DANISH EMISSION INVENTORIES FOR STATIONARY COMBUSTION PLANTS

Inventories until 2008

NERI Technical Report no. 795 2010

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Data sheet

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Abstract: Emission inventories for stationary combustion plants are presented and the methodologies and assumptions used for the inventories are described. The pollutants considered are SO_2, NO_x, NMVOC, CH_4, CO, CO_2, N_2O, NH_3, particulate matter, heavy metals, dioxins, HCB and PAH. The CO_2 emission in 2008 was 16 % lower than in 1990. However, fluctuations in the emission level are large as a result of electricity import/export. The emission of CH_4 has increased due to increased use of lean-burn gas engines in combined heating and power (CHP) plants. However, the emission has decreased in recent years due to structural changes in the Danish electricity market. The N_2O emission was higher in 2008 than in 1990 but the fluctuations in the time-series are significant. A considerable decrease of the SO_2, NO_x and heavy metal emissions is mainly a result of decreased emissions from large power plants and waste incineration plants. The combustion of wood in residential plants has increased considerably in recent years resulting in increased emission of PAH, particulate matter and CO. The emission of NMVOC has increased since 1990 as a result of both the increased combustion of wood in residential plants and the increased emission from lean-burn gas engines. The dioxin emission decreased since 1990 due to flue gas cleaning on waste incineration plants. However in recent years the emission has increased as a result of the increased combustion of wood in residential plants.

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Contents

List of abbreviations

As	Arsenic
BAT	Best Available Techniques
BREF	BAT Reference Document
Cd	Cadmium
CH_4	Methane
CHP	Combined Heat and Power
CLRTAP	Convention on Long-Range Transboundary Air Pollution
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CORINAIR	CORe INventory on AIR emissions
Cr	Chromium
CRF	Common Reporting Format
Cu	Copper
DEA	Danish Energy Agency
DEPA	Danish Environmental Protection Agency
EEA	European Environment Agency
EMEP	European Monitoring and Evaluation Programme
EU ETS	EU Emission Trading Scheme
GHG	GreenHouse Gas
HCB	Hexachlorobenzene
Hg	Mercury
HM	Heavy metals
IIR	Informative Inventory Report
IPCC	Intergovernmental Panel on Climate Change
LPG	Liquefied Petroleum Gas
LRTAP	Long-Range Transboundary Air Pollution
LULUCF	Land Use, Land-Use Change and Forestry
MSW	Municipal Solid Waste
N_2O	Nitrous Oxide
NECD	European Commissions National Emissions Ceiling Directive
NH_3	Ammonia
Ni	Nickel
NIR	National Inventory Report
NMVOC	Non-Methane Volatile Organic Compounds
NO_x	Nitrogen Oxides
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCB	Polychlorinated biphenyl
PCDD/-F	Poly Chlorinated Dibenzo Dioxins and Furans
PM	Particulate Matter
PM_{10}	Particulate Matter < 2.5 µm
$PM_{2.5}$	Particulate Matter < 10 µm
POP	Persistent Organic Pollutant
Se	Selenium
SNAP	Selected Nomenclature for Air Pollution
SO_2	Sulphur dioxide
TSP	Total Suspended Particulates
UHC	Unburned hydrocarbons
UNECE	United Nations Economic Commission for Europe
Zn	Zinc

Preface

On behalf of the Ministry of the Environment and the Ministry of Climate and Energy, the Danish National Environmental Research Institute (NERI) at Aarhus University prepares the Danish atmospheric emission inventories and reports the results on an annual basis to the United Nations Framework Convention on Climate Change (UNFCCC) and to the United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution (LRTAP Convention). This report forms part of the documentation for the inventories and covers emissions from stationary combustion plants. The results of inventories up to 2008 are included. The report updates the four reports published in 2004, 2006, 2007 and 2009.

The 2004, 2006 and 2009 updates of this report were reviewed by Jan Erik Johnsson from the Technical University of Denmark, Bo Sander from Elsam Engineering and Annemette Geertinger from FORCE Technology.

Summary

Danish emission inventories are prepared on an annual basis and are reported to the United Nations Framework Convention on Climate Change (UNFCCC or Climate Convention) and to the Kyoto Protocol as well as to the United Nations Economic Commission for Europe (UN-ECE) Convention on Long-Range Transboundary Air Pollution (LRTAP Convention). Furthermore, a greenhouse gas emission inventory is reported to the European Union (EU) due to the EU – as well as the individual member states – being party to the Climate Convention. Four pollutants are estimated for reporting to the European Commissions National Emissions Ceiling Directive (NECD). The annual Danish emission inventories are prepared by the Danish National Environmental Research Institute (NERI), Aarhus University (AU). The inventories include the following pollutants relevant to stationary combustion: CO_2, CH_4, N_2O, SO_2, NO_x, NMVOC, CO, particulate matter, NH_3, heavy metals, dioxins, PAH and HCB. In addition to annual national emissions, the report includes emission data for a number of source categories. Every five years the reporting includes data on the geographical distribution of the emissions, a projection of emissions, data and details of the activity data, e.g. fuel consumption – on which the inventories are based.

The inventories for stationary combustion are based on the Danish energy statistics and on a set of emission factors for various source categories, technologies and fuels. Plant specific emissions for large combustion sources are incorporated into the inventories. This report provides detailed background information on the methodology and references for the input data in the inventory - energy statistics and emission factors.

The emission factors are based on either national references or on international guidebooks (EEA, 2008; IPCC, 1997). The majority of the country-specific emission factors refer to: Danish legislation, Danish research reports or calculations based on plant-specific emission data from a considerable number of large point sources. The plant-specific emission factors are provided by plant operators, e.g. in annual environmental reports or in the EU ETS[1].

In the inventory for the year 2008, 70 stationary combustion plants are specified as large point sources. The point sources include large power plants, municipal waste incineration plants, industrial combustion plants and petroleum refining plants. The fuel consumption of these large point sources corresponds to 58 % of the overall fuel consumption of stationary combustion.

In 2008 the total fuel consumption was 7 % higher than in 1990; the fossil fuel consumption, however, was 7 % lower than in 1990. The use of coal has decreased whereas the use of natural gas and biomass has increased. The fuel consumption for stationary combustion plants fluctuates due to variation in the import/export of electricity from year to year.

[1] EU Emission Trading Scheme.

Stationary combustion plants account for more than 50 % of the national emission for the following pollutants: SO_2, CO_2, heavy metals (except Cu, Pb and Zn), PM_{10}, $PM_{2.5}$, dioxin, HCB and PAH. Furthermore, the emission from stationary combustion plants accounts for more than 10 % of the national emission for the following pollutants: NO_x, CO, NMVOC, TSP, Cu, Pb and Zn. Stationary combustion plants account for less than 10 % of the national emission of CH_4, N_2O and NH_3.

Public electricity and heat production are the most important stationary combustion emission source for CO_2, N_2O, SO_2 and NO_x.

Lean-burn gas engines installed in decentralised combined heating and power (CHP) plants and combustion of biomass in residential plants are the two largest emission sources for CH_4.

Residential plants represent the most important stationary combustion emission source for CO, NMVOC, particulate matter, PAH and dioxin. Wood combustion in residential plants is the predominant emission source.

Industrial plants, public electricity and heat production plants and residential plants are the main emission sources for the different heavy metals.

The greenhouse gas (GHG) emission trend follows the CO_2 emission trend closely. Both the CO_2 and the total GHG emission were lower in 2008 than in 1990: CO_2 by 16 % and GHG by 15 %. However, fluctuations in the GHG emission level are large. The fluctuations in the time-series are mainly a result of electricity import/export but also of outdoor temperature variations from year to year that results in fluctuations in the consumption for space heating.

The CH_4 emission from stationary combustion has increased by a factor of 3.5 since 1990. This is mainly a result of the considerable number of lean-burn gas engines installed in CHP plants in Denmark during the 1990s. In recent years the emission has declined. This is due to structural changes in the Danish electricity market, which means that the fuel consumption in gas engines has decreased. The CH_4 emission from residential plants has increased since 1990 due to increased combustion of wood in residential plants.

The emission of N_2O was 7 % higher in 2008 than in 1990. The fluctuations follow the fluctuations of the fuel consumption, which is a result of import/export of electricity.

SO_2 emission from stationary combustion plants has decreased by 90 % since 1990. The considerable emission decrease is mainly a result of the reduced emission from electricity and heat production due to installation of desulphurisation technology and the use of fuels with lower sulphur content. These improvements are a result of both sulphur tax laws and legislation concerning sulphur content of fuels, emission ceilings for large power plants and emission limits for several plant categories.

The NO_x emission from stationary combustion plants has decreased by 56 % since 1990. The reduced emission is mainly a result of the reduced

emission from electricity and heat production due to installation of low NO_x burners and selective catalytic reduction (SCR) units. The installation of the technical improvements was launched by legislation including emission ceilings for large power plants and lower emission limits for several plant categories. The fluctuations in the emission time-series follow fluctuations in electricity import/export.

In 2008 the wood consumption in residential plants was four times the 1990 level. This increase causes considerable changes in the emission of NMVOC, CO, PM and PAH from stationary combustion due to the fact that residential wood combustion is a major emission source for these pollutants. However, a change of technology (installation of modern stoves) has caused decreasing emission factors for several pollutants.

The CO emission from stationary combustion has increased 16 % since 1990. The increase in CO emission from residential plants is less than the increase in wood consumption because the CO emission factor for wood combustion in residential plants has decreased since 1990. Furthermore, the emission from straw-fired farmhouse boilers has decreased considerably.

The NMVOC emission from stationary combustion plants has increased 50 % since 1990. The increased NMVOC emission is mainly a result of the increasing wood combustion in residential plants and the increased use of lean-burn gas engines. The emission from straw-fired farmhouse boilers has decreased.

The emission of TSP, PM_{10} and $PM_{2.5}$ has increased by 57-62 % since 2000 due to the increase of wood combustion in residential plants. The emission of PAHs has increased by 120-170 % since 1990, also a result of the increased combustion of wood in residential plants.

All the heavy metal emissions have decreased considerably since 1990 – between 65 % and 87 %; Zn, however, only 5 %. This is a result of the installation and improved performance of gas cleaning devices in municipal waste incineration plants and large power plants.

Dioxin emission has decreased 55 % since 1990 mainly due to installation of dioxin filters in municipal solid waste (MSW) incineration plants that was necessary due to the emission limit included in Danish legislation. However, the emission from residential plants has increased due to the increased wood combustion in the sector. This has caused an increase of dioxin emission from stationary combustion since 2004.

The uncertainty level of the Danish greenhouse gas (GHG) emission from stationary combustion is estimated to be within a range of ±2.1 % and the trend in GHG emission (1990-2008) is -14.6 % ± 1.4 %-age points[2].

[2] Tier 1 approach. This year a tier 2 approach for uncertainty estimates have also been applied.

Sammendrag

Opgørelser over de samlede danske luftemissioner rapporteres årligt til Klimakonventionen (United Nation Framework Convention on Climate Change, UNFCCC) og Kyotoprotokollen samt til UNECE (United Nations Economic Commission for Europe) Konventionen om langtransporteret grænseoverskridende luftforurening (UNECE Convention on Long-Range Transboundary Air Pollution, der forkortes LRTAP Convention). Endvidere rapporteres drivhusgasemissionen til EU, fordi EU – såvel som de enkelte medlemslande – har ratificeret klimakonventionen. Der udarbejdes også opgørelser til rapportering til Europa-Kommissionens NEC (National Emissions Ceiling) direktiv. De danske emissioner opgøres og rapporteres af Danmarks Miljøundersøgelser (DMU) ved Aarhus Universitet (AU). Emissionsopgørelserne omfatter følgende stoffer af relevans for stationær forbrænding: CO_2, CH_4, N_2O, SO_2, NO_x, NMVOC, CO, partikler, NH_3, tungmetaller, dioxin, PAH og HCB. Foruden de årlige opgørelser over samlede nationale emissioner, rapporteres også sektoropdelt emission. Hvert femte år rapporteres endvidere en geografisk fordeling af emissionerne, fremskrivning af emissionerne samt de aktivitetsdata – fx brændselsforbrug – der ligger til grund for opgørelserne.

Emissionsopgørelserne for stationære forbrændingsanlæg (ikke mobile kilder) er baseret på den danske energistatistik og på et sæt emissionsfaktorer for forskellige sektorer, teknologier og brændsler. Anlægsspecifikke emissionsdata for store anlæg, som fx kraftværker, indarbejdes i opgørelserne. Denne rapport giver detaljeret baggrundsinformation om den anvendte metode samt referencer for de data der ligger til grund for opgørelsen – energistatistikken og emissionsfaktorerne.

Emissionsfaktorerne stammer enten fra danske referencer eller fra internationale guidebøger (EEA, 2009 og IPCC, 1997) udarbejdet til brug for denne type emissionsopgørelser. De danske referencer omfatter miljølovgivning, danske rapporter samt middelværdier baseret på anlægsspecifikke emissionsdata fra et betydeligt antal større værker. Anlægsspecifikke emissionsfaktorer oplyses af anlægsejere, bl.a. i grønne regnskaber og i CO_2-kvoteindberetninger.

I emissionsopgørelsen for 2008 er 70 stationære forbrændingsanlæg defineret som punktkilder. Punktkilderne omfatter: kraftværker, decentrale kraftvarmeværker, affaldsforbrændingsanlæg, industrielle forbrændingsanlæg samt raffinaderier. Brændselsforbruget for disse anlæg udgør 58 % af det samlede brændselsforbrug for stationære forbrændingsanlæg.

Variationen i årlig import/eksport af el medvirker til at brændselsforbruget til stationære forbrændingsanlæg varierer. I 2008 var det samlede brændselsforbruget 7 % højere end i 1990, mens forbruget af fossile brændsler var 7 % lavere. Forbruget af kul er faldet, mens forbruget af naturgas og af biobrændsler er steget.

For følgende stoffer udgør emissionen fra stationær forbrænding over 50 % af den nationale emission: SO_2, CO_2, tungmetaller (dog ikke Cu, Pb og Zn), PM_{10}, $PM_{2.5}$, dioxin, HCB og PAH. Endvidere udgør emissionen over 10 % for NO_x, CO, NMVOC, TSP, Cu, Pb og Zn. Stationær forbrænding bidrager med mindre end 10 % af den nationale emission af CH_4, N_2O og NH_3.

Indenfor stationær forbrænding er kraftværker og decentrale kraftvarmeværker den betydeligste emissionskilde for CO_2, N_2O, SO_2 og NO_x.

Gasmotorer installeret på decentrale kraftvarmeværker er sammen med forbrænding af biomasse i forbindelse med beboelse de største emissionskilder for CH_4.

Emissioner fra kedler, brændeovne mv. i forbindelse med beboelse er den betydeligste emissionskilde for CO, NMVOC, partikler, dioxin og PAH. Det er især forbrænding af træ, som bidrager til disse emissioner.

Både industrianlæg, kraftværker/kraftvarmeværker samt villakedler/-brændeovne er væsentlige emissionskilder for de forskellige tungmetaller.

I rapporten vises tidsserier for emissioner fra stationær forbrænding.

Udviklingen i drivhusgasemissionen følger udviklingen i CO_2-emissionen ganske tæt. Både CO_2-emissionen og den samlede drivhusgasemission fra stationær forbrænding er lavere i 2008 end i 1990. CO_2 er 16 % lavere og drivhusgasemissionen er 15 % lavere. Emissionerne fluktuerer dog betydeligt, primært pga. variationerne i import/eksport af el men også pga. varierende udetemperatur og deraf følgende brændselsforbrug til rumopvarmning.

CH_4-emissionen fra stationær forbrænding er steget med en faktor 3,5 siden 1990. Denne stigning skyldes primært, at der i 1990'erne blev installeret et betydeligt antal gasmotorer på decentrale kraftvarmeværker. De senere år er emissionen dog faldet lidt. Som følge af de ændrede afregningsregler i henhold til det frie elmarked. Emissionen fra beboelse er steget væsentligt de senere år pga. den øgede forbrænding af træ i brændeovne mv.

Emissionen af N_2O var 7 % højere i 2008 end i 1990. Emissionen af N_2O fluktuerer som følge af variationerne i import/eksport af el.

SO_2-emissionen fra stationær forbrænding er faldet med 90 % siden 1990. Den store reduktion er primært et resultat af installering af afsvovlningsanlæg fra el- og fjernvarmeproducerende anlæg samt brug af brændsler med lavere svovlindhold. Dette er sket på baggrund af en indført svovlafgift, grænseværdier for svovlindhold i brændsler, emissionskvotebestemmelser for centrale kraftværker samt emissionsgrænseværdier.

NO_x-emissionen fra stationær forbrænding er faldet med 56 % siden 1990. Reduktionen er primært et resultat af, at emissionen fra el- og fjernvarmeproducerende anlæg er faldet som følge af, at der benyttes lav-NO_x-brændere på flere anlæg og at der er idriftsat NO_x-røggasrensning på flere store kraftværker. Baggrunden herfor er emissi-

onskvotebestemmelser for de centrale kraftværker samt skærpede emissionsgrænseværdier for flere anlægstyper. NO_x-emissionen fluktuerer som følge af variationen i import/eksport af el.

Mængden af træ forbrændt i villakedler og brændeovne var i 2008 fire gange så højt som i 1990. Dette har stor betydning for emissionstidsserierne for en række emissionskomponenter for hvilke netop træ, anvendt i villakedler/brændeovne, er en væsentlig emissionskilde: NMVOC, CO, partikler og PAH. Emissionen fra nyere brændeovne mv. er lavere end for de ældre, idet forbrændingsteknologien er forbedret, og stigningen i emissioner er således lavere end stigningen i brændselsforbruget.

CO-emissionen fra stationær forbrænding er steget 16 % siden 1990. Emissionen fra brændeovne er steget, men samtidig er emissionen fra halmfyrede gårdanlæg faldet.

Emissionen af NMVOC fra stationær forbrænding er øget med 50 % siden 1990. Stigningen er primært et resultat af det øgede forbrug af træ i forbindelse med beboelse (brændeovne mv.) og idriftsættelsen af gasmotorer på decentrale kraftvarmeværker.

Emissionen af TSP er steget 57 % siden år 2000 - igen på grund af den øgede brug af træ i brændeovne og små villakedler. Emissionen af de forskellige PAH'er er af samme grund steget 120-170 % siden 1990.

Emissionen af dioxin var 55 % lavere i 2008 end i 1990. Dette fald skyldes primært installering af dioxinrensningsanlæg på affaldsforbrændingsanlæg som alle affaldsforbrændingsanlæg iht. forbrændingsbekendtgørelsen[3] skulle idriftsætte senest i 2005. Emissionen fra brændeovne er dog samtidig steget og dette har resulteret i en stigning i dioxinemissionen de senere år.

Tungmetalemissionerne er faldet betydeligt siden 1990. Emissionen af de enkelte tungmetaller er reduceret mellem 65 % og 87 %, Zn dog kun 5 %. Reduktionen er et resultat af den forbedrede røggasrensning på affaldsforbrændingsanlæg og på kraftværker.

Emissionen af drivhusgasser er bestemt med en usikkerhed på ±2,1 %. Drivhusgasemissionen er siden 1990 faldet 14,6 % ± 1,4 %-point[4].

[3] Bekendtgørelse om anlæg der forbrænder affald, Bekendtgørelse 162 af 11. marts 2003.
[4] Resultater af Tier 1 approach. I år er der endvidere beregnet usikkerhed med tier 2 approach.

1 Introduction

Danish emission inventories are prepared on an annual basis and are reported to the United Nations Framework Convention on Climate Change (UNFCCC or Climate Convention) and to the Kyoto Protocol as well as to the United Nations Economic Commission for Europe (UN-ECE) Convention on Long-Range Transboundary Air Pollution (LRTAP Convention). Furthermore, a greenhouse gas emission inventory is reported to the European Union (EU), due to the EU – as well as the individual member states – being party to the Climate Convention. Four pollutants are estimated for reporting to the European Commissions National Emissions Ceiling Directive (NECD). The annual Danish emission inventories are prepared by the Danish National Environmental Research Institute (NERI), Aarhus University (AU) on behalf of the Ministry of the Environment and the Ministry of Climate and Energy.

The data in this report do not include emissions from Greenland and the Faroe Islands.

Stationary combustion plants include power plants, district heating plants, non-industrial and industrial combustion plants, industrial process burners, petroleum-refining plants, as well as combustion in oil/gas extraction and in pipeline compressors. Emissions from flaring in oil/gas production and from flaring carried out in refineries are not covered by this report.

This report presents detailed emission inventories and time-series for emissions from stationary combustion plants. Furthermore, emissions from stationary combustion plants are compared with national emissions.

The methodology and references for the emission inventories for stationary combustion plants are described.

Furthermore, the report includes key source analysis, uncertainty estimates and reporting of QA/QC activities.

2 National emissions

An overview of the national emission inventories for 2008 including all emission source categories is shown in Table 1 to 4[5]. The emission inventories reported to the LRTAP Convention and to the Climate Convention are organised in six main source categories and a number of subcategories. The emission source *Energy* covers combustion in stationary and mobile sources as well as fugitive emissions from the energy source category.

Emissions from incineration of municipal waste in power plants or district heating plants are included in the source category *Energy*, rather than in the source category *Waste*.

Links to the latest emission inventories can be found at the NERI home page: http://www.dmu.dk/Luft/Emissioner/Home+of+Inventory/ or via http://www.dmu.dk/. Surveys of the latest inventories and the updated emission factors are also available on the NERI homepage.

Note that according to convention decisions emissions from certain specific sources are not included in the inventory totals. These emissions are reported as memo items and are thus estimated, but not included in the totals. The data for the national emission included in this report does not include memo items.

CO_2 emission from combustion of biomass is not included in national totals, but reported as a memo item. Likewise emissions from international bunkers and from international aviation are not included in national totals.

Further emission data for stationary combustion plants are provided in Chapters 4 to 11.

Table 1 National greenhouse gas emission for the year 2008 (Nielsen et al., 2010a).

Pollutant	CO_2	CH_4	N_2O	HFCs, PFCs & SF_6
Unit	Gg CO_2 equivalent			
1. Energy	492 12	580	438	-
2. Industrial Processes	13 60	-	-	897
3. Solvent and Other Product Use	65	-	27	-
4. Agriculture	-	3 872	6 154	-
5. Land-Use Change and Forestry	492	-	9	-
6. Waste	29	1 107	105	-
National emission excluding LULUCF [1)]	63 845			
National emission including LULUCF [2)]	64 346			

[1)] Not including Land Use, Land-Use Change and Forestry.

[2)] Including Land Use, Land-Use Change and Forestry.

[5] Emissions from Greenland and the Faroe Islands are not included.

Table 2 National emissions 2008 reported to the LRTAP Convention (Nielsen et al., 2010b).

Pollutant	NO_x Gg	CO Gg	NMVOC Gg	SO_2 Gg	NH_3 Gg	TSP Mg	PM_{10} Mg	$PM_{2.5}$ Mg
1. Energy	151	432	66	19	2	32 288	29 075	27 012
2. Industrial Processes	0	0	10	0	0	-	-	-
3. Solvent and Other Product Use	-	-	27	-	-	-	-	-
4. Agriculture	0	3	2	0	71	11 855	5 914	1 267
5. Land-Use Change and Forestry	-	-	-	-	-	-	-	-
6. Waste	0	1	0	1	0	14	13	13
National emission	152	436	106	20	74	44 158	35 002	28 291

Table 3 National heavy metal (HM) emissions 2008 reported to the LRTAP Convention (Nielsen et al., 2010b).

Pollutant	Pb Mg	Cd Mg	Hg Mg	As Mg	Cr Mg	Cu Mg	Ni Mg	Se Mg	Zn Mg
1. Energy	4.37	0.41	0.77	0.43	1.10	9.48	7.43	1.76	12.32
2. Industrial Processes	0.07	0.00	-	-	-	0.05	-	-	0.63
3. Solvent and Other Product Use	-	-	-	-	-	-	-	-	-
4. Agriculture	0.04	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00
5. Land-Use Change and Forestry	-	-	-	-	-	-	-	-	-
6. Waste	3.74	0.01	0.05	0.00	0.02	0.12	0.01	0.00	14.60
National emission	8.21	0.42	0.82	0.43	1.12	9.65	7.45	1.77	27.56

Table 4 National PAH, dioxin and hexachlorobenzene (HCB) emissions 2008 reported to the LRTAP Convention (Nielsen et al., 2010b).

Pollutant	Benzo(a)pyrene Mg	Benzo(b)fluoranthene Mg	Benzo(k)fluoranthene Mg	Indeno(1,2,3-c,d)pyrene Mg	Dioxin g I-teq	HCB kg
1. Energy	4.80	5.11	2.83	3.42	21.46	0.54
2. Industrial Processes	-	-	-	-	0.01	-
3. Solvent and Other Product Use	-	-	-	-	-	-
4. Agriculture	0.12	0.12	0.05	0.04	0.03	-
5. Land-Use Change and Forestry	-	-	-	-	-	-
6. Waste	0.09	0.11	0.09	0.13	10.04	0.01
7. Other	-	-	-	-	-	-
National emission	5.02	5.34	2.97	3.59	31.54	0.55

3 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 1. The majority - 58 % - of all fuels is combusted in the source category, *Public electricity and heat production.* Other source categories with high fuel consumption are *Residential* and *Industry*.

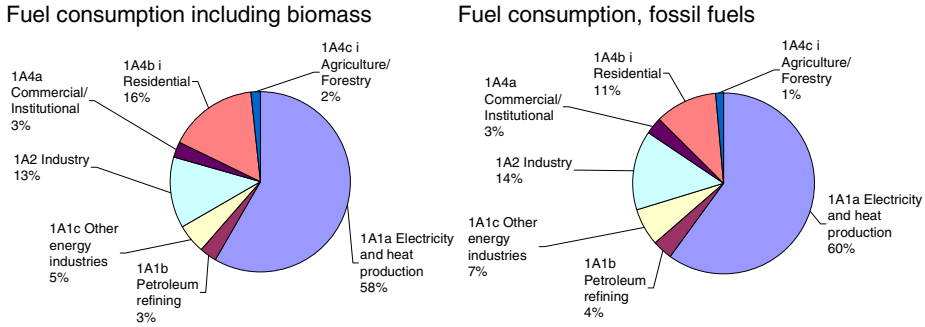


Figure 1 Fuel consumption of stationary combustion source categories, 2008 (based on DEA (2009a)).

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 offshore gas turbines (see Figure 2).

Detailed fuel consumption rates are shown in Appendix 4.

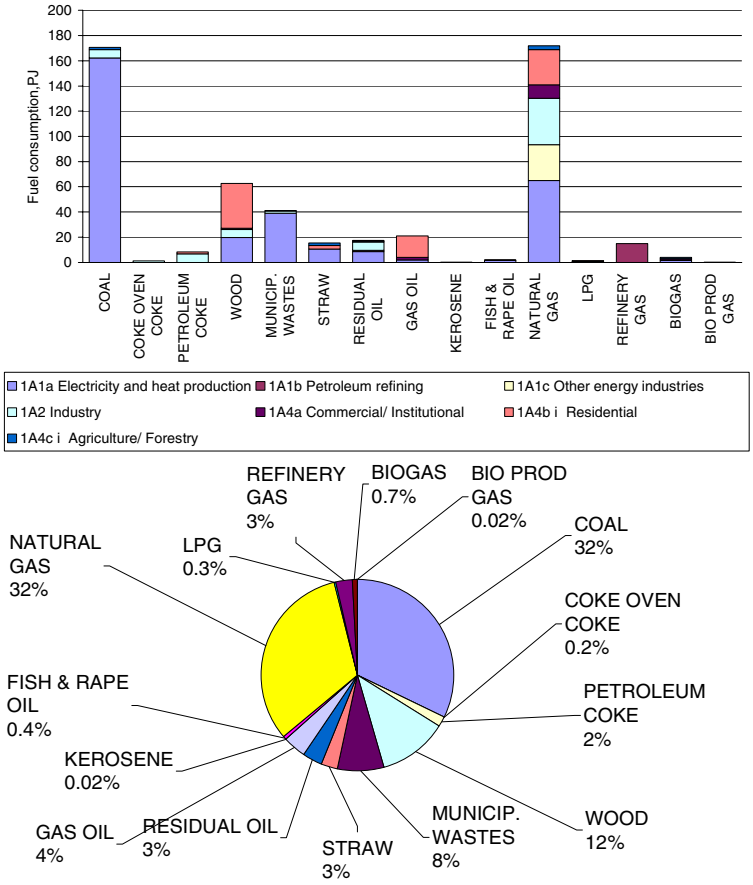


Figure 2 Fuel consumption of stationary combustion 2008, disaggregated to fuel type (based on DEA, 2009a).

Fuel consumption time-series for stationary combustion plants are presented in Figure 3[6]. 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.

[6] Time-series 1980 onwards are included in Appendix 15.

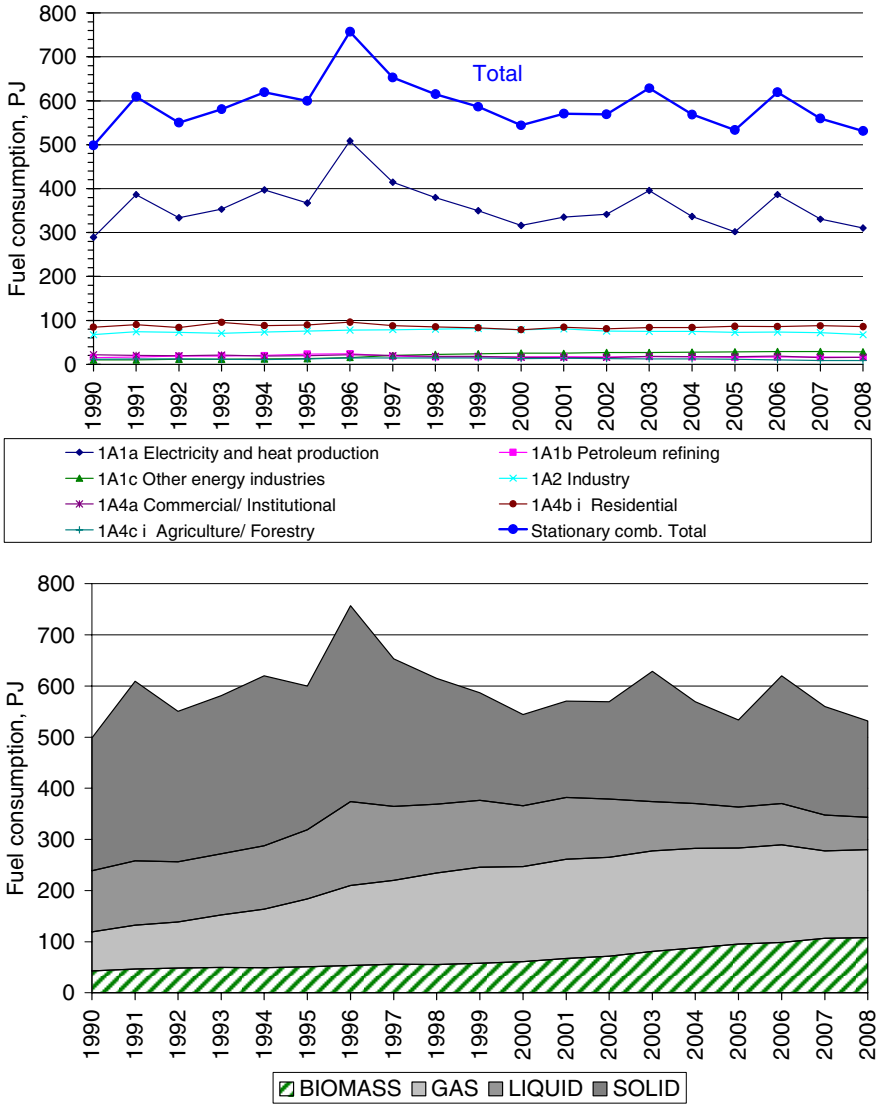


Figure 3 Fuel consumption time-series, stationary combustion (based on DEA, 2009a).

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, CO_2 and NO_x emission are illustrated and compared in Figure 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 rainfalls in Norway and Sweden causing insufficient hydropower production in both countries.

To be able to follow the national energy consumption for statistical and reporting purposes, the Danish Energy Agency produces a correction of the actual fuel consumption and CO_2 emission without random variations in electricity imports/exports and in ambient temperature. This fuel consumption trend is also illustrated in Figure 4. The corrections are included here to explain the fluctuations in the time-series for fuel rate and emission.

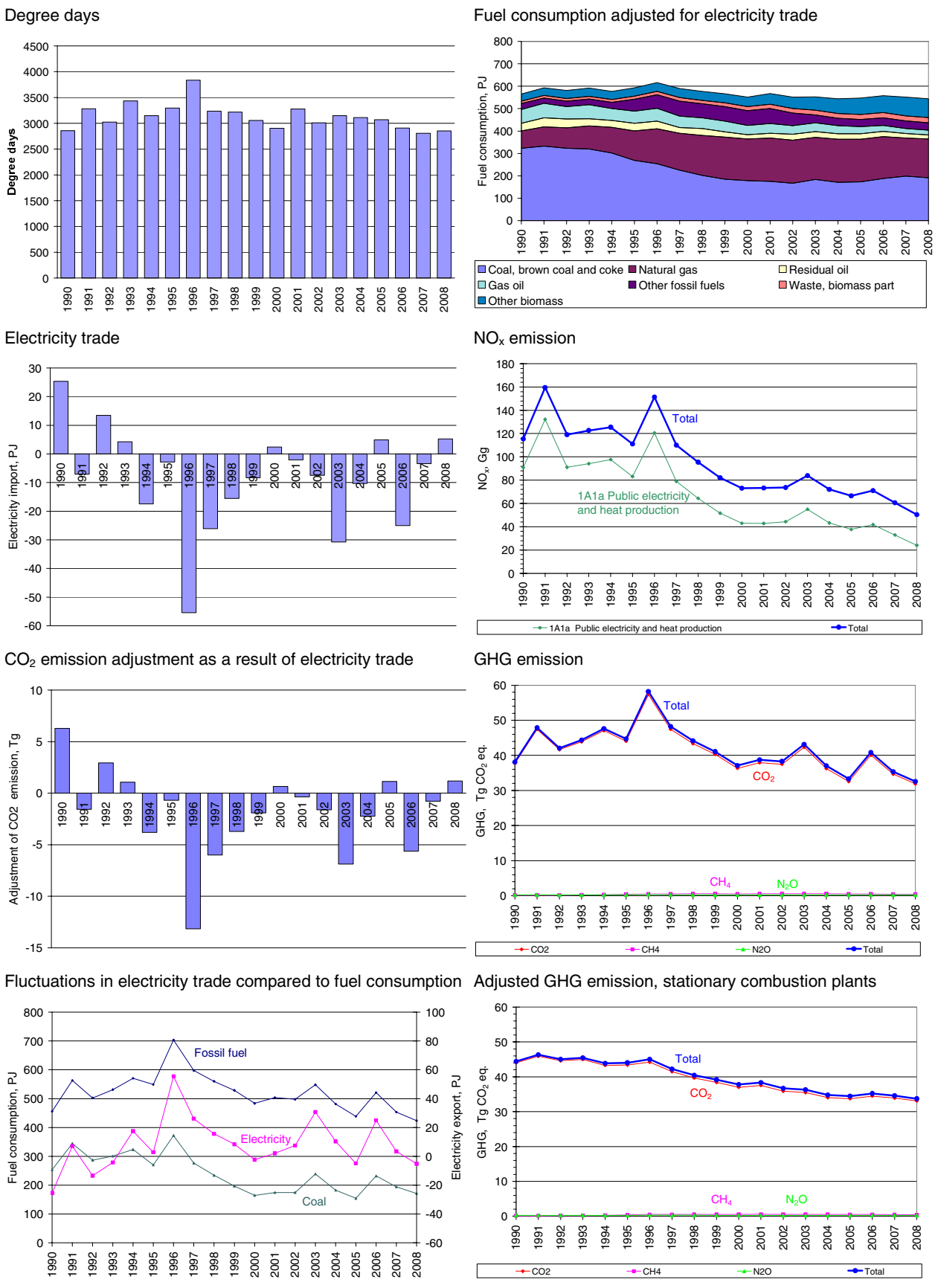


Figure 4 Comparison of time-series fluctuations for electricity trade, fuel consumption and NO_x emission (based on DEA 2009b).

Fuel consumption time-series for the subcategories to stationary combustion are shown in Figure 5, 6 and 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 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* has decreased 6 % since 1990 (Figure 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 12.

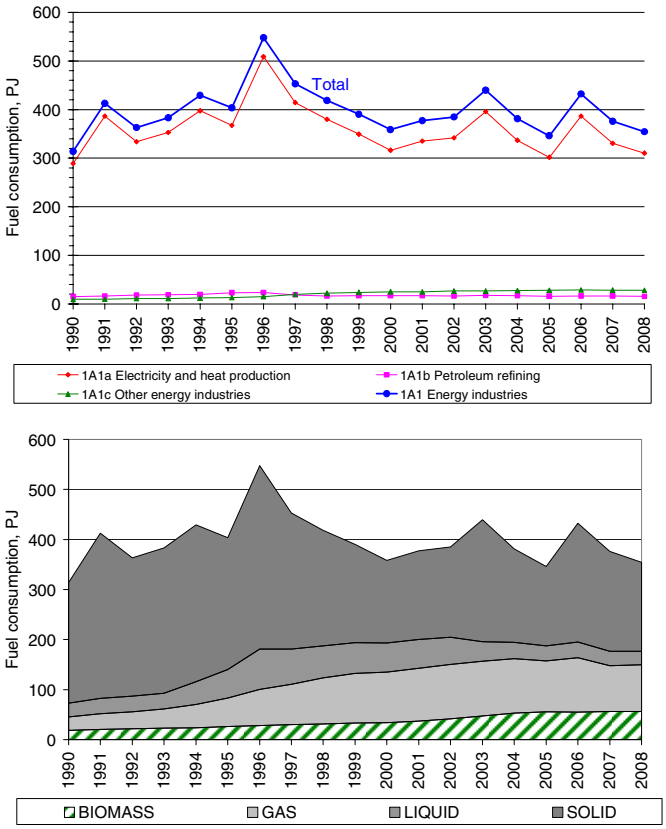


Figure 5 Fuel consumption time-series for subcategories - 1A1 Energy Industries.

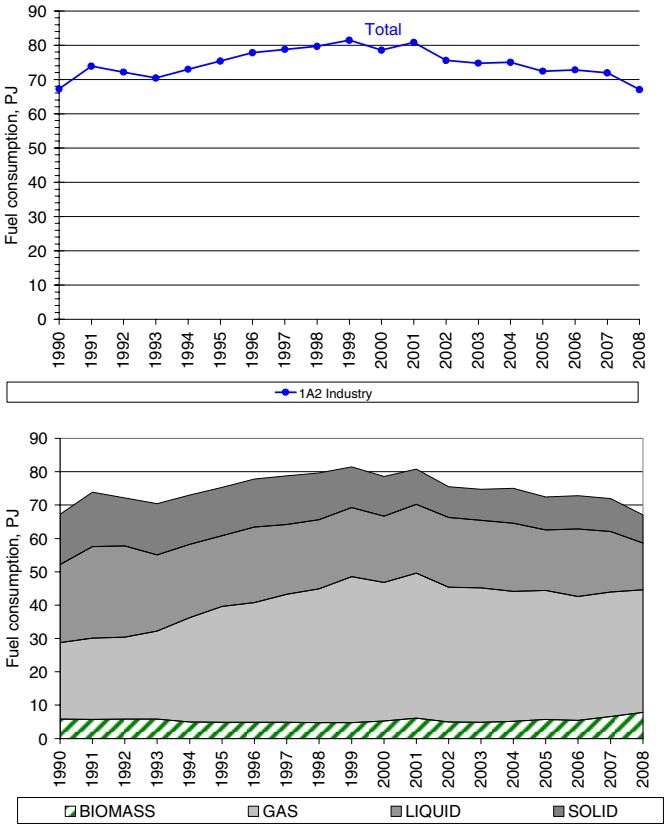


Figure 6 Fuel consumption time-series for subcategories - 1A2 Industry.

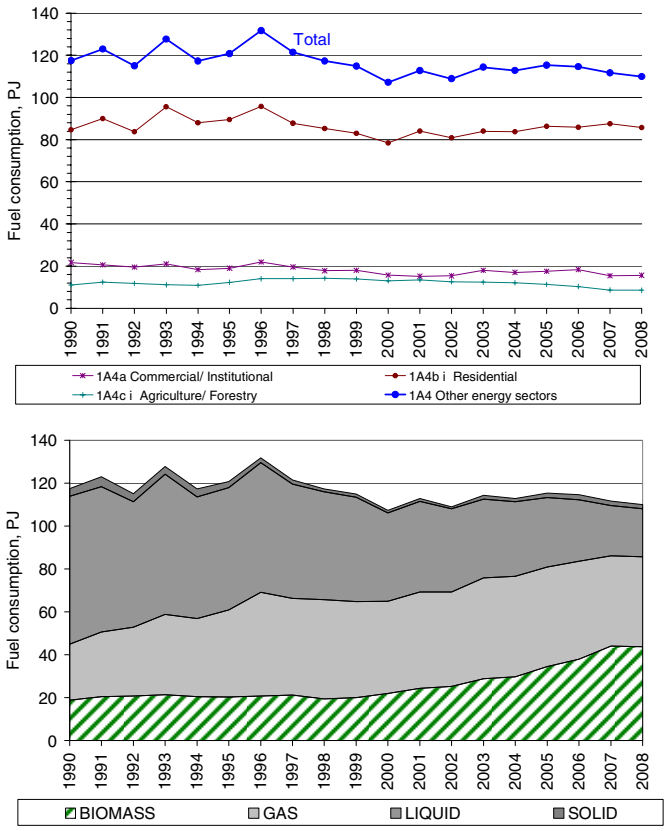


Figure 7 Fuel consumption time-series for subcategories - 1A4 Other Sectors.

4 Greenhouse gas emission

The national greenhouse gas (GHG) emission in 2008 was 64,346 Gg CO_2 equivalent, including Land-Use, Land-Use Change and Forestry (LULUCF) or 63,845 Gg CO_2 equivalent, excluding LULUCF. The greenhouse gas pollutants HFCs, PFCs and SF_6 are not emitted from combustion plants and, as such, only the pollutants CO_2, CH_4 and N_2O are considered below.

The global warming potentials of CH_4 and N_2O applied in greenhouse gas inventories refer to the second IPCC assessment report (IPCC 1995):

- 1 g CH_4 equals 21 g CO_2
- 1 g N_2O equals 310 g CO_2

The GHG emissions from stationary combustion are listed in Table 5. The emission from stationary combustion accounted for 51 % of the national GHG emission (excluding LULUCF) in 2008.

The CO_2 emission from stationary combustion plants accounts for 63 % of the national CO_2 emission (excluding LULUCF). The CH_4 emission accounts for 8 % of the national CH_4 emission and the N_2O emission for 4 % of the national N_2O emission.

Table 5 Greenhouse gas emission, 2008 [1].

	CO_2	CH_4	N_2O
	Gg CO_2 equivalent		
1A1 Fuel Combustion, Energy industries	23 553	183	133
1A2 Fuel Combustion, Manufacturing Industries and Construction[1]	4 081	20	43
1A4 Fuel Combustion, Other sectors [1]	4 239	218	81
Emission from stationary combustion plants	31 872	421	257
National emission (excluding LULUCF)	50 665	5 559	6 724
		%	
Emission share for stationary combustion	63 %	8 %	4 %

[1] Only stationary combustion sources of the category is included.

CO_2 is the most important GHG pollutant accounting for 97.9 % of the GHG emission (CO_2 eq.) from stationary combustion. CH_4 accounts for 1.3 % and N_2O for 0.8 % of the GHG emission (CO_2 eq.) from stationary combustion (Figure 8).

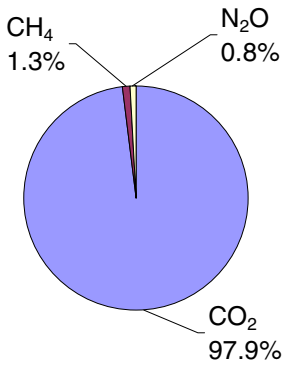


Figure 8 Stationary combustion - GHG emission (CO_2 equivalent), contribution from each pollutant.

Figure 9 depicts the time-series of GHG emission (CO_2 eqv.) from stationary combustion and it can be seen that the GHG emission development follows the CO_2 emission development very closely. Both the CO_2 and the total GHG emission are lower in 2008 than in 1990, CO_2 by 16 % and GHG by 15 %. However, fluctuations in the GHG emission level are large.

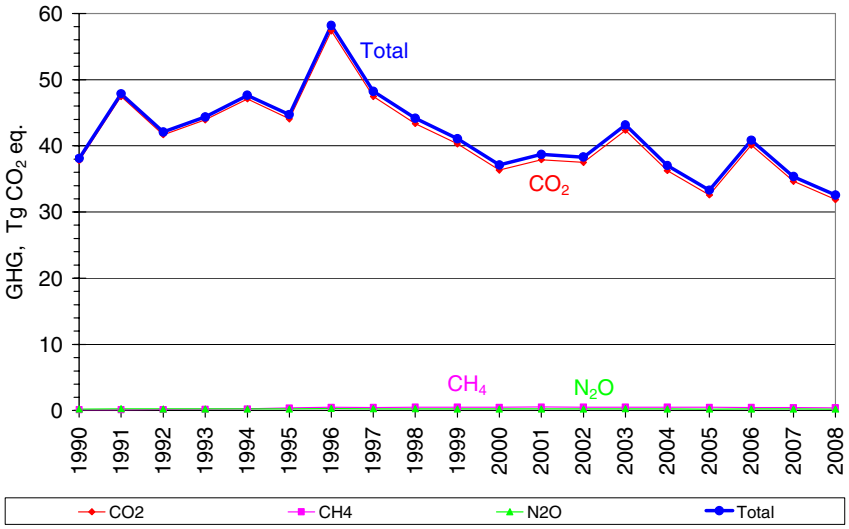


Figure 9 GHG emission time-series for stationary combustion.

The fluctuations in the time-series are largely a result of electricity import/export but also of outdoor temperature variations from year to year. The fluctuations follow the fluctuations in fuel consumption discussed in Chapter 3. As mentioned in Chapter 3, the Danish Energy Agency estimates a correction of the actual CO_2 emission without random variations in electricity imports/exports and in ambient temperature. The GHG emission corrected for electricity import/export and ambient temperature has decreased by 24 % since 1990 and the CO_2 emission by 25 %. These data are included here to explain the fluctuations in the emission time-series.

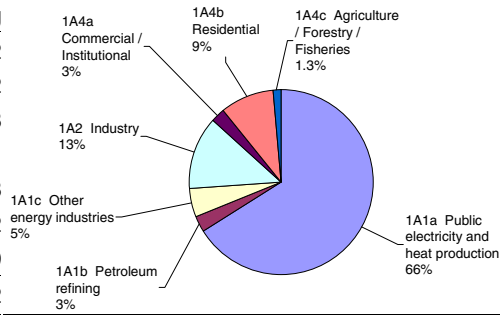
4.1 CO_2

The carbon dioxide (CO_2) emission from stationary combustion plants is one of the most important GHG emission sources. Thus the CO_2 emission from stationary combustion plants accounts for 63 % of the national

CO_2 emission. Table 6 lists the CO_2 emission inventory for stationary combustion plants for 2008. *Electricity and heat production* accounts for 66 % of the CO_2 emission from stationary combustion. This share is somewhat higher than the fossil fuel consumption share for this category, which is 60 % (Figure 1). This is due to a large share of coal in this category. Other large CO_2 emission sources are *Industry* and *Residential* plants. These are the source categories, which also account for a considerable share of fuel consumption.

Table 6 CO_2 emission from stationary combustion plants, 2008[1)].

		CO_2 2008 Gg
1A1a	Public electricity and heat production	21 032
1A1b	Petroleum refining	912
1A1c	Other energy industries	1 608
1A2	Industry	4 081
1A4a	Commercial/Institutional	818
1A4b	Residential	3 012
1A4c	Agriculture/Forestry/Fisheries	409
Total		31 872

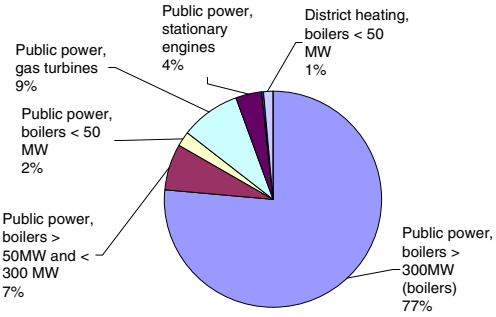


[1)] Only emission from stationary combustion plants in the categories is included.

