indeno(1,2,3-c,d) pyr. | 24 | 22 | 10 | 1000 | 1000,050 | 268,689 | -0,112090122 | 0,3247 | -112,09012 | 4,591751708 | 112,184133 |
| Total | indeno(1,2,3-c,d) pyr. | 67,312397 | 81,344866 | | | | 607031,268 | | | | | 25086,7868 |
| Total uncertainties | | | | | **Year (%):** | | **779,122** | | | **Trend (%):** | | **158,388** |

# Annex 2C

## Agriculture

## Annex 2C.1 Background information - $NH_3$ from Manure Management

### 1. N-excretion

In Table 2C.1 is given the average N-excretion (total N) for each NFR livestock category from 1985 to 2008. Notice that each livestock category is an aggregated average of different subcategories (see Table 6.3 in Chapter 6). The N-excretion is based on information from the Danish Institute of Agricultural Science.

Table 2C.1 Nitrogen excretion (total N) rates in average, 1985 – 2008, kg N pr head pr year.

| Livestock categories: | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dairy cattle | 121.49 | 123.66 | 125.82 | 128.05 | 130.33 | 129.49 | 128.63 | 127.76 | 126.89 | 126.06 | 125.22 | 125.09 |
| Non-dairy | 35.73 | 35.77 | 35.91 | 36.13 | 36.33 | 36.57 | 36.68 | 36.80 | 36.92 | 36.64 | 36.56 | 36.62 |
| Sheep | 21.04 | 21.04 | 21.04 | 21.04 | 21.04 | 21.18 | 21.33 | 21.47 | 21.61 | 21.76 | 21.90 | 20.11 |
| Goats | 21.04 | 21.04 | 21.04 | 21.04 | 21.04 | 21.18 | 21.33 | 21.47 | 21.61 | 21.76 | 21.90 | 20.11 |
| Horses | 50.00 | 50.00 | 50.00 | 50.00 | 50.00 | 48.89 | 47.77 | 46.66 | 45.54 | 44.42 | 43.31 | 43.31 |
| Swine | 11.84 | 11.80 | 11.42 | 11.35 | 11.09 | 10.48 | 10.32 | 10.07 | 9.39 | 9.39 | 8.64 | 8.89 |
| Poultry | 0.54 | 0.57 | 0.57 | 0.64 | 0.65 | 0.70 | 0.70 | 0.62 | 0.64 | 0.71 | 0.66 | 0.65 |
| Fur farming | 5.28 | 5.20 | 5.11 | 5.03 | 4.93 | 4.90 | 4.83 | 4.80 | 4.75 | 4.70 | 4.65 | 4.66 |
| Deer | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 |
| Ostrich | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.60 | 15.60 | 15.60 | 15.60 |
| Pheasant | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| N-excretion. total (M kg N/year) | 267 | 269 | 271 | 273 | 275 | 273 | 272 | 270 | 267 | 265 | 263 | 259 |

*Continued*

| Livestock categories: | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dairy cattle | 124.94 | 124.82 | 124.60 | 125.31 | 125.31 | 127.74 | 129.79 | 131.56 | 133.30 | 134.66 | 137.58 | 137.98 |
| Non-dairy | 36.81 | 36.71 | 36.98 | 37.20 | 37.61 | 37.59 | 37.44 | 38.39 | 40.79 | 43.05 | 44.93 | 45.01 |
| Sheep | 18.32 | 16.53 | 14.75 | 16.95 | 16.95 | 16.95 | 16.95 | 16.95 | 16.95 | 16.95 | 16.95 | 16.95 |
| Goats | 18.32 | 16.53 | 14.75 | 16.95 | 16.95 | 16.36 | 16.36 | 16.36 | 16.36 | 16.36 | 15.61 | 16.32 |
| Horses | 43.31 | 43.31 | 43.31 | 43.31 | 43.31 | 43.31 | 43.31 | 43.31 | 43.31 | 43.31 | 39.56 | 39.56 |
| Swine | 8.73 | 8.67 | 8.85 | 8.69 | 8.27 | 8.59 | 8.25 | 8.50 | 8.07 | 7.68 | 7.61 | 7.85 |
| Poultry | 0.66 | 0.65 | 0.60 | 0.57 | 0.60 | 0.61 | 0.69 | 0.79 | 0.75 | 0.64 | 0.63 | 0.79 |
| Fur farming | 4.65 | 4.64 | 4.63 | 4.63 | 4.62 | 4.61 | 4.61 | 5.09 | 5.38 | 5.18 | 5.18 | 5.29 |
| Deer | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 |
| Ostrich | 15.60 | 15.60 | 15.60 | 15.60 | 15.60 | 15.60 | 15.60 | 15.60 | 15.60 | 15.60 | 15.60 | 15.60 |
| Pheasant | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| N-excretion. total (M kg N/year) | 256 | 252 | 248 | 254 | 254 | 256 | 257 | 261 | 265 | 268 | 268 | 270 |