In the Danish inventory the source category *Electricity and heat production* is further disaggregated. The CO_2 emission from each of the subcategories is shown in Table 7. The largest subcategory is power plant boilers >300MW.

Table 7 CO_2 emission from subcategories to 1A1a Electricity and heat production.

Sub-category ID (SNAP)	Subcategory name	CO_2, Gg
0101	Public power	
010100	Public power	0
010101	Combustion plants ≥ 300MW (boilers)	16 094
010102	Combustion plants ≥ 50MW and < 300 MW (boilers)	1 460
010103	Combustion plants <50 MW (boilers)	432
010104	Gas turbines	1 875
010105	Stationary engines	829
0102	District heating plants	
010200	District heating plants	
010201	Combustion plants ≥ 300MW (boilers)	4
010202	Combustion plants ≥ 50MW and < 300 MW (boilers)	47
010203	Combustion plants <50 MW (boilers)	285
010204	Gas turbines	0
010205	Stationary engines	8



CO_2 emission from combustion of biomass fuels is not included in the total CO_2 emission data because biomass fuels are considered CO_2 neutral. The CO_2 emission from biomass combustion is reported as a memo item in the Climate Convention reporting. In 2008 the CO_2 emission from biomass combustion was 11 688 Gg.

In Figure 10 the fuel consumption share (fossil fuels) is compared to the CO_2 emission share disaggregated to fuel origin. Due to the higher CO_2 emission factor for coal than for oil and gas, the CO_2 emission share from coal combustion is higher than the fuel consumption share. Coal accounts for 40 % of the fossil fuel consumption and for 51 % of the CO_2

emission. Natural gas accounts for 42 % of the fossil fuel consumption but only for 31 % of the CO_2 emission.

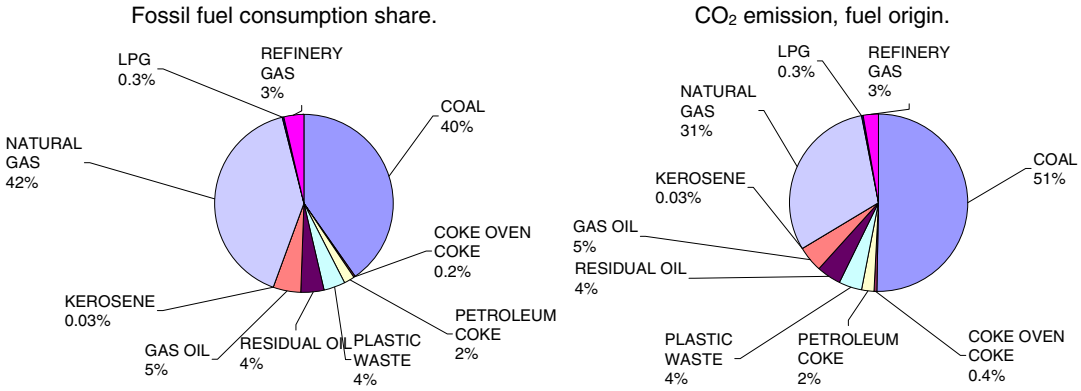


Figure 10 CO_2 emission, fuel origin.

Time-series for CO_2 emission are provided in Figure 11. Despite an increase in fuel consumption of 7 % since 1990 the CO_2 emission from stationary combustion has decreased by 16 % because of the change of fuel type used.

The fluctuations in total CO_2 emission follow the fluctuations in CO_2 emission from *Electricity and heat production* (Figure 11) and in coal consumption (Figure 4). The fluctuations are a result of electricity import/export as discussed in Chapter 3.

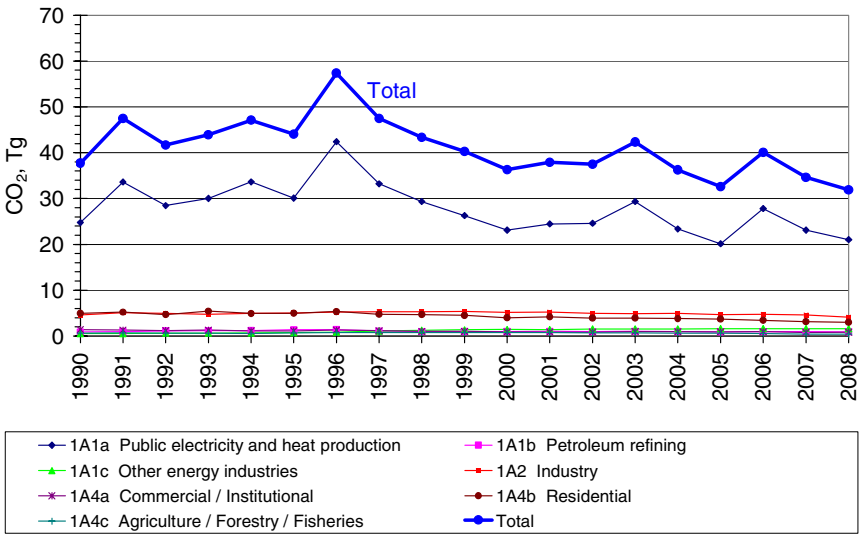


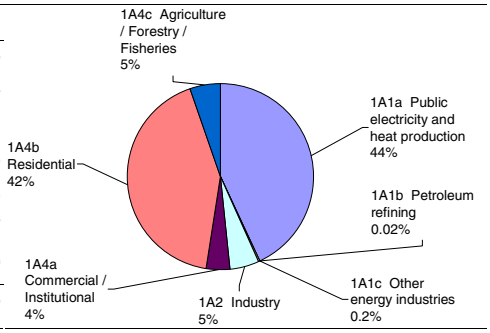
Figure 11 CO_2 emission time-series for stationary combustion plants.

4.2 CH_4

The methane (CH_4) emission from stationary combustion plants accounts for 8 % of the national CH_4 emission. Table 8 lists the CH_4 emission inventory for stationary combustion plants in 2008. *Electricity and heat production* accounts for 43 % of the CH_4 emission from stationary combustion, which is somewhat less than the fuel consumption share. The emission from residential plants adds up to 42 % of the emission.

Table 8 CH_4 emission from stationary combustion plants, 2008[1].

		CH_4 2008 Mg
1A1a	Public electricity and heat production	8 643
1A1b	Petroleum refining	4
1A1c	Other energy industries	45
1A2	Industry	976
1A4a	Commercial/Institutional	848
1A4b	Residential	8 477
1A4c	Agriculture/Forestry/Fisheries	1 040
Total		20 033



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

The CH_4 emission factor for reciprocating gas engines is much higher than for other combustion plants due to the continuous ignition/burn-out of the gas. Lean-burn gas engines have an especially high emission factor as discussed in Chapter 14.7.3. A considerable number of lean-burn gas engines are in operation in Denmark and in 2008 these plants accounted for 49 % of the CH_4 emission from stationary combustion plants (Figure 12). Most engines are installed in CHP plants and the fuel used is either natural gas or biogas. Residential wood combustion is also a large emission source.

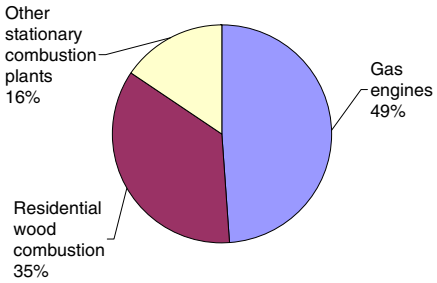


Figure 12 CH_4 emission share for gas engines and residential wood combustion, 2008.

Figure 13 shows the time-series for CH_4 emission. The CH_4 emission from stationary combustion has increased by a factor of 3.5 since 1990. This results from the considerable number of lean-burn gas engines installed in CHP plants in Denmark during the 1990s. Figure 14 provides time-series for the fuel consumption rate in gas engines and the corresponding increase of CH_4 emission. The decline in later years is due to structural changes in the Danish electricity market, which means that the fuel consumption in gas engines has been decreasing.

The emission from residential plants has increased since 1990 due to increased combustion of biomass in residential plants. Combustion of wood accounted for more than 80 % of the emission from residential plants in 2008.

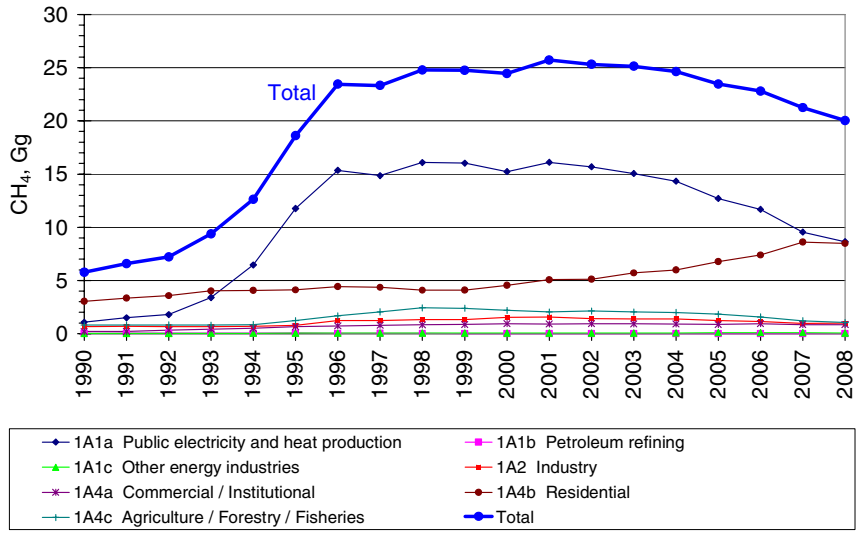


Figure 13 CH_4 emission time-series for stationary combustion plants.

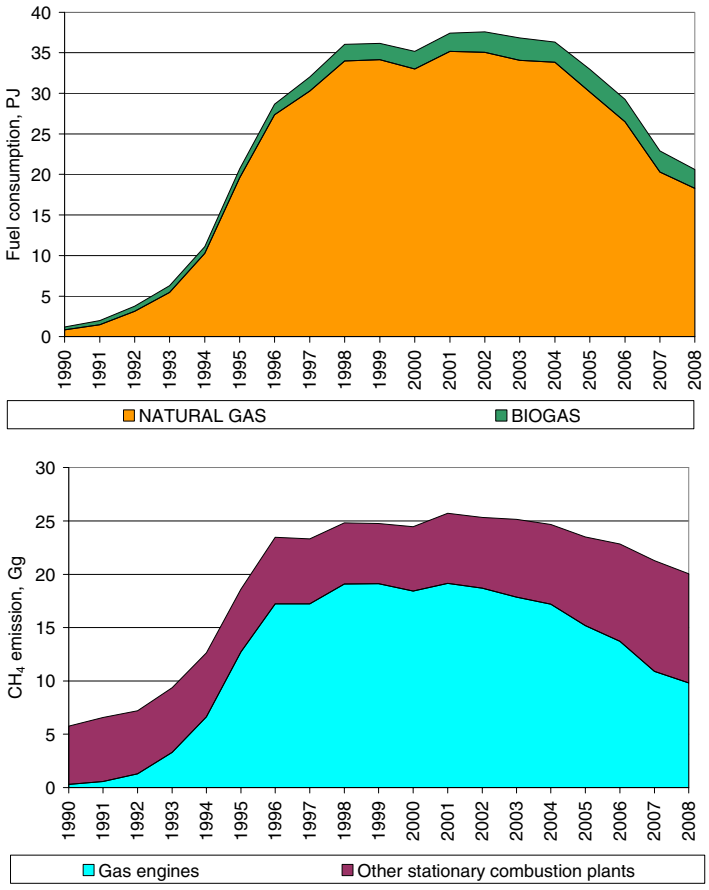


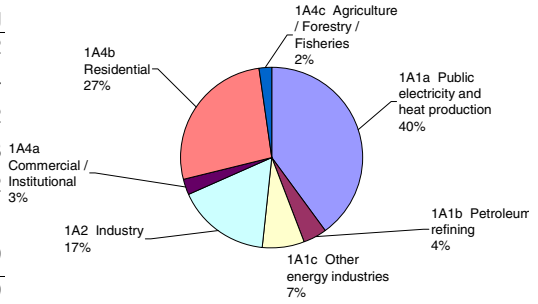
Figure 14 Fuel consumption and CH_4 emission from gas engines, time-series.

4.3 N_2O

The nitrous oxide (N_2O) emission from stationary combustion plants accounts for 4 % of the national N_2O emission. Table 9 lists the N_2O emission inventory for stationary combustion plants in 2008. *Electricity and heat production* accounts for 40 % of the N_2O emission from stationary combustion.

Table 9 N_2O emission from stationary combustion plants, 2008[1)].

	N_2O 2008 Mg
1A1a Public electricity and heat production	332
1A1b Petroleum refining	34
1A1c Other energy industries	62
1A2 Industry	138
1A4a Commercial/Institutional	22
1A4b Residential	221
1A4c Agriculture/Forestry/Fisheries	19
Total	829



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

Figure 15 shows time-series for N_2O emission. The N_2O emission from stationary combustion has increased by 7 % from 1990 to 2008, but again fluctuations in emission level due to electricity import/export are considerable.

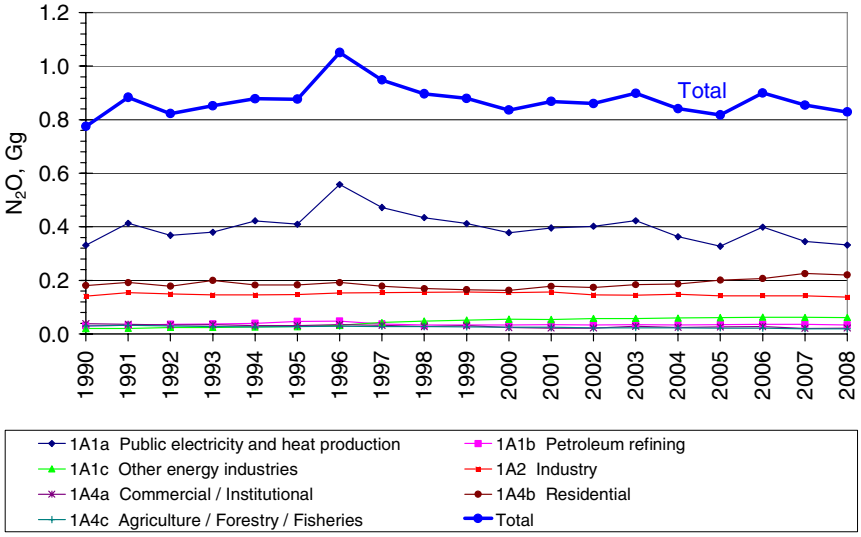


Figure 15 N_2O emission time-series for stationary combustion plants.

5 SO_2, NO_x, NMVOC and CO

The emissions of sulphur dioxide (SO_2), nitrogen oxides (NO_x), non-volatile organic compounds (NMVOC) and carbon monoxide (CO) from Danish stationary combustion plants 2008 are presented in Table 10. The emission of these pollutants is included in the reporting to both the Climate Convention and the LRTAP Convention. Emissions of SO_2, NO_x and NMVOC are also included in the reporting to the National Emissions Ceiling Directive (NECD). The NECD reporting also includes NH_3.

SO_2 from stationary combustion plants accounts for 83 % of the national emission. NO_x, CO and NMVOC account for 33 %, 38 % and 21 % of national emissions, respectively.

Table 10 SO_2, NO_x, NMVOC and CO emission, 2008[1].

Pollutant	NO_x	CO	NMVOC	SO_2
	Gg	Gg	Gg	Gg
1A1 Fuel consumption, Energy industries	32.6	8.2	1.9	6.6
1A2 Fuel consumption, Manufacturing Industries and Construction[1]	9.6	12.9	0.4	5.4
1A4 Fuel consumption, Other sectors[1]	8.2	144.0	20.1	4.3
Emission from stationary combustion plants	50.4	165.1	22.3	16.3
Emission share for stationary combustion	33	38	21	83

[1] Only emissions from stationary combustion plants in the source categories are included.

5.1 SO_2

Stationary combustion is the most important emission source for SO_2 accounting for 83 % of the national emission. Table 11 presents the SO_2 emission inventory for the stationary combustion subcategories.

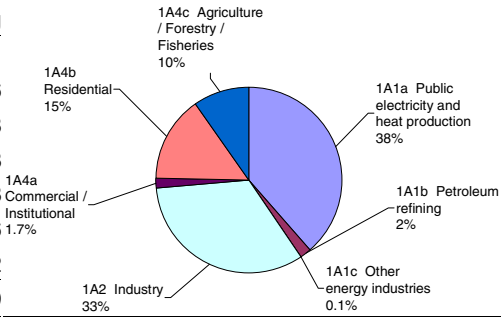
Electricity and heat production is the largest emission source accounting for 39 % of the emission. However, the SO_2 emission share is lower than the fuel consumption share for this source category, which is 58 %. This is a result of effective flue gas desulphurisation equipment installed in power plants combusting coal. In the Danish inventory the source category *Electricity and heat production* is further disaggregated. Figure 16 shows the SO_2 emission from *Electricity and heat production* on a disaggregated level. Power plants >300MW_{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 17[7]. 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*, which was made possible due to installation of desulphurisation plants and due to the use of fuels with lower sulphur content. These improvements are a result of both sulphur tax laws and legislation concerning sulphur content of fuels, emission ceilings for large power plants and emission limits for several plant categories. Despite the considerable reduction in emission from plants producing electricity and district heating, these still account for 39 % of the emission from stationary combustion, as mentioned above. The emission from other source categories has also decreased considerably since 1980. Time-series for subcategories are shown in Chapter 12.

Table 11 SO_2 emission from stationary combustion plants, 2008[1)].

		SO_2 2008 Mg
1A1a	Public electricity and heat production	6 281
1A1b	Petroleum refining	316
1A1c	Other energy industries	8
1A2	Industry	5 383
1A4a	Commercial/Institutional	273
1A4b	Residential	2 466
1A4c	Agriculture/Forestry/Fisheries	1 572
Total		16 299



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

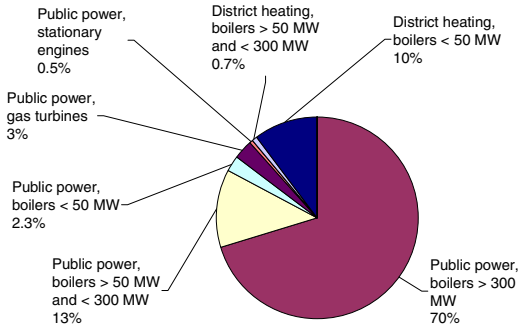


Figure 16 Disaggregated SO_2 emissions from 1A1a Energy and heat production.

[7] Time-series 1980-2008 are shown in Appendix 15.

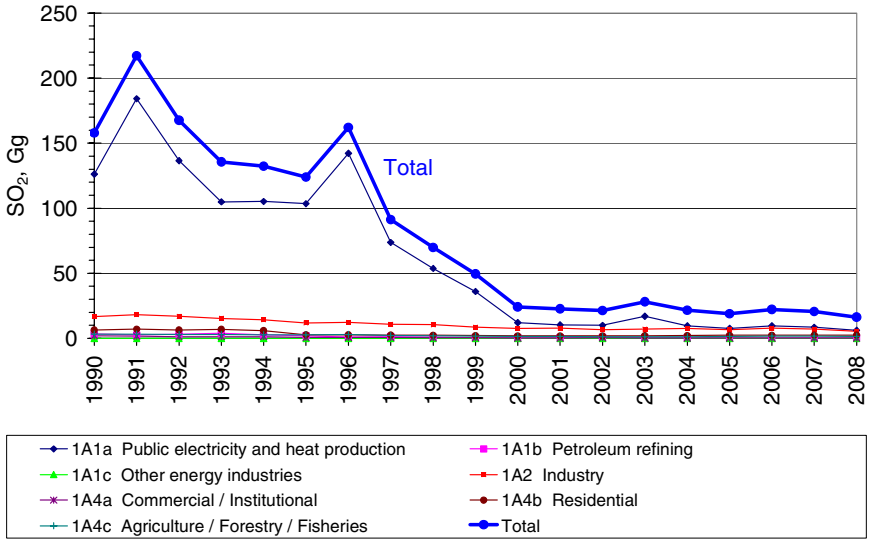


Figure 17 SO_2 emission time-series for stationary combustion.

5.2 NO_x

Stationary combustion accounts for 33 % of the national NO_x emission. Table 12 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.

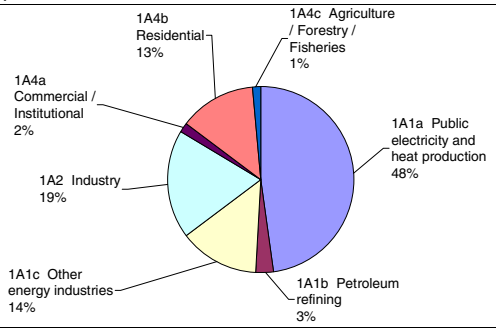
Other energy industries, which is mainly off-shore gas turbines accounts for 14 % of the NO_x emission.

Time-series for NO_x emission from stationary combustion are shown in Figure 18[8]. 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. These improvements are a result of both emission ceilings for large power plants and lower emission limits for several plant categories. The fluctuations in the time-series follow the fluctuations in electricity and heat production, which, in turn, result from electricity trade fluctuations.

[8] Time-series 1985-2008 are shown in Appendix 15.

Table 12 NO_x emission from stationary combustion plants, 2008[1)].

		NO_x 2008 Mg
1A1a	Public electricity and heat production	24 056
1A1b	Petroleum refining	1 490
1A1c	Other energy industries	7 031
1A2	Industry	9 557
1A4a	Commercial/Institutional	811
1A4b	Residential	6 702
1A4c	Agriculture/Forestry/Fisheries	715
Total		50 361



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

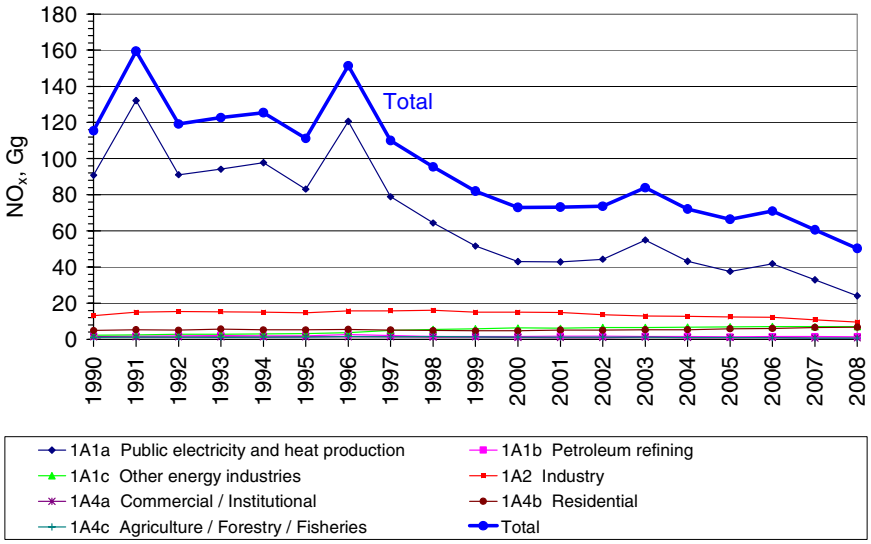


Figure 18 NO_x emission time-series for stationary combustion.

5.3 NMVOC

Stationary combustion plants account for 21 % of the national NMVOC emission. Table 13 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 plants NMVOC is mainly emitted from wood and straw combustion, see Figure 19.

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 19). The gas engines are either natural gas or biogas fuelled.

Time-series for NMVOC emission from stationary combustion are shown in Figure 20[9]. 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 as discussed in Chapter 14.7.3.

[9] Time-series 1985-2008 are shown in Appendix 15.

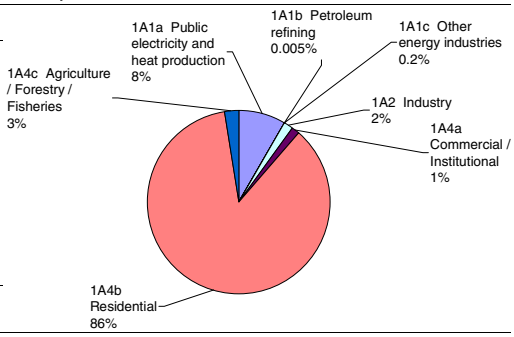
The emission from residential plants has increased 59 % since 1990. The NMVOC emission from wood combustion in 2008 was 2.9 times the 1990 level due to increased wood consumption. However, the emission factor has decreased since 1990 due to installation of modern stoves and boilers with improved combustion technology. Further the emission from straw combustion in farmhouse boilers has decreased (75 %) over this period due to both a decreasing emission factor and a 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 13 NMVOC emission from stationary combustion plants, 2008[1)].

		NMVOC 2008 Mg
1A1a	Public electricity and heat production	1 838
1A1b	Petroleum refining	1
1A1c	Other energy industries	40
1A2	Industry	371
1A4a	Commercial/Institutional	271
1A4b	Residential	19 222
1A4c	Agriculture/Forestry/Fisheries	570
Total		22 313



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

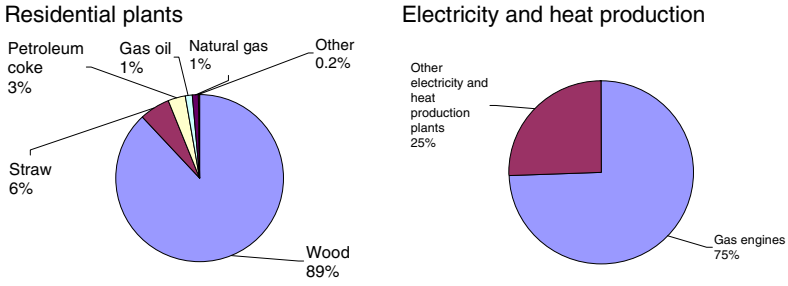


Figure 19 NMVOC emission from Residential plants and from Electricity and heat production, 2008.

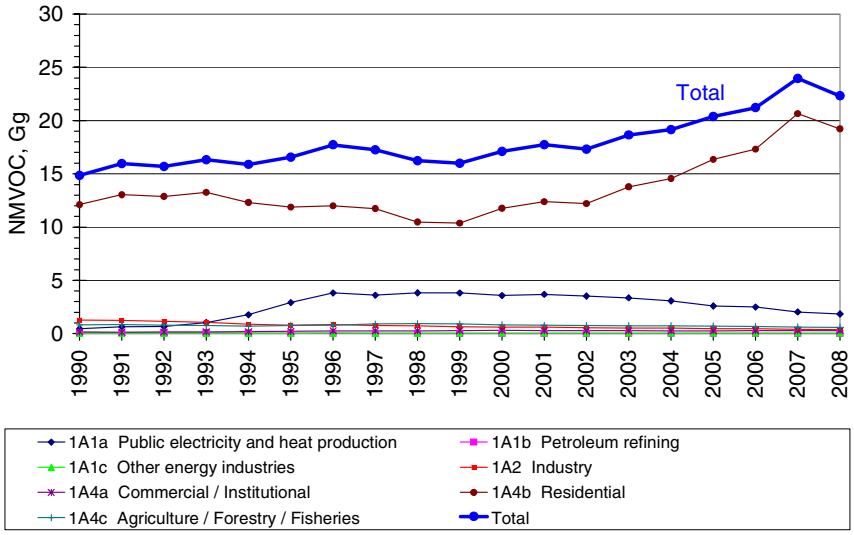


Figure 20 NMVOC emission time-series for stationary combustion.

5.4 CO

Stationary combustion accounts for 38 % of the national CO emission. Table 14 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 21. 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 22[10]. 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.

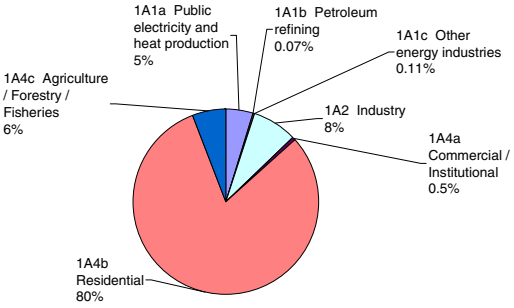
The consumption of wood in residential plants in 2008 was 4.0 times the 1990 level. However, the CO emission factor for wood has decreased since 1990 causing the CO emission from wood combustion in residential plants in 2008 to be only 3.2 times the 1990 level (Figure 23). Both straw consumption and CO emission factor for residential plants have decreased since 1990.

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.

[10] Time-series 1985-2008 are shown in Appendix 15.

Table 14 CO emission from stationary combustion plants, 2008[1)].

		CO 2008 Mg
1A1a	Public electricity and heat production	7 909
1A1b	Petroleum refining	119
1A1c	Other energy industries	183
1A2	Industry	12 879
1A4a	Commercial/Institutional	839
1A4b	Residential	133 437
1A4c	Agriculture/Forestry/Fisheries	9709
Total		165 077



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

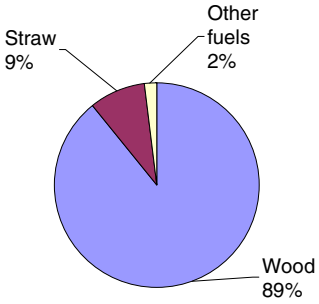


Figure 21 CO emission sources, residential plants, 2008.

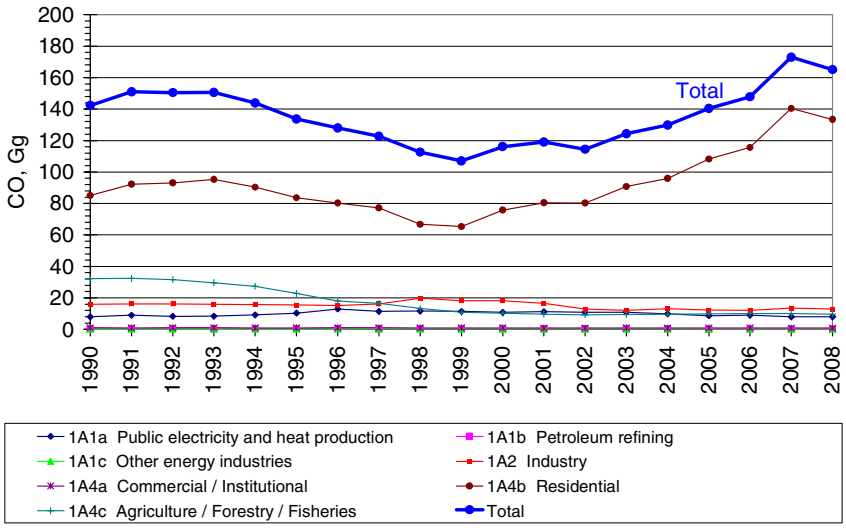


Figure 22 CO emission time-series for stationary combustion.

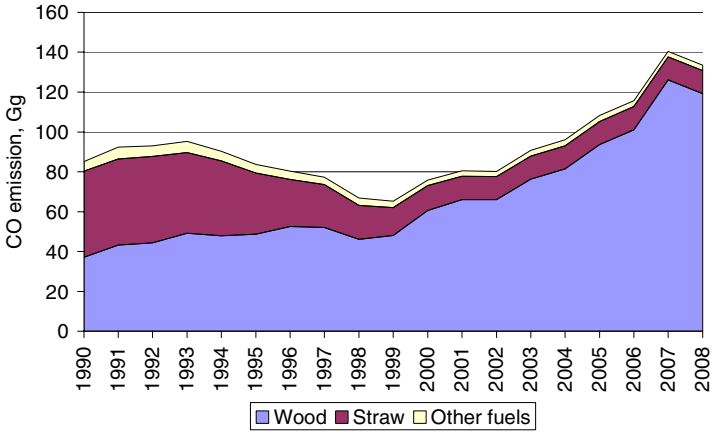


Figure 23 CO emission time-series for source category *1A4b Residential plants*, fuel origin.

6 Particulate matter (PM)

The emissions of total suspended particulates (TSP), particulate matter < 10 µm (PM_{10}) and particulate matter < 2.5 µm ($PM_{2.5}$) from Danish stationary combustion plants 2008 are presented in Table 15. The particulate matter (PM) emissions are reported to the LRTAP Convention.

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 15 PM emissions, 2008[1)].

Pollutant	TSP	PM_{10}	$PM_{2.5}$
	Mg	Mg	Mg
1A1 Fuel combustion, Energy industries	990	761	640
1A2 Fuel combustion, Manufacturing Industries and Construction (Stationary combustion)[1)]	863	625	370
1A4 Fuel combustion, Other sectors (Stationary combustion)[1)]	21 833	20 746	20 275
Emission from stationary combustion plants	23 687	22 131	21 285
National emission	44 158	35 002	28 291
Emission share for stationary combustion (%)	54	63	75

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

Table 16 and Figure 24 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., 2008) has demonstrated that the emission factor uncertainty for residential combustion of wood in stoves and boilers is extremely high.

Figure 25 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 is shown in Figure 26. 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 (Figure 26 and Figure 27).

Table 16 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	21 150	20 102	19 676
1A4c	Agriculture/Forestry/Fisheries	508	472	438
Total		23 687	22 131	21 285

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

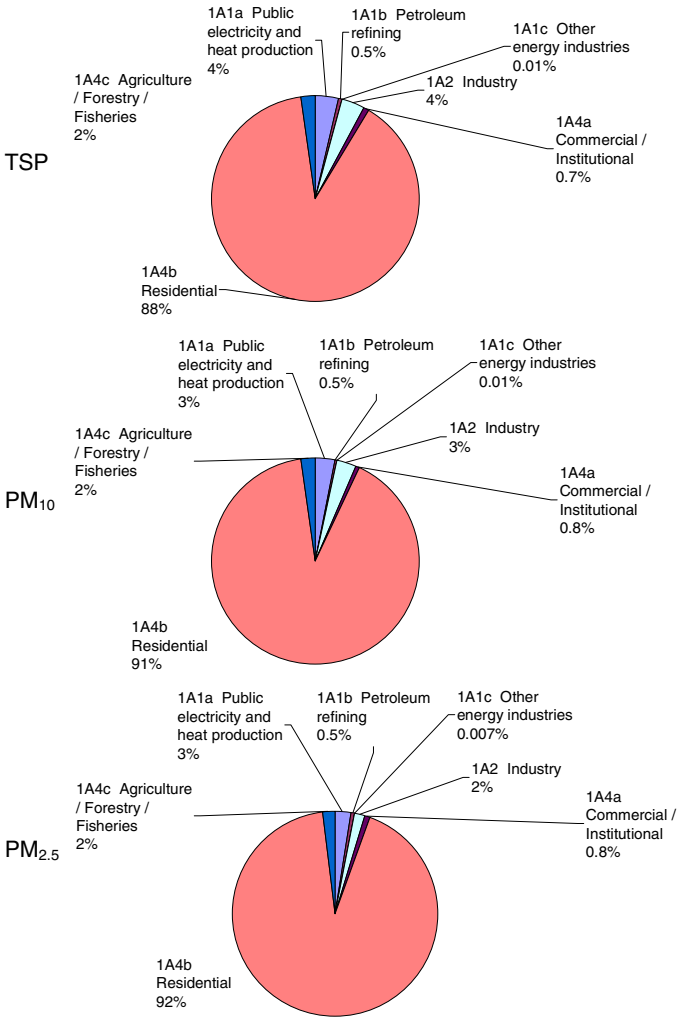


Figure 24 PM emission sources, stationary combustion plants, 2008.

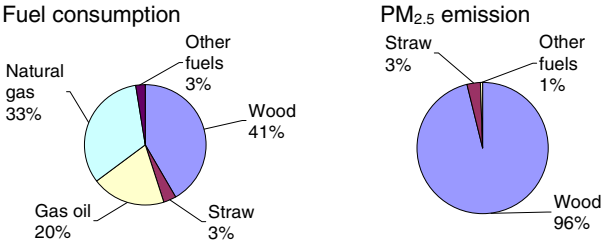


Figure 25 Fuel consumption and $PM_{2.5}$ emission from residential plants.

Figure 26 PM emission time-series for stationary combustion.

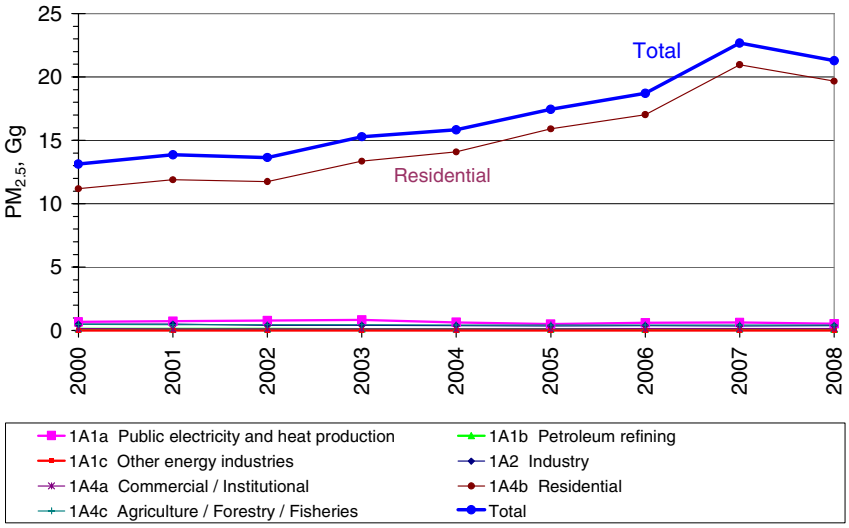


Figure 27 $PM_{2.5}$ emission time-series for residential plants.

7 Heavy metals

Emission inventories for nine heavy metals (HM) are reported to the LRTAP Convention. Three of the metals are considered priority metals: Pb, Cd and Hg. The 2008 emissions are presented in Table 17.

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 %, see Table 17.

Table 17 The emission of heavy metals, 2008.

Pollutant	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
1A1 Fuel combustion, Energy industries	0.75	0.13	0.43	0.17	0.36	0.32	1.59	1.01	1.55
1A2 Fuel combustion, Manufacturing Industries and Construction (Stationary combustion)	0.78	0.16	0.23	0.17	0.33	0.16	4.17	0.52	1.44
1A4 Fuel combustion, Other sectors (Stationary combustion)	1.53	0.07	0.09	0.07	0.14	0.34	0.84	0.13	4.02
Emission from stationary combustion plants	3.06	0.35	0.76	0.41	0.83	0.83	6.59	1.66	7.02
National emission	6.89	0.63	1.04	0.42	1.05	9.61	7.38	1.74	29.85
Emission share for stationary combustion, (%)	44	56	72	98	78	9	89	96	24

Table 18 and Figure 28 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 18 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 19 presents the emission share for municipal waste incineration plants. The emission share has decreased considerably since year 2000.

Table 19 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

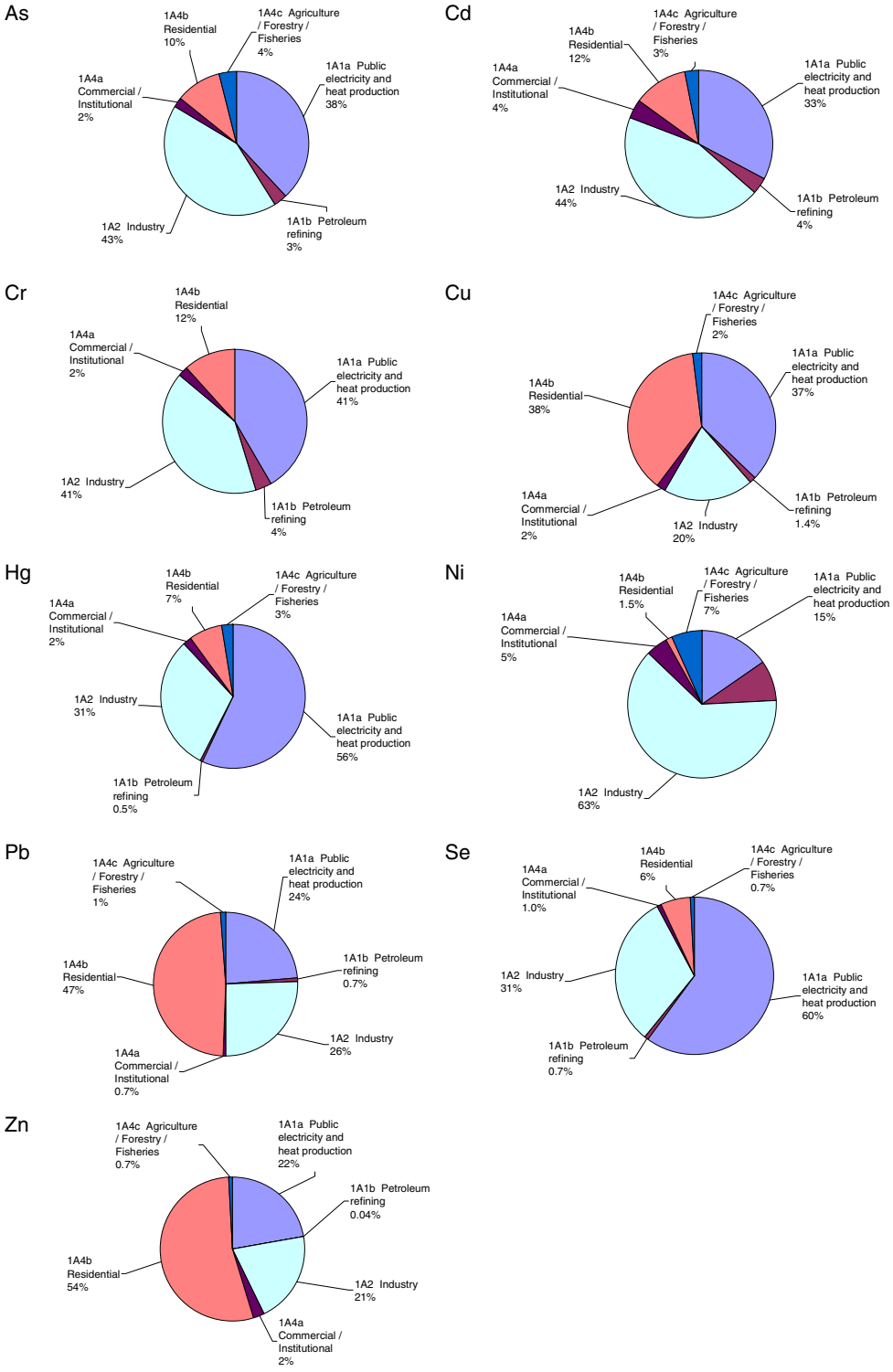


Figure 28 Heavy metal emission sources, stationary combustion plants, 2008.

Time-series for heavy metal emissions are provided in Figure 29. Emissions of all heavy metals, except Zn, have decreased considerably since 1990, see Table 20. 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 20 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

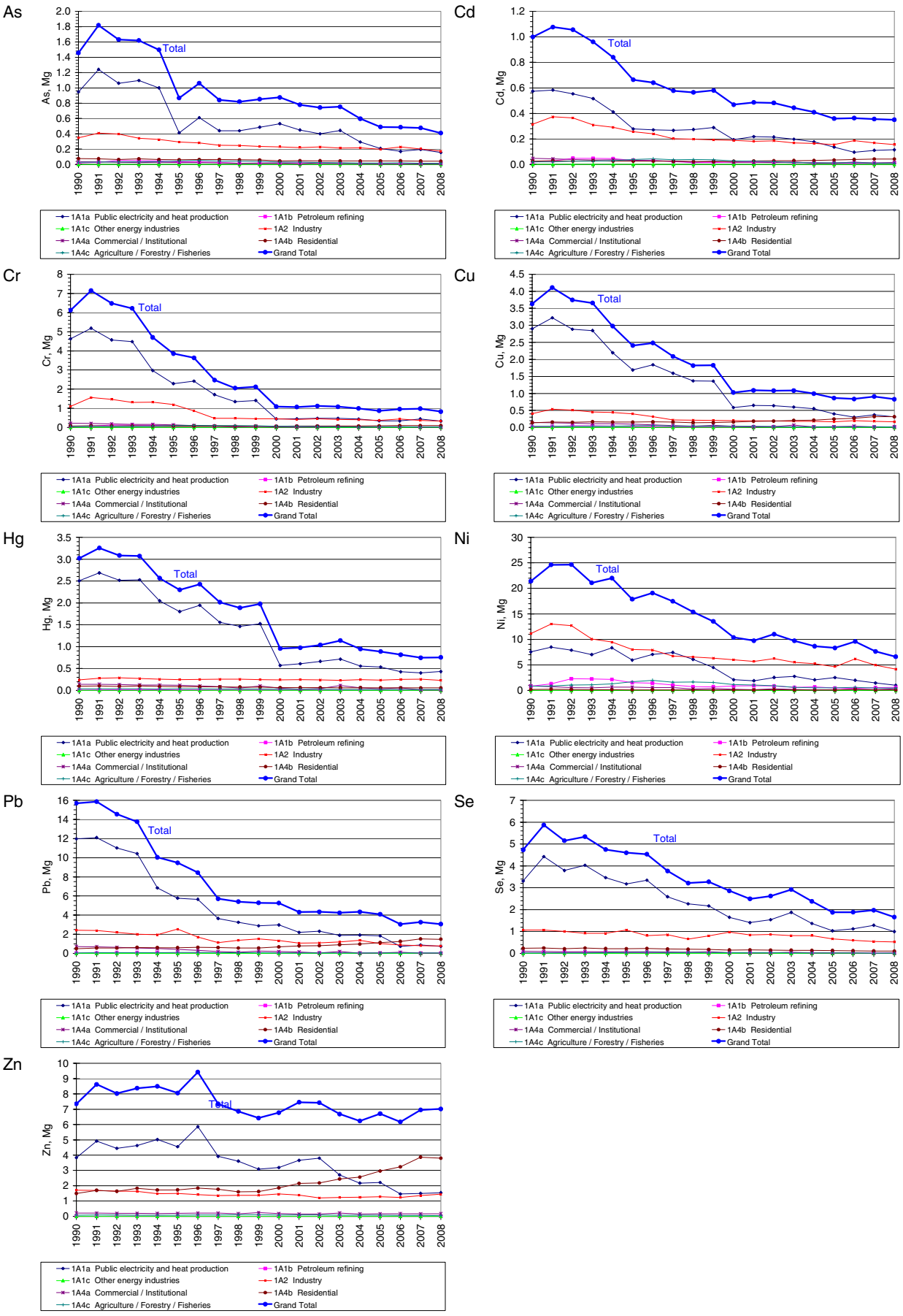


Figure 29 Heavy metal emission time-series, stationary combustion plants.

8 PAH

Emission inventories for four polycyclic aromatic hydrocarbons (PAH) are reported to the LRTAP Convention. The emission inventories for PAHs are presented in Table 21. Stationary combustion plants accounted for more than 93 % of the PAH emissions in 2008.

Table 21 PAH emission, 2008.

Pollutant	Benzo(a)-pyrene, Mg	Benzo(b)fluo-ranthene, Mg	Benzo(k)fluo-ranthene, Mg	Indeno(1,2,3-c,d)pyrene, Mg
1A1 Fuel combustion, Energy industries	0.01	0.03	0.02	0.01
1A2 Fuel combustion, Manufacturing Industries and Construction (Stationary combustion)	0.02	0.08	0.02	0.01
1A4 Fuel combustion, Other sectors (Stationary combustion)	4.71	4.90	2.70	3.32
Emission from stationary combustion plants	4.74	5.01	2.73	3.33
National emission	4.90	5.22	2.92	3.55
Emission share for stationary combustion (%)	97	96	93	94

Table 22 and Figure 30 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 31.

Time-series for PAH emission are presented in Figure 32. 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 32.

Table 22 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	4 380	4 507	2 595	2 954
1A4c Agriculture/Forestry/Fisheries	149	160	23	239
Total	4 739	5 013	2 727	3 334

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

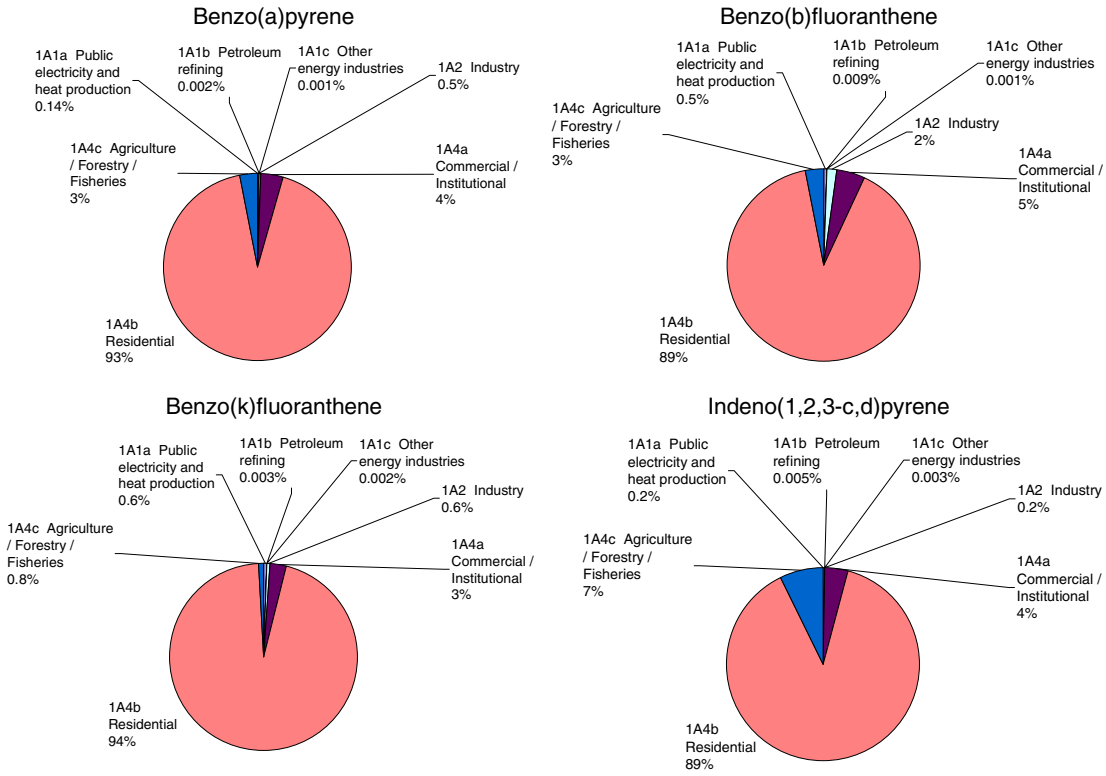


Figure 30 PAH emission sources, stationary combustion plants, 2008.

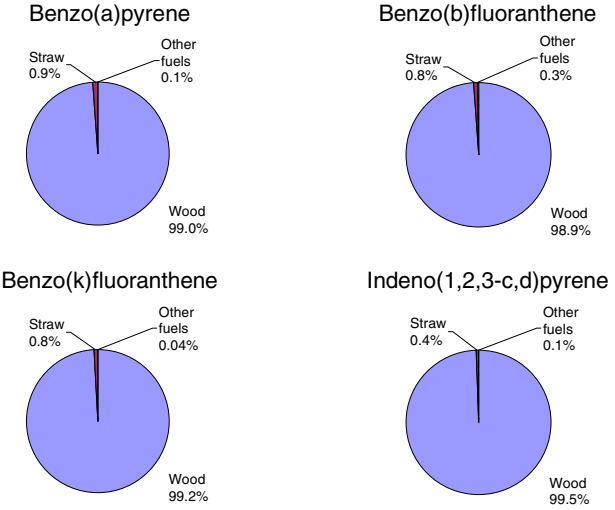


Figure 31 PAH emission from residential combustion plants (stationary), fuel origin.

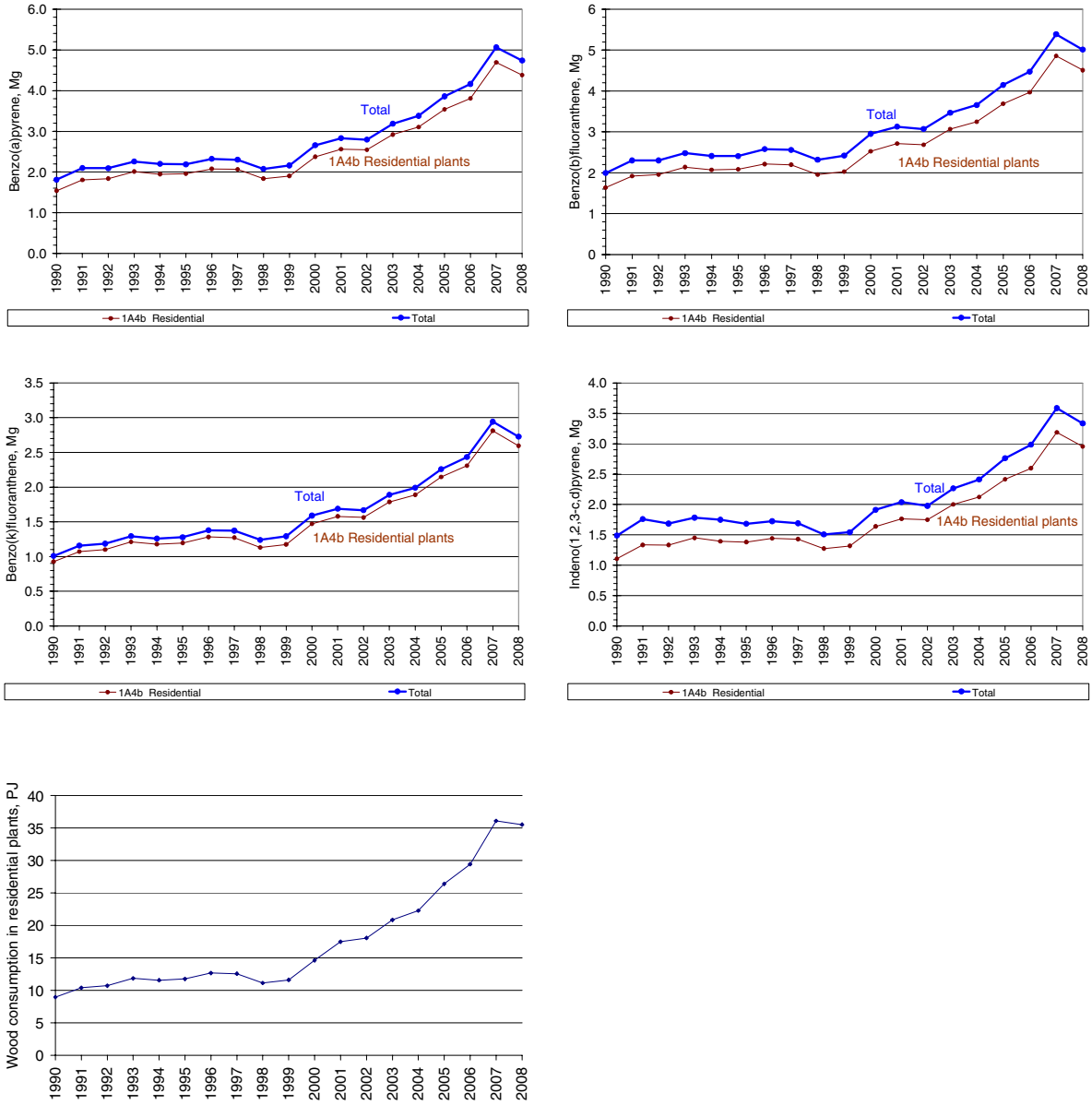


Figure 32 PAH emission time-series for stationary combustion plants. Comparison with wood consumption in residential plants.

9 Dioxin

Emission inventories for dioxin[11] are reported to the LRTAP Convention. The emission inventory for dioxin is presented in Table 23. Stationary combustion plants accounted for 67 % of the national dioxin emission in 2008.

Table 23 Dioxin emission, 2008.

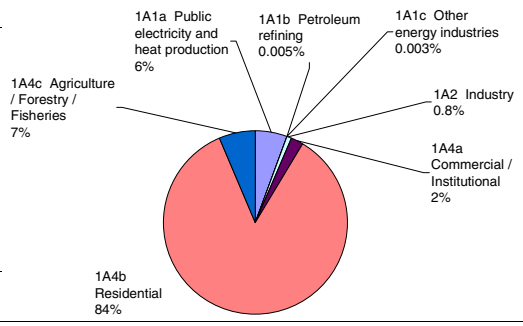
Pollutant	Dioxin, g I-teq
1A1 Fuel combustion, Energy industries	1.2
1A2 Fuel combustion, Manufacturing Industries and Construction (Stationary combustion)	0.2
1A4 Fuel combustion, Other sectors (Stationary combustion)	19.8
Emission from stationary combustion plants	21.1
National emission	31.5
Emission share for stationary combustion, %	67

Table 24 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 33).

Time-series for dioxin emission are presented in Figure 34. The dioxin emission has decreased 55 % since 1990 mainly due to installation of dioxin filters in MSW incineration plants that was needed to meet the lower emission limit value in Danish legislation valid for most MSW incineration plants since 2005 (DEPA, 2003). The emission from residential plants has increased due to increased wood consumption in this source category.

Table 24 Dioxin emission from stationary combustion plants, 2008[1)].

		Dioxin 2008 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.

[11] Poly Chlorinated Dibenzo Dioxins and Furans (PCDD/-F).

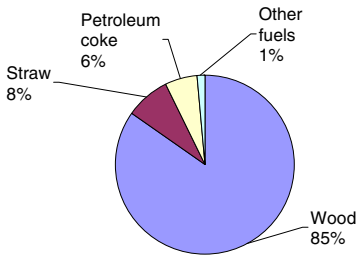


Figure 33 Dioxin emission from residential plants, fuel origin.

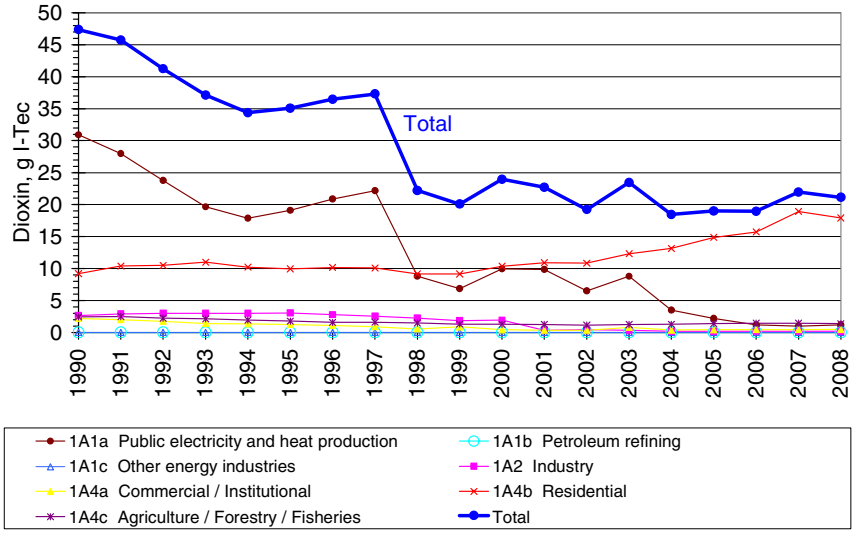


Figure 34 Dioxin emission time-series, stationary combustion plants.

10 HCB

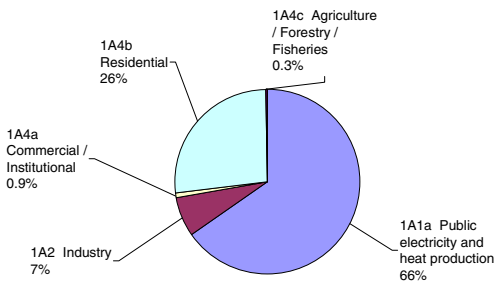
Emission inventories for hexachlorobenzene (HCB) are reported to the LRTAP Convention. The emission has been estimated only for stationary combustion plants and for cremation. Stationary plants accounted for more than 98 % of the estimated national HCB emission in 2008.

Table 25 shows the HCB emission inventory for the stationary combustion subcategories. *Public electricity and heat production* accounts for 65 % of the emission. *Residential plants* accounts for 26 % of the emission.

Time-series for HCB emission are presented in Figure 35. The HCB 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 25 HCB emission from stationary combustion plants, 2008[1)].

		HCB 2008 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.

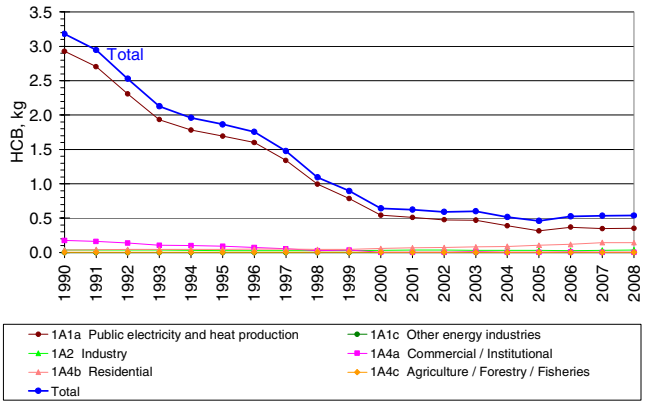


Figure 35 HCB emission time-series, stationary combustion plants.

11 NH_3

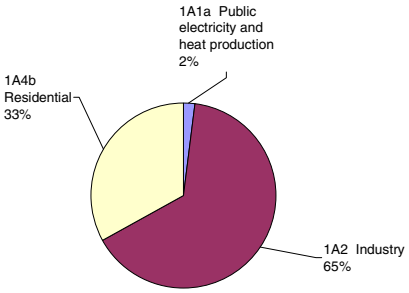
Emission inventories for ammonia (NH_3) are reported to the LRTAP Convention. Stationary combustion plants accounted for only 0.8 % of the national NH_3 emission in 2008.

Table 26 shows the NH_3 emission inventory for the stationary combustion subcategories. *Industry* accounts 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 36. The NH_3 emission was 3 % higher in 2008 than in 1990.

Table 26 NH_3 emission from stationary combustion plants, 2008[1)].

		NH_3 2008 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.

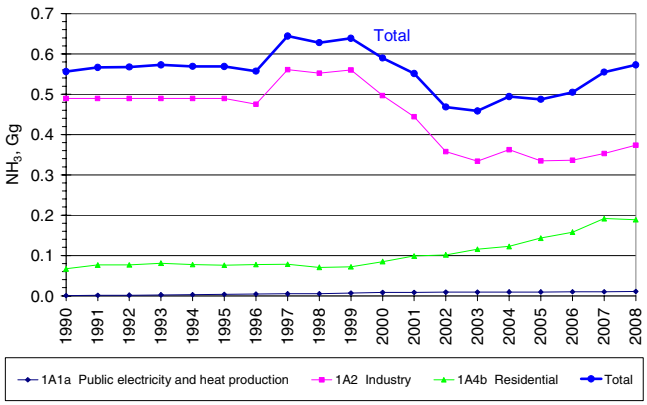


Figure 36 NH_3 emission time-series, stationary combustion plants.

12 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 emission.

12.1 1A1 Energy industries

The emission source category *1A1 Energy Industries* consists of the sub-categories:

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

Figure 37 – 42 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.

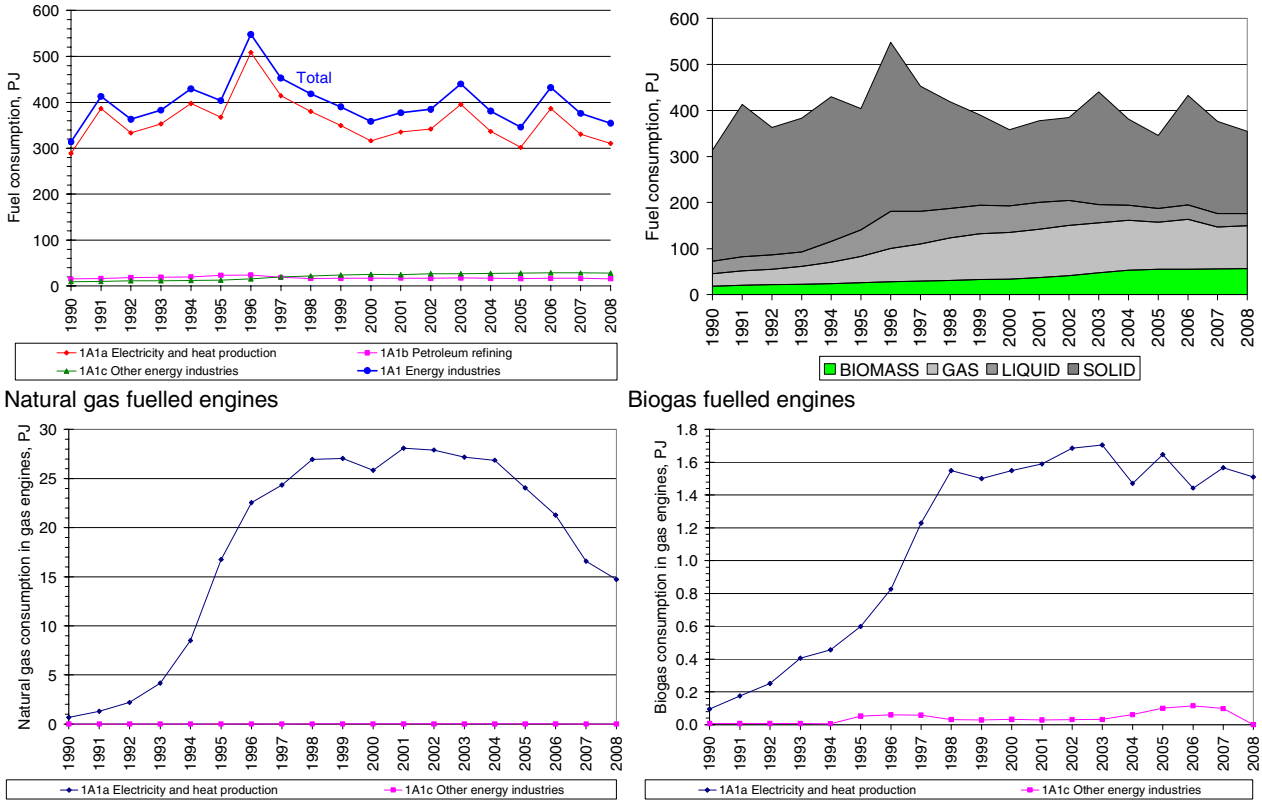


Figure 37 Time-series for fuel consumption, 1A1 Energy industries.

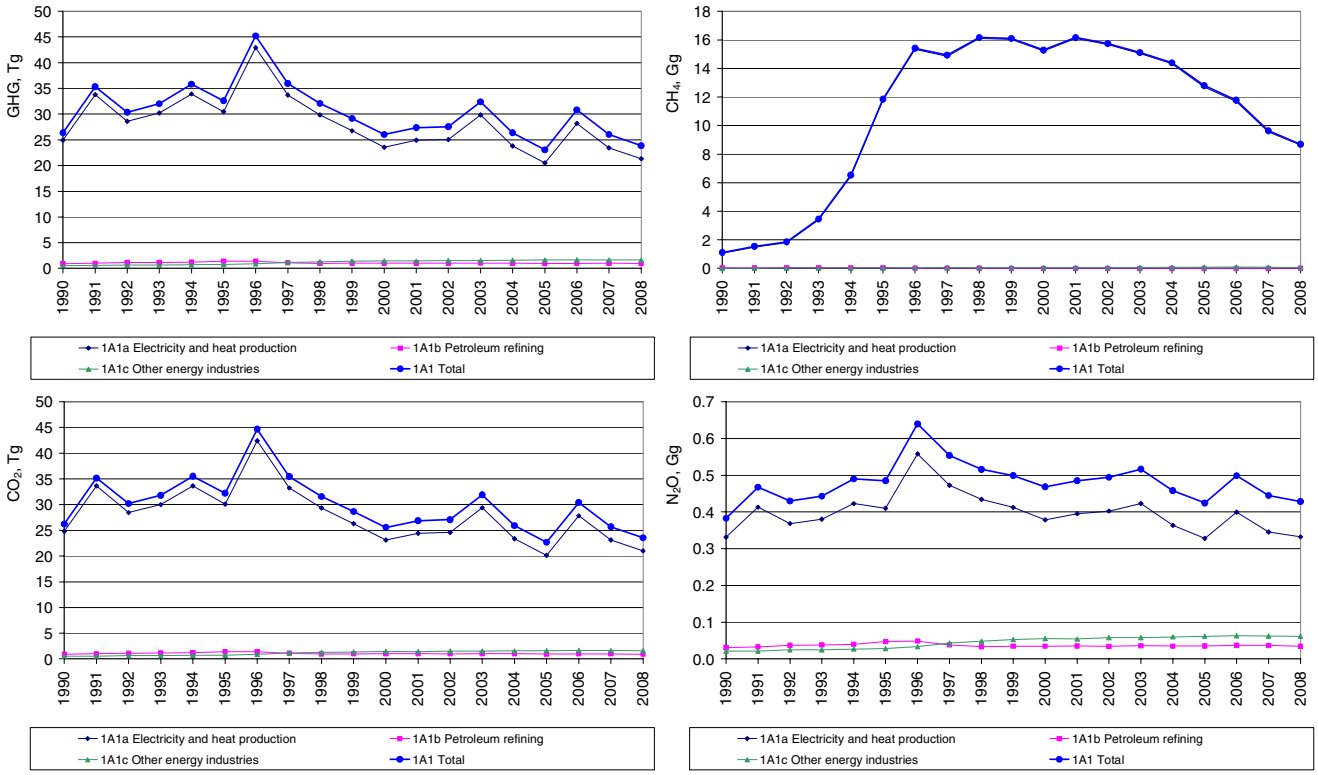


Figure 38 Time-series for greenhouse gas emission, 1A1 Energy industries.

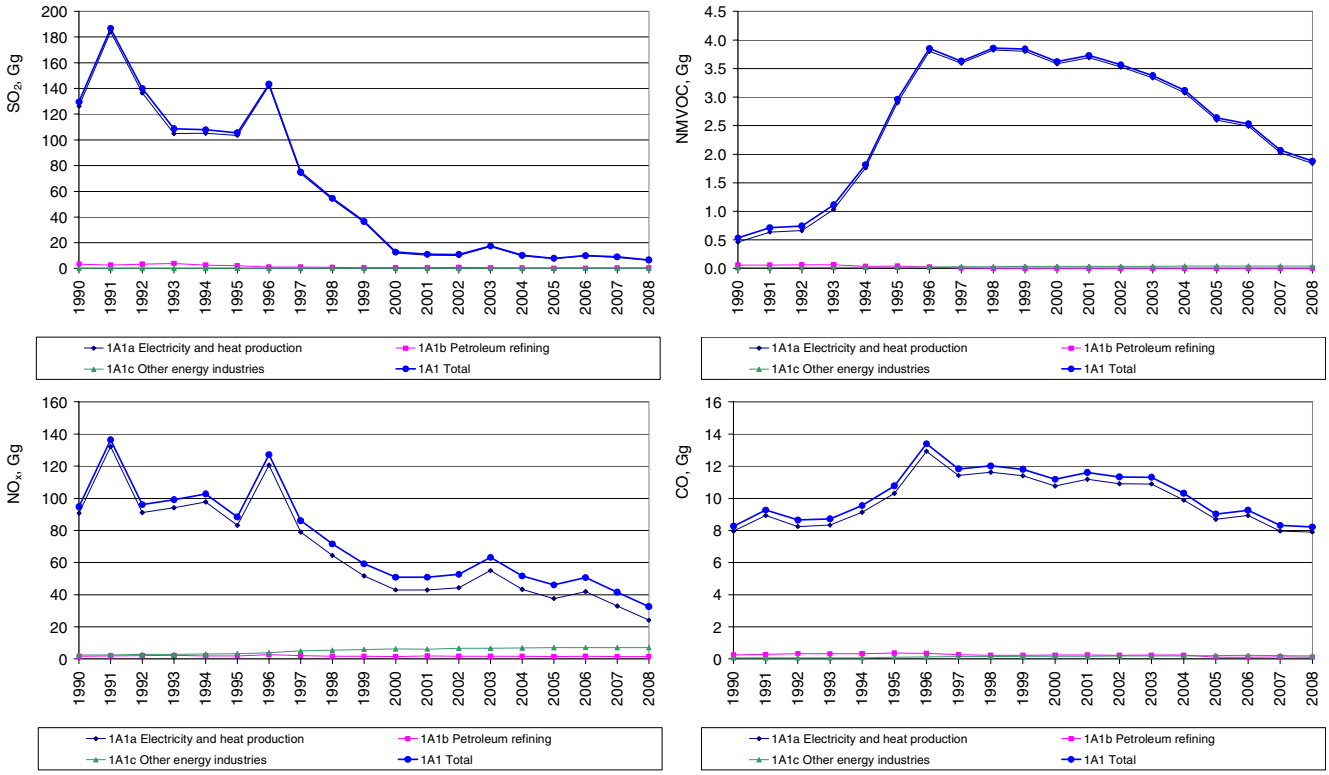


Figure 39 Time-series for SO_2, NO_x, NMVOC and CO emission, 1A1 Energy industries.

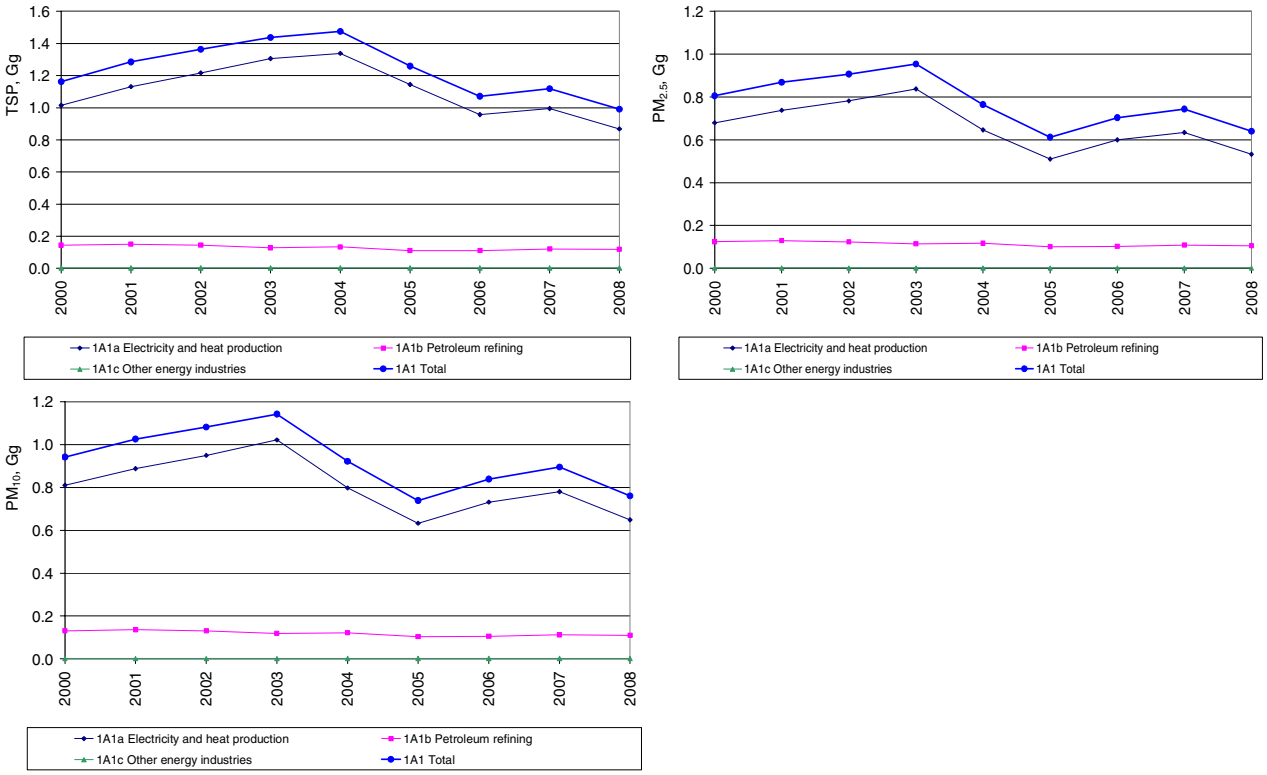


Figure 40 Time-series for PM emission, 1A1 Energy industries.

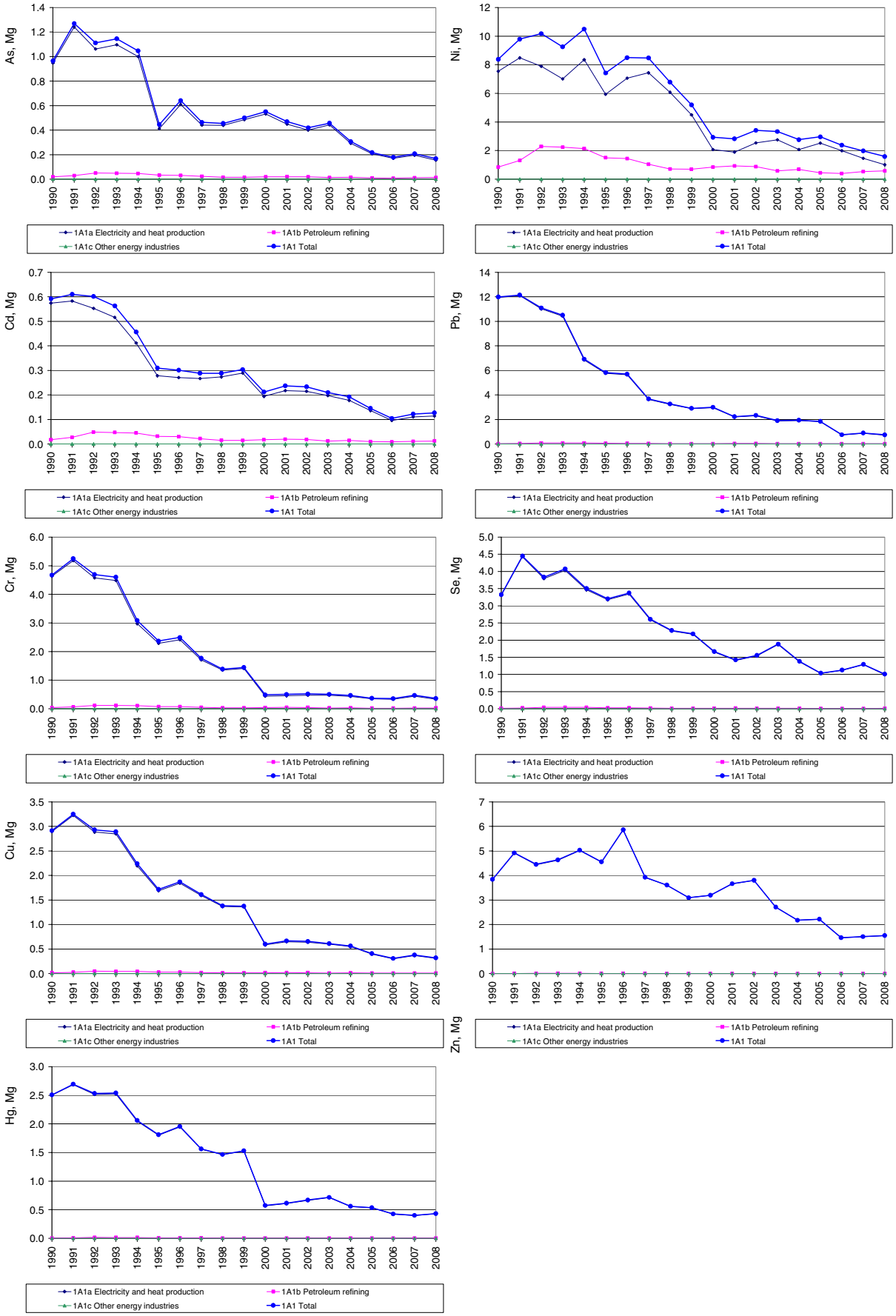


Figure 41 Time-series for HM emission, 1A1 Energy industries.

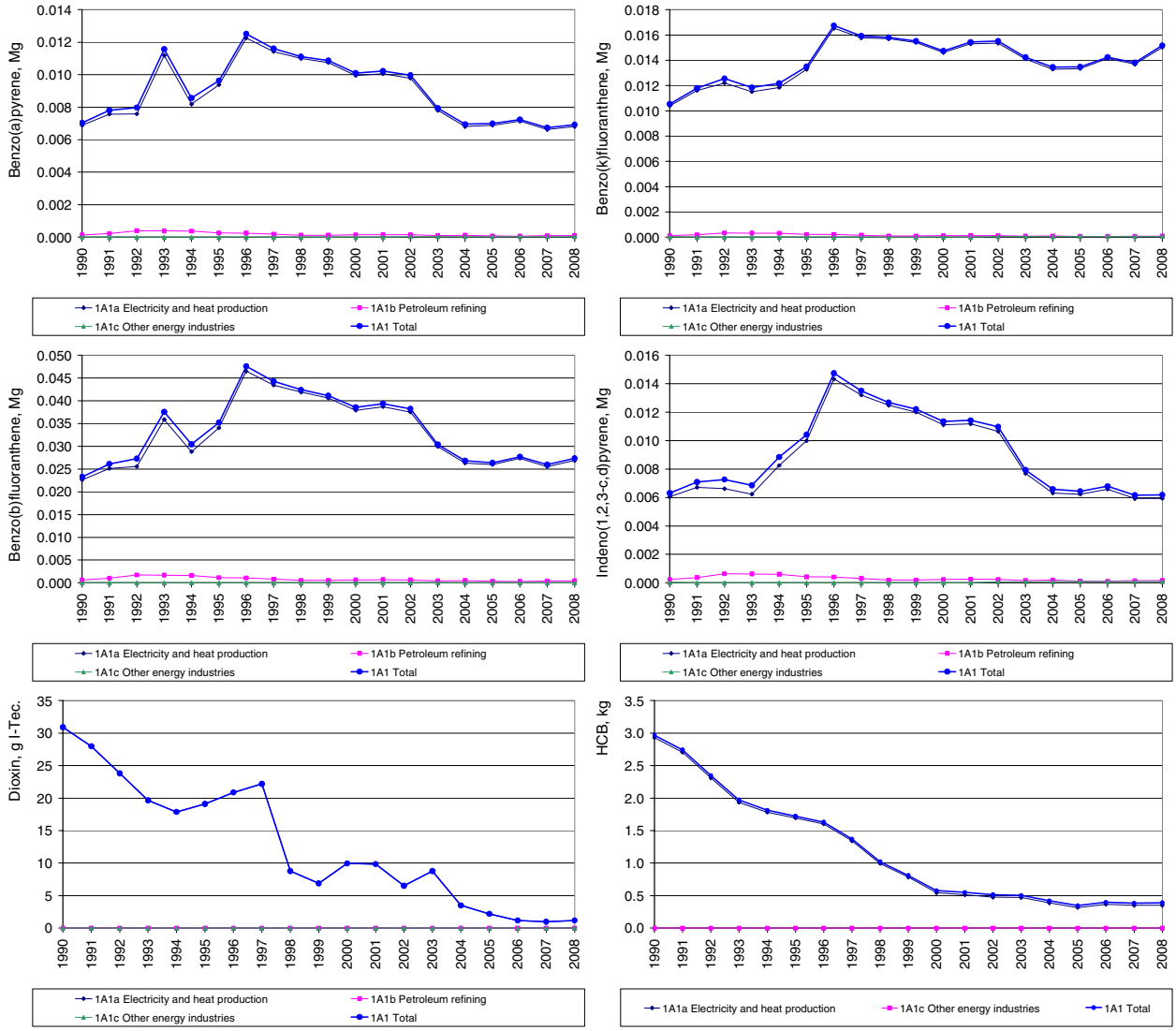


Figure 42 Time-series for PAH, dioxin and HCB emission, 1A1 Energy industries.

12.1.1 1A1a Electricity and heat production

Public electricity and heat production is the largest source category regarding both fuel consumption and greenhouse gas emissions for stationary combustion. Figure 43 shows the time-series for fuel consumption and emissions of the pollutants included in the reporting to the Climate Convention.

The fuel consumption in electricity and heat production was 7 % higher in 2008 than in 1990. As discussed in Chapter 3 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 37). The consumption of municipal waste and biomass has increased.

The CO_2 emission was 15 % lower in 2008 than in 1990. This decrease – in spite of higher fuel consumption - is a result of the change of fuel discussed above.

For CH_4 the emission increase until the mid-nineties is a result of the considerable number of lean-burn gas engines installed in CHP plants in Denmark in this period. The decline in later years is due to structural changes in the Danish electricity market, which means that the fuel consumption in gas engines has been decreasing (Figure 37). The emission in 2008 was 8.1 times the 1990 emission level.

The N_2O emission was the same in 2008 as in 1990. The emission fluctuates similar to the fuel consumption.

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 four times the 1990 emission level. This is a result of the large number of gas engines that has been installed in Danish CHP plants as mentioned above.

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.

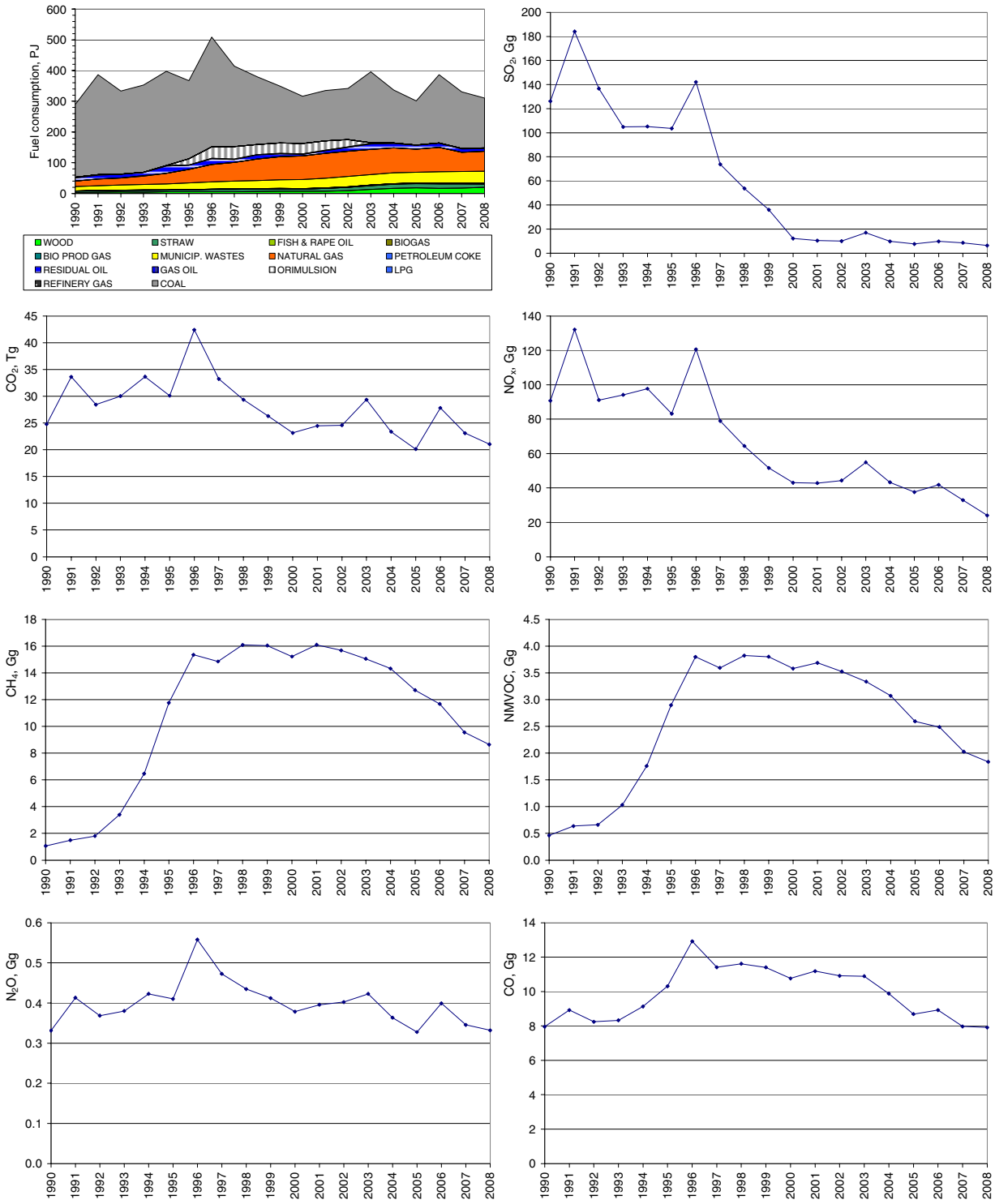


Figure 43 Time-series for 1A1a Electricity and heat production

12.1.2 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 44 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 and the CO_2 emission has increased 2 %.

The reduction in CH_4 emission from 1995 to 1999 is due to a combination of the closure of a refinery and a change of emission factor.

The N_2O emission has increased 12 %.

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 Chapter 3.5 of the Danish National Inventory Report (Nielsen et al. 2010a).

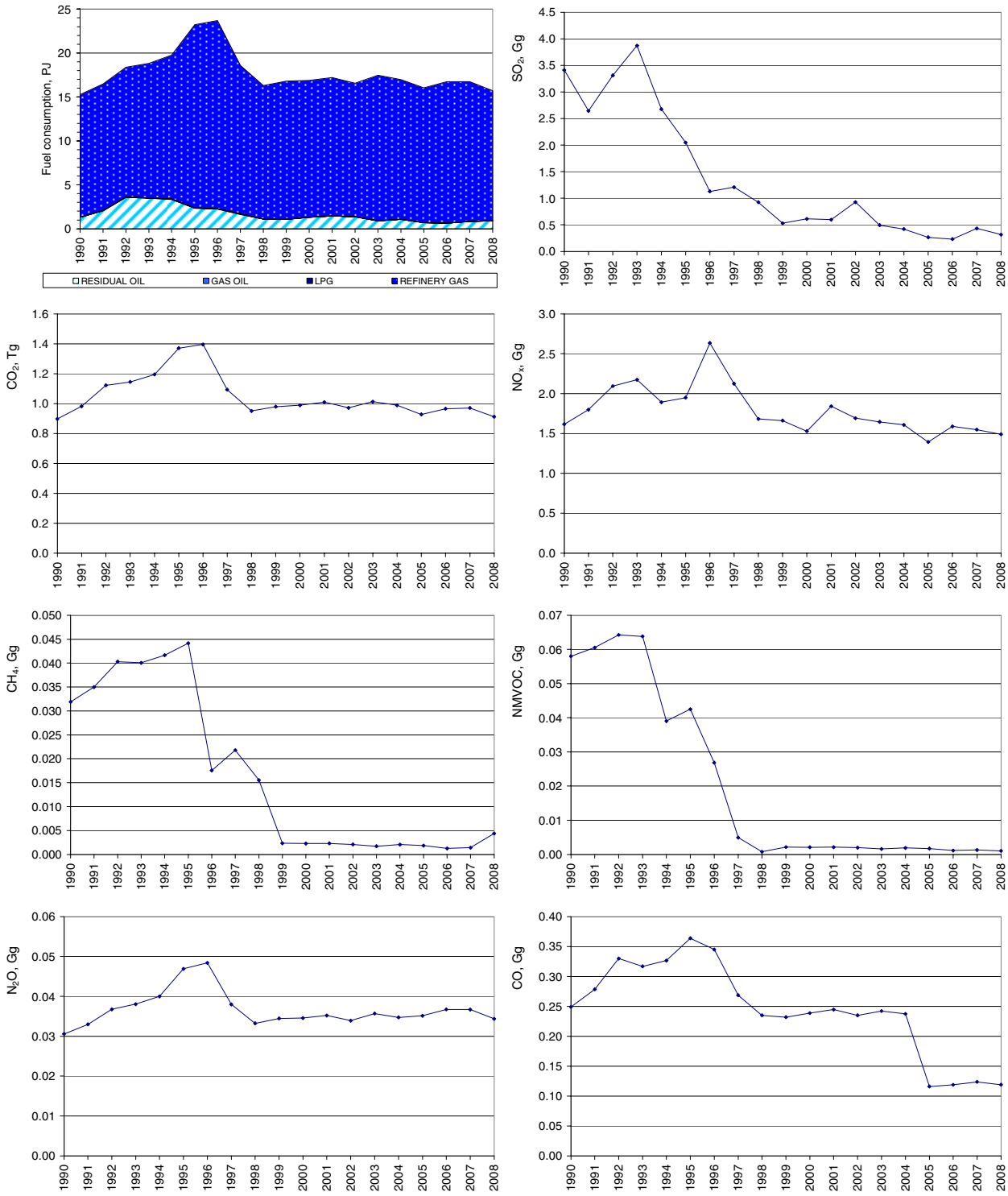


Figure 44 Time-series for 1A1b Petroleum refining.

12.1.3 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 45 shows the time-series for fuel consumption and emissions.

The fuel consumption in 2008 was three times the consumption in 1990. The CO_2 emission follows the fuel consumption and the emission in 2008 was also three times the emission in 1990.

The two main sources for CH_4 emission in 2008 was off-shore gas turbines and biogas fuelled gas engines[12]. The increase in emission from 2003 to 2006 is due to an increase in biogas consumption in gas engines. The CH_4 emission factor for biogas fuelled gas engines (434 g pr GJ[13]) is much higher than emission factors for off-shore gas turbines (1.7 g pr GJ[6]) and this causes the increase in CH_4 emission despite the low consumption of biogas in this emission source category.

The emissions from other pollutants follow the increase of fuel consumption.

[12] The consumption of biogas will be relocated to other emission source categories in future inventories.
[13] In 2008.

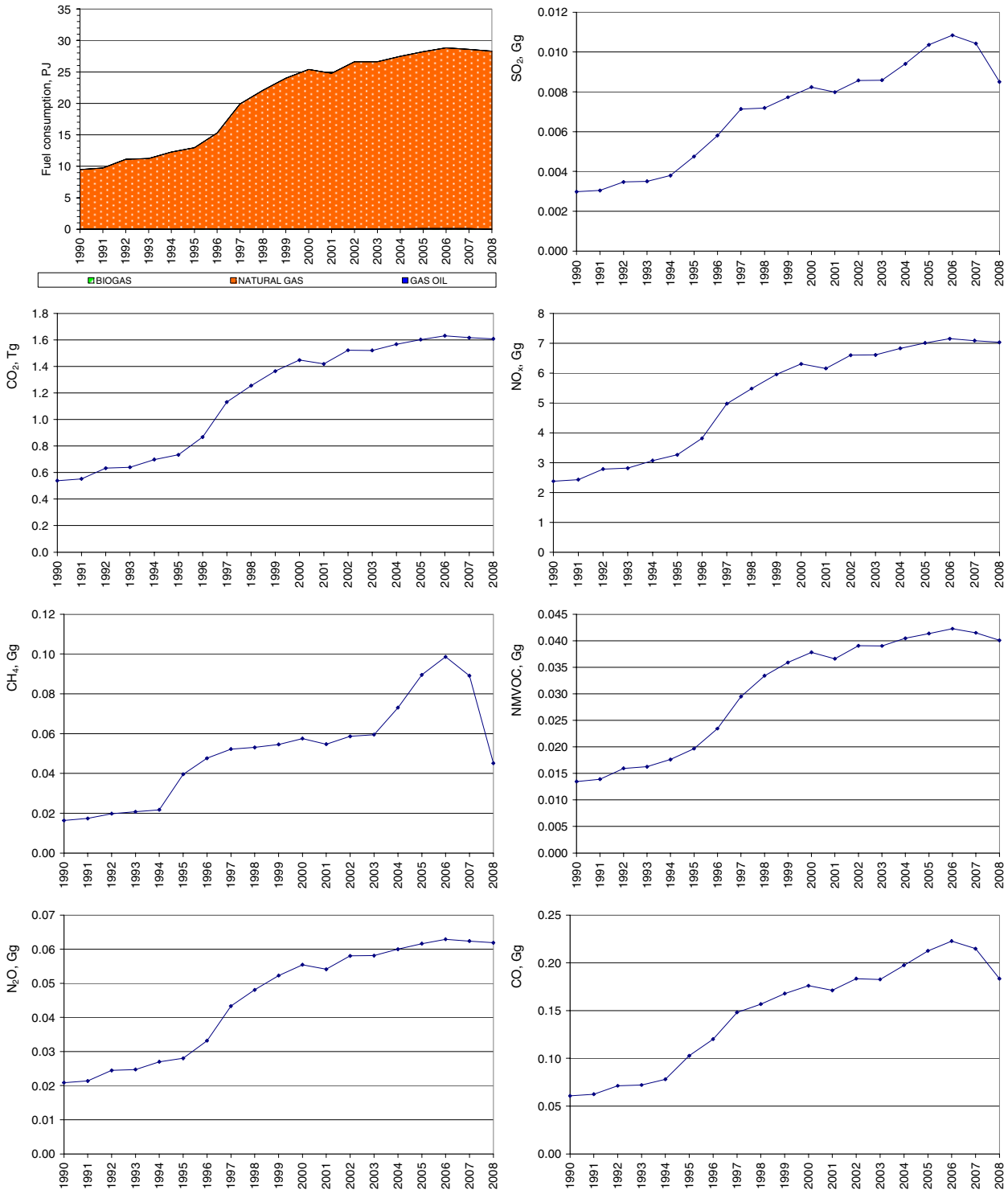


Figure 45 Time-series for 1A1c Other energy industries.