### 2. Stable system

A systematic statement of the stabling of husbandry does not exist and the stabling is therefore based on estimate from the Danish Agricultural Advisory Centre (Rasmussen, J.B. and Lundgaard, N.H., pers. comm.). The structural development in the agricultural sector has an influence in change of stable types. The last few years new stables have been build and for most of these new stables, tied-up stables are replaced by bigger stables with loose-holding. In 1985 85% of the dairy cattle were kept in tied-up stables and in 2008 the part is reduced to 17%. In loose-holding systems the cattle have more space and this will increase the ammonia emission per animal compared to the tied-up stables. In Table 2C.2 the distribution of stable type for dairy cattle and slaughtering pigs from 1985-2008 is listed.

Table 2C.2 The percentage distribution of stable type – Dairy cattle and slaughtering pigs 1985 – 2008.

| Distribution of stable type | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dairy cattle | | | | | | | | | | | | |
| Tied-up stables | 85 | 84 | 83 | 82 | 80 | 79 | 78 | 77 | 75 | 74 | 73 | 72 |
| Loose-holdings with beds | 14 | 15 | 15 | 16 | 17 | 18 | 18 | 19 | 20 | 21 | 21 | 22 |
| Deep litter | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 |
| Slaughtering pigs | | | | | | | | | | | | |
| Full slatted floor | 29 | 33 | 38 | 42 | 47 | 51 | 56 | 60 | 60 | 60 | 60 | 60 |
| Partly slatted floor | 30 | 29 | 27 | 26 | 24 | 23 | 21 | 20 | 21 | 23 | 24 | 25 |
| Solid floor | 40 | 36 | 33 | 29 | 26 | 22 | 19 | 15 | 14 | 12 | 11 | 9 |
| Deep litter | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 5 | 5 | 6 |
| Distribution of stable type | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| Dairy cattle | | | | | | | | | | | | |
| Tied-up stables | 66 | 60 | 60 | 46 | 40 | 35 | 26 | 22 | 26 | 26 | 17 | 17 |
| Loose-holdings with beds | 26 | 30 | 30 | 43 | 49 | 54 | 63 | 67 | 66 | 66 | 76 | 76 |
| Deep litter | 8 | 10 | 10 | 11 | 11 | 11 | 11 | 11 | 8 | 8 | 7 | 7 |
| Slaughtering pigs | | | | | | | | | | | | |
| Full slatted floor | 60 | 60 | 60 | 58 | 57 | 56 | 55 | 53 | 49 | 49 | 53 | 53 |
| Partly slatted floor | 26 | 28 | 29 | 31 | 33 | 34 | 35 | 38 | 38 | 38 | 38 | 38 |
| Solid floor | 8 | 6 | 5 | 5 | 4 | 4 | 4 | 3 | 7 | 7 | 4 | 4 |
| Deep litter | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 |

## 3. Emission of ammonia

### 3.1 Stable

The emission from stables is thus determined by a number of different conditions that depends on stable type and the different kinds of manure disposal systems placed in these stables. Faculty of Agricultural Sciences, University of Aarhus has carried out a number of emission surveys and estimated emission coefficients for different types of stables (Poulsen et al., 2001). In Table 2C.3 is shown the emission from Dairy cattle and slaughtering pigs in different stable systems. For the slurry and liquid manure is given TAN emission coefficients (TAN ab animal) and for solid and deep litter manure is given N ab animal, because the emission coefficients for solid and deep litter is not jet adjusted to TAN.