12.2 1A2 Industry

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

Figure 46-51 show the time-series for fuel consumption and emissions. The data have not been disaggregated to industrial subcategories due to the fact that the Danish inventory is based on data for the industrial

plants as a whole. Disaggregation to subcategories for the reporting to the Climate Convention is discussed in Chapter 14.8.

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 wheras the consumption of petroleum coke increased. The biomass part of fuel has not changed considerably since 1990.

The GHG emission and the CO_2 emission are both rather stable following the small fluctuations in fuel consumption. In spite of the unchanged fuel consumption the CO_2 emission has decreased 11 % since 1990 due to the change of fuels.

The CH_4 emission has increased from 1995-2000 and decreased again from 2004 onwards. In 2008 the emission was 51 % higher than in 1990. The CH_4 emission follows the consumption of natural gas in gas engines. Most industrial CHP plants based on gas engines came in operation during 1995 to 1999. The decrease in later years is a result of the liberalisation of the electricity market.

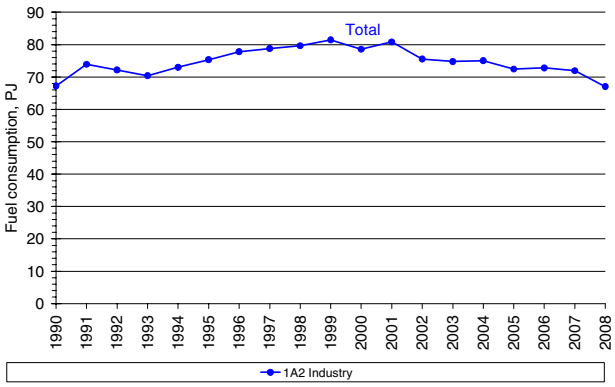
The N_2O emission follows the small fluctuations of the fuel consumption in industrial plants. In 2008 the emission was 3 % lower than in 1990.

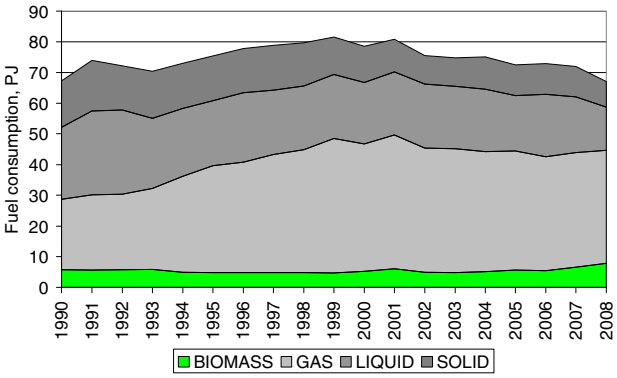
The SO_2 emission has decreased 68 % since 1990. This is mainly a result of lower consumption of residual oil in the industrial sector. Further the sulphur content of residual oil and several other fuels has decreased since 1990 due to legislation and tax laws.

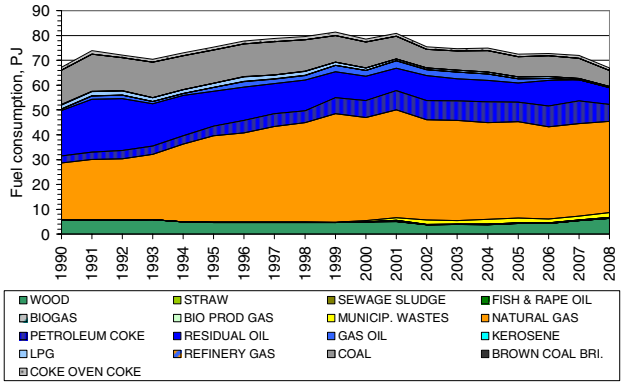
The NO_x emission fluctuations follow the fuel consumption in the cement production. However, the NO_x emission has decreased 27 % since 1990 due to the reduced emission from industrial boilers in general.

The NMVOC emission has decreased 71 % since 1990. The decrease is mainly a 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, which 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.

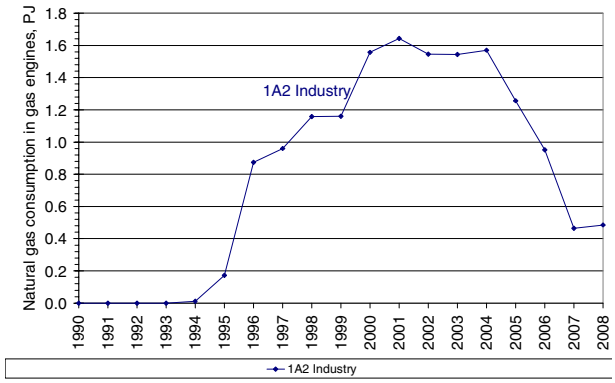






Fuel consumption in natural gas fuelled engines

Fuel consumption, residual oil



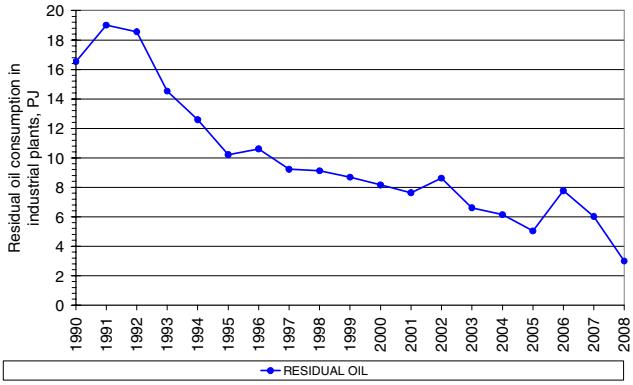


Figure 46 Time-series for fuel consumption, 1A2 Industry.

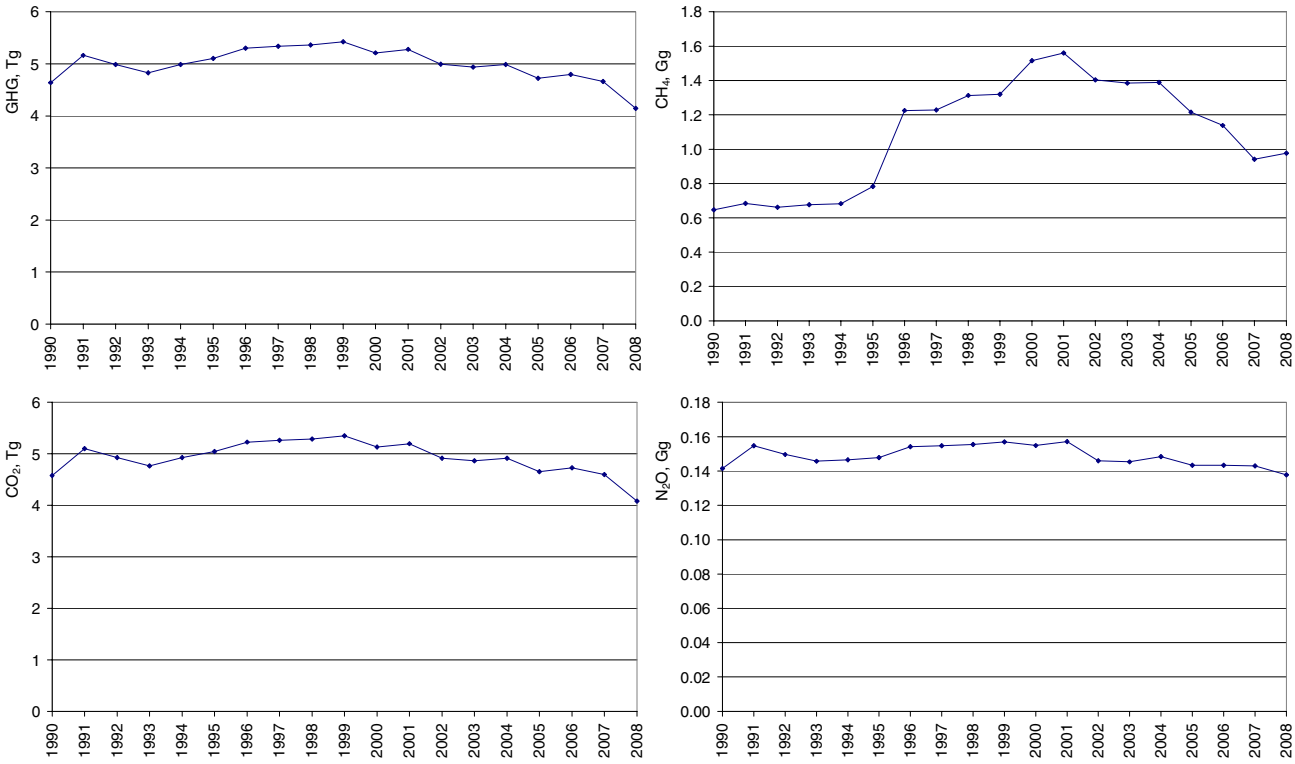


Figure 47 Time-series for greenhouse gas emission, 1A2 Industry.

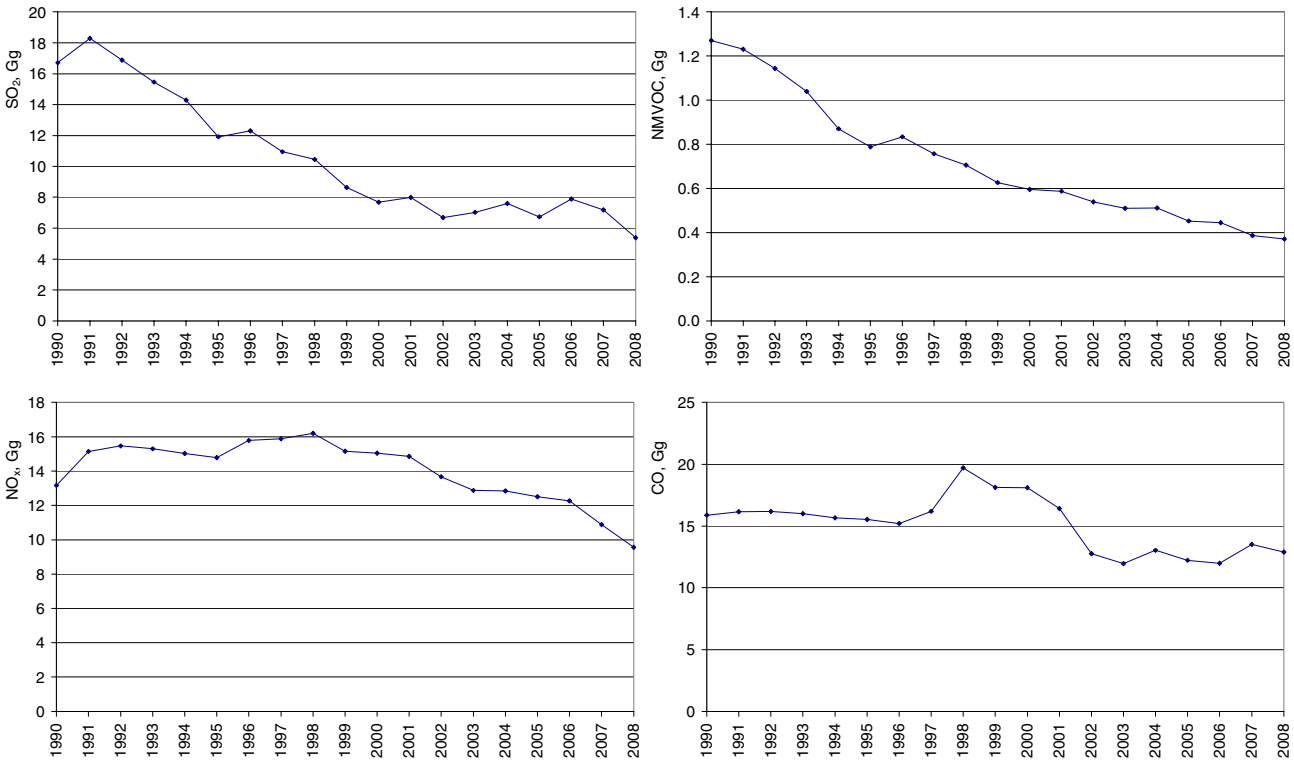


Figure 48 Time-series for SO_2, NO_x, NMVOC and CO emission, 1A2 Industry.

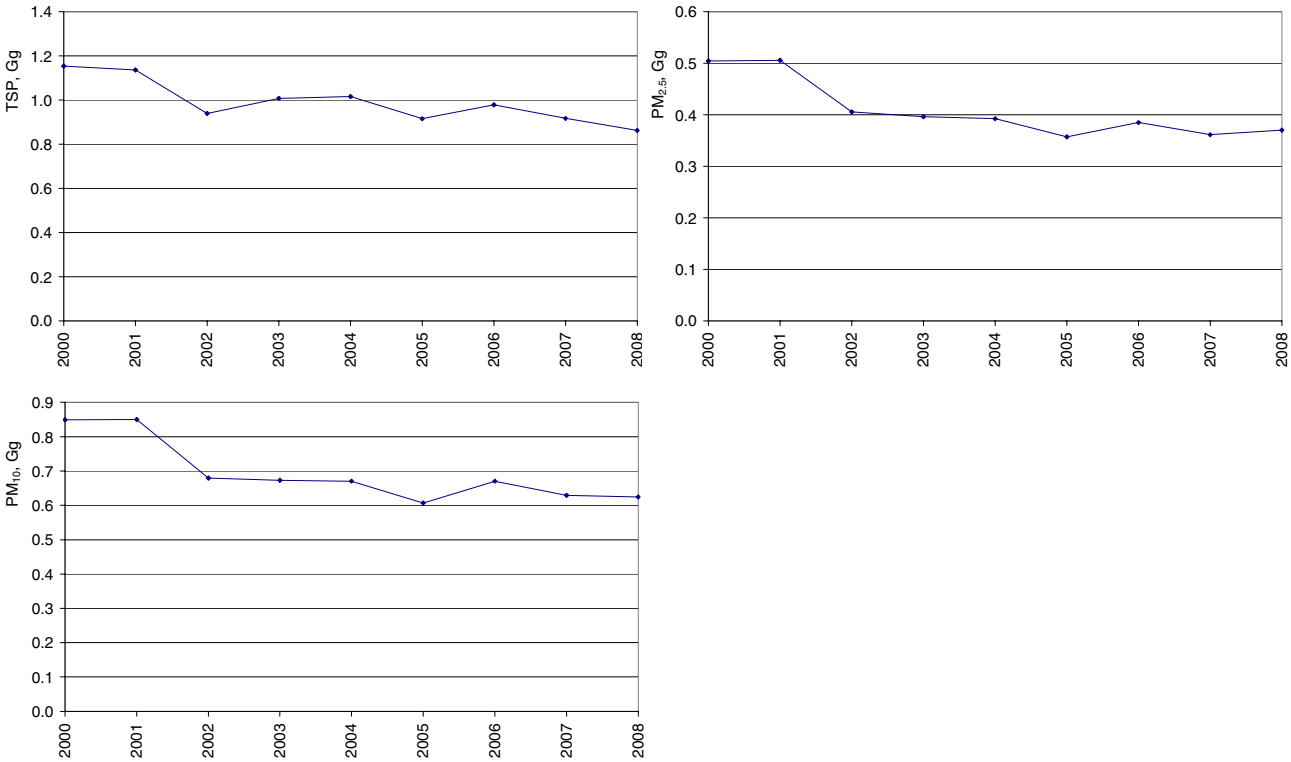


Figure 49 Time-series for PM emission, 1A2 Industry.

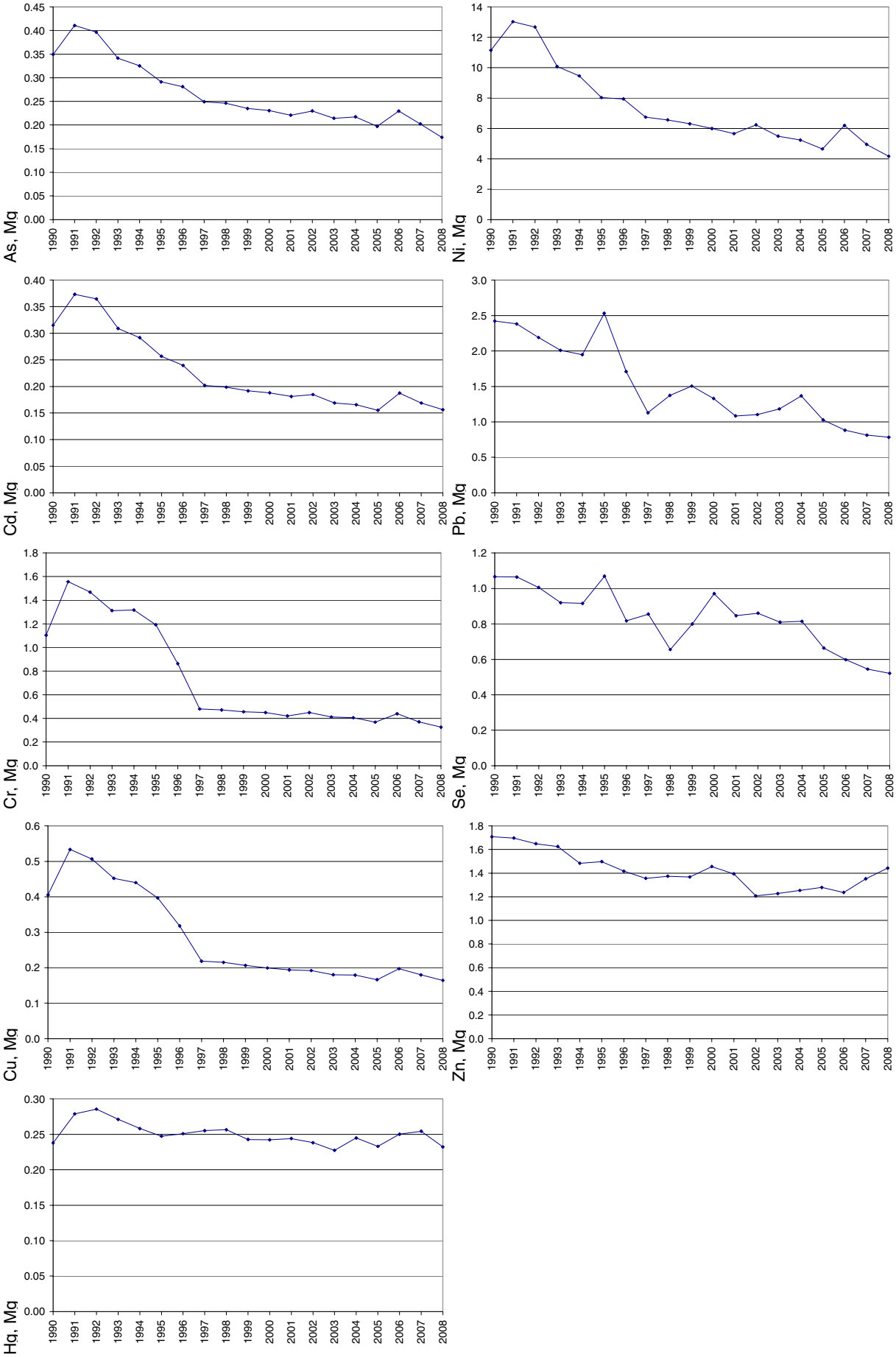


Figure 50 Time-series for HM emission, 1A2 Industry.

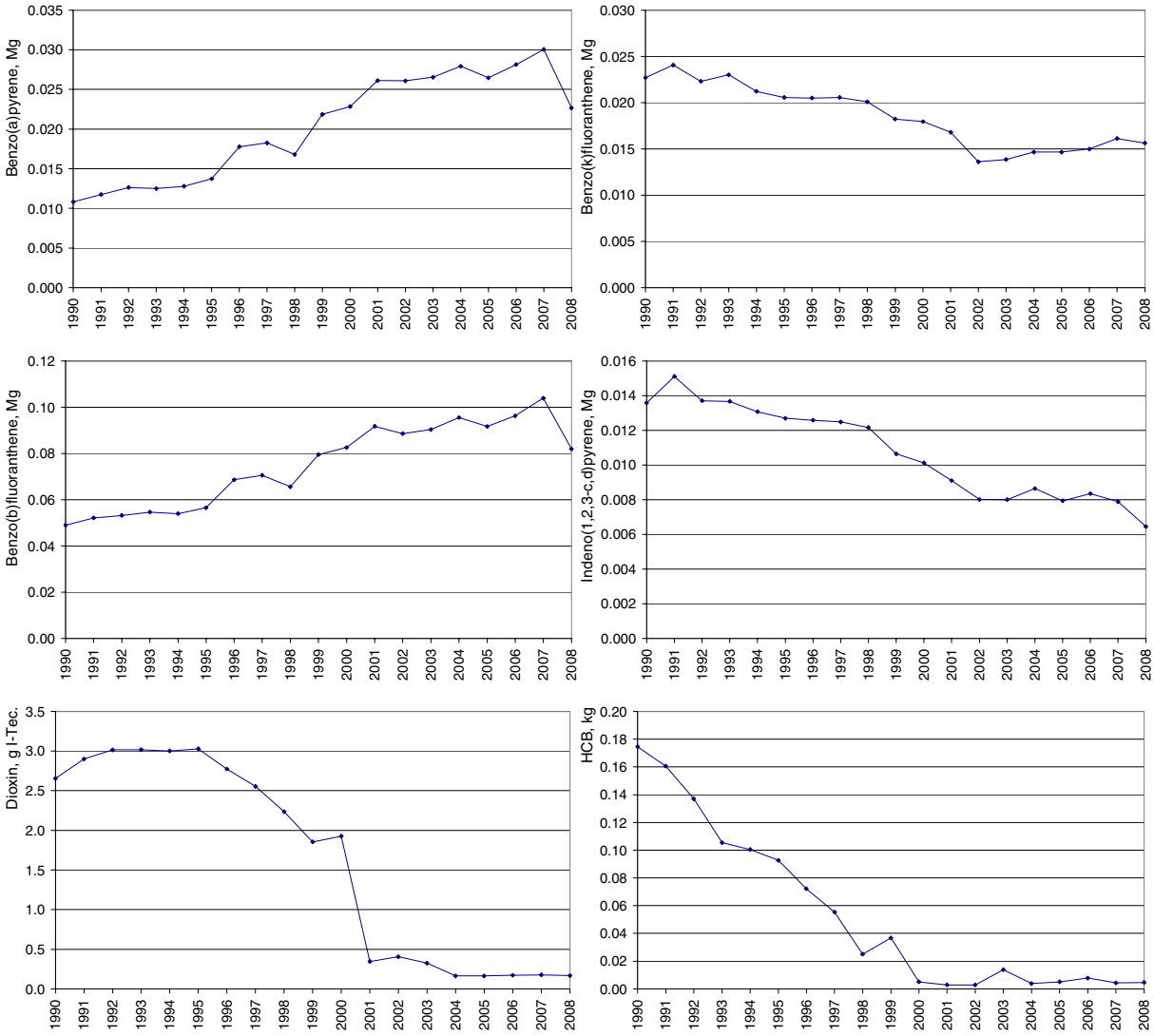


Figure 51 Time-series for PAH, dioxin and HCB emission, 1A2 Industry.

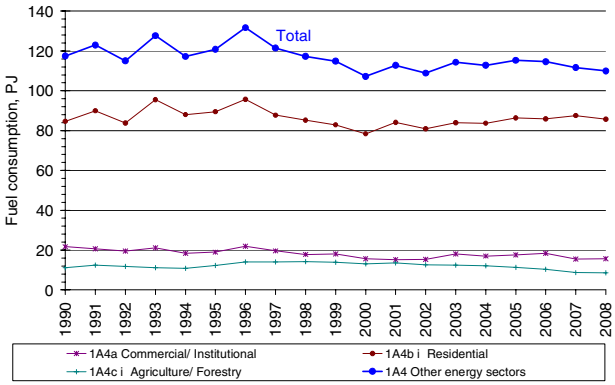
12.3 1A4 Other Sectors

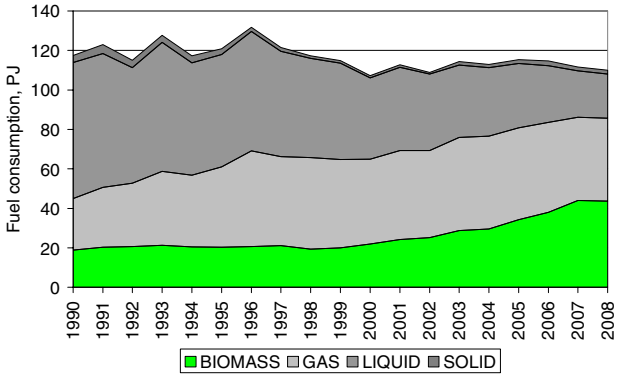
The emission source category *1A4 Other Sectors* consists of the subcategories:

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

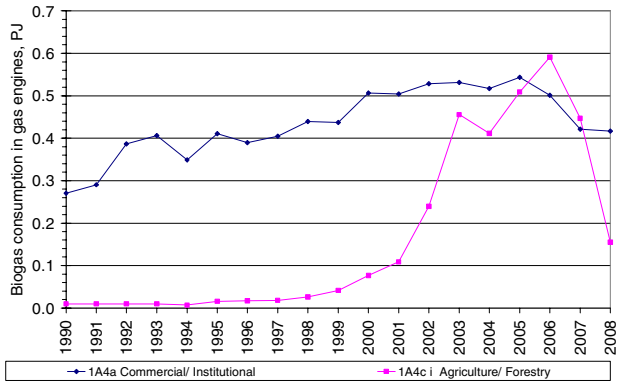
Figure 52-57 present time-series for this emission source category. *Residential plants* is the largest subcategory accounting for the largest part of all emissions. Time-series are discussed below for each subcategory.

1A4 Other Sectors

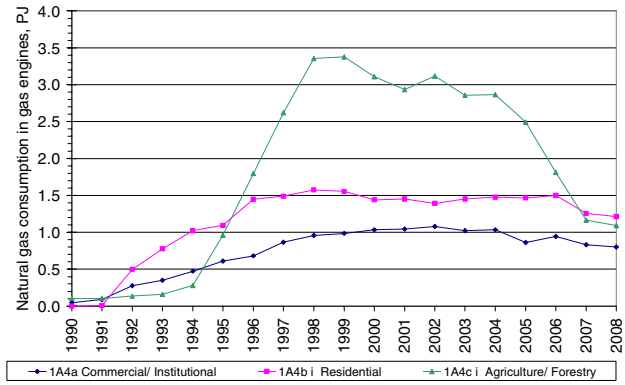




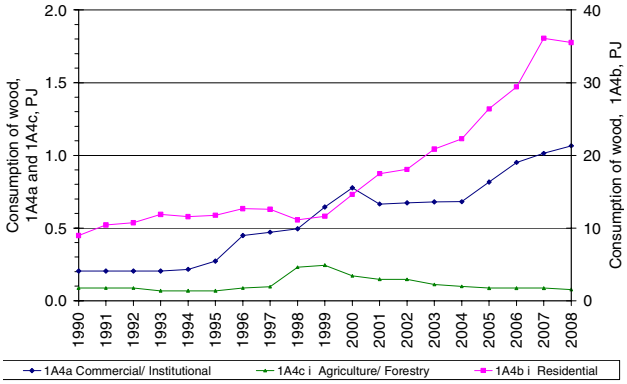
Gas engines, biogas (subsectors to Other Sectors)



Gas engines, natural gas (subsectors to Other Sectors)



Combustion of wood in Other Sectors



Combustion of straw in Other Sectors

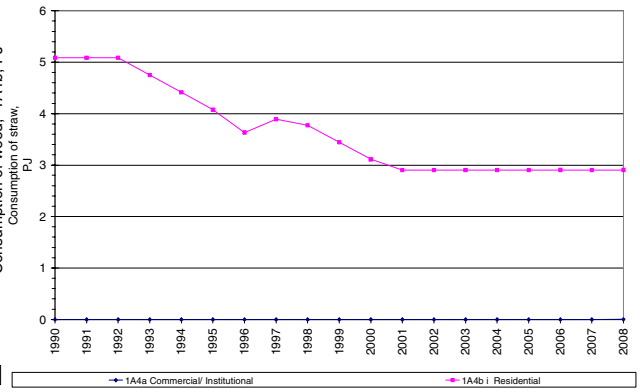


Figure 52 Time-series for fuel consumption, 1A4 Other Sectors.

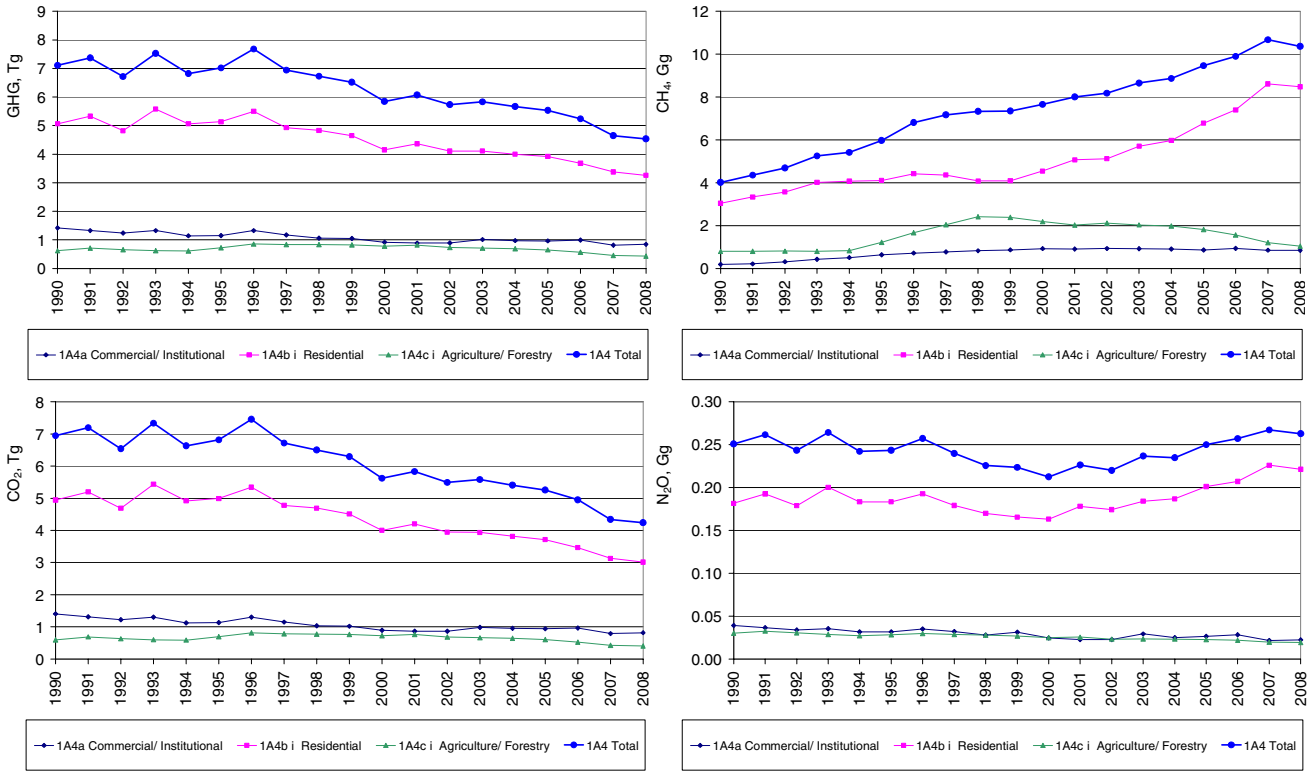


Figure 53 Time-series for greenhouse gas emission, 1A4 Other Sectors.

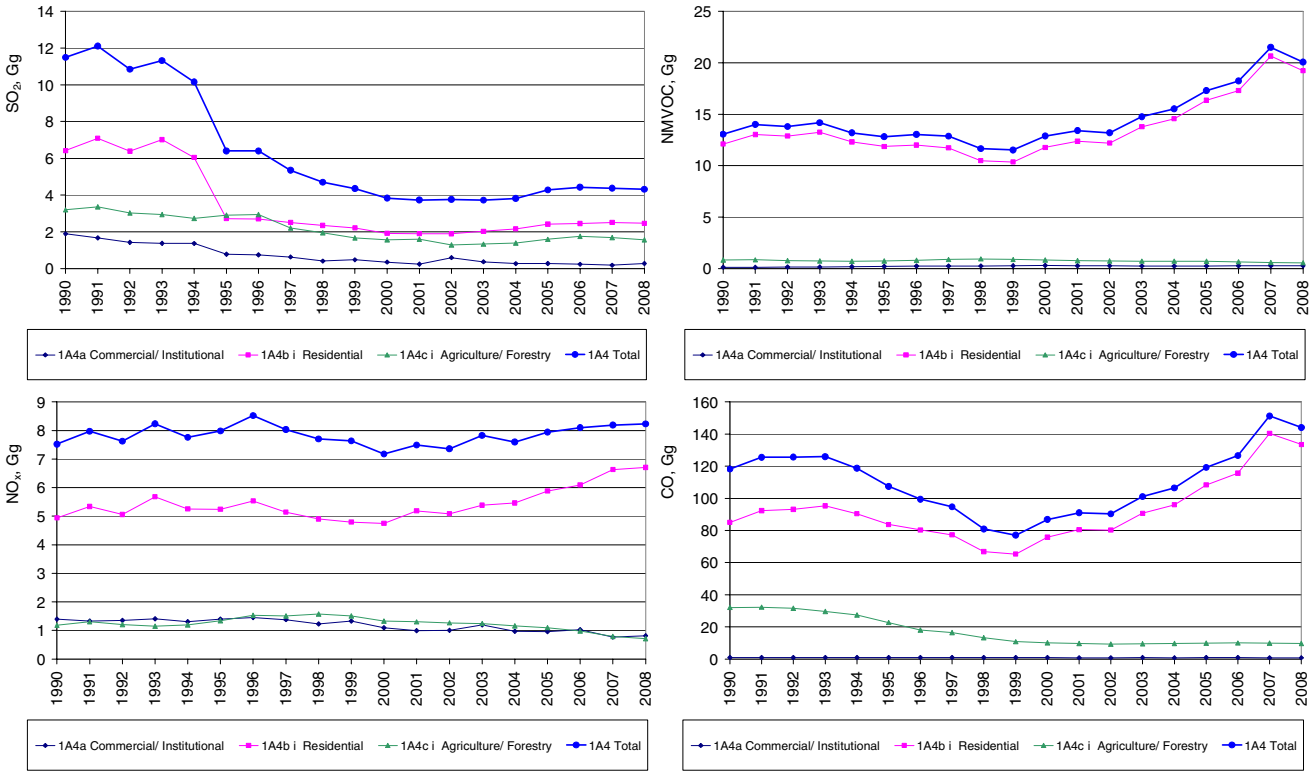


Figure 54 Time-series for SO_2, NO_x, NMVOC and CO emission, 1A4 Other Sectors.

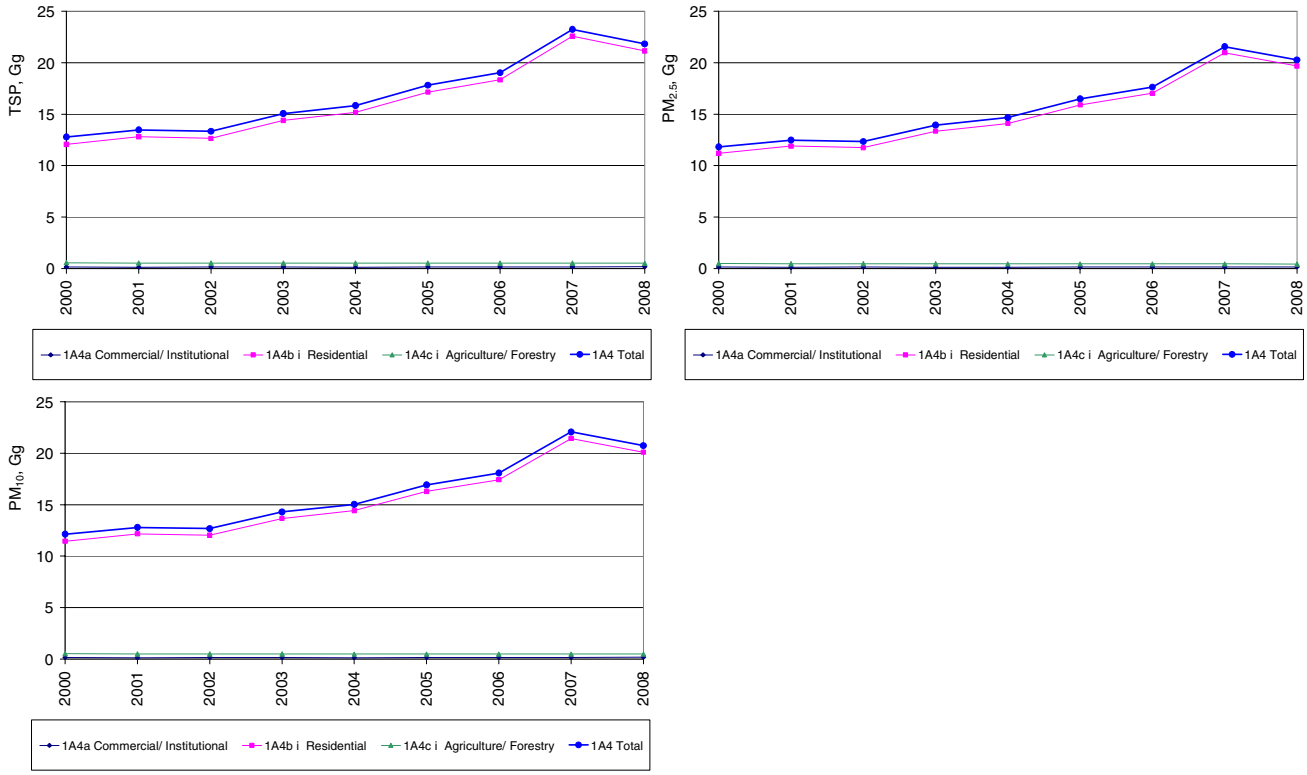


Figure 55 Time-series for PM emission, 1A4 Other Sectors.

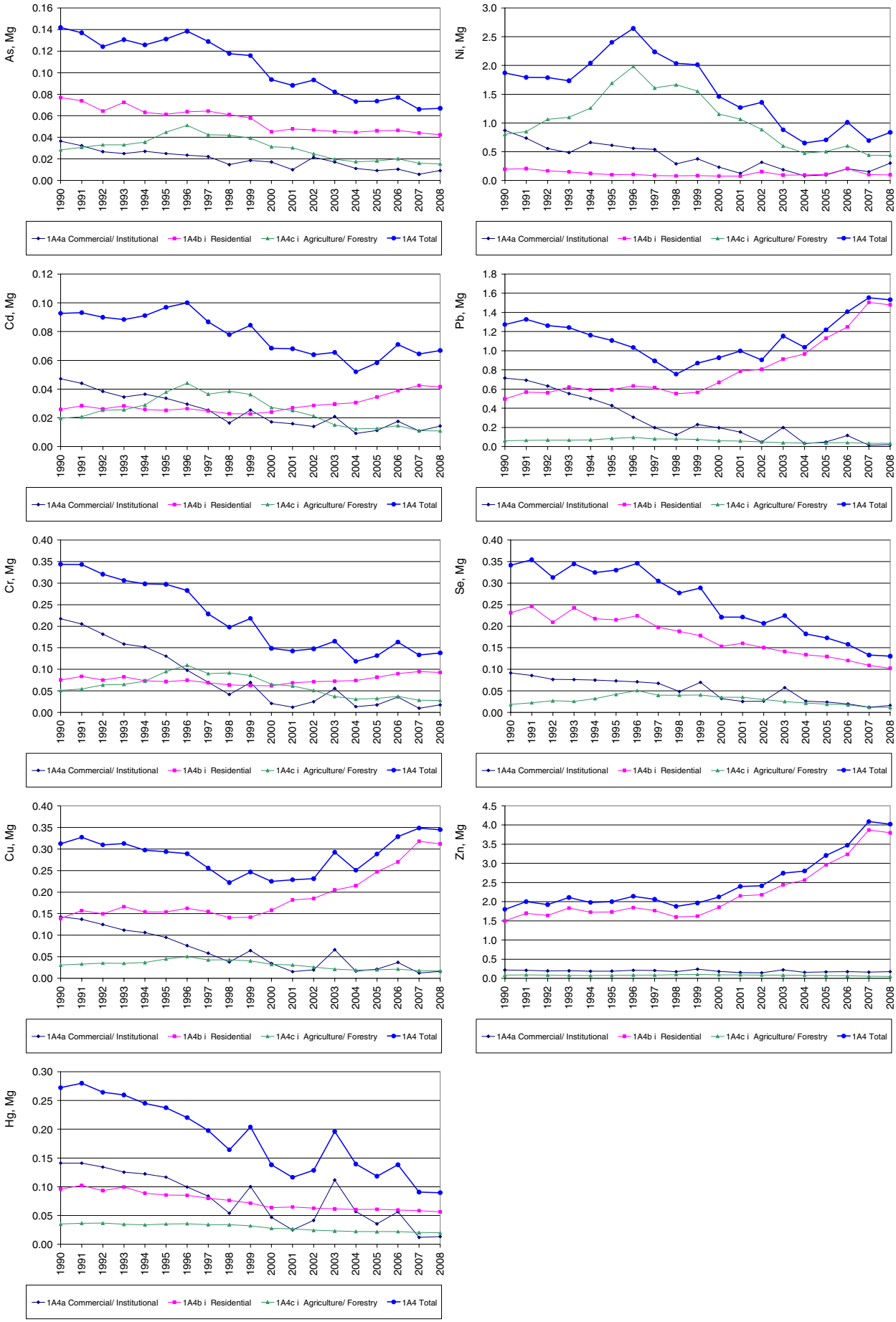


Figure 56 Time-series for HM emission, 1A4 Other Sectors.

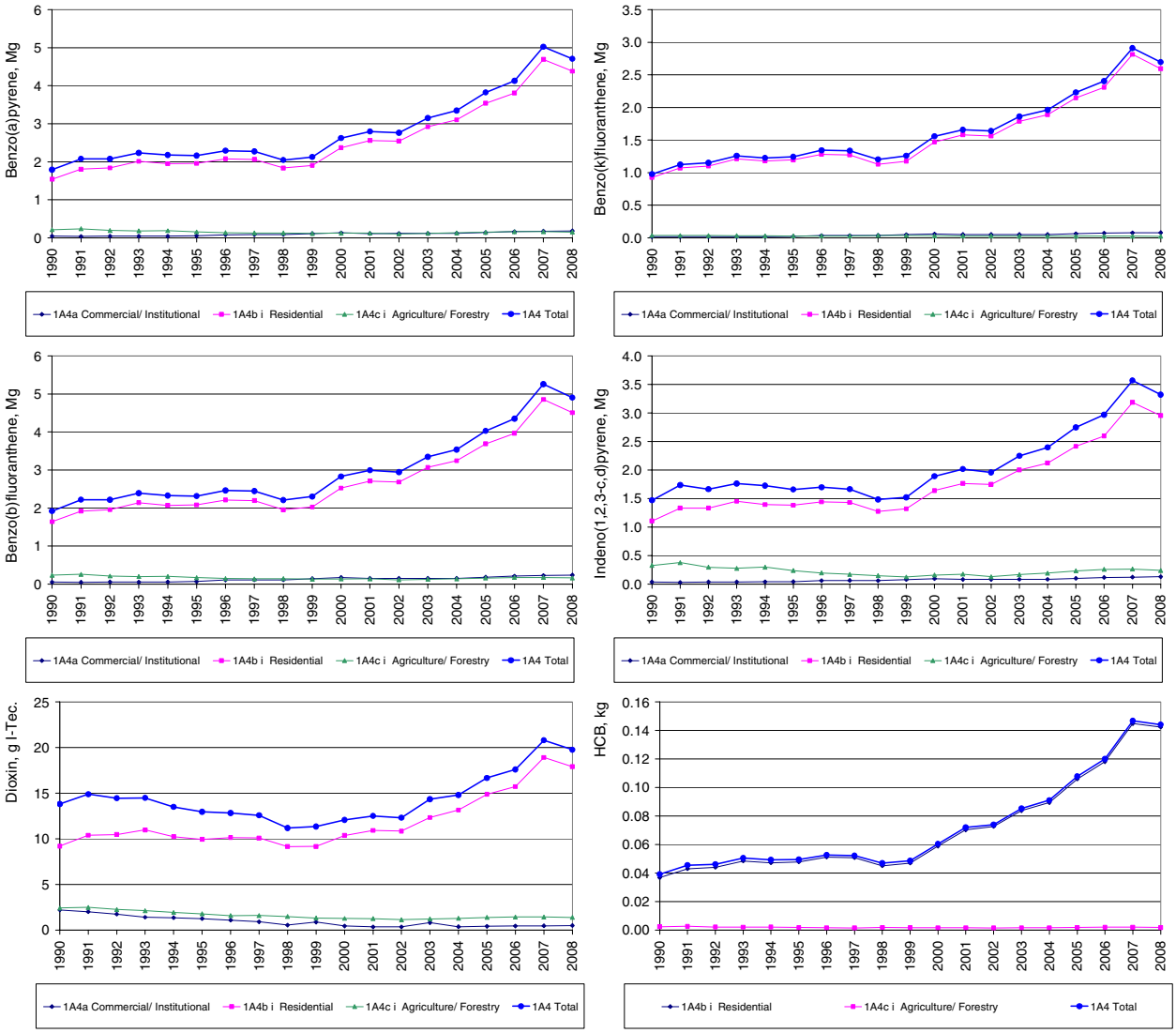


Figure 57 Time-series for PAH, dioxin and HCB emission, 1A4 Other Sectors.

12.3.1 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 58 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 CO_2 emission has decreased 42 % since 1990. Both the decrease of fuel consumption and the change of fuels – from gas oil to natural gas - contribute to the decreased CO_2 emission.

The CH_4 emission in 2008 was 4.5 times the 1990 level. The increase is mainly a result of the increased emission from natural gas fuelled engines. The emissions from biogas fuelled engines and from combustion

of wood also contribute to the increase. The time-series for consumption of natural gas and biogas are shown in Figure 52.

The N_2O emission in 2008 was 43 % lower than in 1990. This decrease is a result of lower fuel consumption and of the change of fuel from gas oil to natural gas. The emission from wood combustion have, however, been increasing. The fluctuations of the N_2O emission follow the fuel consumption.

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.

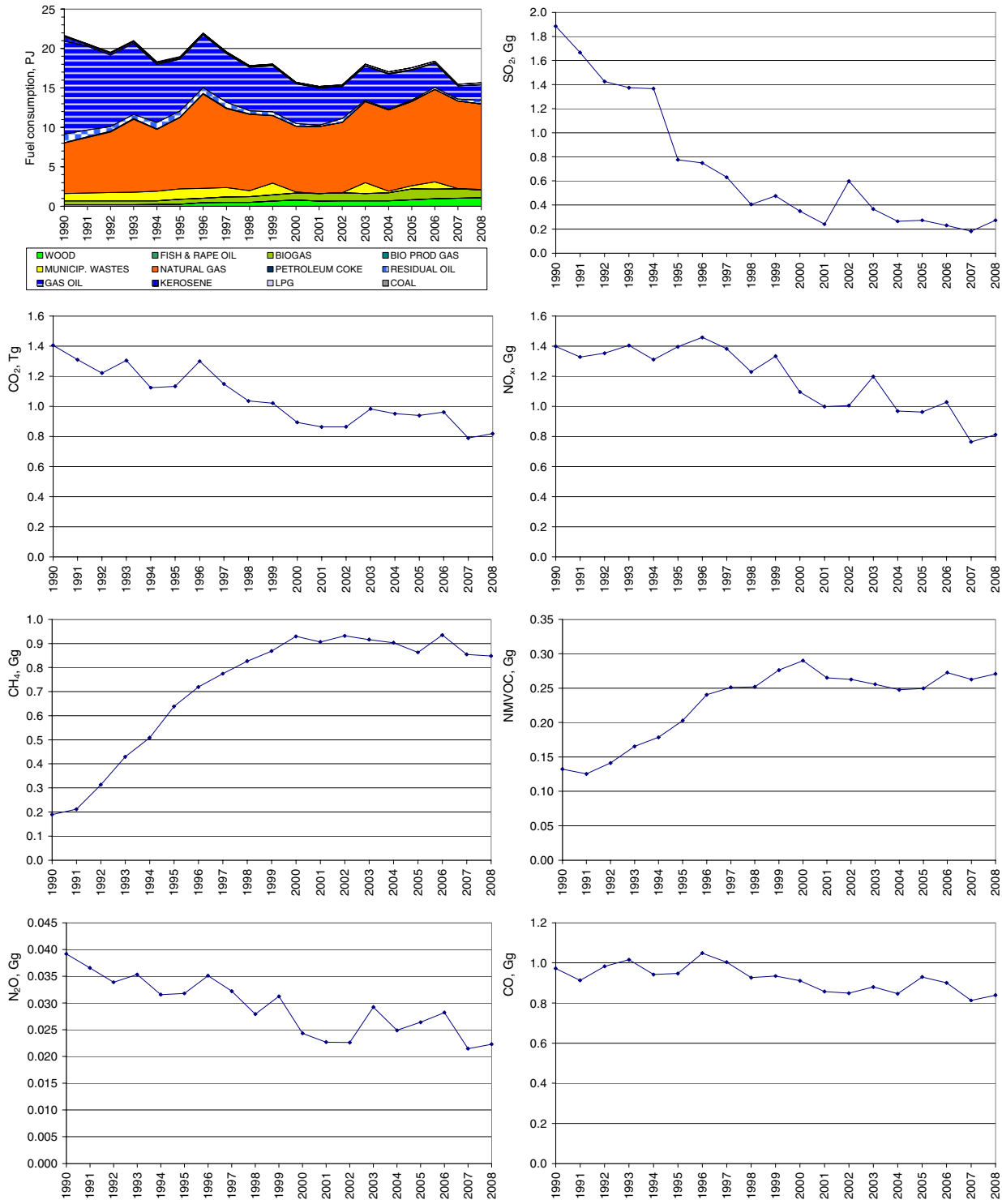


Figure 58 Time-series for 1A4a Commercial /institutional.