Table 2C.3 Ammonia emission from stables 2008 – Dairy cattle and slaughtering pigs.

| Livestock category | Manure system | Manure type | Ammonia emission pct $NH_3$-N of N ab Animal | Ammonia emission pct $NH_3$-N of TAN ab Animal |
|---|---|---|---|---|
| Dairy cattle | Tied-up | Solid manure | 6.0 | |
| | | + Liquid | | 10.0 |
| | Tied-up | Slurry | | 6.0 |
| | Loose-holding with beds, slatted floor | Slurry | | 16.0 |
| | Loose-holding with beds, slatted floor, scrapes | Slurry | | 12.0 |
| | Loose-holding with beds, solid floor | Slurry | | 20.0 |
| | Loose-holding with beds, drained floor | Slurry | | 8.0 |
| | Deep litter (all) | Deep litter | 6.0 | |
| | Deep litter, slatted floor | Deep litter | 6.0 | |
| | | + Slurry | | 16.0 |
| | Deep litter, slatted floor, scrapes | Deep litter | 6.0 | |
| | | + Slurry | | 12.0 |
| | Deep litter, solid floor, scrapes | Deep litter | 6.0 | |
| | | + Slurry | | 20.0 |
| Slaughtering pigs | Full slatted floor | Slurry | | 24.0 |
| | Partly slatted floor (50-75% solid floor) | Slurry | | 13.0 |
| | Partly slatted floor (25-49% solid floor) | Slurry | | 17.0 |
| | Solid floor | Solid manure | 25.0 | |
| | | + Liquid | | 27.0 |
| | Deep litter | Deep litter | 25.0 | |
| | Partly slatted floor and partly deep litter | Deep litter | 25.0 | |
| | | + Slurry | | 18.0 |

### 3.2 Storage

Livestock manure is collected either as solid manure or as slurry depending on stable type. In Table 2C.4 is shown the emission factor used for storage. It is assumed that the part of solid manure taken directly from the stable into the field is 65% from cattle, 25% from pigs, 50% sows, 15% from poultry and 5% from hens (Poulsen et al. 2008). The remaining part of the solid manure is deposited in stock piles in the field before field application.

By law all slurry tanks have to be covered by a crust in order to reduce ammonia emission. However, investigations show that that slurry tanks were incompletely covered earlier (COWI 2000), which result in a higher ammonia emission. In 2008 it is assumed that 5% of the tanks with pig slurry and 2% of tanks with cattle slurry are incompletely covered. This information has been incorporated in the emission inventory.

Table 2C.4 Emission factors for storage 2008.

| | | Liquid manure | Slurry | Solid manure | Deep litter |
|---|---|---|---|---|---|
| | | Loss of $NH_3$-N in % | | | |
| Animal category | | of TAN ab stable | of TAN ab stable | of N ab stable | of N ab stable |
| Cattle | | 2.2 | 3.5 | 4.0 | 1.05 |
| Swine | Slaughter pigs | 2.2 | 2.9 | 19.0 | 9.75 |
| | Sows | | 2.9 | 19.0 | 6.50 |
| Poultry | Hens and pullet | | 2.0[a] | 7.5 | 4.75 |
| | Broilers, geese and ducks | | | 7.5 | 6.80 |
| | Turkey | | | 7.5 | 8.00 |
| Fur farming | | | 3.1 | 11.5 | |
| Sheep/goats | | | | | 3.0 |
| Horses | | | | | 3.0 |

[a] Loss of $NH_3$-N in % of N ab stable.

### 3.3 Spreading in fields

There is no statistical information on how the farmer handling the manure in practice. In calculation of emission from application of manure on the fields is used to different weighted emission factors, which distinguish between solid manure and liquid manure. In 2008 the emission factor for solid manure is estimated to 6% and liquid manure is estimated to 15% for cattle and 11% for swine of TAN ab storage.

The weighted emission factor will vary from year to year depending on changes in the practice of spreading. The weighted emission factor is based on background estimates of time of spreading, application methods, spreading in growing crops or on bare soil and the time from spreading to ploughing in soil. In Table 2C.5 background information for 2008 are given.