12.3.2 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 59 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 consump-

tion of wood has increased considerably (four times the 1990 level). The consumption of natural gas has also increased since 1990.

The CO_2 emission has decreased by 39 % since 1990. This decrease is mainly a result of the considerable change of applied fuel from gas oil to wood and natural gas.

The CH_4 emission from residential plants has increased to almost three times the 1990 level due to the increased combustion of wood in residential plants, which is the main source of emission. The increased emission from gas engines also contributes to the increased emission.

The N_2O emission follows the fluctuations of the total fuel consumption. The change of fuel from gas oil to wood has resulted in a 22 % increase of N_2O emission since 1990 due to a higher emission factor for wood than for gas oil.

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.

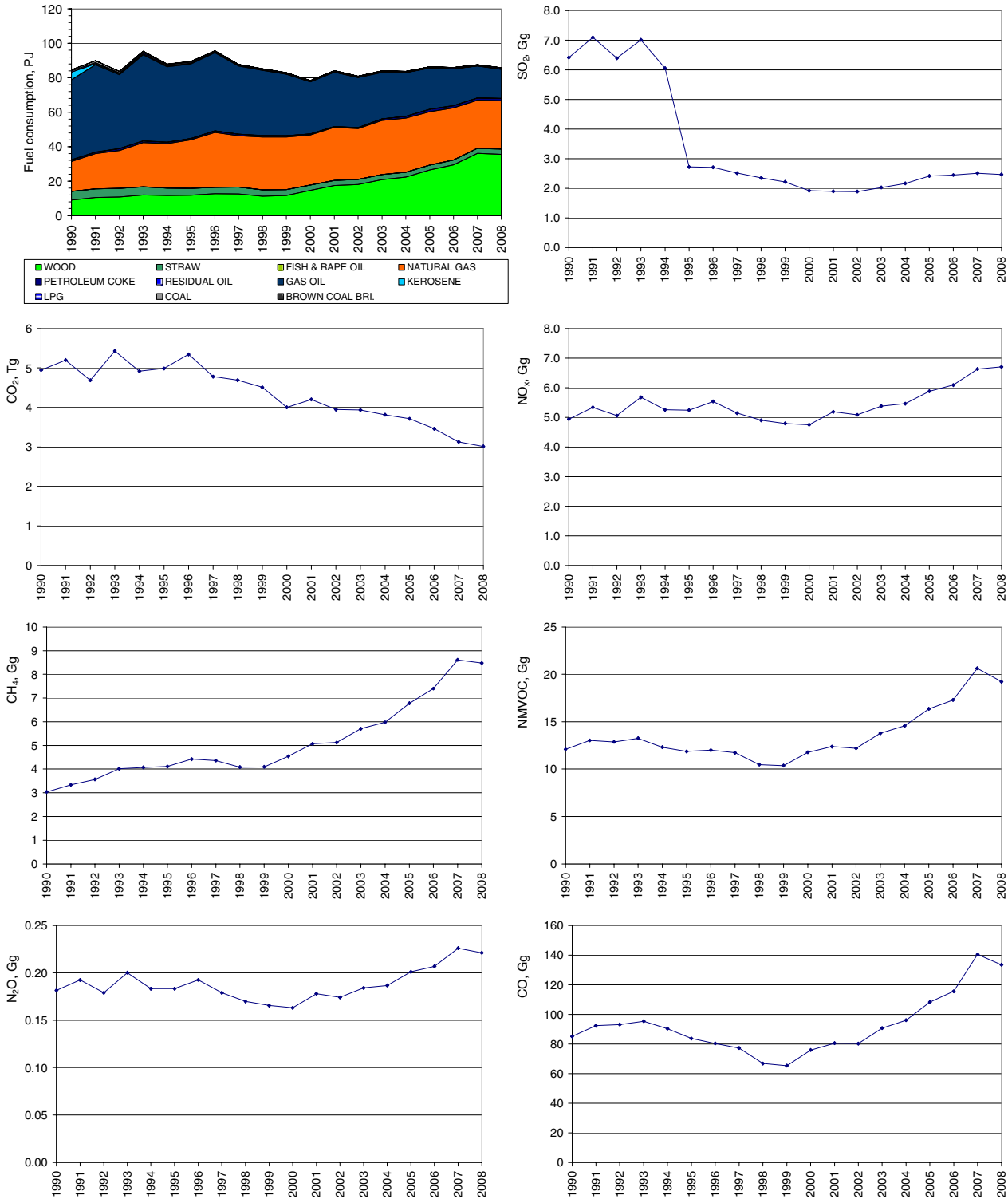


Figure 59 Time-series for 1A4b Residential plants.

12.3.3 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 60 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 52). 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 CO_2 emission in 2008 was 31 % lower than in 1990. The CO_2 emission increased from 1990 to 1996 due to increased fuel consumption. Since 1996 the CO_2 emission has decreased in line with the decrease in fuel consumption.

The CH_4 emission in 2008 was 31 % higher than the emission in 1990. The emission follows the time-series for natural gas combusted in gas engines (Figure 52). The emission from combustion of straw has decreased as a result of the decreasing consumption of straw in the sector.

The emission of N_2O has decreased by 36 % since 1990. The decrease is a result of the lower fuel consumption as well as the change of fuel. The decreasing consumption of straw contributes considerably to the decrease of emission.

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.

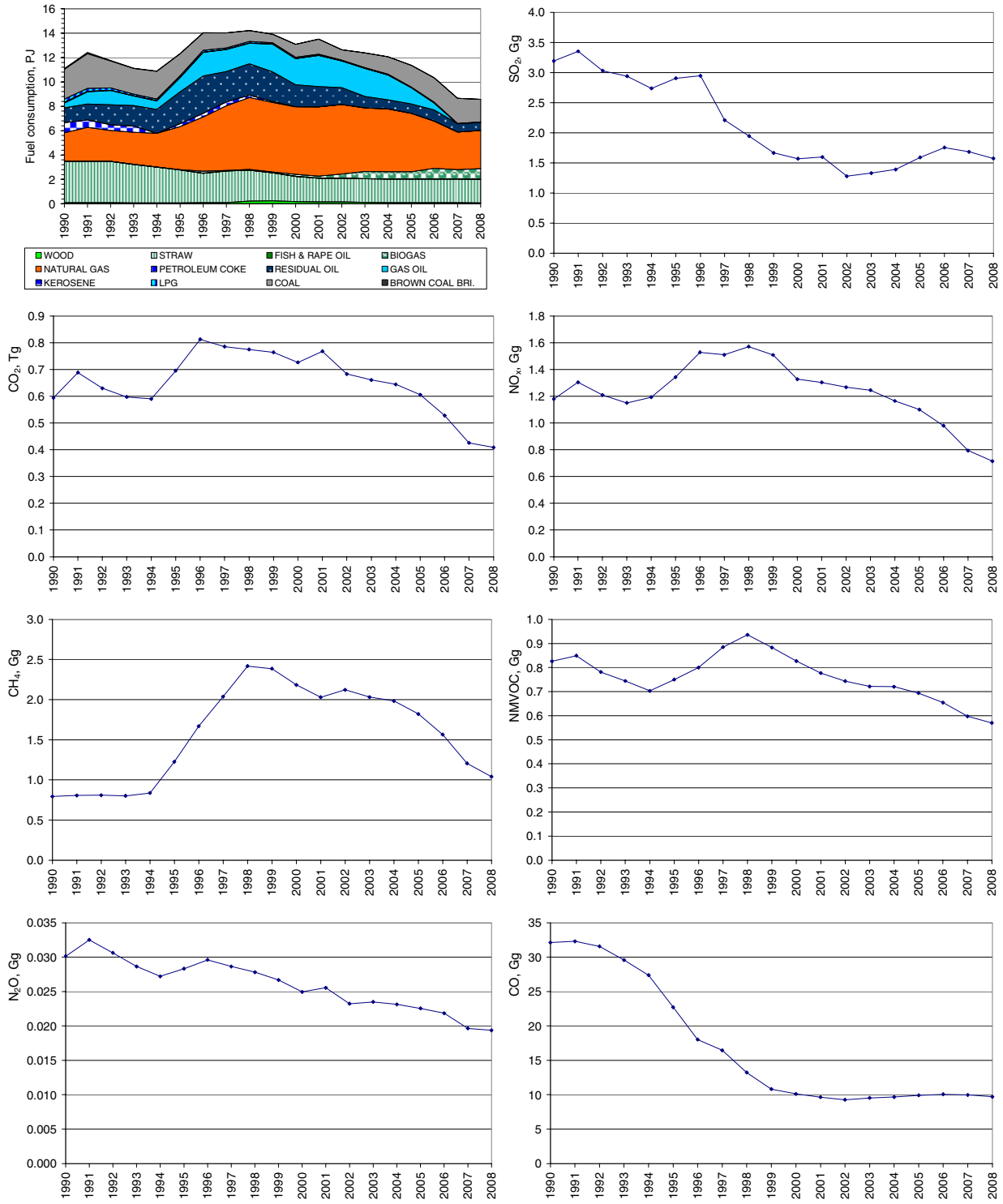


Figure 60 Time-series for 1A4c Agriculture/Forestry.

13 Geographical distribution of the emissions

Geographical distribution of emissions has been reported to the LRTAP Convention for the years 1990, 1995, 2000 and 2005 (Jensen et al., 2008). The emissions are disaggregated to a grid of 50x50 km^2. Gridded data are reported for SO_2, NO_x, NMVOC, CO, PM, heavy metals, dioxin and PAH. The assumptions and methodology will not be discussed here but gridded emission data for SO_2 are illustrated in Figure 61. The gridded emission data are available on the EU EIONET (European Environment Information and Observation Network) homepage, which can be linked from the NERI home page, www.dmu.dk.

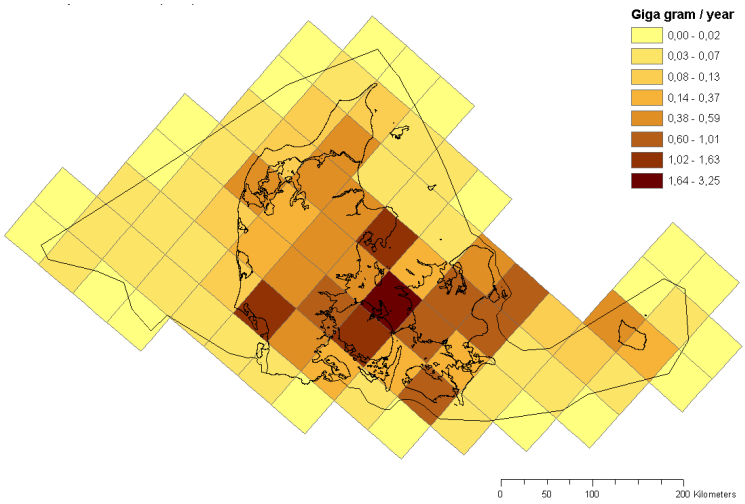


Figure 61 Gridded SO_2 emission from stationary combustion, 2005 (Jensen et al., 2008).

14 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.

14.1 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 the CORINAIR system. The emission inventories are prepared from a complete emission database based on the SNAP source categories. Aggregation to the source category codes used for both the Climate Convention and the LRTAP Convention is based on a correspondence list enclosed in Appendix 3.

The emission source codes applied in the reporting activity will be referred to as IPCC source categories. The IPCC source categories define six main source categories, listed in Table 27 and a number of subcategories. Stationary combustion is part of the IPCC source category 1, *Energy*. Table 28 presents subcategories in the IPCC energy category. The table also presents the source category in which the NERI documentation is included. Though industrial combustion is part of the stationary combustion detailed documentation for some of the specific industries is discussed in the industry chapters/reports. Stationary combustion is defined as combustion activities in the SNAP categories 01-03.

Table 27 IPCC main source categories.

1. Energy
2. Industrial Processes
3. Solvent and Other Product Use
4. Agriculture
5. Land-Use Change and Forestry
6. Waste

Table 28 IPCC emission source subcategories for energy.

IPCC id	IPCC source category name	NERI documentation
1	Energy	Stationary combustion, Transport, Fugitive, Industrial Processes
1A	Fuel Combustion Activities	Stationary combustion, Transport, Industrial Processes
1A1	Energy Industries	Stationary combustion
1A1a	Electricity and Heat Production	Stationary combustion
1A1b	Petroleum Refining	Stationary combustion, Fugitive
1A1c	Solid Fuel Transf./Other Energy Industries	Stationary combustion
1A2	Fuel Combustion Activities/Industry (ISIC)	Stationary combustion, Transport, Industrial Processes
1A2a	Iron and Steel	Stationary combustion, Industrial Processes
1A2b	Non-Ferrous Metals	Stationary combustion, Industrial Processes
1A2c	Chemicals	Stationary combustion, Industrial Processes
1A2d	Pulp, Paper and Print	Stationary combustion, Industrial Processes
1A2e	Food Processing, Beverages and Tobacco	Stationary combustion, Industrial Processes
1A2f	Other (please specify)	Stationary combustion, Transport, Industrial Processes
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

Stationary combustion plants are included in the emission source sub-categories to *Energy, Fuel combustion*:

- 1A1 Energy Industries.
- 1A2 Manufacturing Industries and Construction.
- 1A4 Other Sectors.

However, the emission sources *1A2* and *1A4* also include emission from transport subcategories. The emission source *1A2* includes emissions from some off-road machinery in the industry. The emission source *1A4* includes off-road machinery in agriculture, forestry and household/gardening. Further emissions from national fishing are included in subcategory *1A4*.

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

The CO_2 emission from calcinations is not part of the source category *Energy*. This emission is included in the source category *Industrial Processes*.

14.2 Tiers

The emission inventory is based on the methodology referred to as Tier 2 and Tier 3 in the IPCC Guidelines (IPCC 1997).

14.3 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 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 Appendix 8. 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. Appendix 8 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. CO_2 emission factors are plant specific for the major power plants. Emissions of CO and NMVOC 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 legislation.
- Emission data reported by DONG Energy and Vattenfall, the two major electricity suppliers.
- CO_2 data reported under the EU Emission Trading Scheme.
- 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. Emissions of the greenhouse gases CH_4 and N_2O from the large point sources are all based on the area source emission factors.

14.4 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 in Chapter 14.7.

14.5 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. Appendix 5. The calorific values, on which the energy statistics are based, are also enclosed in Appendix 5. The correspondence list between the energy statistics and SNAP categories is enclosed in Appendix 13.

The fuel consumption of the IPCC 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. The disaggregation of fuel consumption and emissions from the industrial category is discussed in Chapter 14.8.

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 CO_2 emission also refer to EU ETS, see Chapter 14.7.1.

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, namely 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* (Nielsen et al., 2010a). The emissions associated with the use of bitumen and lubricants are included in *Industrial Processes* (Nielsen et al., 2010a). The non-energy use of fuels is included in the reference approach for Climate Convention reporting.

In Denmark all municipal waste incineration is 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.

14.6 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 29 (KE, 2009).

Table 29 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

The lower heating value of the town gas currently used is 19.3 MJ per Nm^3 and the CO_2 emission factor 56.4 kg per GJ. This is very close to the emission factor used for natural gas of 56.77 kg per GJ. According to the supplier both the composition and heating value will change during the year. It has not been possible to obtain a yearly average.

In earlier years the composition of town gas was somewhat different. Table 30 is constructed with the input from Københavns Energi (KE) (Copenhagen Energy) and Danish Gas Technology Centre (DGC), (Jeppesen, 2008; Kristensen, 2007). The data refer to three measurements performed several years apart; the first in 2000 and the latest in 2005.

Table 30 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

The lower calorific value has been between 15.6 and 17.8 MJ per Nm^3. The CO_2 emission factors - derived from the few available measurements - are in the range of 52-57 kg per GJ.

The Danish approach includes town gas as part of the fuel category natural gas and thus indirectly assumes the same CO_2 emission factor. This is a conservative approach ensuring that the CO_2 emissions are not underestimated.

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.

14.7 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: EMEP/EEA Guidebook (EEA, 2009)[14] and IPCC Reference Manual (IPCC, 1997).

A complete list of emission factors, including time-series and references, is presented in Appendix 6.

14.7.1 CO_2, use of EU ETS data

The CO_2 emission factors for some large power plants and for combustion in the cement industry are plant specific and based on the reporting to the EU Emission Trading Scheme (EU ETS). The EU ETS data have been applied for the years 2006 - 2008.

The Danish emission inventory only includes data from plants using higher tier methods as defined in an EU decision (EU Commission, 2004) where the specific methods for determining carbon contents, oxidation factor and calorific value are specified. The EU decision includes rules for measuring, reporting and verification. For more information regarding the specifics of the EU ETS please refer to the Commission webpage: http://ec.europa.eu/environment/climat/emission/implementation_en.htm

NERI performs some QA/QC checks on the emission reports made by the plants.

The EU ETS data for power plants include plant specific emission factors for coal, residual oil and gas oil. The EU ETS data account for 50 % of the CO_2 emission from stationary combustion.

EU ETS data for 2008 were available from 17 coal fired units. The plant specific information accounts for roughly 95 % of the Danish coal consumption and 48 % of the total CO_2 emission from stationary combustion plants. The average CO_2 emission factor for coal for these 17 units was 94.0 kg per GJ (Table 31).

Table 31 EU ETS data for 17 coal fired power plant units, 2008.

	Average	Min	Max
Heating value, GJ pr tonne	24.3	23.2	25.3
CO_2 implied emission factor, kg pr GJ	94.0	93.2	96.2
Oxidation factor	0.995	0.985	1.000

EU ETS data for 2008 based on higher tier methodologies were available from 19 units combusting residual oil and for five units combusting gas oil. Aggregated data are shown in Table 32 and Table 33. The EU ETS data accounts for 43 % of the residual oil consumption in stationary combustion and 5 % of the gas oil consumption.

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

Table 32 EU ETS data for 19 power plant units combusting residual oil.

	Average	Min	Max
Heating value, GJ pr tonne	40.5	40.1	41.4
CO_2 implied emission factor, kg pr GJ	78.6	77.2	79.8
Oxidation factor	1.00	1.00	1.00

Table 33 EU ETS data for 5 power plant units combusting gas oil.

	Average	Min	Max
Heating value, GJ pr tonne	42.7	42.5	42.8
CO_2 implied emission factor, kg pr GJ	73.7	73.4	75.2
Oxidation factor	1.00	1.00	1.00

Plant specific CO_2 emission factors have also been applied for the cement production, which is part of source category 1A2f Industry. The CO_2 emission factors refer to EU ETS for coal and residual oil.

14.7.2 CO_2, other emission factors

The CO_2 emission factors that are not included in EU ETS data or that are included but based on lower tier methodologies are not plant specific in the Danish inventory. The emission factors that are not plant specific accounts for 50 % of the CO_2 emission.

The CO_2 emission factors applied for 2008 are presented in Table 34. For municipal waste and natural gas time-series have been estimated. For all other fuels the same emission factor has been applied for 1990-2008.

In reporting for the Climate Convention, the CO_2 emission is aggregated to five fuel types: Solid fuel, Liquid fuel, Gas, Biomass and Other fuels. The correspondence list between the NERI fuel categories and the IPCC fuel categories is also provided in Table 34.

Only emissions from fossil fuels are included in the total national CO_2 emission. The biomass emission factors are also included in the table as emissions from biomass are reported to the Climate Convention as a memo item.

The CO_2 emission from incineration of municipal waste (79.6 + 32.5 kg per GJ) is divided into two parts: The emission from combustion of the plastic content of the waste, which is included in the national total, and the emission from combustion of the rest of the waste – the biomass part, which is reported as a memo item. In the IPCC reporting, the fuel consumption and emissions from the plastic content of the waste is reported in the fuel category, *Other fuels*.

The CO_2 emission factors have been confirmed by the two major power plant operators, both directly (Christiansen, 1996; Andersen; 1996) and indirectly by applying the NERI emission factors in the annual environmental reports[15] for the large power plants and by accepting use of the NERI factors in Danish legislation. However, for recent years CO_2 emission factors for most power plants refer to EU ETS data.

[15] Until 2006. After that, EU ETS data have been applied.

Table 34 CO_2 emission factors, 2008.

Fuel	Emission factor kg per GJ		Reference type	IPCC fuel category
	Biomass	Fossil fuel		
Coal		95 [1)3)]	Country specific	Solid
Brown coal briquettes		94.6 [2)]	IPCC 1997	Solid
Coke oven coke		108	IPCC 1997	Solid
Petroleum coke		92 [3)]	Country specific	Liquid
Wood	102		EEA 2002	Biomass
Municipal waste	79.6 [3)4)]	+ 32.5[3)4)]	Country specific	Biomass and Other fuels
Straw	102		EEA 2002	Biomass
Residual oil		78 [1)3)]	EEA 2007	Liquid
Gas oil		74 [1)]	EEA 2007	Liquid
Kerosene		72	IPCC 1997	Liquid
Fish & rape oil	74		Country specific	Biomass
Orimulsion		80 [2)]	Country specific	Liquid
Natural gas		56.77	Country specific	Gas
LPG		65	EEA 2007	Liquid
Refinery gas		56.9	Country specific	Liquid
Biogas	83.6		Country specific	Biomass
Biomass producer gas	102[5)]		Country specific	Biomass

[1)] Plant specific data from EU ETS incorporated for individual plants.

[2)] Not applied in 2008.

[3)] Plant specific data from EU ETS incorporated for cement production.

[4)] The emission factor for municipal waste is (76.6+32.5) kg CO_2 per GJ municipal waste. The fuel consumption and the CO_2 emission have been disaggregated to the two IPCC fuel categories *Biomass* and *Other fuels* in CRF. The IEF for CO_2, Other fuels is 78.88 kg CO_2 per GJ fossil municipal waste.

[5)] The CO_2 emission factor for wood has been applied. However, the composition of the gas is well-known and the emission factor will be recalculated.

Coal

The emission factor for coal, 95 kg per GJ, is based on Fenhann & Kilde (1994). The CO_2 emission factors have been confirmed by the two major power plant operators in 1996 (Christiansen, 1996; Andersen, 1996). One of the major power plant owners (Elsam[16]) reconfirmed the factor in 2001 (Christiansen, 2001). The same emission factor has been applied for 1990-2008.

As mentioned above EU ETS data have been utilised for the 2006 - 2008 emission inventories. In 2008 the implied emission factor for the power plants using coal was 94.0 kg per GJ (see Chapter 14.7.1). However, the CO_2 emission factor was above 95 kg per GJ for several plants. Thus the emission factor 95 kg per GJ is a slightly conservative estimate within the range of the EU ETS data.

In 2008 only 3 % of the CO_2 emission from coal consumption was based on the general emission factor, whereas 97 % of the coal consumption was covered by EU ETS data[17].

Brown coal briquettes

The emission factor for brown coal briquettes, 94.6 kg per GJ, is based on a default value from the IPCC Guidelines (IPCC, 1997) assuming full oxidation. The default value in the IPCC Guidelines is 25.8 t C per TJ, corresponding to $25.8 \cdot (12+2 \cdot 16)/12 = 94.6$ kg CO_2 per GJ assuming full oxidation. The same emission factor has been applied for 1990-2008.

[16] Elsam was one of the two major power plant owners. Now part of DONG Energy.
[17] Including EU ETS data for cement production.

Coke oven coke

The emission factor for coke oven coke, 108 kg per GJ, is based on a default value from the IPCC Guidelines (IPCC, 1997) assuming full oxidation. The default value in the IPCC Guidelines is 29.5 t C per TJ, corresponding to $29.5 \cdot (12+2 \cdot 16)/12 = 108$ kg CO_2 per GJ assuming full oxidation. The same emission factor has been applied for 1990-2008.

Petroleum coke

The emission factor for petroleum coke, 92 kg per GJ, has been estimated by SK Energy (a former major power plant operator in eastern Denmark) in 1999 based on a fuel analysis carried out by dk-Teknik in 1993 (Bech, 1999). The emission factor level was confirmed by a new fuel analysis, which, however, is considered confidential. The same emission factor has been applied for 1990-2008.

Plant specific EU ETS data have been utilised for the 2006 - 2008 emission inventories for combustion of petroleum coke in the cement production (see Chapter 14.7.1).

Wood

The emission factor for wood, 102 kg per GJ, refers to Fenhann & Kilde (1994). The factor is based on the interval stated in a former edition of the EMEP/CORINAIR Guidebook (EEA, 2002) and the actual value is the default value from the CollectER database. The same emission factor has been applied for 1990-2008.

Municipal waste

The CO_2 emission from incineration of municipal waste is divided into two parts: The emission from combustion of the fossil content of the waste, which is included in the national total, and the emission from combustion of the rest of the waste – the biomass part, which is reported as a memo item.

The total CO_2 emission factor for municipal waste refers to a Danish study (Jørgensen & Johansen, 2003). Based on emission measurements on five municipal waste incineration plants the total CO_2 emission factor for municipal waste incineration has been determined to 112.1 kg per GJ.

The current disaggregation of the emission factor in a fossil part and a biomass part has been estimated - by a working group - to be between 30 and 35 kg CO_2 per GJ municipal waste (Nielsen, 2009). NERI has assumed that the fossil fuel emission factor is 32.5 kg CO_2 per GJ municipal waste.

An ongoing project, *Biogenic carbon in Danish combustible waste* (Astrup et al. 2009) will further improve knowledge concerning the disaggregation of the CO_2 emission factor in a fossil and a biomass fraction.

The lower calorific value of municipal waste refers to the Danish energy statistics (ENS, 2009b). Time-series for the CO_2 emission factors have been based on the assumption that the increasing calorific value of the waste is a result of the increased fraction of fossil waste since 1990. This assumption is highly uncertain but better data are not available at present. Table 35 shows time-series for the CO_2 emission factors. The CO_2

emission from the biomass part is the total CO_2 emission minus the CO_2 emission from the fossil part.

Emission data from four waste incineration plants (Jørgensen & Johansen, 2003) demonstrate the fraction of the carbon content of the waste not oxidised to be approximately 0.3 %. The un-oxidised fraction of the carbon content is assumed to originate from the biomass content and all carbon originating from the fossil part are assumed to be oxidised.

Table 35 CO_2 emission factors for municipal waste, time-series.

Year	Lower heating value of municipal waste [1]	CO_2 emission factor, fossil	CO_2 emission factor for municipal waste, total [2]	CO_2 emission factor, biomass
	GJ pr Mg waste	kg pr GJ waste	kg pr GJ waste	kg pr GJ waste
1990	8.2	25.4	112.1	86.7
1991	8.2	25.4	112.1	86.7
1992	9.0	27.9	112.1	84.2
1993	9.4	29.1	112.1	83.0
1994	9.4	29.1	112.1	83.0
1995	10.0	31.0	112.1	81.1
1996	10.5	32.5	112.1	79.6
1997	10.5	32.5	112.1	79.6
1998	10.5	32.5	112.1	79.6
1999	10.5	32.5	112.1	79.6
2000	10.5	32.5	112.1	79.6
2001	10.5	32.5	112.1	79.6
2002	10.5	32.5	112.1	79.6
2003	10.5	32.5	112.1	79.6
2004	10.5	32.5	112.1	79.6
2005	10.5	32.5	112.1	79.6
2006	10.5	32.5	112.1	79.6
2007	10.5	32.5	112.1	79.6
2008	10.5	32.5	112.1	79.6

[1] DEA 2009b.
[2] Based on data from Jørgensen & Johansen (2003).

The composition of the fossil part of the municipal waste has been estimated by NERI based on Hulgaard (2003). The lower heating values and CO_2 emission factors for different plastic types have been estimated by Hulgaard (2003), see Table 36.

Table 36 Composition of the fossil part of municipal waste in Denmark.

Plastic type	Mass share in municipal waste in Denmark		Lower heating value of plastic	Energy content of plastic	CO_2 emission factor for plastic
	kg plastic pr kg municipal waste	% of plastic	GJ pr tonnes	GJ pr tonnes municipal waste	kg pr GJ municipal waste
PE	0.058	46	41	2.36	16.3
PS/EPS	0.035	28	37	1.29	10.6
PVC	0.019	15	18	0.34	2.5
Other (PET, PUR, PC, POM, ABS, PA etc.)	0.014	11	24	0.34	3.1
Total	0.13	100	34.5	4.33	32.5

Plant specific EU ETS data have been utilised for cement production in the 2006 - 2008 emission inventories.

Straw

The emission factor for straw, 102 kg per GJ, refers to Fenhann & Kilde (1994). The factor is based on the interval stated in the EMEP/Corinair Guidebook (EEA, 2002) and the actual value is the default value from the

Collecter database. The same emission factor has been applied for 1990-2008.

Residual oil

The emission factor of 78 kg per GJ refers to Fenhann & Kilde (1994). The factor refers to the EMEP/Corinair Guidebook (EEA, 2007). The factor is slightly higher than the IPCC default emission factor for residual fuel oil (77.4 kg per GJ assuming full oxidation). The CO_2 emission factor has been confirmed by the two major power plant operators in 1996 (Christiansen, 1996; Andersen, 1996). The same emission factor has been applied for 1990-2008.

Plant specific EU ETS data have been utilised for some power plants and for the cement production in the 2006 - 2008 emission inventories (see Chapter 14.7.1). In 2008 the implied emission factor for the power plants using residual oil was 78.6 kg per GJ. However, the EU ETS CO_2 emission factors for power plants were in the interval 77.2 - 79.8 kg per GJ. In 2008 54 % of the CO_2 emission from residual oil consumption was based on the general emission factor, whereas 46 % was covered by EU ETS data[18].

Gas oil

The emission factor for gas oil, 74 kg per GJ, refers to Fenhann & Kilde (1994). The factor is based on the interval stated in the EMEP/Corinair Guidebook (EEA, 2008). The factor agrees with the IPCC default emission factor for gas oil (74.1 kg per GJ assuming full oxidation). The CO_2 emission factor has been confirmed by the two major power plant operators in 1996 (Christiansen, 1996; Andersen, 1996). The same emission factor has been applied for 1990-2008.

Plant specific EU ETS data have been utilised for a few power plants in the 2006 - 2008 emission inventories (see Chapter 14.7.1). In 2008 the implied emission factor for the power plants using gas oil was 73.7 kg per GJ. The EU ETS CO_2 emission factors for power plants were in the interval 73.4 - 75.2 kg per GJ. In 2008 only 5 % of the CO_2 emission from gas oil consumption was based on EU ETS data[19].

Kerosene

The emission factor for kerosene, 72 kg per GJ, refers to Fenhann & Kilde (1994). The factor agrees with the IPCC default emission factor for other kerosene (71.9 kg per GJ assuming full oxidation). The same emission factor has been applied for 1990-2008.

Fish & rape oil

The emission factor is assumed to be the same as for gas oil – 74 kg per GJ. The consumption of fish and rape oil is relatively low.

Orimulsion

The emission factor for orimulsion, 80 kg per GJ, refers to the DEA (DEA, 2008). The IPCC default emission factor is almost the same: 80.7 kg per GJ assuming full oxidation. The CO_2 emission factor has been confirmed by the only major power plant operator using orimulsion (Andersen,

[18] Including EU ETS data for cement production.
[19] Including EU ETS data for cement production.

1996). The same emission factor has been applied for all years. Orimulsion has not been applied in Denmark in recent years.

Natural gas

The emission factor for natural gas is estimated by the Danish gas transmission company, Energinet.dk[20]. Only natural gas from the Danish gas fields is utilised in Denmark. The calculation is based on gas analyses carried out daily by Energinet.dk. Energinet.dk and DGC have calculated emission factors for 2000-2008. The emission factor applied for 1990-1999 refers to Fenhann & Kilde (1994). This emission factor was confirmed by the two major power plant operators in 1996 (Christiansen, 1996; Andersen, 1996). Time-series for the CO_2 emission factors are provided in Table 37.

Table 37 CO_2 emission factor for natural gas.

Year	CO_2 emission factor kg pr GJ
1990-1999	56.9
2000	57.1
2001	57.25
2002	57.28
2003	57.19
2004	57.12
2005	56.96
2006	56.78
2007	56.78
2008	56.77

LPG

The emission factor for LPG, 65 kg per GJ, refers to Fenhann & Kilde (1994). The emission factor is based on the EMEP/Corinair Guidebook (EEA, 2007). The emission factor is somewhat higher than the IPCC default emission factor (63 kg per GJ assuming full oxidation). The same emission factor has been applied for 1990-2008.

Refinery gas

The emission factor applied for refinery gas is the same as the emission factor for natural gas 1990-1999. The emission factor is within the interval of the emission factor for refinery gas stated in the EMEP/Corinair Guidebook (EEA, 2007). The same emission factor has been applied for 1990-2008.

Biogas

The emission factor for biogas, 83.6 kg per GJ, is based on a biogas with 65 % (vol.) CH_4 and 35 % (vol.) CO_2. DGC has stated that this is a typical manure-based biogas as utilised in stationary combustion plants (Kristensen, 2001). The same emission factor has been applied for 1990-2008.

Biomass producer gas

The CO_2 emission factor for biomass producer gas has been assumed equal to the emission factor for wood. However, the gas composition is well-known and in future inventories a recalculated emission factor will be applied. The consumption of biomass producer gas is low; 87 TJ in 2008.

[20] Former Gastra and before that part of DONG Energy. Historical data refer to these companies.

14.7.3 CH_4

The CH_4 emission factors applied for 2008 are presented in Table 38. In general, the same emission factors have been applied for 1990-2008. However, time-series have been estimated for both natural gas fuelled engines and biogas fuelled engines. Time-series has also been estimated for MSW incineration plants, which, however, is not a large emission source.

Emission factors for CHP plants < 25 MW_e refer to emission measurements carried out on Danish plants (Nielsen et al. 2010c; Nielsen & Illerup, 2003; Nielsen et al. 2008). Most other emission factors refer to the EMEP/Corinair Guidebook, 2007 update (EEA, 2007).

Gas engines combusting natural gas or biogas accounts for approximately half the CH_4 emission from stationary combustion plants. The relatively high emission factor for gas engines is well-documented and further discussed below.

Time-series for the CH_4 emission factor for wood combustion in residential plants have not been estimated. Due to the increasing importance of this source this will be considered in future inventories.

Table 38 CH_4 emission factors 2008.

Fuel group	Fuel	CRF source category	CRF source category	SNAP	Emission factor, g per GJ	Reference
BIOMASS	WOOD	1A1a	Electricity and heat production	010102, 010103, 010104	3.1	Nielsen et al. 2010c
				010202, 010203	32	EEA 2007
		1A2	Industry	030100, 030102	32	EEA 2007
		1A4a	Commercial/Institutional	020100	200	EEA 2007
		1A4b i	Residential	020200	200	EEA 2007
		1A4c i	Agriculture/Forestry	020300	200	EEA 2007
	STRAW	1A1a	Electricity and heat production	010101, 010102, 010103, 010104	0.47	Nielsen et al. 2010c
				010202, 010203	32	EEA 2007
		1A4b i	Residential	020200	200	EEA 2007
		1A4c i	Agriculture/Forestry	020300	200	EEA 2007
	FISH & RAPE OIL	1A1a	Electricity and heat production	010101, 010102, 010103, 010202, 010203	1.5	EEA 2007, assuming same emission factor as for gas oil
		1A2	Industry	030105	1.5	EEA 2007, assuming same emission factor as for gas oil
		1A4b i	Residential	020200	1.5	EEA 2007, assuming same emission factor as for gas oil
	BIOGAS	1A1a	Electricity and heat production	010102, 010103, 010203	4	EEA 2007
				010105, 010205	434	Nielsen et al. 2010c
		1A2	Industry	030100, 030102, 030103	4	EEA 2007
				030105	434	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100, 020103	4	EEA 2007
				020105	434	Nielsen et al. 2010c
		1A4c i	Agriculture/Forestry	020300	4	EEA 2007
				020304	434	Nielsen et al. 2010c
	BIO PROD GAS	1A1a	Electricity and heat production	010105	13	Nielsen et al. 2010c
		1A2	Industry	030105	13	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020105	13	Nielsen et al. 2010c
OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010102, 010103	0.34	Nielsen et al. 2010c
				010203	6	EEA 2007
		1A2	Industry	030102	6	EEA 2007
		1A4a	Commercial/Institutional	020103	6	EEA 2007
GAS	NATURAL GAS	1A1a	Electricity and heat production	010101, 010102, 010202	6	DGC 2001
				010103, 010203	15	Gruijthuijsen & Jensen 2000
				010104 (Gas turbines)	1.7	Nielsen et al. 2010c
				010105, 010205 (Gas engines)	481	Nielsen et al. 2010c
		1A1c	Other energy industries	010504 (Gas turbines)	1.5	Nielsen & Illerup 2003
				010505 (Gas engines)	481	Nielsen et al. 2010c
		1A2	Industry	030100	6	DGC 2001
				030103	15	Gruijthuijsen & Jensen 2000
				030104 (Gas turbines)	1.7	Nielsen et al. 2010c
				030105 (Gas engines)	481	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100	6	DGC 2001
				020103	15	Gruijthuijsen & Jensen 2000
				020105 (Gas engines)	481	Nielsen et al. 2010c
		1A4b i	Residential	020200	6	DGC 2001
				020202	15	Gruijthuijsen & Jensen 2000
				020204 (Gas engines)	481	Nielsen et al. 2010c
		1A4c i	Agriculture/Forestry	020300	6	DGC 2001
				020303 (Gas turbines)	1.7	Nielsen et al. 2010c
				020304 (Gas engines)	481	Nielsen et al. 2010c
LIQUID	PETROLEUM COKE	1A4a	Commercial/Institutional	020100	15	EEA 2007
		1A4b i	Residential	020200	15	EEA 2007
	RESIDUAL OIL	1A1a	Electricity and heat production	010101, 010104, 010202, 010203	3	EEA 2007
				010102, 010203	1.3	Nielsen et al. 2010c
		1A1b	Petroleum refining	010306	3	EEA 2007
		1A2	Industry	030100, 030105	3	EEA 2007
				030102, 030103	1.3	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100	3	EEA 2007
		1A4b i	Residential	020200	3	EEA 2007
		1A4c i	Agriculture/Forestry	020300, 020302	3	EEA 2007
	GAS OIL	1A1a	Electricity and heat production	010101, 010102, 010103, 010104, 010201, 010202, 010203	1.5	EEA 2007
				010105, 010205	24	Nielsen et al. 2010c
		1A1b	Petroleum refining	010306	1.5	EEA 2007
		1A2	Industry	030100, 030102, 030103, 030104	1.5	EEA 2007
				030105	24	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100, 020103	1.5	EEA 2007
				020105	24	Nielsen et al. 2010c
		1A4b i	Residential	020200	1.5	EEA 2007
				020105	24	Nielsen et al. 2010c
	KEROSENE	1A2	Industry	030100	7	EEA 2007
		1A4a	Commercial/Institutional	020100	7	EEA 2007
		1A4b i	Residential	020200	7	EEA 2007
		1A4c i	Agriculture/Forestry	020300	7	EEA 2007

Fuel group	Fuel	CRF source category	CRF source category	SNAP	Emission factor, g per GJ	Reference
	LPG	1A1a	Electricity and heat production	010102, 010203	1	EEA 2007
		1A2	Industry	030100	1	EEA 2007
		1A4a	Commercial/Institutional	020100, 020105	1	EEA 2007
		1A4b i	Residential	020200	1	EEA 2007
		1A4c i	Agriculture/Forestry	020300	1	EEA 2007
	REFINERY GAS	1A1b	Petroleum refining	010304, 010306	1.5	EEA 2007
SOLID	COAL	1A1a	Electricity and heat production	010101, 010102, 010103	1.5	EEA 2007
		1A2	Industry	030100	15	EEA 2007
		1A4b i	Residential	020200	15	EEA 2007
		1A4c i	Agriculture/Forestry	020300	15	EEA 2007
	COKE OVEN COKE	1A2	Industry	030100	15	EEA 2007, assuming same emission factor as for coal
		1A4b i	Residential	020200	15	EEA 2007, assuming same emission factor as for coal

CHP plants

A considerable part of the electricity production in Denmark is based on decentralised CHP plants. Well-documented emission factors for these plants are therefore of importance. In a project carried out for the electricity transmission company, Energinet.dk, emission factors for CHP plants <25MW_e have been estimated. The work was reported in 2010 (Nielsen et al., 2010c).

The work included MSW incineration plants, CHP plants combusting wood and straw, natural gas and biogas-fuelled (reciprocating) engines, natural gas fuelled gas turbines, gas oil fuelled engines, gas oil fuelled gas turbines, steam turbines fuelled by residual oil and engines fuelled by biomass producer gas. CH_4 emission factors for these plants all refer to Nielsen et al. (2010c). The estimated emission factors were based on existing emission measurements as well as on emission measurements performed within the project. The number of emission data sets was comprehensive. Emission factors for subgroups of each plant type were estimated, e.g. the CH_4 emission factor for different gas engine types has been determined.

Time-series for the CH_4 emission factors are based on a similar project estimating emission factors for year 2000 (Nielsen & Illerup, 2003).

Natural gas, gas engines

SNAP 010105, 010205, 010505, 030105, 020105, 020204 and 020304

The CH_4 emission factor for natural gas engines refers to Nielsen et al. (2010c). The emission factor includes the increased emission during start/stop of the engines estimated by Nielsen et al. (2008). Emission factor time-series for the years 1990-2007 have been estimated based on Nielsen & Illerup (2003). These three references are discussed below.

Nielsen et al. 2010c:

> *CH_4 emission factors for gas engines were estimated for 2003-2006 and for 2007-2009. The dataset was split in two due to new emission limits for the engines from October 2006. The emission factors were based on emission measurements from 366 (2003-2006) and 157 (2007-2009) engines respectively. The engines from which emission measurements were available for 2007-2009 represent 38 % of the gas consumption. The emission factors were estimated based on fuel consumption for each gas engine type and the emission factor for each engine type. The majority of*

emission measurements that were not performed within the project related solely to the emission of total unburned hydrocarbon (CH_4 + NMVOC). A constant disaggregation factor was estimated based on 9 emission measurements including both CH_4 and NMVOC.

Nielsen & Illerup (2003):

An emission factor for natural gas engines was estimated based on 291 emission measurements in 114 different plants. The plants from which emission measurements were available represented 44 % of the total gas consumption in gas engines in year 2000.

Nielsen et al. (2008):

This study calculated a start/stop correction factor applied to the full-load emission factor. This factor was applied for the time-series estimated in Nielsen & Illerup (2003). Further the correction factors were applied in Nielsen et al. (2010c).

The emission factor for lean-burn gas engines is relatively high, especially for pre-chamber engines, which account for more than half the gas consumption in Danish gas engines. However, the emission factors for different pre-chamber engine types differ considerably.

The installation of natural gas engines in decentralised CHP plants in Denmark has taken place since 1990. The first engines installed were relatively small open-chamber engines but later mainly pre-chamber engines were installed. As mentioned above, pre-chamber engines have a higher CH_4 emission factor than open-chamber engines; therefore, the emission factor has increased during the period 1990-1995. After that technical improvements of the engines have been implemented as a result of upcoming emission limits that most installed gas engines had to meet in late 2006 (MST, 2005).

The time-series were based on:

- Full load emission factors for different engine types in year 2000 (Nielsen & Illerup, 2003), 2003-2006 and 2007-2009 (Nielsen et al. 2010c).
- Data for year of installation for each engine and fuel consumption of each engine 1994-2002 from the Danish Energy Agency (DEA, 2003).
- Research concerning the CH_4 emission from gas engines carried out in 1997 (Nielsen & Wit, 1997).
- Correction factors including increased emission during start/stop of the engines (Nielsen et al. 2008)

Table 39 Time-series for the CH_4 emission factor for natural gas fuelled engines.

Year	Emission factor, g pr GJ
1990	266
1991	309
1992	359
1993	562
1994	623
1995	632
1996	616
1997	551
1998	542
1999	541
2000	537
2001	522
2002	508
2003	494
2004	479
2005	465
2006	473
2007	481
2008	481

Gas engines, biogas

SNAP 010105, 010205, 030105, 020105 and 020304

The emission factor for biogas engines was estimated to 434 g per GJ in 2008. The emission factor is lower than the factor for natural gas, mainly because most engines are lean-burn open-chamber engines - not pre-chamber engines.

Time-series for the emission factor have been estimated. The emission factors for biogas engines were based on Nielsen et al. (2010c) and Nielsen & Illerup (2003). The two references are discussed below. The time-series are shown in Table 40.

Nielsen et al. 2010c:

> *CH_4 emission factors for gas engines were estimated for 2006 based on emission measurements performed in 2003-2009. The emission factor was based on emission measurements from 10 engines. The engines from which emission measurements were available represent 8 % of the gas consumption. The emission factor was estimated based on fuel consumption for each gas engine type and the emission factor for each engine type. The majority of emission measurements that were not performed within the project related solely to the emission of total unburned hydrocarbon (CH_4 + NMVOC). A constant disaggregation factor was estimated based on 3 emission measurements including both CH_4 and NMVOC.*

Nielsen & Illerup (2003):

> *The emission factor for natural gas engines was based on 18 emission measurements from 13 different engines. The engines from which emission measurements were available represented 18 % of the total biogas consumption in gas engines in year 2000.*

Table 40 Time-series for the CH_4 emission factor for biogas fuelled engines.

Year	Emission factor, g pr GJ
1990	239
1991	251
1992	264
1993	276
1994	289
1995	301
1996	305
1997	310
1998	314
1999	318
2000	323
2001	342
2002	360
2003	379
2004	397
2005	416
2006	434
2007	434
2008	434

Gas turbines, natural gas

SNAP 010104, 020104, 020303 and 030104

The emission factor for gas fuelled turbines was estimated to be below 1.7 g per GJ in 2005 (Nielsen et al. 2010c). The emission factor was based on emission measurements on five plants. The emission factor in year 2000 was 1.5 g per GJ (Nielsen & Illerup, 2003). A time series have been estimated.

CHP, wood

SNAP 010102 and, 010103 and 010104

The emission factor for CHP plants combusting wood was estimated to be below 3.1 g per GJ (Nielsen et al. 2010c) and the emission factor 3.1 g per GJ has been applied for all years. The emission factor was based on emission measurements on two plants.

CHP, straw

SNAP 010101, 010102 and 010103

The emission factor for CHP plants combusting straw was estimated to be below 0.47 g per GJ (Nielsen et al. 2010c) and the emission factor 0.47 g per GJ has been applied for all years. The emission factor was based on emission measurements on four plants.

CHP, municipal waste

SNAP 010102 and 010103

The emission factor for CHP plants combusting municipal waste was estimated to be below 0.34 g per GJ in 2006 (Nielsen et al. 2010c) and 0.59 g per GJ in year 2000 (Nielsen & Illerup, 2003). A time-series have been estimated. The emission factor was based on emission measurements on nine plants.

Other stationary combustion plants

Emission factors for other plants refer to the EMEP/Corinair Guidebook (EEA, 2007) and DGC (2001), Nielsen & Illerup (2003) or Gruijthuijsen &

Jensen (2000). The same emission factors have been applied for 1990-2008.

14.7.4 N_2O

The N_2O emission factors applied for the 2008 inventory are listed in Table 41. Time-series have been estimated for natural gas fuelled gas turbines. All other emission factors have been applied unchanged for 1990-2008.

Emission factors for natural gas fuelled reciprocating engines, natural gas fuelled gas turbines, CHP plants < 300 MW combusting wood, straw or residual oil, MSW incineration plants, engines fuelled by gas oil and gas engines fuelled by biomass producer gas all refer to emission measurements carried out on Danish plants (Nielsen et al. 2010c).