Table 2C.5 Estimate for application method, time of spreading and time before the manure is incorporated in the soil (Based on information from the Organisation "Danish Agriculture").

| Application methods 2008 | Time of spreading | Percentage distribution of manure | | Time before incorporation in soil: 0 | | Harrowed | | Ploughed | | Not incorporated | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cattle | Swine | Cattle | Swine | Cattle | Swine | Cattle | Swine | Cattle | Swine |
| Liquid manure | | | | | | | | | | | |
| Incorporated | winter-spring | 49 | 24 | 49 | 24 | - | - | - | - | - | - |
| Incorporated | summer-autumn | 14 | 4 | 14 | 4 | - | - | - | - | - | - |
| Trailing horses | winter-spring | 26 | 64 | - | - | 2 | 3 | 2 | 2 | 22 | 59 |
| Trailing horses | spring-summer | 2 | 2 | - | - | - | - | - | - | 2 | 2 |
| Trailing horses | late summer-autumn | 9 | 6 | - | - | 3 | 2 | 2 | 1 | 4 | 3 |
| Broad spreading | winter-spring | - | - | - | - | - | - | - | - | - | - |
| Broad spreading | spring-summer | - | - | - | - | - | - | - | - | - | - |
| Broad spreading | late summer-autumn | - | - | - | - | - | - | - | - | - | - |
| Total | | 100 | 100 | 63 | 28 | 5 | 5 | 4 | 3 | 28 | 64 |
| | | | | Time before incorporation in soil: 0 | | 4 hours | | 6 hours | | Not incorporated | |
| | | | | Cattle | Swine | Cattle | Swine | Cattle | Swine | Cattle | Swine |
| Solid manure | | | | | | | | | | | |
| Broad spreading | winter-spring | 81 | 81 | - | - | 60 | 60 | 12 | 12 | 9 | 9 |
| Broad spreading | spring-summer | 0 | 0 | - | - | - | - | - | - | - | - |
| Broad spreading | late summer-autumn | 19 | 19 | - | - | 8,5 | 8,5 | 8,5 | 8,5 | 2 | 2 |
| Total | | 100 | 100 | - | - | 68.5 | 68.5 | 20.5 | 20.5 | 11 | 11 |

## Annex 2C.2 Background information - $NH_3$ from Agricultural Soils

### 1. Synthetic fertiliser

Since 1985 there has been a significant decrease in use of synthetic fertiliser. This is due to requirements to utilising of nitrogen in manure as outlined for example in the Action Plan on the Aquatic Environment. Further, the use of different fertiliser types has changed. At present, urea constitutes less than 1% of the total nitrogen used as fertiliser (Table 2C.6). It is estimated that 1.8% of the total nitrogen used in synthetic fertiliser is emitted as ammonia in 2008. It means the implied emission factor for 2007 is 1.8% compared to 10% in the EMEP/EEA Guidebook.

Data on the use of synthetic fertiliser is based on the sale estimations collected by the Danish Plant Directorate (2008). Emission factors are based on the values given in EMEP/EEA (2009).

The use of mineral fertiliser includes fertiliser used in parks, golf courses and private gardens. Approximately 1-2 percent of the mineral fertiliser can be related to this use out side the agriculture area.

Table 2C.6 Synthetic fertiliser consumption 2008 and emission factors.

| Synthetic fertiliser year 2008 | $NH_3$ Emission factor[1], Kg $NH_3$-N pr kg N | Consumption[2], t N |
|---|---|---|
| Fertiliser type | | |
| Calcium and boron calcium nitrate | 0.01 | 0.1 |
| Ammonium sulphate | 0.02 | 6.2 |
| Calcium ammonium nitrate and other nitrate types | 0.01 | 104.9 |
| Ammonium nitrate | 0.01 | 9.7 |
| Liquid ammonia | 0.02 | 4.1 |
| Urea | 0.13 | 0.1 |
| Other nitrogen fertiliser | 0.06 | 18.1 |
| Magnesium fertiliser | 0.01 | 0.0 |
| NPK-fertiliser | 0.01 | 66.2 |
| Diammonphosphate | 0.01 | 0.4 |
| Other NP fertiliser types | 0.01 | 4.3 |
| NK fertiliser | 0.01 | 6.2 |
| Total consumption of N in synthetic fertiliser | | 220.4 |
| Total emission of $NH_3$-N (M kg) | 4.00 | |
| Average $NH_3$-N emission (FracGASF) | 0.02 | |

[1] EMEP/EEA (2009).
[2] The Danish Plant Directorate.