The emission factor for public power plants combusting coal refers to research conducted by Elsam (now part of DONG Energy). The emission factor for off-shore gas turbines refer to a Danish study concerning CHP plants (Nielsen & Illerup, 2003).

All other emission factors refer to the EMEP/CORINAIR Guidebook, 2007 update (EEA, 2007).

Table 41 N_2O emission factors 1990-2008.

Fuel group	Fuel	CRF source category	CRF source category	SNAP	Emis-sion factor g pr GJ	Reference
BIOMASS	WOOD	1A1a	Electricity and heat production	010102, 010103, 010104	0.8	Nielsen et al. 2010c
				010202, 010203	4	EEA 2007
		1A2	Industry	all	4	EEA 2007
		1A4a	Commercial/Institutional	020100	4	EEA 2007
		1A4b i	Residential	020200	4	EEA 2007
		1A4c i	Agriculture/Forestry	020300	4	EEA 2007
	STRAW	1A1a	Electricity and heat production	010101, 010102, 010103, 010104	1.1	Nielsen et al. 2010c
				010202, 010203	4	EEA 2007
		1A4b i	Residential	020200	4	EEA 2007
		1A4c i	Agriculture/Forestry	020300	4	EEA 2007
	FISH & RAPE OIL	1A1a	Electricity and heat production	All	2	EEA 2007, assuming same emission factor as gas oil
		1A2	Industry	030105	2	EEA 2007, assuming same emission factor as gas oil
		1A4b i	Residential	020200	2	EEA 2007, assuming same emission factor as gas oil
	BIOGAS	1A1a	Electricity and heat production	010102, 010103, 010203	2	EEA 2007
				010105, 010205 (Gas engines)	1.6	Nielsen et al. 2010c
		1A2	Industry	030100, 030102, 030103	2	EEA 2007
				030105 (Gas engines)	1.6	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100, 020103	2	EEA 2007
				020105 (Gas engines)	1.6	Nielsen et al. 2010c
		1A4c i	Agriculture/Forestry	020300	2	EEA 2007
				020304 (Gas engines)	1.6	Nielsen et al. 2010c
	BIO PROD GAS	1A1a	Electricity and heat production	010105	2.7	Nielsen et al. 2010c
		1A2	Industry	030105	2.7	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020105	2.7	Nielsen et al. 2010c
OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010102, 010103	1.2	Nielsen et al. 2010c
				010203	4	EEA 2007
		1A2	Industry	030102	4	EEA 2007
		1A4a	Commercial/Institutional	020103	4	EEA 2007
GAS	NATURAL GAS	1A1a	Electricity and heat production	010101, 010102, 010103, 010202, 010203	1	EEA 2007
				010104 (Gas turbines)	1	Nielsen et al. 2010c
				010105, 010205 (Gas engines)	0.58	Nielsen et al. 2010c
		1A1c	Other energy industries	010504 (Gas turbines)	2.2	Nielsen & Illerup 2003
				010505 (Gas engines)	0.58	Nielsen et al. 2010c
		1A2	Industry	030100, 030103	1	EEA 2007
				030104 (Gas turbines)	1	Nielsen et al. 2010c
				030105 (Gas engines)	0.58	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100, 020103	1	EEA 2007
				020105 (Gas engines)	0.58	Nielsen et al. 2010c
		1A4b i	Residential	020200, 020202	1	EEA 2007
				020204 (Gas engines)	0.58	Nielsen et al. 2010c
		1A4c i	Agriculture/Forestry	020300, 020303	1	EEA 2007
				020303 (Gas turbines)	1	Nielsen et al. 2010c
				020304 (Gas engines)	0.58	Nielsen et al. 2010c
LIQUID	PETROLEUM COKE	1A4a	Commercial/Institutional	020100	3	EEA 2007
		1A4b i	Residential	020200	3	EEA 2007
	RESIDUAL OIL	1A1a	Electricity and heat production	010101, 010104, 010202, 010203	2	EEA 2007
				010102, 010103	5	Nielsen et al. 2010c
		1A1b	Petroleum refining	010306	2	EEA 2007
		1A2	Industry	030100, 030105	2	EEA 2007
				030102, 030103	5	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100	2	EEA 2007
		1A4b i	Residential	020200	2	EEA 2007
		1A4c i	Agriculture/Forestry	020300, 020302	2	EEA 2007
	GAS OIL	1A1a	Electricity and heat production	010101, 010102, 010103, 010104, 010201, 010202, 010203	2	EEA 2007
				010105, 020105 (Engines)	2.1	Nielsen et al. 2010c
		1A1b	Petroleum refining	010306	2	EEA 2007
		1A1c	Other energy industries	010505	2	EEA 2007
		1A2	Industry	030100, 030102, 030103, 030104	2	EEA 2007
				030105 (Engines)	2.1	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100, 020103	2	EEA 2007
				020105 (Engines)	2.1	Nielsen et al. 2010c
		1A4b i	Residential	020200	2	EEA 2007
				020104 (Engines)	2.1	
	KEROSENE	1A2	Industry	030100	2	EEA 2007
		1A4a	Commercial/Institutional	020100	2	EEA 2007
		1A4b i	Residential	020200	2	EEA 2007
		1A4c i	Agriculture/Forestry	020300	2	EEA 2007
	LPG	1A1a	Electricity and heat production	010102, 010203	2	EEA 2007

Fuel group	Fuel	CRF source category	CRF source category	SNAP	Emis-sion factor g pr GJ	Reference
		1A2	Industry	030100	2	EEA 2007
		1A4a	Commercial/Institutional	020100, 020105	2	EEA 2007
		1A4b i	Residential	020200	2	EEA 2007
		1A4c i	Agriculture/Forestry	020300	2	EEA 2007
	REFINERY GAS	1A1b	Petroleum refining	010304, 010306	2.2	Nielsen & Illerup 2003, assuming same emission factor as for natural gas
SOLID	COAL	1A1a	Electricity and heat production	010101, 010102, 010103	0.8	Elsam 2005
		1A2	Industry	030100	3	EEA 2007
		1A4b i	Residential	020200	3	EEA 2007
		1A4c i	Agriculture/Forestry	020300	3	EEA 2007
	COKE OVEN COKE	1A2	Industry	030100	3	EEA 2007
		1A4b i	Residential	020200	3	EEA 2007

14.7.5 SO_2, NO_x, NMVOC and CO

Emission factors for SO_2, NO_x, NMVOC and CO are listed in Appendix 6. 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, 1997).
- Danish legislation:
  - 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. 2010c; 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 Appendix 6.

14.7.6 Particulate matter (PM)

Emission factors for PM and references for the emission factors are listed in Appendix 6. 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:
  - *Luftvejledningen* (MST, 2001), legislation from Danish Environmental Protection Agency.
  - *Bek. 689* (MST, 1990), 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 programs for decentralised CHP plants (Nielsen et al. 2010c; 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.

14.7.7 Heavy metals

Emission factors for 2008 for heavy metals (HM) are presented in Appendix 6. 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. 2010c; 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 Appendix 6 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.

14.7.8 PAH

Emission factors 2008 for PAHs are shown in Appendix 6. 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. 2010c; 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 technology specific emission factors (EEA, 2009; DEPA, 2010).

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.

14.7.9 Dioxin

Emission factors 2008 for dioxin are shown in Appendix 6.

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[21] refer to an emission measurement program for these plants (Nielsen et al. 2010c).

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.

14.7.10 HCB

Emission factors for HCB are shown in Appendix 6. 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 been considered constant in 1990-2008.

[21] 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.

14.7.11 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. 2010c) and all other emission factors refer to the EMEP/EEA Guidebook (EEA, 2009). Time-series have not been estimated.

14.7.12 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 Appendix 7. The implied emission factors are calculated as total emission divided by total fuel consumption.

14.8 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. However, separate national statistics from Statistics Denmark include a disaggregation to industrial subsectors. This part of the energy statistics is also included in the official energy statistics from the DEA.

Every other year Statistics Denmark collects fuel consumption data for all industrial companies of a considerable size. The deviation between the total fuel consumption from the DEA and the data collected by Statistics Denmark is rather small. Thus the disaggregation to industrial subsectors available from Statistics Denmark can be applied for estimating disaggregation keys for fuel consumption and emissions.

The industrial fuel consumption is considered in three aspects:

- Fuel consumption for transport. This part of the fuel consumption is not disaggregated to the industrial subcategories.
- Fuel consumption applied in power or district heating plants. Disaggregation of fuel and emissions is plant specific.
- Fuel consumption for other purposes. The total fuel consumption and the total emissions are disaggregated to industrial subcategories.

All pollutants included in the Climate Convention reporting have been disaggregated to industrial subcategories.

15 Uncertainty

According to the IPCC Good Practice Guidance (IPCC, 2000) and the Good Practice Guidance for LRTAP Emission Inventories (Pulles & Aardenne, 2003) uncertainty estimates should be included in the annual National Inventory Report (NIR) and the annual Informative Inventory Report (IIR), respectively.

Uncertainty estimates include uncertainty with regard to the total emission inventory as well as uncertainty with regard to trends. The GHG emission from stationary combustion plants has been estimated with an uncertainty interval of ±2.1 %[22] and the decrease in the GHG emission since 1990 has been estimated to be 14.6 % ± 1.4 %-age-points[22].

15.1 Methodology

15.1.1 Greenhouse gases

The uncertainty for GHG emissions have been estimated according to the IPCC Good Practice Guidance (IPCC, 2000). The uncertainty has been estimated by two approaches; Tier 1 and Tier 2. Both approaches are further described in the NIR Chapter 1.7 (Nielsen et al. 2010a).

The **Tier 1 approach** is based on a normal distribution and a confidence interval of 95 %.

The input data for the Tier 1 approach are:

- Emission data for the base year and the latest year.
- Uncertainties for emission factors.
- Uncertainty for fuel consumption rates.

The emission source categories applied are listed in Table 42.

The **Tier 2 approach** is a Monte Carlo approach based on a lognormal distribution. The input data for the model is based on 67 % confidence interval (standard deviation) whereas the results are given as 95 % confidence intervals. The input data for the Tier 2 approach are:

- Fuel consumption data for the base year and the latest year.
- Emission factors or implied emission factors (IEF) for the base year and the latest year.
- Standard deviation for emission factors for the base year and the latest year. If the same standard deviation is applied for both years the data can be indicated as statistically dependent or independent.
- Standard deviation for fuel consumption rates in the base year and the latest year. If the same standard deviation is applied for both years the data can be indicated as statistically dependent or independent.

[22] Tier 1 approach, 95 % confidence interval.

The same emission source categories and emission data have been applied for both approaches. In general, the same uncertainty levels have been applied for both approaches. However, the Tier 2 approach allows different uncertainty levels for 1990 and 2008 and this is relevant to a few uncertainties as discussed below. The 2008 uncertainty levels have been applied in the Tier 1 approach. Due to the difference of confidence interval of the input data for the two approaches the uncertainty input for the Tier 2 approach have been estimated based on the Tier 1 approach divided by a factor 2.

Most of the applied uncertainty estimates for activity rates and emission factors are default values from the IPCC Reference Manual or aggregated by NERI based on the default values. Some of the uncertainty estimates are, however, based on national estimates.

In general the uncertainty of the fuel consumption data have been assumed to be the same in 1990 and 2008 and the uncertainty has been assumed to be statistically independent. However, a considerable part of the residential wood consumption is non-traded and the uncertainty of biomass consumption has been assumed statistically dependent.

For coal combustion the uncertainty of the CO_2 emission factor is lower in 2008 than in 1990 due to availability of EU ETS data. Further, the CO_2 emission factor for the fossil part of municipal waste is less uncertain for 2008 than for 1990.

The uncertainty of the CH_4 emission factors for gas engines has been assumed higher in 1990 than in 2008 due to the emission measurement programmes on which the emission factors in later years are based.

All other uncertainty levels for emission factors have been assumed equal in 1990 and 2008 and statistically dependent.

Uncertainty estimates for the non-CO_2 emission factors for decentralised CHP plants will be updated in the next inventory when uncertainty estimates for the emission measurement programme (Nielsen et al. 2010c), on which these emission factors are based, have been reported.

Table 42 Uncertainty rates for fuel consumption and emission factors, 2008.

IPCC Source category	Gas	Fuel consumption uncertainty %			Emission factor uncertainty %		
		Tier 1[1)]	Tier 2[2)]		Tier 1[1)]	Tier 2[2)]	
			1990	2008		1990	2008
Stationary Combustion, Coal	CO_2	1.1[3)]	0.55	0.55	1.1[9)]	2.5[6)]	0.55
Stationary Combustion, BKB	CO_2	3.0[3)]	1.5	1.5	5[4)]	2.5	
Stationary Combustion, Coke	CO_2	2.0[3)]	1.05	1	5[4)]	2.5	
Stationary Combustion, Petroleum coke	CO_2	2.2[3)]	1.2	1.1	5[4)]	2.5	
Stationary Combustion, Plastic waste	CO_2	5.0[7)]	5	2.5	25[7)]	17.5	12.5
Stationary Combustion, Residual oil	CO_2	1.5[3)]	0.85	0.75	2[6)]	1	
Stationary Combustion, Gas oil	CO_2	2.8[3)]	1.45	1.4	5[4)]	2.5	
Stationary Combustion, Kerosene	CO_2	2.9[3)]	1.5	1.45	5[4)]	2.5	
Stationary Combustion, Natural gas	CO_2	1.7[3)]	1	0.85	1[6)]	0.5	
Stationary Combustion, LPG	CO_2	2.7[3)]	1.2	1.35	5[4)]	2.5	
Stationary Combustion, Refinery gas	CO_2	1.0[3)]	0.5	0.5	5[4)]	2.5	
1A1+1A2+1A4, BIOMASS	CH_4	15.9[3)]	7.95		100[4)]	50	
Biogas fuelled engines, BIOMASS	CH_4	3.0[3)]	1.5	1.5	10[5)]	10	5
1A1+1A2+1A4, GAS	CH_4	1.7[3)]	0.85	0.85	100[4)]	50	
Natural gas fuelled engines, GAS	CH_4	1.0[3)]	0.5	0.5	5[5)]	5	2.5
1A1+1A2+1A4, LIQUID	CH_4	1.9[3)]	0.95	0.95	100[4)]	50	
1A1+1A2+1A4, WASTE	CH_4	5.0[3)]	2.5	2.5	100[4)]	50	
1A1+1A2+1A4, SOLID	CH_4	1.1[3)]	0.55	0.55	100[4)]	50	
1A1 + 1A2 + 1A4, BIOMASS	N_2O	15.9[3)]	7.95		400[8)]	200	
1A1 + 1A2 + 1A4, GAS	N_2O	1.7[3)]	0.85	0.85	300[8)]	150	
1A1 + 1A2 + 1A4, LIQUID	N_2O	1.9[3)]	0.95	0.95	400[8)]	200	
1A1 + 1A2 + 1A4, WASTE	N_2O	5.0[3)]	2.5	2.5	200[8)]	100	
1A1 + 1A2 + 1A4, SOLID	N_2O	1.1[3)]	0.55	0.55	200[8)]	100	

[1)] Based on 95 % confidence interval.

[2)] Based on 67 % confidence interval (standard deviation). Estimated as ½ the Tier 1 uncertainty.

[3)] Estimated by NERI based on default uncertainty levels in IPCC Good Practice Guidance, Table 2.6 (IPCC 2000).

[4)] IPCC Good Practice Guidance, default value (IPCC 2000).

[5)] Estimated by NERI based on Nielsen et al. (2010c).

[6)] Jensen & Lindroth (2002).

[7)] Estimated by NERI based on ongoing work (Nielsen 2009).

[8)] NERI, rough estimate based on a default value of ± 400 % and an uncertainty of ± 200 % when the emission factor is based on emission measurements from plants in Denmark. Input data will be improved when ongoing work has been reported (Nielsen et al. 2010c).

[9)] NERI estimate based on EU ETS data.

The separate uncertainty estimation for gas engine CH_4 emission and CH_4 emission from other plants does not follow the recommendations in the IPCC Good Practice Guidance. Disaggregation is applied because in Denmark the CH_4 emission from gas engines is much larger than the emission from other stationary combustion plants, and the CH_4 emission factor for gas engines is estimated with a much smaller uncertainty level than for other stationary combustion plants.

15.1.2 Other pollutants

With regard to other pollutants, IPCC methodologies for uncertainty estimates have been adopted for the LRTAP Convention reporting activities (Pulles & Aardenne, 2003). 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 (2003).

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 43. The uncertainty for fuel consumption in stationary combustion plants is assumed to be 2 %.

Table 43 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	1 000	500	1 000
02	20	50	50	50	500	1 000	1 000	1 000	1 000	1 000
03	10	20	50	20	50	100	100	1 000	1 000	1 000

15.2 Results

The Tier 1 uncertainty estimates for stationary combustion emission inventories are shown in Table 44. Detailed calculation sheets are provided in Appendix 10. The Tier 2 uncertainty estimates are shown in Table 45 and detailed results are provided in Appendix 10.

The Tier 1 uncertainty interval for GHG is estimated to be ±2.1 % and the trend of the GHG emission is -14.6 % ± 1.4 %-age points. The main sources of uncertainty for GHG emission 2008 are the CO_2 emission from the fossil part of municipal waste, the CO_2 emission from coal combustion and the N_2O emission from biomass combustion. The main source of uncertainty in the trend in GHG emission is CO_2 emission from the combustion of coal, municipal waste and natural gas and N_2O emission from biomass combustion.

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 %.

The Tier 1 and Tier 2 approaches point out the same emission source categories as main contributors to the total uncertainty for GHG emission from stationary combustion.

Table 44 Danish uncertainty estimates, Tier 1 approach, 2008.

Pollutant	Uncertainty Total emission, %	Trend 1990-2008, %	Uncertainty trend, %-age points
GHG	± 2.1	-14.6	± 1.4
CO_2	± 1.5	-15.6	± 1.2
CH_4	± 45	+247	± 99
N_2O	± 167	+6.9	± 101
SO_2	± 7.5	-90	± 0.6
NO_x	± 16	-56	± 2.8
NMVOC	± 45	+50	± 7.5
CO	± 44	+16	± 3.8
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

[1)] The base year for particulate matter is year 2000.

Table 45 Danish uncertainty estimates, Tier 2 approach, 2008.

Pollutant	Uncertainty of total emission, %		Trend 1990-2008, %	Uncertainty of trend, %-age points	
GHG	-3.0	+3.7	-14.6	-1.8	+2.0
CO_2	-2.8	+3.0	-15.6	-1.7	+1.7
CH_4	-26	+55	+247	-51	+104
N_2O	-60	+221	+6.9	-73	+111

16 QA/QC and verification

The elaboration of a formal QA/QC plan began in 2004. A first version is available from Sørensen et al. (2005). This quality manual describes the concepts of quality work and definitions of sufficient quality, critical control points and a list of Point for Measuring. Source specific QA/QC is included in Appendix 16.

Documentation concerning verification of the Danish emission inventories has been published by Fauser et al. (2007). The reference approach, which is a verification for the energy sector, is shown in Chapter 16.1.

The sector reports for stationary combustion published in 2009, 2006 and 2004 (Nielsen et al. 2009; Nielsen et al. 2006; Nielsen et al. 2004) have been reviewed by external Danish experts (see Chapter 16.2). This 2010 update of the report has not been reviewed.

External data sources are shown in Table 46.

Table 46 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	Rikke A. Hansen, 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.

16.1 Reference approach

In addition to the sector-specific CO_2 emission inventories (the national approach), the CO_2 emission is also estimated using the reference approach described in the IPCC Reference Manual (IPCC, 1997). The reference approach is based on data for fuel production, import, export and stock change. The CO_2 emission inventory based on the reference approach is reported to the Climate Convention and used for verification of the official data in the national approach.

Data for import, export and stock change used in the reference approach originate from the annual "basic data" table prepared by the DEA and published on their home page (DEA, 2009b). The fraction of carbon oxidised has been assumed to be 1.00. The carbon emission factors are default factors originating from the IPCC Reference Manual (IPCC, 1997). The country-specific emission factors are not used in the reference approach, the approach being for the purposes of verification.

The Climate Convention reporting tables include a comparison of the national approach and the reference approach estimates. To make results comparable, the fuel consumption and the CO_2 emission from incineration of the plastic content of municipal waste are included in the reference approach in the fuel category *Other Solid Fossil*.

Three fuels are used for non-energy purposes, namely lube oil, bitumen and white spirit. The total consumption for non-energy purposes is relatively low – 11.1 PJ in 2008.

In 2008 the fuel consumption rates in the two approaches differ by -0.80 % and the CO_2 emission differs by -0.51 %. In the period 1990-2008 both the fuel consumption and the CO_2 emission differ by less than 1.9 %. The differences are below 1 % for all years except 1998 and 2006. According to the IPCC Good Practice Guidance (IPCC, 2000) the difference should be within 2 %. A comparison of the national approach and the reference approach is illustrated in Figure 62.

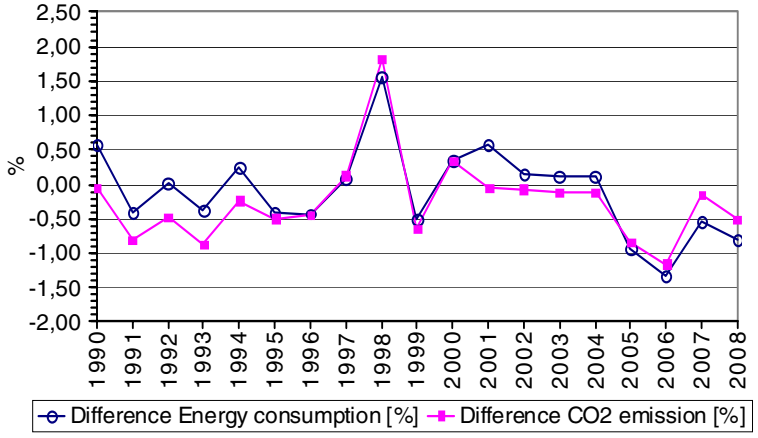


Figure 62 Comparison of the reference approach and the national approach.

16.2 External review

The 2004, 2006 and 2009 updates of this report were reviewed by Jan Erik Johnsson from the Technical University of Denmark, Bo Sander from Elsam Engineering and Annemette Geertinger from FORCE Technology. This update of the report (2010) has been not been reviewed by external national experts.

In addition the national emission inventories reported to the Climate Convention are reviewed annually by a UNFCCC Expert Review Team (ERT). Further the national inventory reported to the LRTAP Convention is also reviewed periodically.

16.3 Key source analysis

16.3.1 Greenhouse gases, national emission

The reporting of the Danish GHG emissions includes a key source analysis. A key source is a source that has a significant influence on national GHG emission of a country in terms of the absolute level of emission, the trend in emissions, or both.

The national key source analysis (including all sectors) for GHGs includes both a *Tier 1* and a *Tier 2* approach. Results of the national key source analysis are shown in Nielsen et al. (2010a). Table 47 shows the stationary combustion key sources of the national key source analysis. The CO_2 emissions from each of the main fuels are key sources in both approaches. The CH_4 emission from biomass combustion is a key source for *Tier 1 trend* as well as for *Tier 2 level* and *trend*. The CH_4 emission from gas fuelled engines is a key source for *Tier 1 trend*. All N_2O emission source categories are key sources in the *Tier 2 level* and *trend* analysis due to the high uncertainty for the N_2O emission factors.

Table 47 Stationary combustion key sources of the national key source analysis for GHGs (Nielsen et al. 2010a).

IPCC Source Categories (LULUCF excluded)			GHG	Key categories with number according to ranking in analysis Identification criteria				
				Level Tier1	Level Tier1	Trend Tier1	Level Tier2	Trend Tier2
				1990	2008	1990-2008	2008	1990-2008
Energy	Stationary Combustion	Coal	CO_2	1	1	1	14	15
Energy	Stationary Combustion	Petroleum Coke	CO_2	21	17	11		
Energy	Stationary Combustion	Plastic Waste	CO_2	22	8	6	11	4
Energy	Stationary Combustion	Residual Oil	CO_2	7	7	8		
Energy	Stationary Combustion	Gas Oil	CO_2	3	6	4	25	9
Energy	Stationary Combustion	Kerosene	CO_2	23		14		
Energy	Stationary Combustion	Natural Gas	CO_2	4	3	2	15	11
Energy	Stationary Combustion	Refinery Gas	CO_2	16	16	24		
Energy	Stationary Combustion	1A1+1A2+1A4, BIOMASS	CH_4			22	16	12
Energy	Stationary Combustion	Natural gas fuelled engines, GAS	CH_4			18		
Energy	Stationary Combustion	1A1 + 1A2 + 1A4, BIOMASS	N_2O				12	8
Energy	Stationary Combustion	1A1 + 1A2 + 1A4, GAS	N_2O				18	14
Energy	Stationary Combustion	1A1 + 1A2 + 1A4, LIQUID	N_2O				17	16
Energy	Stationary Combustion	1A1 + 1A2 + 1A4, SOLID	N_2O				24	22

16.3.2 Greenhouse gases, stationary combustion

A separate key source analysis has been estimated for stationary combustion. This key source analysis for stationary combustion plants follows the Tier 1 approach of the IPCC Guidelines (IPCC, 2006).

The aggregation level of the key source analysis is shown in Table 48. The source categories have been further disaggregated compared to the aggregation level for the national key source analysis. As for the national key source analysis the emission of CH_4 from gas engines has been treated as a separate source category due to the fact that the emission factor for gas engines is much higher for gas engines than for other plants. The uncertainty estimates also treat gas engines separately.

Table 48 Aggregation level for key source analysis.

Category Code	Category Title	Gas	Disaggregation level for fuel
1A1	Energy Industries	CO_2	Disaggregation to all fuel types
1A2	Industry	CO_2	
1A4	Other Sectors	CO_2	
1A1	Energy Industries	CH_4	Disaggregation to mail fuel types: Solid, Liquid, Gas and Biomass
1A2	Industry	CH_4	
1A4	Other Sectors	CH_4	
1A1, 1A2 and 1A4	Natural gas fuelled engines	CH_4	-
1A1, 1A2 and 1A4	Biogas fuelled engines	CH_4	-
1A1	Energy Industries	N_2O	Disaggregation to mail fuel types: Solid, Liquid, Gas and Biomass
1A2	Industry	N_2O	
1A4	Other Sectors	N_2O	

Emission from key sources adds up to 95 % of the total emission. The key sources for stationary combustion plants are shown below. Most of the key sources are key sources for both level (1990 and 2008) and trend. Detailed calculation sheets are shown in Appendix 14.

All emission level key sources are CO_2 emissions. CO_2 emission from coal combustion in the energy industries (1A1) is the largest source of GHG emission accounting for 50 % of the emission in 2008. CH_4 emission from natural gas fuelled reciprocating engines is an emission trend key source. All other trend key sources are CO_2 emissions. The largest trend key sources are CO_2 emission from combustion of coal and natural gas in *Energy Industries* and combustion of gas oil in *Other Sectors*.

All the key sources are also key sources[23] in the Danish inventory as a whole (Chapter 16.3.1).

Table 49 Key source analysis for stationary combustion (Tier 1 approach).

IPCC Category Code	IPCC Category	Fuel	Greenhouse gas	Identification criteria[1)]	Comments
1A1	Energy Industries	COAL	CO_2	$L1_{2008}$, $L1_{1990}$, T1	Level 2008: 47 %, Level 1990: 59 %, Trend 24 %
1A1	Energy Industries	NATURAL GAS	CO_2	$L1_{2008}$, $L1_{1990}$, T1	Trend 25 %
1A4	Other Sectors	NATURAL GAS	CO_2	$L1_{2008}$, $L1_{1990}$, T1	
1A2	Industry	NATURAL GAS	CO_2	$L1_{2008}$, $L1_{1990}$, T1	
1A4	Other Sectors	GAS OIL	CO_2	$L1_{2008}$, $L1_{1990}$, T1	Trend 14 %
1A1	Energy Industries	PLASTIC WASTE	CO_2	$L1_{2008}$, $L1_{1990}$, T1	
1A1	Energy Industries	REFINERY GAS	CO_2	$L1_{2008}$, $L1_{1990}$, T1	
1A1	Energy Industries	RESIDUAL OIL	CO_2	$L1_{2008}$, $L1_{1990}$	
1A2	Industry	PETROLEUM COKE	CO_2	$L1_{2008}$, T1	
1A2	Industry	COAL	CO_2	$L1_{2008}$, $L1_{1990}$, T1	
1A2	Industry	RESIDUAL OIL	CO_2	$L1_{2008}$, $L1_{1990}$, T1	
1A4	Other Sectors	KEROSENE	CO_2	$L1_{1990}$, T1	
1A1, 1A2 and 1A4	Natural gas fuelled engines	NATURAL GAS	CH_4	T1	

L1: Level, Tier 1 approach, T1: Trend, Tier 1 approach.

The key source analysis will be implemented as part of the QA/QC in future inventories.

[23] Or included as part of a key source category.

16.3.3 Other pollutants

A key source analysis for SO_2, NO_x, NMVOC, CO and PM has been performed for stationary combustion. The key source analysis has been based on the methodology in the EMEP/EEA Guidebook (EEA, 2009). Disaggregation to fuel types has, however, not been estimated. For these pollutants emission sources that add up to 80 % of total emission are considered key sources. Trend key sources have been estimated with 1990 as base year. Trend key sources have not been estimated for PM. Detailed calculation sheets are shown in Appendix 14.

Table 50 shows key sources for each pollutant.

Table 50 Key source analysis, other pollutants.

	SO_2	NO_x	NMVOC	CO	TSP	PM_{10}	$PM_{2.5}$
1A1a Public electricity and heat production	L, T	L, T	T				
1A1b Petroleum refining							
1A1c Other energy industries		L, T					
1A2 Industry	L, T	L	T				
1A4a Commercial/Institutional							
1A4b Residential	L, T	T	L, T	L, T	L	L	L
1A4c Agriculture/Forestry/Fisheries				T			

17 Improvements and recalculations since reporting in 2009

Improvements and recalculations since the 2009 emission inventory submission include:

- The national energy statistics has been updated for the years 1980-2007. This has only resulted in small differences.
- The split of the CO_2 emission factor for municipal waste between biomass and fossil fuel has been recalculated.
- In CRF the fossil fuel content of municipal waste and the corresponding emissions are now included in fuel category *Other fuels.* The biomass content of municipal waste and the corresponding emissions are reported as part of the fuel category *Biomass*.
- Improved emission factors for decentralised CHP plants referring to a Danish emission measurement program (Nielsen et al. 2010c) have been implemented.
- A time-series has 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 of NMVOC, TSP, PM_{10}, $PM_{2.5}$ and dioxin 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 (EEA, 2009).
- A Tier 2 approach for uncertainty has been applied for greenhouse gases.
- Data from the EU ETS have been utilised for the third time in the 2010 inventory submission. The uncertainty estimates (Tier 1 and Tier 2) now take into account the lower uncertainty of the heating values and CO_2 emission factors based on the EU ETS data compared to the national heating values and emission factors.

18 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) Uncertainty estimates

Uncertainty estimates are based mainly on default uncertainty levels for activity rates and emission factors. Default uncertainty levels will be updated according to the updated EMEP/Corinair Guidebook (EEA, 2009). More country-specific uncertainty estimates will be incorporated in future inventories. Uncertainty data for emission factors for decentralised CHP plants will be included (Nielsen et al. 2010c).

3) Improved CO_2 emission factor for municipal waste

Ongoing work will further improve the CO_2 emission factor for municipal waste.

4) Implementation of emission factors from EEA 2009

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

19 Conclusion

The annual Danish emission inventories are prepared and reported by the Danish National Environmental Research Institute (NERI), Aarhus University. The inventories for stationary combustion are based on the Danish energy statistics and on a set of emission factors for various source categories, technologies and fuels. Plant specific emissions for large combustion sources are incorporated into the inventories.

In 2008 the fuel consumption was 7 % higher than in 1990; the fossil fuel consumption, however, was 7 % lower than in 1990. The use of coal has decreased whereas the use of natural gas and biomass has increased. The fuel consumption for stationary combustion fluctuates due to variation in the import/export of electricity from year to year.

Stationary combustion plants account for more than 50 % of the national emission for the following pollutants: SO_2, CO_2, heavy metals (except Cu, Pb and Zn), PM_{10}, $PM_{2.5}$, dioxin, HCB and PAH. Furthermore, the emission from stationary combustion plants accounts for more than 10 % of the national emission for the following pollutants: NO_x, CO, NMVOC, TSP, Cu, Pb and Zn. Stationary combustion plants account for less than 10 % of the national emission of CH_4, N_2O and NH_3.

Public electricity and heat production are the most important stationary combustion emission source for CO_2, N_2O, SO_2 and NO_x.

Lean-burn gas engines installed in decentralised CHP plants and combustion of biomass in residential plants are the two largest emission sources for CH_4.

Residential plants represent the most important stationary combustion emission source for CO, NMVOC, particulate matter, PAH and dioxin. Wood combustion in residential plants is the predominant emission source.

Industrial plants, public electricity and heat production plants and residential plants are the main emission sources for the different heavy metals.

The greenhouse gas (GHG) emission trend follows the CO_2 emission trend closely. Both the CO_2 and the total GHG emission were lower in 2008 than in 1990; CO_2 by 16 % and GHG by 15 %. However, fluctuations in the GHG emission level are large. The fluctuations in the time-series are a result of electricity import/export and of outdoor temperature variations from year to year.

The CH_4 emission from stationary combustion has increased by a factor of 3.5 since 1990. This is mainly a result of the considerable number of lean-burn gas engines installed in CHP plants in Denmark during the 1990s. In recent years the emission has declined. This is due to structural changes in the Danish electricity market, which means that the fuel consumption in gas engines has been decreasing. The CH_4 emission from

residential plants has increased since 1990 due to increased combustion of wood in residential plants.

The emission of N_2O was 7 % higher in 2008 than in 1990. The fluctuations follow the fluctuations of the fuel consumption that is a result of import/export of electricity.

SO_2 emission from stationary combustion plants has decreased by 96 % from 1980 and by 90 % from 1990. The considerable emission decrease is mainly a result of the reduced emission from electricity and heat production due to installation of desulphurisation technology and the use of fuels with lower sulphur content. These improvements are a result of both sulphur tax laws and legislation concerning sulphur content of fuels, emission ceilings for large power plants and emission limits for several plant categories.

The NO_x emission from stationary combustion plants has decreased by 66 % since 1985 and by 56 % since 1990. The reduced emission is mainly a result of the reduced emission from electricity and heat production due to installation of low NO_x burners and selective catalytic reduction (SCR) units. The technical improvements were launched by legislation including emission ceilings for large power plants and lower emission limits for several plant categories. The fluctuations in the emission time-series follow fluctuations in electricity import/export.

In 2008 the wood consumption in residential plants was four times the 1990 level. This increase causes considerable changes of the emission of NMVOC, CO, PM and PAH from stationary combustion due to the fact that residential wood combustion is a major emission source for these pollutants. A change of technology (installation of modern stoves) has, however, caused decreasing emission factors for several pollutants.

The CO emission from stationary combustion has increased by 16 % since 1990. The increase in CO emission from residential plants is less than the increase in wood consumption because the CO emission factor for wood combustion in residential plants has decreased since 1990. Furthermore, the emission from straw-fired farmhouse boilers has decreased considerably.

The NMVOC emission from stationary combustion plants has increased 33 % since 1985 and 50 % since 1990. The increased NMVOC emission is mainly a result of the increasing wood combustion in residential plants and the increased use of lean-burn gas engines. The emission from straw-fired farmhouse boilers has decreased.

The emission of TSP, PM_{10} and $PM_{2.5}$ has increased by 57-62 % since 2000 due to the increase of wood combustion in residential plants. The emission of PAHs has increased by 120-170 % since 1990, also a result of the increased combustion of wood in residential plants.

All the heavy metal emissions have decreased considerably since 1990 – between 65 % and 87 %, Zn, however, only 5 %. This is a result of the installation and improved performance of gas cleaning devices in municipal waste incineration plants and large power plants.

Dioxin emission has decreased 55 % since 1990 mainly due to installation of dioxin filters in MSW incineration plants that was necessary due to the emission limit included in Danish legislation. However, the emission from residential plants has increased in recent years due to the increased wood combustion in the sector. This has caused an increase of dioxin emission from stationary combustion since 2004.

The uncertainty level of the Danish greenhouse gas emission from stationary combustion is estimated to be within a range of ±2.1 % and the trend in GHG emission (1990-2008) is -14.6 % ± 1.4 %-age points[24].

[24] Tier 1 approach. This year a Tier 2 approach for uncertainty estimates has also been applied.

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Appendix

Appendix 1: The Danish emission inventory for the year 2008 reported to the Climate Convention in 2010

Appendix 2: Emission inventory for the year 2008 reported to the LRTAP Convention in 2010

Appendix 3: IPCC/SNAP source correspondence list

Appendix 4: Fuel rate

Appendix 5: Lower Calorific Value (LCV) of fuels

Appendix 6: Emission factors

Appendix 7: Implied emission factors for power plants and municipal waste incineration plants

Appendix 8: Large point sources

Appendix 9: Adjustment of CO_2 emission

Appendix 10: Uncertainty estimates

Appendix 11: Reference approach

Appendix 12: Emission inventory 2008 based on SNAP sectors

Appendix 13: Description of the Danish energy statistics

Appendix 14: Key source analysis

Appendix 15: Time-series 1980-2008

Appendix 16: Source specific QA/QC

Appendix 1 The Danish emission inventory for the year 2008 reported to the Climate Convention in 2010

Table 49 The Danish emission inventory for the year 2008 reported to the Climate Convention in 2010 (Nielsen et al. 2010a)[1].

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
Total National Emissions and Removals	**51,156.80**	**264.71**	**21.72**	**746.98**	**852.72**	**4.19**	**12.79**	**0.01**	**0.00**	**151.60**	**434.52**	**105.95**	**18.65**
1. Energy	**49,212.33**	**27.62**	**1.41**							**151.47**	**431.68**	**66.27**	**18.64**
A. Fuel Combustion — Reference Approach[2]	48,588.19												
A. Fuel Combustion — Sectoral Approach[2]	48,836.37	21.50	1.41							151.28	431.46	53.16	17.47
1. Energy Industries	23,552.70	8.69	0.43							32.58	8.21	1.88	6.61
2. Manufacturing Industries and Construction	5,199.31	1.02	0.19							19.66	19.94	1.75	5.42
3. Transport	13,802.15	1.09	0.45							70.86	146.83	19.09	0.79
4. Other Sectors	6,174.59	10.70	0.35							27.67	256.17	30.40	4.63
5. Other	107.62	0.00	0.00							0.52	0.31	0.04	0.02
B. Fugitive Emissions from Fuels	375.96	6.12	0.00							0.19	0.22	13.11	1.18
1. Solid Fuels	NA,NO	NA,NO	NA,NO							NA,NO	NA,NO	NA,NO	NA,NO
2. Oil and Natural Gas	375.96	6.12	0.00							0.19	0.22	13.11	1.18
2. Industrial Processes	**1,359.54**	**IE,NA,NO**	**IE,NA,NO**	**746.98**	**852.72**	**4.19**	**12.79**	**0.01**	**0.00**	**0.02**	**0.31**	**10.12**	**0.01**
A. Mineral Products	1,320.47	IE,NA	IE,NA							IE,NA	0.31	0.58	IE,NA
B. Chemical Industry	2.40	NA,NO	NA,NO	NA	NA	NA	NA	NA	NA	0.02	NA,NO	0.02	0.01
C. Metal Production	NE,NO	NA,NO	NO				NO		NO	NO	NO	NO	NO
D. Other Production[3]	2.67									NE	NE	9.51	NE
E. Production of Halocarbons and SF_6					NA,NO		NA,NO		NO				
F. Consumption of Halocarbons and SF_6				746.98	852.72	4.19	12.79	0.01	0.00				
G. Other	34.01	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6		NO_x	CO	NMVOC
				P	A	P	A	P	A			
	(Gg)			CO_2 equivalent (Gg)						(Gg)		
3. Solvent and Other Product Use	**64.79**		**0.09**							**NA**	**NA**	**27.43**
4. Agriculture		**184.36**	**19.85**							**0.10**	**2.53**	**2.14**
A. Enteric Fermentation		134.26										
B. Manure Management		49.99	1.63									NE,NO
C. Rice Cultivation		NO										NO
D. Agricultural Soils[4]		NA,NE	18.22									1.87
E. Prescribed Burning of Savannas		NA	NA							NO	NO	NO
F. Field Burning of Agricultural Residues		0.12	0.00							0.10	2.53	0.27
G. Other		NA	NA							NA	NA	NA
5. Land Use, Land-Use Change and Forestry	[5] **491.64**	**NA,NE,NO**	**0.03**							**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Forest Land	[5] -216.79	NA,NE,NO	0.03							NO	NO	NO
B. Cropland	[5] 789.90	NA,NO	0.00							NE,NO	NE,NO	NE,NO
C. Grassland	[5] -57.46	NA	NA							NE,NO	NE,NO	NE,NO
D. Wetlands	[5] -30.00	NA,NE	0.00							NE	NE	NE
E. Settlements	[5] 5.99	NE,NO	NE,NO							NE	NE	NE
F. Other Land	[5] NA	NA	NA							NA	NA	NA
G. Other	[5] NE	NE	NE							NE	NE	NE
6. Waste	**28.50**	**52.73**	**0.34**							**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**
A. Solid Waste Disposal on Land	[6] NA,NE,NO	50.32								NA,NO	NA,NO	NA,NO
B. Waste-water Handling		2.25	0.34							NA	NA	NA
C. Waste Incineration	[6] 28.50	0.16	0.00							IE	IE	IE
D. Other	NO	NO	NO							NO	NO	NO
7. Other *(please specify)* [7]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
Memo Items: [8]													
International Bunkers	**5,759.96**	**0.13**	**0.29**							**88.84**	**10.03**	**2.92**	**21.40**
Aviation	2,641.90	0.05	0.09							11.30	2.00	0.49	0.84
Marine	3,118.05	0.08	0.20							77.54	8.03	2.43	20.56
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**11,704.51**												

[1] Not including Greenland and Faroe Islands

Appendix 2 Emission inventory for the year 2008 reported to the LRTAP Convention in 2010

Table 50 Emission inventory for the year 2008 reported to the LRTAP in 2010 (a) (Nielsen et al. 2010b).

	NO_x Gg NO_2	CO Gg	NMVOC Gg	SO_x Gg SO_2	NH_3 Gg	TSP Mg	PM_{10} Mg	$PM_{2.5}$ Mg
1 A 1 a Public Electricity and Heat Production	24.06	7.91	1.84	6.28	0.01	868	649	533
1 A 1 b Petroleum refining	1.49	0.12	0.00	0.32	NA	119	110	106
1 A 1 c Manufacture of Solid Fuels and Other Energy Industries	7.03	0.18	0.04	0.01	NA	3	2	1
1 A 2 Manufacturing Industries and Construction	-	-	-	-	-	-	-	-
1 A 2 a Iron and Steel	IE	IE	IE	IE	NA	148	44	7
1 A 2 b Non-ferrous Metals	IE	IE	IE	IE	NA	39	35	16
1 A 2 c Chemicals	IE	IE	IE	IE	NA	IE	IE	IE
1 A 2 d Pulp, Paper and Print	IE	IE	IE	IE	NA	IE	IE	IE
1 A 2 e Food Processing, Beverages and Tobacco	IE	IE	IE	IE	NA	IE	IE	IE
1 A 2 f Other (Please specify in a covering note)	19.66	19.94	1.75	5.42	0.38	1 536	1 406	1 208
1 A 3 a ii Civil Aviation (Domestic, LTO)	0.23	0.69	0.12	0.01	0.00	1	1	1
1 A 3 a ii Civil Aviation (Domestic, Cruise)	0.48	0.14	0.03	0.04	-	2	2	2
1 A 3 b Road Transportation	-	-	-	-	-	-	-	-
1 A 3 b i R.T., Passenger cars	16.93	105.07	9.13	0.04	1.50	720	720	720
1 A 3 b ii R.T., Light duty vehicles	7.15	9.11	1.18	0.01	0.06	756	756	756
1 A 3 b iii R.T., Heavy duty vehicles	36.96	7.90	1.46	0.03	0.02	887	887	887
1 A 3 b iv R.T., Mopeds & Motorcycles	0.21	17.19	3.27	0.00	0.00	58	58	58
1 A 3 b v R.T., Gasoline evaporation	NA	NA	2.72	NA	NA	NA	NA	NA
1 A 3 b vi R.T., Automobile tyre and brake wear	NA	NA	NA	NA	NA	1 609	1 203	657
1 A 3 b vii R.T., Automobile road abrasion	NA	NA	NA	NA	NA	1 135	567	306
1 A 3 c Railways	2.92	0.53	0.20	0.00	0.00	101	101	101
1 A 3 d ii National Navigation	5.98	6.20	0.99	0.65	0.00	244	242	242
1 A 3 e Other (Please specify in a covering note)	-	-	-	-	-	-	-	-
1 A 3 e i Pipeline compressors	IE	IE	IE	IE	IE	IE	IE	IE
1 A 3 e ii Other mobile sources and machinery	NO	NO	NO	NO	NO	NO	NO	NO
1 A 4 a Commercial/Institutional	0.81	0.84	0.27	0.27	NA	176	172	161
1 A 4 b Residential	-	-	-	-	-	-	-	-
1 A 4 b i Residential plants	6.70	133.44	19.22	2.47	0.19	21 150	20 102	19 676
1 A 4 b ii Household and gardening (mobile)	0.30	95.38	7.95	0.00	0.00	81	81	81
1 A 4 c Agriculture/Forestry/Fishing	-	-	-	-	-	-	-	-
1 A 4 c i Stationary	0.71	9.71	0.57	1.57	NA	508	472	438
1 A 4 c ii Off-road Vehicles and Other Machinery	10.84	15.66	2.04	0.04	0.00	859	859	859
1A 4 c iii National Fishing	8.30	1.15	0.35	0.28	-	131	129	129
1 A 5 a Other, Stationary (including Military)	NO	NO	NO	NO	NO	NO	NO	NO
1 A 5 b Other, Mobile (Including military)	0.52	0.31	0.04	0.02	0.00	15	15	15
1B1 Fugitive Emissions from Solid Fuels	-	-	-	-	-	-	-	-
1 B 1 a Coal Mining and Handling	NA	NA	NA	NA	NA	1 135	454	45
1 B 1 b Solid fuel transformation	NO	NO	NO	NO	NO	NO	NO	NO
1 B 1 c Other (Please specify in a covering note)	NO	NO	NO	NO	NO	NO	NO	NO
1 B 2 Oil and natural gas	-	-	-	-	-	-	-	-
1 B 2 a Oil	-	-	-	-	-	-	-	-
1 B 2 a i Exploration Production, Transport	NA	NA	7.99	IE	NA	NA	NA	NA
1 B 2 a iv Refining / Storage	NA	NA	3.78	0.79	NA	NA	NA	NA
1 B 2 a v Distribution of oil products	NA	NA	1.21	NA	NA	NA	NA	NA
1 B 2 a vi Other	NO	NO	NO	NO	NO	NO	NO	NO
1 B 2 b Natural gas	NA	NA	0.07	NA	NA	NA	NA	NA
1 B 2 c Venting and flaring	0.19	0.22	0.05	0.38	NA	6	6	6
2 A MINERAL PRODUCTS (b)	-	-	-	-	-	-	-	-
2 A 1 Cement Production	IE	IE	IE	IE	IE	IE	IE	IE
2 A 2 Lime Production	IE	IE	IE	IE	IE	IE	IE	IE
2 A 3 Limestone and Dolomite Use	IE	IE	IE	IE	IE	IE	IE	IE
2 A 4 Soda Ash Production and use	IE	IE	IE	IE	IE	IE	IE	IE
2 A 5 Asphalt Roofing	NE	0.00	0.01	NE	NE	NE	NE	NE
2 A 6 Road Paving with Asphalt	NE	0.31	0.56	NE	NE	NE	NE	NE
2 A 7 Other including Non Fuel Mining & Construction (Please specify in a covering note)	NE	NE	0.02	NE	0.11	NE	NE	NE
2 B Chemical Industry	-	-	-	-	-	-	-	-
2 B 1 Ammonia Production	NO	NO	NO	NO	NO	NO	NO	NO
2 B 2 Nitric Acid Production	NA	NA	NA	NA	NA	NA	NA	NA
2 B 3 Adipic Acid Production	NO	NO	NO	NO	NO	NO	NO	NO
2 B 4 Carbide Production	NO	NO	NO	NO	NO	NO	NO	NO
2 B 5 Other (Please specify in a covering note)	0.02	NE	0.02	0.01	0.11	NE	NE	NE
2 C Metal Production	NA	NE	NE	NA	NA	NE	NE	NE
2 D Other Production (b)	-	-	-	-	-	-	-	-
2 D 1 Pulp and Paper	NE	NE	NE	NE	NE	NE	NE	NE

2 D 2 Food and Drink	NE	NE	9.51	NE	NE	NE	NE	NE
2 G Other (Please specify in a covering note)	NO	NO	NO	NO	NO	NO	NO	NO
3 A Paint Application	NA	NA	3.67	NA	NA	NA	NA	NA
3 B Degreasing and Dry Cleaning	NA	NA	0.00	NA	NA	NA	NA	NA
3 C Chemical Products, Manufacture and Processing	NA	NA	5.85	NA	NA	NA	NA	NA
3 D Other including products containing HMs and POPs (Please specify in a covering note)	NA	NA	17.90	NA	NA	NA	NA	NA
4 B Manure Management (c)	-	-	-	-	-	-	-	-
4 B 1 Cattle	NA	NA	NA	NA	-	-	-	-
4 B 1 a Dairy	NA	NA	NA	NA	14.67	855	393	253
4 B 1 b Non-Dairy	NA	NA	NA	NA	5.57	493	227	146
4 B 2 Buffalo	NO	NO	NO	NO	NO	NO	NO	NO
4 B 3 Sheep	NA	NA	NA	NA	0.13	4	2	1
4 B 4 Goats	NA	NA	NA	NA	0.01	1	0	0
4 B 5 Camels and Llamas	NO	NO	NO	NO	NO	NO	NO	NO
4 B 6 Horses	NA	NA	NA	NA	0.89	37	17	11
4 B 7 Mules and Asses	NO	NO	NO	NO	NO	NO	NO	NO
4 B 8 Swine	NA	NA	NA	NA	26.64	9 438	4 247	693
4 B 9 Poultry	NA	NA	NA	NA	4.12	1 027	1 027	162
4 B 13 Other	NA	NA	NA	NA	6.90	NE	NE	NE
4 C Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO
4 D Agricultural Soils	-	-	-	-	-	-	-	-
4 D 1 Direct Soil Emission	NA	NA	1.87	NA	12.28	NE	NE	NE
4 F Field Burning of Agricultural Wastes	0.10	2.53	0.27	0.01	0.10	0	0	0
4 G Other (d)	NO	NO	NO	NO	0.04	NO	NO	NO
5 B Forest and Grassland Conversion	NO	NO	NO	NO	NO	NO	NO	NO
6 A Solid Waste Disposal on Land	NA	NA	NE	NA	NA	NA	NA	NA
6 B Waste-Water Handling	NA	NA	NE	NA	NA	NA	NA	NA
6 C Waste Incineration (e)	0.02	0.00	0.00	0.00	0.00	5	4	3
6 D Other Waste (f)	0.07	1.16	0.35	0.93	NO	10	10	10
7 Other	NA	NA	NA	NA	NA	NA	NA	NA
National Total	**151.69**	**435.68**	**106.31**	**19.60**	**73.73**	**44 158**	**35 002**	**28 291**
Memo Items								
International Aviation (LTO)	1.08	0.81	0.14	0.07	0.00	4	4	4
International Aviation (Cruise)	10.22	1.19	0.34	0.77	-	39	39	39
International Navigation	77.54	8.03	2.43	20.56	NA	2 025	2 005	1 995
5 E Other	NO	NO	NO	NO	NO	NO	NO	NO
X (11 08 Volcanoes)	NO	NO	NO	NO	NO	NO	NO	NO

Table 51 Emission inventory for the year 2008 reported to the LRTAP in 2010 (b) (Nielsen et al. 2010b).

	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
1 A 1 a Public Electricity and Heat Production	0.73	0.11	0.43	0.16	0.33	0.31	1.01	1.00	1.55
1 A 1 b Petroleum refining	0.02	0.01	0.00	0.01	0.03	0.01	0.58	0.01	0.00
1 A 1 c Manufacture of Solid Fuels and Other Energy Industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 2 Manufacturing Industries and Construction	-	-	-	-	-	-	-	-	-
1 A 2 a Iron and Steel	0.53	0.01	IE	0.02	0.08	IE	0.10	0.37	0.37
1 A 2 b Non-ferrous Metals	0.01	0.00	IE	IE	IE	0.00	IE	IE	-
1 A 2 c Chemicals	IE	IE	IE	IE	IE	IE	IE	IE	IE
1 A 2 d Pulp, Paper and Print	IE	IE	IE	IE	IE	IE	IE	IE	IE
1 A 2 e Food Processing, Beverages and Tobacco	IE	IE	IE	IE	IE	IE	IE	IE	IE
1 A 2 f Other (Please specify in a covering note)	0.24	0.15	0.23	0.15	0.26	0.73	4.10	0.15	1.40
1 A 3 a ii Civil Aviation (Domestic, LTO)	1.18	0.00	NE	NE	0.00	0.02	0.00	0.00	0.01
1 A 3 a ii Civil Aviation (Domestic, Cruise)	-	0.00	-	-	0.00	0.07	0.00	0.00	0.04
1 A 3 b Road Transportation	-	-	-	-	-	-	-	-	-
1 A 3 b i R.T., Passenger cars	0.05	0.02	NE	NE	0.11	3.65	0.15	0.02	2.15
1 A 3 b ii R.T., Light duty vehicles	0.00	0.01	NE	NE	0.03	1.09	0.05	0.01	0.64
1 A 3 b iii R.T., Heavy duty vehicles	0.00	0.01	NE	NE	0.06	2.14	0.09	0.01	1.26
1 A 3 b iv R.T., Mopeds & Motorcycles	0.00	0.00	NE	NE	0.00	0.05	0.00	0.00	0.03
1 A 3 b v R.T., Gasoline evaporation	NA	NA	NA	NA	NA	NA	NA	NA	NA
1 A 3 b vi R.T., Automobile tyre and brake wear	NA	NA	NA	NA	NA	NA	NA	NA	NA
1 A 3 b vii R.T., Automobile road abrasion	NA	NA	NA	NA	NA	NA	NA	NA	NA
1 A 3 c Railways	NA	0.00	NA	NA	0.00	0.13	0.01	0.00	0.07
1 A 3 d ii National Navigation	0.01	0.00	0.01	0.01	0.01	0.07	0.47	0.03	0.09
1 A 3 e Other (Please specify in a covering note)	-	-	-	-	-	-	-	-	-
1 A 3 e i Pipeline compressors	IE	IE	IE	IE	IE	IE	IE	IE	IE
1 A 3 e ii Other mobile sources and machinery	NO	NO	NO	NO	NO	NO	NO	NO	NO
1 A 4 a Commercial / Institutional	0.02	0.01	0.01	0.01	0.02	0.02	0.30	0.02	0.17
1 A 4 b Residential	-	-	-	-	-	-	-	-	-
1 A 4 b i Residential plants	1.48	0.04	0.06	0.04	0.09	0.31	0.10	0.10	3.80
1 A 4 b ii Household and gardening (mobile)	0.00	0.00	NE	NE	0.00	0.13	0.01	0.00	0.07
1 A 4 c Agriculture / Forestry / Fishing	-	-	-	-	-	-	-	-	-
1 A 4 c i Stationary	0.03	0.01	0.02	0.02	0.03	0.02	0.44	0.01	0.05
1 A 4 c ii Off-road Vehicles and Other Machinery	0.00	0.00	NA	NA	0.02	0.67	0.03	0.00	0.39
1A 4 c iii National Fishing	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.03	0.07
1 A 5 a Other, Stationary (including Military)	NO	NO	NO	NO	NO	NO	NO	NO	NO
1 A 5 b Other, Mobile (Including military)	0.04	0.00	-	-	0.00	0.06	0.00	0.00	0.03
1B1 Fugitive Emissions from Solid Fuels	-	-	-	-	-	-	-	-	-
1 B 1 a Coal Mining and Handling	NA	NA	NA	NA	NA	NA	NA	NA	NA
1 B 1 b Solid fuel transformation	NO	NO	NO	NO	NO	NO	NO	NO	NO
1 B 1 c Other (Please specify in a covering note)	NO	NO	NO	NO	NO	NO	NO	NO	NO
1 B 2 Oil and natural gas	-	-	-	-	-	-	-	-	-
1 B 2 a Oil	-	-	-	-	-	-	-	-	-
1 B 2 a i Exploration Production, Transport	NA	NA	NA	NA	NA	NA	NA	NA	NA
1 B 2 a iv Refining / Storage	NA	NA	NA	NA	NA	NA	NA	NA	NA
1 B 2 a v Distribution of oil products	NA	NA	NA	NA	NA	NA	NA	NA	NA
1 B 2 a vi Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
1 B 2 b Natural gas	NA	NA	NA	NA	NA	NA	NA	NA	NA
1 B 2 c Venting and flaring	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.09
2 A MINERAL PRODUCTS (b)	-	-	-	-	-	-	-	-	-
2 A 1 Cement Production	IE	IE	IE	IE	IE	IE	IE	IE	IE
2 A 2 Lime Production	IE	IE	IE	IE	IE	IE	IE	IE	IE
2 A 3 Limestone and Dolomite Use	IE	IE	IE	IE	IE	IE	IE	IE	IE
2 A 4 Soda Ash Production and use	IE	IE	IE	IE	IE	IE	IE	IE	IE
2 A 5 Asphalt Roofing	NE	NE	NE	NE	NE	NE	NE	NE	NE
2 A 6 Road Paving with Asphalt	NE	NE	NE	NE	NE	NE	NE	NE	NE

2 A 7 Other including Non Fuel Mining & Construction	NE	NE	NE	NE	NE	NE	NE	NE	NE
(Please specify in a covering note)	-	-	-	-	-	-	-	-	-
2 B CHEMICAL INDUSTRY	NO	NO	NO	NO	NO	NO	NO	NO	NO
2 B 1 Ammonia Production	NA	NA	NA	NA	NA	NA	NA	NA	NA
2 B 2 Nitric Acid Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2 B 3 Adipic Acid Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2 B 4 Carbide Production	NE	NE	NE	NE	NE	NE	NE	NE	NE
2 B 5 Other (Please specify in a covering note)	0.07	0.00	-	NE	-	0.05	-	NE	0.63
2 C METAL PRODUCTION	-	-	-	-	-	-	-	-	-
2 D OTHER PRODUCTION (b)	NA	NA	NA	NA	NA	NA	NA	NA	NA
2 D 1 Pulp and Paper	NA	NA	NA	NA	NA	NA	NA	NA	NA
2 D 2 Food and Drink	NO	NO	NO	NO	NO	NO	NO	NO	NO
2 G OTHER (Please specify in a covering note)	-	-	-	-	-	-	-	-	-
3 A PAINT APPLICATION	NA	NA	NA	NA	NA	NA	NA	NA	NA
3 B DEGREASING AND DRY CLEANING	NA	NA	NA	NA	NA	NA	NA	NA	NA
3 C CHEMICAL PRODUCTS, MANUFACTURE AND PROCESSING	NA	NA	NA	NA	NA	NA	NA	NA	NA
3 D OTHER including products containing HMs and POPs (Please specify in a covering note)	NA	NA	NA	NA	NA	NA	NA	NA	NA
4 B MANURE MANAGEMENT (c)	-	-	-	-	-	-	-	-	-
4 B 1 Cattle	NA	NA	NA	NA	NA	NA	NA	NA	NA
4 B 1 a Dairy	NA	NA	NA	NA	NA	NA	NA	NA	NA
4 B 1 b Non-Dairy	NA	NA	NA	NA	NA	NA	NA	NA	NA
4 B 2 Buffalo	NO	NO	NO	NO	NO	NO	NO	NO	NO
4 B 3 Sheep	NA	NA	NA	NA	NA	NA	NA	NA	NA
4 B 4 Goats	NA	NA	NA	NA	NA	NA	NA	NA	NA
4 B 5 Camels and Llamas	NO	NO	NO	NO	NO	NO	NO	NO	NO
4 B 6 Horses	NA	NA	NA	NA	NA	NA	NA	NA	NA
4 B 7 Mules and Asses	NO	NO	NO	NO	NO	NO	NO	NO	NO
4 B 8 Swine	NA	NA	NA	NA	NA	NA	NA	NA	NA
4 B 9 Poultry	NA	NA	NA	NA	NA	NA	NA	NA	NA
4 B 13 Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
4 C RICE CULTIVATION	NO	NO	NO	NO	NO	NO	NO	NO	NO
4 D AGRICULTURAL SOILS	-	-	-	-	-	-	-	-	-
4 D 1 Direct Soil Emission	NA	NA	NA	NA	NA	NA	NA	NA	NA
4 F FIELD BURNING OF AGRICULTURAL WASTES	0.04	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00
4 G OTHER (d)	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 B FOREST AND GRASSLAND CONVERSION	NO	NO	NO	NO	NO	NO	NO	NO	NO
6 A SOLID WASTE DISPOSAL ON LAND	NA	NA	NA	NA	NA	NA	NA	NA	NA
6 B WASTE-WATER HANDLING	NA	NA	NA	NA	NA	NA	NA	NA	NA
6 C WASTE INCINERATION (e)	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.01
6 D OTHER WASTE (f)	3.74	0.01	0.00	0.00	0.02	0.12	0.01	NO	14.60
7 OTHER	NA	NA	NA	NA	NA	NA	NA	NA	NA
National Total	**8.21**	**0.42**	**0.82**	**0.43**	**1.12**	**9.65**	**7.45**	**1.77**	**27.56**
Memo Items									
International Aviation (LTO)	0.11	0.00	-	-	0.00	0.12	0.01	0.00	0.07
International Aviation (Cruise)	-	0.01	-	-	0.04	1.30	0.05	0.01	0.76
International Navigation	0.16	0.02	0.03	0.35	0.15	0.35	19.95	0.33	0.76
5 E Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
X (11 08 Volcanoes)	NO	NO	NO	NO	NO	NO	NO	NO	NO

Table 52 Emission inventory for the year 2008 reported to the LRTAP in 2010 (c) (Nielsen et al. 2010b).

	Dioxin	Benzo(a)-pyrene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Indeno(1,3,3-c,d)pyrene	HCB
	g I-TEQ	Mg	Mg	Mg	Mg	kg
1 A 1 a Public Electricity and Heat Production	1.19	0.01	0.03	0.02	0.01	0.35
1 A 1 b Petroleum refining	0.00	0.00	0.00	0.00	0.00	NA
1 A 1 c Manufacture of Solid fuels and Other Energy	0.00	0.00	0.00	0.00	0.00	-
1 A 2 Manufacturing Industries and Construction	-	-	-	-	-	-
1 A 2 a Iron and Steel	NA	NA	NA	NA	NA	NA
1 A 2 b NAn-ferrous Metals	0.04	NA	NA	NA	NA	NA
1 A 2 c Chemicals	NA	NA	NA	NA	NA	NA
1 A 2 d Pulp, Paper and Print	NA	NA	NA	NA	NA	NA
1 A 2 e Food Processing, Beverages & Tobacco	NA	NA	NA	NA	NA	NA
1 A 2 f Other (Please specify in a covering NAte)	0.14	0.03	0.09	0.02	0.01	0.04
1 A 3 a ii Civil Aviation (Domestic, LTO)	0.00	0.00	0.00	0.00	0.00	NA
1 A 3 a ii Civil Aviation (Domestic, Cruise)	-	-	-	-	-	-
1 A 3 b Road Transportation	-	-	-	-	-	-
1 A 3 b i R.T., Passenger cars	0.07	0.03	0.03	0.03	0.04	NA
1 A 3 b ii R.T., Light duty vehicles	0.01	0.01	0.01	0.01	0.01	NA
1 A 3 b iii R.T., Heavy duty vehicles	0.05	0.00	0.03	0.04	0.01	NA
1 A 3 b iv R.T., Mopeds & Motorcycles	0.03	0.00	0.00	0.00	0.00	NA
1 A 3 b v R.T., GasoliNR evaporation	NA	NA	NA	NA	NA	NA
1 A 3 b vi R.T., Automobile tyre and brake wear	NA	NA	NA	NA	NA	NA
1 A 3 b vii R.T., Automobile road abrasion	NA	NA	NA	NA	NA	NA
1 A 3 c Railways	0.00	0.00	0.00	0.00	0.00	NA
1 A 3 d ii National Navigation	0.06	0.00	0.00	0.00	0.01	NA
1 A 3 e Other (Please specify in a covering NAte)	-	-	-	-	-	-
1 A 3 e i PipeliNR compressors	NA	NA	NA	NA	NA	NA
1 A 3 e ii Other mobile sources and machiNRry	NO	NO	NO	NO	NO	NO
1 A 4 a Commercial / Institutional	0.48	0.18	0.24	0.08	0.13	0.00
1 A 4 b Residential	-	-	-	-	-	-
1 A 4 b i Residential plants	17.91	4.38	4.51	2.59	2.95	0.14
1 A 4 b ii Household and gardening (mobile)	0.02	0.00	0.00	0.00	0.00	NA
1 A 4 c Agriculture / Forestry / Fishing	-	-	-	-	-	-
1 A 4 c i Stationary	1.38	0.15	0.16	0.02	0.24	0.00
1 A 4 c ii Off-road Vehicles and Other MachiNRry	0.01	0.00	0.01	0.01	0.00	NA
1A 4 c iii National Fishing	0.07	0.00	0.00	0.00	0.01	NA
1 A 5 a Other, Stationary (including Military)	NO	NO	NO	NO	NO	NO
1 A 5 b Other, Mobile (Including military)	0.00	0.00	0.00	0.00	0.00	NA
1B1 Fugitive Emissions from Solid Fuels	-	-	-	-	-	-
1 B 1 a Coal Mining and Handling	NA	NA	NA	NA	NA	NA
1 B 1 b Solid fuel transformation	NO	NO	NO	NO	NO	NO
1 B 1 c Other (Please specify in a covering NAte)	NO	NO	NO	NO	NO	NO
1 B 2 Oil and natural gas	-	-	-	-	-	-
1 B 2 a Oil	-	-	-	-	-	-
1 B 2 a i Exploration Production, Transport	NA	NA	NA	NA	NA	NA
1 B 2 a iv Refining / Storage	NA	NA	NA	NA	NA	NA
1 B 2 a v Distribution of oil products	NA	NA	NA	NA	NA	NA
1 B 2 a vi Other	NA	NA	NA	NA	NA	NA
1 B 2 b Natural gas	NA	NA	NA	NA	NA	NA
1 B 2 c Venting and flaring	0.00	0.00	0.00	0.00	0.00	NA
2 A MINRRAL PRODUCTS (a)	-	-	-	-	-	-
2 A 1 Cement Production	NA	NA	NA	NA	NA	NA
2 A 2 Lime Production	0.01	NA	NA	NA	NA	NA
2 A 3 LimestoNR and Dolomite Use	NA	NA	NA	NA	NA	NA
2 A 4 Soda Ash Production and use	NA	NA	NA	NA	NA	NA
2 A 5 Asphalt Roofing	NA	NA	NA	NA	NA	NA
2 A 6 Road Paving with Asphalt	NA	NA	NA	NA	NA	NA
2 A 7 Other including NAn Fuel Mining & Construction (Please specify in a covering NAte)	NA	NA	NA	NA	NA	NA
2 B CHEMICAL INDUSTRY	-	-	-	-	-	-
2 B 1 Ammonia Production	NO	NO	NO	NO	NO	NO
2 B 2 Nitric Acid Production	NA	NA	NA	NA	NA	NA
2 B 3 Adipic Acid Production	NO	NO	NO	NO	NO	NO
2 B 4 Carbide Production	NO	NO	NO	NO	NO	NO
2 B 5 Other (Please specify in a covering NAte)	NA	NA	NA	NA	NA	NA
2 C METAL PRODUCTION	-	NA	NA	NA	NA	NA
2 D OTHER PRODUCTION (a)	NA	NA	NA	NA	NA	NA
2 D 1 Pulp and Paper	NA	NA	NA	NA	NA	NA
2 D 2 Food and Drink	NA	NA	NA	NA	NA	NA
2 G OTHER (Please specify in a covering NAte)	NO	NO	NO	NO	NO	NO
3 A PAINT APPLICATION	NA	NA	NA	NA	NA	NA
3 B DEGREASING AND DRY CLEANING	NA	NA	NA	NA	NA	NA
3 C CHEMICAL PRODUCTS, MANUFACTURE	NA	NA	NA	NA	NA	NA

AND PROCESSING						
3 D OTHER including products containing HMs and POPs (Please specify in a covering NAte)	NA	NA	NA	NA	NA	NA
4 B MANURE MANAGEMENT (b)	-	-	-	-	-	-
4 B 1 Cattle	NA	NA	NA	NA	NA	NA
4 B 1 a Dairy	NA	NA	NA	NA	NA	NA
4 B 1 b NAn-Dairy	NA	NA	NA	NA	NA	NA
4 B 2 Buffalo	NO	NO	NO	NO	NO	NO
4 B 3 Sheep	NA	NA	NA	NA	NA	NA
4 B 4 Goats	NA	NA	NA	NA	NA	NA
4 B 5 Camels and Llamas	NO	NO	NO	NO	NO	NO
4 B 6 Horses	NA	NA	NA	NA	NA	NA
4 B 7 Mules and Asses	NO	NO	NO	NO	NO	NO
4 B 8 SwiNR	NA	NA	NA	NA	NA	NA
4 B 9 Poultry	NA	NA	NA	NA	NA	NA
4 B 13 Other	NA	NA	NA	NA	NA	NA
4 C RICE CULTIVATION	NO	NO	NO	NO	NO	NO
4 D AGRICULTURAL SOILS	NA	NA	NA	NA	NA	NA
4 D 1 Direct Soil Emission	NA	NA	NA	NA	NA	NA
4 F FIELD BURNING OF AGRICULTURAL WASTES	0.03	0.12	0.12	0.05	0.04	NO
4 G OTHER (c)	NO	NO	NO	NO	NO	NO
5 B FOREST AND GRASSLAND CONVERSION	NO	NO	NO	NO	NO	NO
6 A SOLID WASTE DISPOSAL ON LAND	NA	NA	NA	NA	NA	NA
6 B WASTEWATER HANDLING	NA	NA	NA	NA	NA	NA
6 C WASTE INCINRRATION (d)	0.05	0.00	0.00	0.00	0.00	0.01
6 D OTHER WASTE (e)	9.99	0.09	0.11	0.09	0.13	NA
7 OTHER	NA	NA	NA	NA	NA	NA
National Total	**31.54**	**5.02**	**5.34**	**2.97**	**3.59**	**0.55**
International Aviation (LTO)	0.00	0.00	0.00	0.00	0.00	-
International Aviation (Cruise)	-	-	-	-	-	-
International MariNR (b)	0.53	0.00	0.01	0.01	0.02	NA
5 E Other	NO	NO	NO	NO	NO	NO
X (11 08 VolcaNAes)	NO	NO	NO	NO	NO	NO

Appendix 3 IPCC/SNAP source correspondence list

Table 53 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	

SNAP_id	SNAP_name	IPCC source
Continued		
030301	Sinter and pelletizing plants	1A2a
030302	Reheating furnaces steel and iron	1A2a
030303	Gray iron foundries	1A2a
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 IPCC sector that also includes stationary combustion plants

[2)] Stoves, fireplaces and cooking is included in the sector 0202 or 020202 in the Danish inventory. Implied emission factors have been estimated for wood combustion in residential plants.

Appendix 4 Fuel rate

Table 54 Fuel consumption rate of stationary combustion plants 2008, GJ.

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 55 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	

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
				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	
			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**

Continued

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

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
				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
				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

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
				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
				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

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
				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		
			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

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
				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
			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**

Continued

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

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008
		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
				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

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008
		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
				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		

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008
				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
				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

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007	2008
				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
				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**

Appendix 5 Lower Calorific Value (LCV) of fuels

Table 56 Time-series for calorific values of fuels (DEA 2008b).

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Crude Oil, Average	GJ per 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 per 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 per tonne	42.70	42.70	42.70	42.70	42.70	42.70	42.70	43.00	43.00	43.00
Refinery Feedstocks	GJ per tonne	41.60	41.60	41.60	41.60	41.60	41.60	41.60	42.70	42.70	42.70
Refinery Gas	GJ per tonne	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00
LPG	GJ per tonne	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00
Naphtha (LVN)	GJ per tonne	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50
Motor Gasoline	GJ per tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
Aviation Gasoline	GJ per tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
JP4	GJ per tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
Other Kerosene	GJ per tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
JP1	GJ per 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 per tonne	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70
Fuel Oil	GJ per tonne	40.40	40.40	40.40	40.40	40.40	40.40	40.70	40.65	40.65	40.65
Orimulsion	GJ per tonne	27.60	27.60	27.60	27.60	27.60	28.13	28.02	27.72	27.84	27.58
Petroleum Coke	GJ per tonne	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40
Waste Oil	GJ per tonne	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90
White Spirit	GJ per tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
Bitumen	GJ per tonne	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80
Lubricants	GJ per tonne	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90
Natural Gas	GJ per 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 per 1000 m^3							17.00	17.00	17.00	17.00
Electricity Plant Coal	GJ per 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 per tonne	26.10	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50
Coke	GJ per 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 per tonne	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30
Straw	GJ per tonne	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
Wood Chips	GJ per 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 per 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 per 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 per tonne	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60
Wood Pellets	GJ per tonne	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50
Wood Waste	GJ per 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 per 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 per tonne								23.00	23.00	23.00
Wastes	GJ per tonne	8.20	8.20	9.00	9.40	9.40	10.00	10.50	10.50	10.50	10.50
Bioethanol	GJ per tonne	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70
Liquid Biofuels		37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60
Fish Oil	GJ per 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 per tonne	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Crude Oil, Golf	GJ per tonne	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80
Crude Oil, North Sea	GJ per tonne	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Refinery Feedstocks	GJ per tonne	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70
Refinery Gas	GJ per tonne	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00
LPG	GJ per tonne	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00
Naphtha (LVN)	GJ per tonne	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50
Motor Gasoline	GJ per tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
Aviation Gasoline	GJ per tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
JP4	GJ per tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
Other Kerosene	GJ per tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
JP1	GJ per tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
Gas/Diesel Oil	GJ per tonne	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70
Fuel Oil	GJ per tonne	40.65	40.65	40.65	40.65	40.65	40.65	40.65	40.65	40.65
Orimulsion	GJ per tonne	27.62	27.64	27.71	27.65	27.65	27.65	27.65	27.65	27.65
Petroleum Coke	GJ per tonne	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40
Waste Oil	GJ per tonne	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90
White Spirit	GJ per tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
Bitumen	GJ per tonne	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80
Lubricants	GJ per tonne	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90
Natural Gas	GJ per 1000 Nm^3	40.15	39.99	40.06	39.94	39.77	39.67	39.54	39.59	39.48
Town Gas	GJ per 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 per tonne	24.80	24.90	25.15	24.73	24.60	24.40	24.80	24.40	24.30
Other Hard Coal	GJ per tonne	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50
Coke	GJ per tonne	29.30	29.30	29.30	29.30	29.30	29.30	29.30	29.30	29.30

Continued

Brown Coal Briquettes	GJ per tonne	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30
Straw	GJ per tonne	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
Wood Chips	GJ per Cubic metre	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Wood Chips	GJ per m^3	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30
Firewood, Hardwood	GJ per m^3	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40
Firewood, Conifer	GJ per tonne	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60
Wood Pellets	GJ per tonne	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50
Wood Waste	GJ per Cubic metre	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
Wood Waste	GJ per 1000 m^3	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Biogas	GJ per tonne	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
Wastes	GJ per tonne	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.50
Bioethanol	GJ per tonne	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70
Liquid Biofuels	GJ per tonne	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60
Fish Oil	GJ per tonne	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20

Table 57 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

Appendix 6 Emission factors

Table 58 CO_2 emission factors 2008.

Fuel	Emission factor kg per GJ		Reference type	IPCC fuel
	Biomass	Fossil fuel		Category
Coal		95 [1)3)]	Country specific	Solid
Brown coal briquettes		94.6 [2)]	IPCC 1996	Solid
Coke oven coke		108	IPCC 1996	Solid
Petroleum coke		92 [3)]	Country specific	Liquid
Wood	102		EEA 2002	Biomass
Municipal waste	79.6 [3)4)]	+ 32.5[3)4)]	Country specific	Biomass and Other fuels
Straw	102		EEA 2002	Biomass
Residual oil		78 [1)3)]	EEA 2007	Liquid
Gas oil		74 [1)]	EEA 2007	Liquid
Kerosene		72	IPCC 1996	Liquid
Fish & rape oil	74		Country specific	Biomass
Orimulsion		80 [2)]	Country specific	Liquid
Natural gas		56.77	Country specific	Gas
LPG		65	EEA 2007	Liquid
Refinery gas		56.9	Country specific	Liquid
Biogas	83.6		Country specific	Biomass
Biomass producer gas	102[5)]		Country specific	Biomass

1) Plant specific data from EU ETS incorporated for individual plants.

2) Not applied in 2008.

3) Plant specific data from EU ETS incorporated for cement production.

4) The emission factor for municipal waste is (76.6+32.5) kg CO_2 per GJ municipal waste. The fuel consumption and the CO_2 emission have been disaggregated to the two IPCC fuel categories *Biomass* and *Other fuels* in CRF. The IEF for CO_2, Other fuels is 78.88 kg CO_2 per GJ fossil municipal waste.

5) The CO_2 emission factor for wood has been applied. However the composition of the gas is well-known and the emission factor will be recalculated.

Time-series for natural gas and municipal waste are shown below. All other emission factors are the same for 1990-2008.

Table 59 CO_2 emission factors, time-series.

Year	Natural gas, kg per GJ	Municipal waste, plastic part, kg per GJ	Municipal waste biomass part, kg per GJ
1990	56.9	25.4	86.7
1991	56.9	25.4	86.7
1992	56.9	27.9	84.2
1993	56.9	29.1	83.0
1994	56.9	29.1	83.0
1995	56.9	31.0	81.1
1996	56.9	32.5	79.6
1997	56.9	32.5	79.6
1998	56.9	32.5	79.6
1999	56.9	32.5	79.6
2000	57.1	32.5	79.6
2001	57.25	32.5	79.6
2002	57.28	32.5	79.6
2003	57.19	32.5	79.6
2004	57.12	32.5	79.6
2005	56.96	32.5	79.6
2006	56.78	32.5	79.6
2007	56.78	32.5	79.6
2008	56.77	32.5	79.6

Table 60 CH_4 emission factors and references 2008.

Fuel group	Fuel	CRF source category	CRF source category	SNAP	Emission factor, g per GJ	Reference
BIOMASS	WOOD	1A1a	Electricity and heat production	010102, 010103, 010104	3.1	Nielsen et al. 2010c
				010202, 010203	32	EEA 2007
		1A2	Industry	030100, 030102	32	EEA 2007
		1A4a	Commercial/Institutional	020100	200	EEA 2007
		1A4b i	Residential	020200	200	EEA 2007
		1A4c i	Agriculture/Forestry	020300	200	EEA 2007
	STRAW	1A1a	Electricity and heat production	010101, 010102, 010103, 010104	0.47	Nielsen et al. 2010c
				010202, 010203	32	EEA 2007
		1A4b i	Residential	020200	200	EEA 2007
		1A4c i	Agriculture/Forestry	020300	200	EEA 2007
	FISH & RAPE OIL	1A1a	Electricity and heat production	010101, 010102, 010103, 010202, 010203	1.5	EEA 2007, assuming same emission factor as for gas oil
		1A2	Industry	030105	1.5	EEA 2007, assuming same emission factor as for gas oil
		1A4b i	Residential	020200	1.5	EEA 2007, assuming same emission factor as for gas oil
	BIOGAS	1A1a	Electricity and heat production	010102, 010103, 010203	4	EEA 2007
				010105, 010205	434	Nielsen et al. 2010c
		1A2	Industry	030100, 030102, 030103	4	EEA 2007
				030105	434	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100, 020103	4	EEA 2007
				020105	434	Nielsen et al. 2010c
		1A4c i	Agriculture/Forestry	020300	4	EEA 2007
				020304	434	Nielsen et al. 2010c
	BIO PROD GAS	1A1a	Electricity and heat production	010105	13	Nielsen et al. 2010c
		1A2	Industry	030105	13	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020105	13	Nielsen et al. 2010c
OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010102, 010103	0.34	Nielsen et al. 2010c
				010203	6	EEA 2007
		1A2	Industry	030102	6	EEA 2007
		1A4a	Commercial/Institutional	020103	6	EEA 2007
GAS	NATURAL GAS	1A1a	Electricity and heat production	010101, 010102, 010202	6	DGC 2001
				010103, 010203	15	Gruijthuijsen & Jensen 2000
				010104 (Gas turbines)	1.7	Nielsen et al. 2010c
				010105, 010205 (Gas engines)	481	Nielsen et al. 2010c
		1A1c	Other energy industries	010504 (Gas turbines)	1.5	Nielsen & Illerup 2003
				010505 (Gas engines)	481	Nielsen et al. 2010c
		1A2	Industry	030100	6	DGC 2001
				030103	15	Gruijthuijsen & Jensen 2000
				030104 (Gas turbines)	1.7	Nielsen et al. 2010c
				030105 (Gas engines)	481	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100	6	DGC 2001
				020103	15	Gruijthuijsen & Jensen 2000
				020105 (Gas engines)	481	Nielsen et al. 2010c
		1A4b i	Residential	020200	6	DGC 2001
				020202	15	Gruijthuijsen & Jensen 2000
				020204 (Gas engines)	481	Nielsen et al. 2010c
		1A4c i	Agriculture/Forestry	020300	6	DGC 2001
				020303 (Gas turbines)	1.7	Nielsen et al. 2010c
				020304 (Gas engines)	481	Nielsen et al. 2010c
LIQUID	PETROLEUM COKE	1A4a	Commercial/Institutional	020100	15	EEA 2007
		1A4b i	Residential	020200	15	EEA 2007
	RESIDUAL OIL	1A1a	Electricity and heat production	010101, 010104, 010202, 010203	3	EEA 2007
				010102, 010203	1.3	Nielsen et al. 2010c
		1A1b	Petroleum refining	010306	3	EEA 2007
		1A2	Industry	030100, 030105	3	EEA 2007
				030102, 030103	1.3	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100	3	EEA 2007
		1A4b i	Residential	020200	3	EEA 2007
		1A4c i	Agriculture/Forestry	020300, 020302	3	EEA 2007
	GAS OIL	1A1a	Electricity and heat production	010101, 010102, 010103, 010104, 010201, 010202, 010203	1.5	EEA 2007
				010105, 010205	24	Nielsen et al. 2010c
		1A1b	Petroleum refining	010306	1.5	EEA 2007
		1A2	Industry	030100, 030102, 030103, 030104	1.5	EEA 2007
				030105	24	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100, 020103	1.5	EEA 2007
				020105	24	Nielsen et al. 2010c
		1A4b i	Residential	020200	1.5	EEA 2007
				020105	24	Nielsen et al. 2010c
	KEROSENE	1A2	Industry	030100	7	EEA 2007
		1A4a	Commercial/Institutional	020100	7	EEA 2007
		1A4b i	Residential	020200	7	EEA 2007
		1A4c i	Agriculture/Forestry	020300	7	EEA 2007

Fuel group	Fuel	CRF source category	CRF source category	SNAP	Emission factor, g per GJ	Reference
	LPG	1A1a	Electricity and heat production	010102, 010203	1	EEA 2007
		1A2	Industry	030100	1	EEA 2007
		1A4a	Commercial/Institutional	020100, 020105	1	EEA 2007
		1A4b i	Residential	020200	1	EEA 2007
		1A4c i	Agriculture/Forestry	020300	1	EEA 2007
	REFINERY GAS	1A1b	Petroleum refining	010304, 010306	1.5	EEA 2007
SOLID	COAL	1A1a	Electricity and heat production	010101, 010102, 010103	1.5	EEA 2007
		1A2	Industry	030100	15	EEA 2007
		1A4b i	Residential	020200	15	EEA 2007
		1A4c i	Agriculture/Forestry	020300	15	EEA 2007
	COKE OVEN COKE	1A2	Industry	030100	15	EEA 2007, assuming same emission factor as for coal
		1A4b i	Residential	020200	15	EEA 2007, assuming same emission factor as for coal

Time-series for CH_4 emission factors for gas engines and MSW incineration plants are shown below. All other CH_4 emission factors are the same for 1990-2008.

Table 61 CH_4 emission factors, time-series.

Year	Natural gas fuelled engines Emission factor, g per GJ	Biogas fuelled engines Emission factor, g per GJ	MSW incineration, g per GJ
1990	266	239	0.59
1991	309	251	0.59
1992	359	264	0.59
1993	562	276	0.59
1994	623	289	0.59
1995	632	301	0.59
1996	616	305	0.59
1997	551	310	0.59
1998	542	314	0.59
1999	541	318	0.59
2000	537	323	0.59
2001	522	342	0.59
2002	508	360	0.59
2003	494	379	0.59
2004	479	397	0.51
2005	465	416	0.42
2006	473	434	0.34
2007	481	434	0.34
2008	481	434	0.34

Table 62 N_2O emission factors and references 2008.

Fuel group	Fuel	CRF source category	CRF cource category	SNAP	Emission factor g/GJ	Reference
BIOMASS	WOOD	1A1a	Electricity and heat production	010102, 010103, 010104	0.8	Nielsen et al. 2010c
				010202, 010203	4	EEA 2007
		1A2	Industry	all	4	EEA 2007
		1A4a	Commercial/Institutional	020100	4	EEA 2007
		1A4b i	Residential	020200	4	EEA 2007
		1A4c i	Agriculture/Forestry	020300	4	EEA 2007
	STRAW	1A1a	Electricity and heat production	010101, 010102, 010103, 010104	1.1	Nielsen et al. 2010c
				010202, 010203	4	EEA 2007
		1A4b i	Residential	020200	4	EEA 2007
		1A4c i	Agriculture/Forestry	020300	4	EEA 2007
	FISH & RAPE OIL	1A1a	Electricity and heat production	All	2	EEA 2007, assuming same emission factor as gas oil
		1A2	Industry	030105	2	EEA 2007, assuming same emission factor as gas oil
		1A4b i	Residential	020200	2	EEA 2007, assuming same emission factor as gas oil
	BIOGAS	1A1a	Electricity and heat production	010102, 010103, 010203	2	EEA 2007
				010105, 010205 (Gas engines)	1.6	Nielsen et al. 2010c
		1A2	Industry	030100, 030102, 030103	2	EEA 2007
				030105 (Gas engines)	1.6	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100, 020103	2	EEA 2007
				020105 (Gas engines)	1.6	Nielsen et al. 2010c
		1A4c i	Agriculture/Forestry	020300	2	EEA 2007
				020304 (Gas engines)	1.6	Nielsen et al. 2010c
	BIO PROD GAS	1A1a	Electricity and heat production	010105	2.7	Nielsen et al. 2010c
		1A2	Industry	030105	2.7	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020105	2.7	Nielsen et al. 2010c
OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010102, 010103	1.2	Nielsen et al. 2010c
				010203	4	EEA 2007
		1A2	Industry	030102	4	EEA 2007
		1A4a	Commercial/Institutional	020103	4	EEA 2007
GAS	NATURAL GAS	1A1a	Electricity and heat production	010101, 010102, 010103, 010202, 010203	1	EEA 2007
				010104 (Gas turbines)	1	Nielsen et al. 2010c
				010105, 010205 (Gas engines)	0.58	Nielsen et al. 2010c
		1A1c	Other energy industries	010504 (Gas turbines)	2.2	Nielsen & Illerup 2003
				010505 (Gas engines)	0.58	Nielsen et al. 2010c
		1A2	Industry	030100, 030103	1	EEA 2007
				030104 (Gas turbines)	1	Nielsen et al. 2010c
				030105 (Gas engines)	0.58	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100, 020103	1	EEA 2007
				020105 (Gas engines)	0.58	Nielsen et al. 2010c
		1A4b i	Residential	020200, 020202	1	EEA 2007
				020204 (Gas engines)	0.58	Nielsen et al. 2010c
		1A4c i	Agriculture/Forestry	020300, 020303	1	EEA 2007
				020303 (Gas turbines)	1	Nielsen et al. 2010c
				020304 (Gas engines)	0.58	Nielsen et al. 2010c
LIQUID	PETROLEUM COKE	1A4a	Commercial/Institutional	020100	3	EEA 2007
		1A4b i	Residential	020200	3	EEA 2007
	RESIDUAL OIL	1A1a	Electricity and heat production	010101, 010104, 010202, 010203	2	EEA 2007
				010102, 010103	5	Nielsen et al. 2010c
		1A1b	Petroleum refining	010306	2	EEA 2007
		1A2	Industry	030100, 030105	2	EEA 2007
				030102, 030103	5	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100	2	EEA 2007
		1A4b i	Residential	020200	2	EEA 2007
		1A4c i	Agriculture/Forestry	020300, 020302	2	EEA 2007
	GAS OIL	1A1a	Electricity and heat production	010101, 010102, 010103, 010104, 010201, 010202, 010203	2	EEA 2007
				010105, 020105 (Engines)	2.1	Nielsen et al. 2010c
		1A1b	Petroleum refining	010306	2	EEA 2007
		1A1c	Other energy industries	010505	2	EEA 2007
		1A2	Industry	030100, 030102, 030103, 030104	2	EEA 2007
				030105 (Engines)	2.1	Nielsen et al. 2010c
		1A4a	Commercial/Institutional	020100, 020103	2	EEA 2007
				020105 (Engines)	2.1	Nielsen et al. 2010c
		1A4b i	Residential	020200	2	EEA 2007
				020104 (Engines)	2.1	
	KEROSENE	1A2	Industry	030100	2	EEA 2007
		1A4a	Commercial/Institutional	020100	2	EEA 2007
		1A4b i	Residential	020200	2	EEA 2007
		1A4c i	Agriculture/Forestry	020300	2	EEA 2007
	LPG	1A1a	Electricity and heat production	010102, 010203	2	EEA 2007
		1A2	Industry	030100	2	EEA 2007
		1A4a	Commercial/Institutional	020100, 020105	2	EEA 2007

Fuel group	Fuel	CRF source category	CRF cource category	SNAP	Emission factor g/GJ	Reference
		1A4b i	Residential	020200	2	EEA 2007
		1A4c i	Agriculture/Forestry	020300	2	EEA 2007
	REFINERY GAS	1A1b	Petroleum refining	010304, 010306	2.2	Nielsen & Illerup 2003, assuming same emission factor as for natural gas
SOLID	COAL	1A1a	Electricity and heat production	010101, 010102, 010103	0.8	Elsam 2005
		1A2	Industry	030100	3	EEA 2007
		1A4b i	Residential	020200	3	EEA 2007
		1A4c i	Agriculture/Forestry	020300	3	EEA 2007
	COKE OVEN COKE	1A2	Industry	030100	3	EEA 2007
		1A4b i	Residential	020200	3	EEA 2007

Time-series have been estimated for natural gas fuelled gas turbines. All other N_2O emission factors have been applied unchanged for 1990-2008.

Table 63 N_2O emission factors, time-series.

Year	Natural gas fuelled gas turbines Emission factor, g per GJ
1990	2.2
1991	2.2
1992	2.2
1993	2.2
1994	2.2
1995	2.2
1996	2.2
1997	2.2
1998	2.2
1999	2.2
2000	2.2
2001	2.0
2002	1.9
2003	1.7
2004	1.5
2005	1.4
2006	1.2
2007	1.0
2008	1.0

Table 63 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.
BIOMASS	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)[2]	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
		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

[2] Error. Should have been 2 g/GJ

Fuel type	Fuel	NFR	NFR_name	snap	SO_2 g/GJ	SO_2 Ref.	NO_x g/GJ	NO_x Ref.	NMVOC g/GJ	NMVOC Ref.	CO g/GJ	CO Ref.
		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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15. Same emission factors as for gas oil is assumed (NERI assumption).
16. Ref. no 13: EEA 2009 assuming same emission factor as for natural gas.
17. NERI calculation based on S content of natural gas 6mg(S)/m_n^3 gas. The S content refers to the Danish natural gas transmission company Gastra (http://www.gastra.dk/dk/index.asp).
18. Estimated by NERI based on 2008 data reported by the plant owners to the electricity transmission companies and the Danish Energy Agency. NERI calculations are based on data forwarded to NERI by the Danish Energy Agency, 2009.
19. NERI calculation based on a sulphur content of 0,8 % and a retention of sulphur in ash of 5 %. The sulphur content has been assumed just below the limit value of 0,9 % (reference no. 24).
20. NERI calculation based on a sulphur content of 1 % (reference no. 24) and a retention of sulphur in ash of 5 %.
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24. Miljøstyrelsen, 2001.Bekendtgørelseom begrænsning af svovlindholdet i visse flydende og faste brændstoffer, Bekendtgørelse 532 af 25/05/2001 (Danish legislation).

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26. NERI calculation based on a H_2S content of 200 ppm. The H_2S content refer to Christiansen J. 2003, Personal communication and to Hjort-Gregersen K., 1999 Centralised Biogas Plants, Danish Institute of Agricultural and Fisheries Economics, 1999.
27. NERI calculation based on a sulphur content of 0,05 % S. The sulphur content refers to Bilag 750, Kom 97/0105 (http://www.folketinget.dk/?/samling/20041/MENU/00000002.htm) and to product sheets from Q8, Shell and Statoil.
28. Miljøstyrelsen 1990. Bekendtgørelse om begrænsning af emissioner af svovldioxid, kvælstofoxider og støv fra store fyringsanlæg, Bekendtgørelse 689 af 15/10/1990 (Danish legislation).
29. Same emission factor as for coal is assumed (NERI assumption).
30. Product sheet from Shell. Available on the internet at: http://www.shell.com/home/dk-da/html/iwgen/app_profile/app_products_0310_1510.html (13-05-2004).
31. 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 englisch summary). Available on the Internet at : http://www2.dmu.dk/1_viden/2_Publikationer/3_fagrapporter/rapporter/FR442.pdf (25-02-2009).
32. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual, 1996. Available on the Internet at http://www.ipcc-nggip.iges.or.jp/public/gl/invs6.htm (25-02-2009).
33. NERI calculation based on plant specific data 2003.
34. NERI calculation based on plant specific data for MSW incineration, district heating plants, 2008.
35. Same emission factor as for natural gas fuelled gas turbines is assumed.
36. Wit, J. d & Andersen, S. D. 2003. Emissioner fra større gasfyrede kedler, Dansk Gasteknisk Center 2003. The emission factor have been assumed to be the average value of the stated interval (NERI assumption).
37. Folkecenter for Vedvarende Energi, 2000. http://www.folkecenter.dk/plant-oil/emission/emission_rapsolie.pdf.
38. Assumed same emission factor as for gas oil (NERI assumption). However the emission factor is not correct – the emission factors 249 g/GJ and 65 g/GJ will be applied in future inventories.
39. 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.
40. NERI calculation based on plant specific data.

Table 64 SO_2, NO_x, NMVOC and CO emission factors time-series, g per GJ.

						1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_EA	nfr_name	snap_id										
SO2	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
NOX	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

Continued

						2000	2001	2002	2003	2004	2005	2006	2007	2008
pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_EA	nfr_name	snap_id									
SO2	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
NOX	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 65 PM emission factors and references, 2008.

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap	TSP g/GJ	Ref.	PM_{10} g/GJ	Ref.	$PM_{2.5}$ g/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[3]	3	1.084[3]	3
				010103	0.29	18	1.126[3]	3	1.084[3]	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

[3] 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/GJ	Ref.	PM_{10} g/GJ	Ref.	$PM_{2.5}$ g/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. –

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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 66 PM emission factors, time-series.

						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	

Continued

						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/ Institutional	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/ Institutional	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/ Institutional	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 67 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	137.5	1 7	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 68 HM emission factors 2008 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

Time-series for emission factors for heavy metals is not constant for municipal waste. Time-series are shown in Table 52. All other factors are constant in 1990-2008.

Table 69 HM emission factors time-series for municipal waste, mg per GJ.

						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

Continued

						2000	2001	2002	2003	2004	2005	2006	2007	2008
pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_EA	nfr_name	snap_id									
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 70 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

					Benzo(a)-pyrene		Benzo(b)-flouran-thene		Benzo(k)-flouran-thene		Indeno-(1,2,3-c,d)-pyrene	
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
				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

					Benzo(a)-pyrene		Benzo(b)-flouran-thene		Benzo(k)-flouran-thene		Indeno-(1,2,3-c,d)-pyrene	
				030105	1.9	7	15	7	1.7	7	1.5	7
		1A4a	Commercial/ Institutional	020100	80	4	42	4	66	4	160	4
				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)

1. -
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9. Same emission factor as for coal is assumed (NERI assumption).
10. 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 71 PAH emission factors time-series, µg per GJ.

						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
			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

						1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	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

Continued

						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 72 Dioxin and HCB emission factors 2008.

					Dioxin, ng per GJ	HCB, ng per 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 73 Dioxin emission factor time-series.

						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

Continued

						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 73 NH_3 emission factors 2008.