### 2. Grazing

It is assumed that 5% of the manure from dairy cattle is deposited in the field, which corresponding to 18 days per year. For heifers 36% of the nitrogen in the manure is estimated deposited during grazing, 61% for suckling cows, 50% for horses and 73% for sheep and goats.

An emission factor of 7% of the total nitrogen content is assumed to evaporate as $NH_3$ (Jarvis *et al.* 1998a, Jarvis *et al.* 1989b and Bussink 1994). The emission factor is used on all animal categories.

### 3. Crops

In the Danish emission inventory it is chosen to include $NH_3$ emission from crops, despite the uncertainties related to this emission source. Literature research shows that the volatilisation from crop types differs considerably (Andersen *et al*. 1999). The emission factors for crops are lowered from 5 to 2 % for crops and from 3 to 0.5 % for grass based on a literary survey (Gyldenkærne and Albrektsen, 2009). However, as for the emission ceiling given in the Gothenburg-Protocol and the EU NEC Directive the emission from crops is not taken into account.

Table 2C.7 Emission factor used to estimate the emission of ammonia from crops.

| Emission factor | Crops<br>kg N pr ha |
| --- | --- |
| Cash crops. beets and silage maize | 2 |
| Grass/clover in rotation | 0.5 |
| Permanent grass | 0.5 |
| Set-a side | 0 |

### 4. Ammonia treated straw

Ammonia is used for conservation of straw for feeding. Investigations show that 80-90% of the supplied ammonia (given in $NH_3$-N) will emit (Andersen *et al*. 1999). However, the emissions can be reduced particularly if the right dose is used. Therefore it is estimated that the emission factor is 65% of the applied ammonia (given in $NH_3$-N). Information on ammonia used for treatment of straw is collected from ammonia suppliers. Ammonia treated straw has been prohibited from 2006.

As for the emission ceiling given in the Gothenburg-Protocol and the EU NEC Directive the emission from ammonia treated straw is not taken into account.

# Annex 2C.3 Background information - Field burning of Agricultural Wastes

Table 2C.8 Emissions of pollutants from field burning of agricultural wastes, 1985-2008.

| | Unit | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $NO_X$ | Gg | 1.53 | 1.32 | 1.25 | 0.93 | 0.98 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 |
| CO | Gg | 37.58 | 32.29 | 30.67 | 22.93 | 24.13 | 1.89 | 1.97 | 1.88 | 2.06 | 1.98 | 2.24 | 2.23 |
| NMVOC | Gg | 4.02 | 3.45 | 3.28 | 2.45 | 2.58 | 0.20 | 0.21 | 0.20 | 0.22 | 0.21 | 0.24 | 0.24 |
| $SO_2$ | Gg | 0.19 | 0.16 | 0.16 | 0.12 | 0.12 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| $NH_3$ | Gg | 1.53 | 1.32 | 1.25 | 0.93 | 0.98 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 |
| TSP | Mg | 3.70 | 3.18 | 3.02 | 2.26 | 2.38 | 0.19 | 0.19 | 0.19 | 0.20 | 0.20 | 0.22 | 0.22 |
| PM10 | Mg | 3.70 | 3.18 | 3.02 | 2.26 | 2.38 | 0.19 | 0.19 | 0.19 | 0.20 | 0.20 | 0.22 | 0.22 |
| PM2,5 | Mg | 3.51 | 3.01 | 2.86 | 2.14 | 2.25 | 0.18 | 0.18 | 0.18 | 0.19 | 0.19 | 0.21 | 0.21 |
| Pb | Mg | 0.55 | 0.47 | 0.45 | 0.34 | 0.35 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Cd | Mg | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hg | Mg | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| As | Mg | 0.04 | 0.03 | 0.03 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cr | Mg | 0.14 | 0.12 | 0.11 | 0.09 | 0.09 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Cu | Mg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ni | Mg | 0.11 | 0.10 | 0.09 | 0.07 | 0.07 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Se | Mg | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Zn | Mg | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| DIOX | g I-Teq | 0.38 | 0.32 | 0.31 | 0.23 | 0.24 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Benzo(a)pyrene | Mg | 1.78 | 1.53 | 1.45 | 1.08 | 1.14 | 0.09 | 0.09 | 0.09 | 0.10 | 0.09 | 0.11 | 0.11 |
| Benzo(b)fluoranthene | Mg | 1.74 | 1.50 | 1.42 | 1.06 | 1.12 | 0.09 | 0.09 | 0.09 | 0.10 | 0.09 | 0.10 | 0.10 |
| Benzo(k)fluoranthene | Mg | 0.68 | 0.59 | 0.56 | 0.42 | 0.44 | 0.03 | 0.04 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 |
| Indeno(1,2,3-cd)pyrene | Mg | 0.65 | 0.56 | 0.53 | 0.40 | 0.42 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 | 0.04 | 0.04 |

*Continued*

| | Unit | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $NO_X$ | Gg | 0.10 | 0.12 | 0.12 | 0.11 | 0.12 | 0.10 | 0.12 | 0.13 | 0.13 | 0.13 | 0.11 | 0.10 |
| CO | Gg | 2.37 | 2.98 | 2.83 | 2.79 | 2.93 | 2.44 | 2.93 | 3.07 | 3.12 | 3.16 | 2.73 | 2.53 |
| NMVOC | Gg | 0.25 | 0.32 | 0.30 | 0.30 | 0.31 | 0.26 | 0.31 | 0.33 | 0.33 | 0.34 | 0.29 | 0.27 |
| $SO_2$ | Gg | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 |
| $NH_3$ | Gg | 0.10 | 0.12 | 0.12 | 0.11 | 0.12 | 0.10 | 0.12 | 0.13 | 0.13 | 0.13 | 0.11 | 0.10 |
| TSP | Mg | 0.23 | 0.29 | 0.28 | 0.27 | 0.29 | 0.24 | 0.29 | 0.30 | 0.31 | 0.31 | 0.27 | 0.25 |
| PM10 | Mg | 0.23 | 0.29 | 0.28 | 0.27 | 0.29 | 0.24 | 0.29 | 0.30 | 0.31 | 0.31 | 0.27 | 0.25 |
| PM2,5 | Mg | 0.22 | 0.28 | 0.26 | 0.26 | 0.27 | 0.23 | 0.27 | 0.29 | 0.29 | 0.30 | 0.26 | 0.24 |
| Pb | Mg | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 | 0.04 | 0.04 |
| Cd | Mg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hg | Mg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| As | Mg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cr | Mg | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Cu | Mg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ni | Mg | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Se | Mg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Zn | Mg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| DIOX | g I-Teq | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Benzo(a)pyrene | Mg | 0.11 | 0.14 | 0.13 | 0.13 | 0.14 | 0.12 | 0.14 | 0.15 | 0.15 | 0.15 | 0.13 | 0.12 |
| Benzo(b)fluoranthene | Mg | 0.11 | 0.14 | 0.13 | 0.13 | 0.14 | 0.11 | 0.14 | 0.14 | 0.14 | 0.15 | 0.13 | 0.12 |
| Benzo(k)fluoranthene | Mg | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 | 0.04 | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 | 0.05 |
| Indeno(1,2,3-cd)pyrene | Mg | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.04 |

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Emission inventories from the base year of the protocols to year 2008

This report is a documentation report on the emission inventories for Denmark as reported to the UNECE Secretariat under the Convention on Long Range Transboundary Air Pollution due by 15 February 2010. The report contains information on Denmark's emission inventories re-garding emissions of (1) $SO_X$ for the years 1980-2008, (2) $NO_X$, CO, NMVOC and $NH_3$ for the years 1985-2008, (3) Particulate matter: TSP, PM10, $PM_{2.5}$ for the years 2000-2008, (4) Heavy Metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se and Zn for the years 1990-2008, (5) Polyaromatic hydro-carbons (PAH): Benzo(a) pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene for the years 1990-2008 and (6) Dioxin and HCB. Further, the report contains information on background data for emissions inventory.

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