					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 010103	0.29 0.29
SOLID	COAL	1A4b i	Residential	020200	3.8
	COKE OVEN COKE	1A4b i	Residential	020200	3.8

Appendix 7 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/GJ
NO_x	110	g/GJ
TSP	1.2	g/GJ
PM_{10}	1.1	g/GJ
$PM_{2.5}$	0.9	g/GJ
As	0.76	mg/GJ
Cd	1.1	mg/GJ
Cr	3.3	mg/GJ
Cu	3.4	mg/GJ
Hg	4.1	mg/GJ
Ni	7.0	mg/GJ
Pb	13	mg/GJ
Se	1.1	mg/GJ
Zn	2.5	mg/GJ

Table 75 Implied emission factors for power plants combusting coal, 2008.

Pollutant	Implied Emission factor	Unit
SO_2	23	g/GJ
NO_x	63	g/GJ
TSP	3.4	g/GJ
PM_{10}	2.7	g/GJ
$PM_{2.5}$	2.2	g/GJ
As	0.60	mg/GJ
Cd	0.09	mg/GJ
Cr	1.1	mg/GJ
Cu	0.61	mg/GJ
Hg	1.1	mg/GJ
Ni	1.2	mg/GJ
Pb	0.80	mg/GJ
Se	4.6	mg/GJ
Zn	2.4	mg/GJ

Appendix 8 Large point sources

Table 76 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
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 Kraftvarme-vaerk	01	MUNICIP. WASTES	211
1A1a	Electricity and heat production	010103	061	Kavo I/S Energien+Slagelse Kraftvarme-vaerk	02	MUNICIP. WASTES	490
1A1a	Electricity and heat production	010103	061	Kavo I/S Energien+Slagelse Kraftvarme-vaerk	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
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 77 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										
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	Frederikshavn 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

Appendix 9 Adjustment of CO_2 emission

Table 78 Adjustment of CO_2 emission (ref. DEA, 2009b).

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Actual Degree Days	Degree days	2857	3284	3 022	3 434	3 148	3 297	3 837	3 236	3 217	3 056
Normal Degree Days	Degree days	3379	3380	3 359	3 365	3 366	3 378	3 395	3 389	3 375	3 339
Net electricity import	TJ	25373	-7099	13486	4266	-17424	-2858	-55444	-26107	-15552	-8327
Actual CO_2 emission	1 000 000 tonnes	37.7	47.5	41.7	43.9	47.1	44.1	57.4	47.4	43.4	40.3
Adjusted CO_2 emission	1 000 000 tonnes	44.0	45.9	44.6	45.0	43.3	43.4	44.2	41.4	39.6	38.4

Continued

		2000	2001	2002	2003	2004	2005	2006	2007	2008
Actual Degree Days	Degree days	2 902	3 279	3 011	3 150	3 113	3 068	2 908	2807	2853
Normal Degree Days	Degree days	3 304	3 289	3 273	3 271	3 261	3 224	3 188	3136	3120
Net electricity import	TJ	2394	-2071	-7453	-30760	-10340	4932	-24971	-3420	5234
Actual CO_2 emission	1 000 000 tonnes	36.3	37.9	37.5	42.3	36.3	32.6	40.1	34.6	31.9
Adjusted CO_2 emission	1 000 000 tonnes	37.0	37.5	35.9	35.5	34.0	33.7	34.5	33.9	33.1

Appendix 10 Uncertainty estimates 2008

Table 79 Uncertainty estimation, GHG. Tier 1 approach

IPCC Source category	Gas	Base year emission	Year t emission	Activity data uncer-tainty	Emission factor unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncer-tarinty	Uncertainty in trend in national emissions introduced by activity data uncer-tainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Gg CO2 eq	Gg CO2 eq	%	%	%	%	%	%	%	%	%
Stationary Combustion, Coal	CO2	24077	16050	1.1	1.1	1.556	0.767	-0.118	0.421	-0.130	0.655	0.668
Stationary Combustion, BKB	CO2	11		3.0	5	5.831		-0.000		-0.001		0.001
Stationary Combustion, Coke	CO2	138	112	2.0	5	5.385	0.019	-0.000	0.003	-0.001	0.008	0.008
Stationary Combustion, Petroleum coke	CO2	410	755	2.2	5	5.463	0.127	0.011	0.020	0.053	0.062	0.081
Stationary Combustion, Plastic waste	CO2	394	1343	5.0	25	25.495	1.052	0.026	0.035	0.660	0.249	0.706
Stationary Combustion, Residual oil	CO2	2505	1359	1.5	2	2.500	0.104	-0.020	0.036	-0.041	0.076	0.086
Stationary Combustion, Gas oil	CO2	4547	1544	2.8	5	5.731	0.272	-0.061	0.041	-0.307	0.160	0.346
Stationary Combustion, Kerosene	CO2	366	9	2.9	5	5.780	0.002	-0.008	0.000	-0.040	0.001	0.040
Stationary Combustion, Natural gas	CO2	4320	9764	1.7	1	1.972	0.592	0.159	0.256	0.159	0.616	0.636
Stationary Combustion, LPG	CO2	169	96	2.7	5	5.682	0.017	-0.001	0.003	-0.006	0.010	0.012
Stationary Combustion, Refinery gas	CO2	806	841	1.0	5	5.099	0.132	0.004	0.022	0.020	0.031	0.037
1A1+1A2+1A4, BIOMASS	CH4	83	187	15.9	100	101.256	0.580	0.003	0.005	0.304	0.110	0.323
Biogas fuelled engines, BIOMASS	CH4	2	21	3.0	10	10.440	0.007	0.001	0.001	0.005	0.002	0.006
1A1+1A2+1A4, GAS	CH4	8	15	1.7	100	100.014	0.046	0.000	0.000	0.021	0.001	0.021
Natural gas fuelled engines, GAS	CH4	5	185	1.0	5	5.099	0.029	0.005	0.005	0.024	0.007	0.025
1A1+1A2+1A4, LIQUID	CH4	7	4	1.9	100	100.018	0.013	-0.000	0.000	-0.004	0.000	0.004
1A1+1A2+1A4, WASTE	CH4	2	1	5.0	100	100.125	0.003	-0.000	0.000	-0.002	0.000	0.002
1A1+1A2+1A4, SOLID	CH4	15	8	1.1	100	100.006	0.025	-0.000	0.000	-0.012	0.000	0.012
1A1 + 1A2 + 1A4, BIOMASS	N2O	39	81	15.9	400	400.316	0.997	0.001	0.002	0.505	0.048	0.507
1A1 + 1A2 + 1A4, GAS	N2O	28	61	1.7	300	300.005	0.565	0.001	0.002	0.296	0.004	0.296
1A1 + 1A2 + 1A4, LIQUID	N2O	76	46	1.9	400	400.005	0.567	-0.000	0.001	-0.195	0.003	0.195
1A1 + 1A2 + 1A4, WASTE	N2O	18	19	5.0	200	200.062	0.120	0.000	0.001	0.020	0.004	0.020
1A1 + 1A2 + 1A4, SOLID	N2O	80	49	1.1	200	200.003	0.301	-0.001	0.001	-0.101	0.002	0.101
Total		38104.774	32549.867				4.243					1.985
Total uncertainties					Overall uncertainty i the year (%):		2.060			Trend uncertainty (%):		1.409

Table 79 Uncertainty estimation, CO_2 . Tier 1 approach

IPCC Source category	Gas	Base year emission	Year t emission	Activity data uncer-tainty	Emission factor unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncer-tarinty	Uncertainty in trend in national emissions introduced by activity data uncer-tainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Gg CO2	Gg CO2	%	%	%	%	%	%	%	%	%
Stationary Combustion, Coal	CO2	24077	16050	1.1	1.1	1.556	0.783	-0.113	0.425	-0.124	0.662	0.673
Stationary Combustion, BKB	CO2	11		3.0	5	5.831		-0.000		-0.001		0.001
Stationary Combustion, Coke	CO2	138	112	2.0	5	5.385	0.019	-0.000	0.003	-0.001	0.008	0.008
Stationary Combustion, Petroleum coke	CO2	410	755	2.2	5	5.463	0.129	0.011	0.020	0.054	0.062	0.082
Stationary Combustion, Plastic waste	CO2	394	1343	5.0	25	25.495	1.074	0.027	0.036	0.669	0.252	0.715
Stationary Combustion, Residual oil	CO2	2505	1359	1.5	2	2.500	0.107	-0.020	0.036	-0.040	0.076	0.086
Stationary Combustion, Gas oil	CO2	4547	1544	2.8	5	5.731	0.278	-0.061	0.041	-0.304	0.162	0.344
Stationary Combustion, Kerosene	CO2	366	9	2.9	5	5.780	0.002	-0.008	0.000	-0.040	0.001	0.040
Stationary Combustion, Natural gas	CO2	4320	9764	1.7	1	1.972	0.604	0.162	0.259	0.162	0.622	0.643
Stationary Combustion, LPG	CO2	169	96	2.7	5	5.682	0.017	-0.001	0.003	-0.006	0.010	0.012
Stationary Combustion, Refinery gas	CO2	806	841	1.0	5	5.099	0.135	0.004	0.022	0.021	0.032	0.038
Total	CO2	37743	31872				2.256					1.513
Total uncertainties					Overall uncertainty i the year (%):		1.502			Trend uncer-tainty (%):		1.230

Table 79 Uncertainty estimation, CH_4. Tier 1 approach

IPCC Source category	Gas	Base year emission	Year t emission	Activity data uncer-tainty	Emission factor unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncer-tarinty	Uncertainty in trend in national emissions introduced by activity data uncer-tainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg CH4	Mg CH4	%	%	%	%	%	%	%	%	%
1A1+1A2+1A4, Biomass	CH4	3948	8886	15.9	100	101.256	44.913	-0.824	1.537	-82.437	34.565	89.390
Biogas fuelled engines, Biomass	CH4	91	994	3.0	10	10.440	0.518	0.117	0.172	1.173	0.730	1.381
1A1+1A2+1A4, Natural gas	CH4	398	717	1.7	100	100.014	3.577	-0.115	0.124	-11.483	0.298	11.487
Natural gas fuelled engines, Natural gas	CH4	221	8806	1.0	5	5.099	2.241	1.390	1.523	6.952	2.154	7.278
1A1+1A2+1A4, Liquid fuels	CH4	322	204	1.9	100	100.018	1.020	-0.158	0.035	-15.776	0.095	15.776
1A1+1A2+1A4, Municipal waste	CH4	88	41	5.0	100	100.125	0.207	-0.045	0.007	-4.537	0.051	4.537
1A1+1A2+1A4, Solid fuels	CH4	712	385	1.1	100	100.006	1.922	-0.360	0.067	-35.971	0.104	35.971
Total	CH4	5781	20033				2040.030					9740.801
Total uncertainties					Overall uncertainty i the year (%):		45.167			Trend uncer-tainty (%):		98.695

Table 79 Uncertainty estimation, N_2O. Tier 1 approach

IPCC Source category	Gas	Base year emission	Year t emission	Activity data uncer-tainty	Emission factor unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncer-tarinty	Uncertainty in trend in national emissions introduced by activity data uncer-tainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg N2O	Mg N2O	%	%	%	%	%	%	%	%	%
1A1 + 1A2 + 1A4, Biomass	N2O	124	261	15.9	400	400.316	126.248	0.165	0.337	66.168	7.582	66.601
1A1 + 1A2 + 1A4, Gasaous fuels	N2O	90	198	1.7	300	300.005	71.616	0.131	0.255	39.379	0.614	39.384
1A1 + 1A2 + 1A4, Liquid fuels	N2O	244	149	1.9	400	400.005	71.769	-0.145	0.192	-57.873	0.515	57.875
1A1 + 1A2 + 1A4, Municipal waste	N2O	59	63	5.0	200	200.062	15.138	-0.001	0.081	-0.154	0.572	0.593
1A1 + 1A2 + 1A4, Solid fuels	N2O	258	158	1.1	200	200.003	38.165	-0.151	0.204	-30.138	0.317	30.140
Total	N2O	775	829				27904.077					10245.063
Total uncertainties					Overall uncertainty i the year (%):		167.045			Trend uncer-tainty (%):		101.218

Table 79 Uncertainty estimation for GHG, tier 2 approach.

		Activity			Emission Factor			Emissions			
Category	Source	Below 2.5%	Above 97.5%	Difference	Below 2.5%	Above 97.5%	Difference	Median	Below 2.5%	Above 97.5%	Difference
all	all							32734	31753	33934	2181
1A1+1A2+1A4 St.comb, CO2	all							31890	30998	32857	1859
1A1+1A2+1A4 St.comb, N2O	all							344	138	1108	970
1A1+1A2+1A4 St.comb, CH4	all							424	317	654	338
1A1+1A2+1A4 St.comb, CO2	Stationary Combustion, Coal, CO2	168.9	172.5	3.6	89.5	98.7	9.2	16055.2	15265.1	16872.7	1607.6
1A1+1A2+1A4 St.comb, CO2	Stationary Combustion, Plastic waste, CO2	16.1	17.7	1.6	58.0	109.0	51.0	1340.3	971.1	1842.6	871.5
1A1+1A2+1A4 St.comb, N2O	Stationary Combustion, BIOMASS, N2O	72.3	97.8	25.5	0.1	8.4	8.3	80.0	9.1	694.4	685.3
1A1+1A2+1A4 St.comb, N2O	Stationary Combustion, LIQUID, N2O	61.7	64.0	2.3	0.1	6.4	6.3	46.3	5.4	403.3	397.9
1A1+1A2+1A4 St.comb, CO2	Stationary Combustion, Natural gas, CO2	169.2	174.9	5.8	56.2	57.3	1.1	9764.0	9580.7	9954.4	373.7
1A1+1A2+1A4 St.comb, N2O	Stationary Combustion, GAS, N2O	169.1	174.8	5.7	0.1	2.2	2.1	62.5	10.0	369.7	359.8
1A1+1A2+1A4 St.comb, CH4	Stationary Combustion, BIOMASS, CH4	70.0	94.7	24.7	1.0	5.1	4.0	186.4	83.5	415.5	332.0
1A1+1A2+1A4 St.comb, N2O	Stationary Combustion, SOLID, N2O	170.0	173.7	3.7	0.1	1.1	1.1	48.8	12.8	196.7	183.9
1A1+1A2+1A4 St.comb, CO2	Stationary Combustion, Gas oil, CO2	20.3	21.5	1.2	70.5	77.6	7.1	1544.4	1460.1	1631.2	171.1
1A1+1A2+1A4 St.comb, CO2	Stationary Combustion, Refinery gas, CO2	14.6	14.9	0.3	54.2	59.7	5.5	841.3	800.5	883.5	83.0
1A1+1A2+1A4 St.comb, CO2	Stationary Combustion, Petroleum coke, CO2	8.0	8.4	0.4	88.0	96.9	8.9	754.8	716.1	795.4	79.2
1A1+1A2+1A4 St.comb, N2O	Stationary Combustion, WASTE, N2O	39.0	43.0	4.0	0.1	1.8	1.7	19.3	5.0	75.5	70.5
1A1+1A2+1A4 St.comb, CO2	Stationary Combustion, Residual oil, CO2	17.1	17.6	0.5	76.6	79.7	3.1	1359.2	1326.5	1392.6	66.1
1A1+1A2+1A4 St.comb, CH4	Natural gas fuelled engines, GAS, CH4	18.1	18.5	0.4	9.2	11.1	1.9	185.0	167.8	203.3	35.4
1A1+1A2+1A4 St.comb, CH4	Stationary Combustion, GAS, CH4	151.2	156.2	5.1	0.0	0.2	0.2	15.1	6.7	33.2	26.5
1A1+1A2+1A4 St.comb, CH4	Stationary Combustion, SOLID, CH4	170.0	173.6	3.7	0.0	0.1	0.1	8.2	3.6	18.4	14.8
1A1+1A2+1A4 St.comb, CO2	Stationary Combustion, Coke, CO2	1.0	1.1	0.0	102.9	113.2	10.3	112.1	106.4	117.9	11.6
1A1+1A2+1A4 St.comb, CO2	Stationary Combustion, LPG, CO2	1.4	1.5	0.1	62.0	68.2	6.2	96.0	90.9	101.4	10.5
1A1+1A2+1A4 St.comb, CH4	Biogas fuelled engines, BIOMASS, CH4	2.2	2.4	0.1	7.5	11.0	3.5	20.9	17.3	25.3	8.1
1A1+1A2+1A4 St.comb, CH4	Stationary Combustion, LIQUID, CH4	61.7	64.0	2.3	0.0	0.2	0.1	4.3	2.0	9.5	7.5
1A1+1A2+1A4 St.comb, CH4	Stationary Combustion, WASTE, CH4	39.0	42.9	3.9	0.0	0.0	0.0	0.9	0.4	2.0	1.6
1A1+1A2+1A4 St.comb, CO2	Stationary Combustion, Kerosene, CO2	0.1	0.1	0.0	68.6	75.6	7.0	8.6	8.1	9.1	1.0
1A1+1A2+1A4 St.comb, CO2	Stationary Combustion, BKB, CO2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 80 Uncertainty estimation, other pollutants

SNAP	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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	SO2	129601.820	6605.660	2.000	10.000	10.198	4.133	-0.043	0.042	-0.426	0.118	0.442
02	SO2	11491.140	4310.020	2.000	20.000	20.100	5.315	0.020	0.027	0.396	0.077	0.403
03	SO2	16707.890	5383.140	2.000	10.000	10.198	3.368	0.023	0.034	0.232	0.096	0.251
Total	SO2	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 unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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	NOx	94757.620	32576.490	2.000	20.000	20.100	13.002	-0.075	0.282	-1.506	0.798	1.704
02	NOx	7517.560	8228.340	2.000	50.000	50.040	8.176	0.043	0.071	2.142	0.202	2.151
03	NOx	13167.170	9556.630	2.000	20.000	20.100	3.814	0.033	0.083	0.660	0.234	0.700
Total	NOx	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 unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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

SNAP	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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 unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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	NH3	0.290	10.460	2.000	1000.000	1000.002	18.260	0.018	0.019	18.262	0.053	18.262
02	NH3	66.940	188.680	2.000	1000.000	1000.002	329.371	0.215	0.339	214.981	0.959	214.983
03	NH3	489.190	373.710	2.000	1000.000	1000.002	652.371	-0.231	0.672	-231.466	1.900	231.474
Total	NH3	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 unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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

SNAP	Gas	Base year emission (year 2000)	Year t emission	Activity data uncertainty	Emission factor unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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	PM10	942.180	760.610	2.000	50.000	50.040	1.720	-0.053	0.055	-2.642	0.154	2.646
02	PM10	12137.330	20746.270	2.000	500.000	500.004	468.710	0.104	1.489	51.994	4.213	52.164
03	PM10	849.100	624.560	2.000	50.000	50.040	1.412	-0.052	0.045	-2.600	0.127	2.603
Total	PM10	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 unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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	PM2,5	804.990	639.660	2.000	50.000	50.040	1.504	-0.051	0.049	-2.532	0.138	2.535
02	PM2,5	11821.070	20274.910	2.000	500.000	500.004	476.276	0.084	1.544	41.989	4.367	42.216
03	PM2,5	504.490	370.440	2.000	50.000	50.040	0.871	-0.034	0.028	-1.703	0.080	1.705
Total	PM2,5	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 unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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 unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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 unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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 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 uncertainty i the year (%):		135.472			Trend uncertainty (%):		11.169

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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 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 uncertainty i the year (%):		143.694			Trend uncertainty (%):		13.434

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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 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 uncertainty i the year (%):		501.210			Trend uncertainty (%):		82.379

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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 unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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 unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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 unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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 unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor unceratinty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Unceratinty i trend in national emissions introduced by emission factor uncertarinty	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

Appendix 11 Reference approach

FUEL TYPES			Unit	Production	Imports	Exports	International bunkers	Stock change	Apparent consumption	Conversion factor (TJ/Unit)	NCV/ GCV [1]	Apparent consumption (TJ)
Liquid Fossil	Primary Fuels	Crude Oil	TJ	603,642.67	101,651.48	372,225.33		-367.39	333,436.22	1.00	NCV	333,436.22
		Orimulsion	TJ	NA	NA	NA		NA	NA	1.00	NCV	NA
		Natural Gas Liquids	TJ	NA	NA	NA		NA	NA	1.00	NCV	NA
	Secondary Fuels	Gasoline	TJ		37,068.35	46,544.84	8.37	-609.40	-8,875.46	1.00	NCV	-8,875.46
		Jet Kerosene	TJ		43,117.06	15,522.05	36,585.83	12,124.60	-21,115.42	1.00	NCV	-21,115.42
		Other Kerosene	TJ		NA	NA	NA	NA	NA	1.00	NCV	NA
		Shale Oil	TJ		NA	NA		NA	NA	1.00	NCV	NA
		Gas / Diesel Oil	TJ		112,584.67	43,305.23	13,503.98	17,043.54	38,731.92	1.00	NCV	38,731.92
		Residual Fuel Oil	TJ		80,640.94	91,214.41	27,163.59	-1,539.82	-36,197.24	1.00	NCV	-36,197.24
		Liquefied Petroleum Gas (LPG)	TJ		654.95	3,170.37		8.33	-2,523.74	1.00	NCV	-2,523.74
		Ethane	TJ		NA	NA		NA	NA	1.00	NCV	NA
		Naphtha	TJ		NA	225.08		61.41	-286.49	1.00	NCV	-286.49
		Bitumen	TJ		8,321.34	312.51		-326.28	8,335.12	1.00	NCV	8,335.12
		Lubricants	TJ		2,514.00	75.42	100.56	2.85	2,335.17	1.00	NCV	2,335.17
		Petroleum Coke	TJ		9,869.21	486.13		1,804.53	7,578.55	1.00	NCV	7,578.55
		Refinery Feedstocks	TJ		5,141.04	20,542.29		1,899.04	-17,300.29	1.00	NCV	-17,300.29
		Other Oil	TJ		NA	NA		NA	NA	1.00	NCV	NA
Other Liquid Fossil												417.25
White Spirit			TJ	NA	487.89	70.64	NA	NA	417.25	1.00	NCV	417.25
Liquid Fossil Totals												304,535.57
Solid Fossil	Primary Fuels	Anthracite [2]	TJ	NA	NA	NA		NA	NA	1.00	NCV	NA
		Coking Coal	TJ	NA	NA	NA		NA	NA	1.00	NCV	NA
		Other Bituminous Coal	TJ	NA	184,827.46	3,810.64	NA	14,045.35	166,971.47	1.00	NCV	166,971.47
		Sub-bituminous Coal	TJ	NA	NA	NA	NA	NA	NA	1.00	NCV	NA
		Lignite	TJ	NA	NA	NA		NA	NA	1.00	NCV	NA
		Oil Shale	TJ	NA	NA	NA		NA	NA	1.00	NCV	NA
		Peat	TJ	NA	NA	NA		NA	NA	1.00	NCV	NA
	Secondary Fuels	BKB [3] and Patent Fuel	TJ		16.95	4.49		NA	12.46	1.00	NCV	12.46
		Coke Oven/Gas Coke	TJ		1,154.33	NA		113.71	1,040.62	1.00	NCV	1,040.62
Other Solid Fossil												16,500.95
Plastic part of municipal waste			TJ	16,500.95	NA	NA	NA	NA	16,500.95	1.00	NCV	16,500.95
Solid Fossil Totals												184,525.50
Gaseous Fossil		Natural Gas (Dry)	TJ	377,640.61	NA	206,436.59		464.09	170,739.93	1.00	NCV	170,739.93
Other Gaseous Fossil												NA
Gaseous Fossil Totals												170,739.93
Total												659,801.00
Biomass total												107,649.05
		Solid Biomass	TJ	81,714.08	21,474.75	NA		NA	103,188.84	1.00	NCV	103,188.84
		Liquid Biomass	TJ	3,722.51	210.33	3,400.62		NA	532.22	1.00	NCV	532.22
		Gas Biomass	TJ	3,928.00	NA	NA		NA	3,928.00	1.00	NCV	3,928.00

FUEL TYPES	REFERENCE APPROACH			SECTORAL APPROACH [1]		DIFFERENCE [2]	
	Apparent energy consumption [3] (PJ)	Apparent energy consumption (excluding non-energy use and feedstocks) [4] (PJ)	CO_2 emissions (Gg)	Energy consumption (PJ)	CO_2 emissions (Gg)	Energy consumption (%)	CO_2 emissions (%)
Liquid Fuels (excluding international bunkers)	304.54	293.45	21,801.82	293.27	21,567.74	0.06	1.09
Solid Fuels (excluding international bunkers) [5]	184.53	184.53	17,207.86	171.79	16,161.57	7.41	6.47
Gaseous Fuels	170.74	170.74	9,578.51	172.00	9,764.45	-0.73	-1.90
Other [5]	NA,NO	NO	NA,NO	16.87	1,342.62	-100.00	-100.00
Total [6]	***659.80***	***648.71***	***48,588.19***	***653.93***	***48,836.37***	***-0.80***	***-0.51***

[1] "Sectoral approach" is used to indicate the approach (if different from the Reference approach) used by the Party to estimate CO_2 emissions from fuel combustion as reported in table 1.A(a), sheets 1-4.

[2] Difference in CO_2 emissions estimated by the Reference approach (RA) and the Sectoral approach (SA) (difference = 100% x ((RA-SA)/SA)). For calculating the difference in energy consumption between the two approaches, data as reported in the column "Apparent energy consumption (excluding non-energy use and feedstocks)" are used for the Reference approach.

[3] Apparent energy consumption data shown in this column are as in table 1.A(b).

[4] For the purposes of comparing apparent energy consumption from the Reference approach with energy consumption from the Sectoral approach, Parties should, in this column, subtract from the apparent energy consumption (Reference approach) the energy content corresponding to the fuel quantities used as feedstocks and/or for non-energy purposes, in accordance with the accounting of energy use in the Sectoral approach

[5] Emissions from biomass are not included.

Note: The Reporting Instructions of the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories require that estimates of CO_2 emissions from fuel combustion, derived using a detailed Sectoral approach, be compared to those from the Reference approach (Worksheet 1-1 of the IPCC Guidelines, Volume 2, Workbook). This comparison is to assist in verifying the Sectoral data.

Documentation Box:

Parties should provide detailed explanations on the fuel combustion sub-sector, including information related to the comparison of CO_2 emissions calculated using the Sectoral approach with those calculated using the Reference approach, in the corresponding part of Chapter 3: Energy (CRF sub-sector 1.A) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

If the CO_2 emission estimates from the two approaches differ by more than 2 per cent, Parties should briefly explain the cause of this difference in this documentation box and provide a reference to relevant section of the NIR where this difference is explained in more detail.

1.AC Difference - Reference and Sectoral Approach:Non-energy use of fuels is not included in the Danish National Approach. Fuel consumption for non-energy is subtracted in Reference Approach to ma
CO2 emission from plastic part of municipal wastes is included in the Danish National Approach.
CO2 emission from the plastic part of municipal wastes is added in Reference Approach to make results comparable. (Other fuels of sources 1A1, 1A2 and 1A4)

Table 103 Fuel category correspondence list for the reference approach.

Reference approach		Danish energy statistics
Biomass	Gas Biomass	Biogas, other
Biomass	Gas Biomass	Biogas, landfill
Biomass	Gas Biomass	Biogas, sewage sludge
Biomass	Liquid Biomass	Liquid biofuels
Biomass	Solid Biomass	Fish oil
Biomass	Solid Biomass	Waste combustion, biomass
Biomass	Solid Biomass	Firewood
Biomass	Solid Biomass	Straw
Biomass	Solid Biomass	Wood Chips
Biomass	Solid Biomass	Firewood
Biomass	Solid Biomass	Wood Pellets
Liquid fossil	Bitumen	Bitumen
Liquid fossil	Crude oil	Crude Oil
Liquid fossil	Crude oil	Waste Oil
Liquid fossil	Ethane	-
Liquid fossil	Gas/diesel oil	Gas/Diesel Oil
Liquid fossil	Gasoline	Aviation Gasoline
Liquid fossil	Gasoline	Motor Gasoline
Liquid fossil	Jet Kerosene	JP1
Liquid fossil	Jet Kerosene	JP4
Liquid fossil	LPG	LPG
Liquid fossil	Lubricants	Lubricants
Liquid fossil	Naphtha	White Spirit
Liquid fossil	Naphtha	Naphtha (LVN)
Gaseous fossil	Natural gas	Natural Gas
Liquid fossil	Natural gas liquids	-
Liquid fossil	Orimulsion	Orimulsion
Liquid fossil	Other kerosene	Other Kerosene
Liquid fossil	Petroleum coke	Petroleum Coke
Liquid fossil	Refinery feedstocks	Refinery Feedstocks
Liquid fossil	Residual fuel oil	Fuel Oil
Liquid fossil	Shale oil	-
Solid fossil	Anthracite	-
Solid fossil	BKB & Patent fuel	Brown Coal Briquettes
Solid fossil	Coke oven/gas coke	Coke
Solid fossil	Coking Coal	-
Solid fossil	Lignite	-
Solid fossil	Oil Shale	-
Solid fossil	Other Bit. Coal	Other Hard Coal
Solid fossil	Other Bit. Coal	Electricity Plant Coal
Solid fossil	Peat	-
Solid fossil	Sub-bit. coal	-
Solid fossil	Other solid	Waste combustion, plastic

Appendix 12 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	Ben-zo(b) kg	Ben-zo(k) kg	Ben-zo(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

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
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
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

[2] SNAP sector codes are shown in appendix 3

Appendix 13 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 cooperation 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 at: http://www.ens.dk/en-US/Info/FactsAndFigures/Energy_statistics_and_indicators/Annual%20Statistics/Sider/Forside.aspx (2010-04-27). 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 Appendix 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

Appendix 14 Key source analysis

Table 106 GHG key source analysis for stationary combustion, Level 2008.

GHG	Year	Fuel	CRF sector	Emission_CO2_eq_Gg	%	Cumulative %
CO2	**2008**	**COAL**	**1A1**	**15255.49**	**46.9%**	**46.9%**
CO2	**2008**	**NATURAL GAS**	**1A1**	**5302.00**	**16.3%**	**63.2%**
CO2	**2008**	**NATURAL GAS**	**1A4**	**2376.87**	**7.3%**	**70.5%**
CO2	**2008**	**NATURAL GAS**	**1A2**	**2085.58**	**6.4%**	**76.9%**
CO2	**2008**	**GAS OIL**	**1A4**	**1393.19**	**4.3%**	**81.1%**
CO2	**2008**	**PLASTIC WASTE**	**1A1**	**1263.57**	**3.9%**	**85.0%**
CO2	**2008**	**REFINERY GAS**	**1A1**	**841.11**	**2.6%**	**87.6%**
CO2	**2008**	**RESIDUAL OIL**	**1A1**	**742.34**	**2.3%**	**89.9%**
CO2	**2008**	**PETROLEUM COKE**	**1A2**	**631.35**	**1.9%**	**91.8%**
CO2	**2008**	**COAL**	**1A2**	**616.98**	**1.9%**	**93.7%**
CO2	**2008**	**RESIDUAL OIL**	**1A2**	**527.55**	**1.6%**	**95.3%**
CH4	2008	NATURAL GAS ENGINES	all	184.92	0.6%	95.9%
CO2	2008	COAL	1A4	177.05	0.5%	96.5%
CH4	2008	BIOMASS	1A4	174.45	0.5%	97.0%
CO2	2008	GAS OIL	1A1	148.19	0.5%	97.5%
CO2	2008	PETROLEUM COKE	1A4	123.17	0.4%	97.8%
CO2	2008	COKE OVEN COKE	1A2	111.98	0.3%	98.2%
CO2	2008	RESIDUAL OIL	1A4	89.35	0.3%	98.4%
CO2	2008	PLASTIC WASTE	1A2	77.03	0.2%	98.7%
CO2	2008	LPG	1A4	69.69	0.2%	98.9%
N2O	2008	BIOMASS	1A4	52.75	0.2%	99.1%
N2O	2008	SOLID	1A1	40.27	0.1%	99.2%
N2O	2008	GAS	1A1	37.44	0.1%	99.3%
CO2	2008	LPG	1A2	26.28	0.1%	99.4%
CH4	2008	BIOGAS ENGINES	all	20.88	0.1%	99.4%
N2O	2008	BIOMASS	1A1	20.26	0.1%	99.5%
N2O	2008	LIQUID	1A1	17.91	0.1%	99.6%
N2O	2008	WASTE	1A1	16.89	0.1%	99.6%
N2O	2008	LIQUID	1A4	14.36	0.0%	99.7%
N2O	2008	LIQUID	1A2	13.84	0.0%	99.7%
N2O	2008	GAS	1A4	12.57	0.0%	99.7%
N2O	2008	GAS	1A2	11.33	0.0%	99.8%
N2O	2008	BIOMASS	1A2	8.03	0.0%	99.8%
CH4	2008	BIOMASS	1A1	7.90	0.0%	99.8%
CO2	2008	KEROSENE	1A4	7.42	0.0%	99.8%
N2O	2008	SOLID	1A2	7.04	0.0%	99.9%
CH4	2008	GAS	1A1	5.82	0.0%	99.9%
CH4	2008	SOLID	1A1	5.11	0.0%	99.9%
CH4	2008	GAS	1A4	4.91	0.0%	99.9%
CH4	2008	GAS	1A2	4.32	0.0%	99.9%
CH4	2008	BIOMASS	1A2	4.25	0.0%	99.9%
CO2	2008	GAS OIL	1A2	2.75	0.0%	100.0%
CH4	2008	LIQUID	1A2	2.48	0.0%	100.0%
N2O	2008	WASTE	1A2	2.48	0.0%	100.0%
CH4	2008	SOLID	1A2	2.38	0.0%	100.0%
CO2	2008	PLASTIC WASTE	1A4	2.03	0.0%	100.0%
N2O	2008	SOLID	1A4	1.73	0.0%	100.0%
CO2	2008	KEROSENE	1A2	1.16	0.0%	100.0%
CH4	2008	LIQUID	1A4	1.13	0.0%	100.0%
CH4	2008	LIQUID	1A1	0.68	0.0%	100.0%
CH4	2008	WASTE	1A1	0.61	0.0%	100.0%
CH4	2008	SOLID	1A4	0.59	0.0%	100.0%
CH4	2008	WASTE	1A2	0.25	0.0%	100.0%
N2O	2008	WASTE	1A4	0.08	0.0%	100.0%
CO2	2008	COKE OVEN COKE	1A4	0.06	0.0%	100.0%
CO2	2008	LPG	1A1	0.01	0.0%	100.0%
CH4	2008	WASTE	1A4	0.01	0.0%	100.0%

Table 107 GHG key source analysis for stationary combustion, Level 1990.

GHG	Year	Fuel	CRF sector	Emission_CO2_eq_Gg	%	Cumulative %
CO2	**1990**	**COAL**	**1A1**	**22461.79999**	**59%**	**58.9%**
CO2	**1990**	**GAS OIL**	**1A4**	**4341.152798**	**11%**	**70.3%**
CO2	**1990**	**NATURAL GAS**	**1A1**	**1539.659639**	**4%**	**74.4%**
CO2	**1990**	**NATURAL GAS**	**1A4**	**1485.695075**	**4%**	**78.3%**
CO2	**1990**	**RESIDUAL OIL**	**1A2**	**1426.942561**	**4%**	**82.0%**
CO2	**1990**	**COAL**	**1A2**	**1317.571568**	**3%**	**85.5%**
CO2	**1990**	**NATURAL GAS**	**1A2**	**1294.177868**	**3%**	**88.9%**
CO2	**1990**	**RESIDUAL OIL**	**1A1**	**882.4296936**	**2%**	**91.2%**
CO2	**1990**	**REFINERY GAS**	**1A1**	**795.3543452**	**2%**	**93.3%**
CO2	**1990**	**PLASTIC WASTE**	**1A1**	**369.7478**	**1%**	**94.3%**
CO2	**1990**	**KEROSENE**	**1A4**	**361.179792**	**1%**	**95.2%**
CO2	1990	COAL	1A4	297.775505	1%	96.0%
CO2	1990	PETROLEUM COKE	1A2	257.5538712	1%	96.7%
CO2	1990	RESIDUAL OIL	1A4	195.868686	1%	97.2%
CO2	1990	GAS OIL	1A1	165.834	0%	97.6%
CO2	1990	PETROLEUM COKE	1A4	152.722208	0%	98.0%
CO2	1990	COKE OVEN COKE	1A2	126.286344	0%	98.3%
CO2	1990	LPG	1A2	102.451375	0%	98.6%
CH4	1990	BIOMASS	1A4	74.45844605	0%	98.8%
CO2	1990	LPG	1A4	65.712985	0%	99.0%
N2O	1990	SOLID	1A1	62.74071398	0%	99.1%
N2O	1990	LIQUID	1A4	43.2095081	0%	99.3%
CO2	1990	GAS OIL	1A2	40.258146	0%	99.4%
CO2	1990	PLASTIC WASTE	1A4	23.2156	0%	99.4%
N2O	1990	BIOMASS	1A4	22.24039994	0%	99.5%
N2O	1990	WASTE	1A1	17.19136	0%	99.5%
N2O	1990	LIQUID	1A1	17.11543992	0%	99.6%
N2O	1990	LIQUID	1A2	15.42195087	0%	99.6%
N2O	1990	SOLID	1A2	13.98986575	0%	99.6%
N2O	1990	GAS	1A1	12.5188637	0%	99.7%
CO2	1990	COKE OVEN COKE	1A4	11.512152	0%	99.7%
CO2	1990	REFINERY GAS	1A2	10.8617548	0%	99.7%
CO2	1990	BROWN COAL BRI.	1A4	10.5532922	0%	99.8%
CH4	1990	SOLID	1A1	9.153679497	0%	99.8%
N2O	1990	BIOMASS	1A1	9.13999536	0%	99.8%
N2O	1990	GAS	1A4	8.074739328	0%	99.8%
N2O	1990	GAS	1A2	7.239214197	0%	99.9%
N2O	1990	BIOMASS	1A2	7.17184132	0%	99.9%
CO2	1990	KEROSENE	1A2	5.01372	0%	99.9%
CH4	1990	SOLID	1A2	4.738502916	0%	99.9%
CH4	1990	NATURAL GAS ENGINES	All	4.635949878	0%	99.9%
CH4	1990	BIOMASS	1A1	4.572494682	0%	99.9%
CH4	1990	BIOMASS	1A2	3.886675296	0%	99.9%
CH4	1990	LIQUID	1A4	3.287671433	0%	99.9%
CH4	1990	GAS	1A4	3.27101355	0%	99.9%
N2O	1990	SOLID	1A4	3.1179459	0%	100.0%
CH4	1990	GAS	1A2	2.843684771	0%	100.0%
CH4	1990	GAS	1A1	2.252048416	0%	100.0%
CH4	1990	LIQUID	1A2	2.102862987	0%	100.0%
CH4	1990	BIOGAS ENGINES	All	1.916008269	0%	100.0%
CH4	1990	WASTE	1A1	1.7217081	0%	100.0%
CH4	1990	LIQUID	1A1	1.377042183	0%	100.0%
N2O	1990	WASTE	1A4	1.13336	0%	100.0%
CH4	1990	SOLID	1A4	1.05607845	0%	100.0%
CO2	1990	PLASTIC WASTE	1A2	0.7120382	0%	100.0%
CO2	1990	LPG	1A1	0.585	0%	100.0%
CO2	1990	BROWN COAL BRI.	1A2	0.4137804	0%	100.0%
CH4	1990	WASTE	1A4	0.115164	0%	100.0%
N2O	1990	WASTE	1A2	0.03476092	0%	100.0%
CH4	1990	WASTE	1A2	0.003532158	0%	100.0%

Table 108 GHG key source analysis, Trend.

IPCC Category Code	IPCC Category	Fuel	Greenhouse Gas	Base Year Estimate, Ex,0	Latest Year Estimate Ex,t	Trend Assessment Tx,t	% Contribution to Trend	Cumulative Total of Column H
1A1	**Energy Sector**	**NATURAL GAS**	**CO2**	**1539.7**	**5302.0**	**0.105**	**24.6%**	**24.6%**
1A1	**Energy Sector**	**COAL**	**CO2**	**22461.8**	**15255.5**	**0.103**	**24.2%**	**48.8%**
1A4	**Other sectors**	**GAS OIL**	**CO2**	**4341.2**	**1393.2**	**0.061**	**14.3%**	**63.1%**
1A4	**Other sectors**	**NATURAL GAS**	**CO2**	**1485.7**	**2376.9**	**0.029**	**6.8%**	**69.9%**
1A2	**Industry**	**NATURAL GAS**	**CO2**	**1294.2**	**2085.6**	**0.026**	**6.0%**	**75.9%**
1A1	**Energy Sector**	**PLASTIC WASTE**	**CO2**	**369.7**	**1263.6**	**0.025**	**5.8%**	**81.8%**
1A2	**Industry**	**RESIDUAL OIL**	**CO2**	**1426.9**	**527.6**	**0.018**	**4.3%**	**86.0%**
1A2	**Industry**	**COAL**	**CO2**	**1317.6**	**617.0**	**0.013**	**3.1%**	**89.1%**
1A2	**Industry**	**PETROLEUM COKE**	**CO2**	**257.6**	**631.3**	**0.011**	**2.5%**	**91.7%**
1A4	**Other sectors**	**KEROSENE**	**CO2**	**361.2**	**7.4**	**0.008**	**1.9%**	**93.5%**
all	**all**	**NATURAL GAS ENGINES**	**CH4**	**4.6**	**184.9**	**0.005**	**1.1%**	**94.7%**
1A1	**Energy Sector**	**REFINERY GAS**	**CO2**	**795.4**	**841.1**	**0.004**	**1.0%**	**95.7%**
1A4	Other sectors	BIOMASS	CH4	74.5	174.5	0.003	0.7%	96.3%
1A4	Other sectors	RESIDUAL OIL	CO2	195.9	89.4	0.002	0.5%	96.8%
1A4	Other sectors	COAL	CO2	297.8	177.0	0.002	0.5%	97.3%
1A2	Industry	PLASTIC WASTE	CO2	0.7	77.0	0.002	0.5%	97.8%
1A2	Industry	LPG	CO2	102.5	26.3	0.002	0.4%	98.1%
1A4	Other sectors	BIOMASS	N2O	22.2	52.7	0.001	0.2%	98.3%
1A2	Industry	GAS OIL	CO2	40.3	2.8	0.001	0.2%	98.5%
1A1	Energy Sector	GAS	N2O	12.5	37.4	0.001	0.2%	98.7%
1A4	Other sectors	LIQUID	N2O	43.2	14.4	0.001	0.1%	98.8%
all	all	BIOGAS ENGINES	CH4	1.9	20.9	0.001	0.1%	99.0%
1A4	Other sectors	PLASTIC WASTE	CO2	23.2	2.0	0.000	0.1%	99.1%
1A4	Other sectors	LPG	CO2	65.7	69.7	0.000	0.1%	99.2%
1A1	Energy Sector	SOLID	N2O	62.7	40.3	0.000	0.1%	99.2%
1A1	Energy Sector	BIOMASS	N2O	9.1	20.3	0.000	0.1%	99.3%
1A1	Energy Sector	RESIDUAL OIL	CO2	882.4	742.3	0.000	0.1%	99.4%
1A4	Other sectors	COKE OVEN COKE	CO2	11.5	0.1	0.000	0.1%	99.4%
1A2	Industry	REFINERY GAS	CO2	10.9	0.0	0.000	0.1%	99.5%
1A4	Other sectors	BROWN COAL BRI.	CO2	10.6	0.0	0.000	0.1%	99.6%
1A4	Other sectors	PETROLEUM COKE	CO2	152.7	123.2	0.000	0.0%	99.6%
1A1	Energy Sector	GAS OIL	CO2	165.8	148.2	0.000	0.0%	99.6%
1A4	Other sectors	GAS	N2O	8.1	12.6	0.000	0.0%	99.7%
1A2	Industry	GAS	N2O	7.2	11.3	0.000	0.0%	99.7%
1A2	Industry	SOLID	N2O	14.0	7.0	0.000	0.0%	99.7%
1A2	Industry	COKE OVEN COKE	CO2	126.3	112.0	0.000	0.0%	99.8%
1A1	Energy Sector	BIOMASS	CH4	4.6	7.9	0.000	0.0%	99.8%
1A1	Energy Sector	GAS	CH4	2.3	5.8	0.000	0.0%	99.8%
1A1	Energy Sector	LIQUID	N2O	17.1	17.9	0.000	0.0%	99.8%
1A2	Industry	KEROSENE	CO2	5.0	1.2	0.000	0.0%	99.9%
1A1	Energy Sector	SOLID	CH4	9.2	5.1	0.000	0.0%	99.9%
1A2	Industry	WASTE	N2O	0.0	2.5	0.000	0.0%	99.9%
1A1	Energy Sector	WASTE	N2O	17.2	16.9	0.000	0.0%	99.9%
1A4	Other sectors	GAS	CH4	3.3	4.9	0.000	0.0%	99.9%
1A2	Industry	BIOMASS	N2O	7.2	8.0	0.000	0.0%	99.9%
1A2	Industry	GAS	CH4	2.8	4.3	0.000	0.0%	99.9%
1A4	Other sectors	LIQUID	CH4	3.3	1.1	0.000	0.0%	99.9%
1A2	Industry	SOLID	CH4	4.7	2.4	0.000	0.0%	100.0%
1A4	Other sectors	SOLID	N2O	3.1	1.7	0.000	0.0%	100.0%
1A2	Industry	BIOMASS	CH4	3.9	4.2	0.000	0.0%	100.0%
1A4	Other sectors	WASTE	N2O	1.1	0.1	0.000	0.0%	100.0%
1A1	Energy Sector	WASTE	CH4	1.7	0.6	0.000	0.0%	100.0%
1A2	Industry	LIQUID	CH4	2.1	2.5	0.000	0.0%	100.0%
1A2	Industry	LIQUID	N2O	15.4	13.8	0.000	0.0%	100.0%
1A1	Energy Sector	LIQUID	CH4	1.4	0.7	0.000	0.0%	100.0%
1A1	Energy Sector	LPG	CO2	0.6	0.0	0.000	0.0%	100.0%
1A2	Industry	BROWN COAL BRI.	CO2	0.4	0.0	0.000	0.0%	100.0%
1A4	Other sectors	SOLID	CH4	1.1	0.6	0.000	0.0%	100.0%
1A2	Industry	WASTE	CH4	0.0	0.3	0.000	0.0%	100.0%
1A4	Other sectors	WASTE	CH4	0.1	0.0	0.000	0.0%	100.0%

Table 109 Key source analysis, Level 2008, SO_2.

NFR	NFR_name	Level Assessment Lx,t	Cumulative Total, %	001
1A1a	Public electricity and heat production	0.385	39%	KS
1A2	Industry	0.330	72%	KS
1A4b	Residential	0.151	87%	KS
1A4c	Agriculture / Forestry / Fisheries	0.096	96%	
1A1b	Petroleum refining	0.019	98%	
1A4a	Commercial / Institutional	0.017	100%	
1A1c	Other energy industries	0.001	100%	

Table 110 Key source analysis, Level 2008, NO_x.

1A1a	Public electricity and heat production	0.478	48%	KS
1A2	Industry	0.190	67%	KS
1A1c	Other energy industries	0.140	81%	KS
1A4b	Residential	0.133	94%	
1A1b	Petroleum refining	0.030	97%	
1A4a	Commercial / Institutional	0.016	99%	
1A4c	Agriculture / Forestry / Fisheries	0.014	100%	
1A1a	Public electricity and heat production	0.478	48%	KS

Table 111 Key source analysis, Level 2008, NMVOC.

NFR	NFR_name	Level Assessment Lx,t	Cumulative Total, %	003
1A4b	Residential	0.861	86%	KS
1A1a	Public electricity and heat production	0.082	94%	
1A4c	Agriculture / Forestry / Fisheries	0.026	97%	
1A2	Industry	0.017	99%	
1A4a	Commercial / Institutional	0.012	100%	
1A1c	Other energy industries	0.002	100%	
1A1b	Petroleum refining	0.000	100%	

Table 112 Key source analysis, Level 2008, CO.

NFR	NFR_name	Level Assessment Lx,t	Cumulative Total, %	005
1A4b	Residential	0.808	81%	KS
1A2	Industry	0.078	89%	
1A4c	Agriculture / Forestry / Fisheries	0.059	95%	
1A1a	Public electricity and heat production	0.048	99%	
1A4a	Commercial / Institutional	0.005	100%	
1A1c	Other energy industries	0.001	100%	
1A1b	Petroleum refining	0.001	100%	

Table 113 Key source analysis, Level 2008, TSP.

NFR	NFR_name	Level Assessment Lx,t	Cumulative Total, %	009
1A4b	Residential	0.893	89%	KS
1A1a	Public electricity and heat production	0.037	93%	
1A2	Industry	0.036	97%	
1A4c	Agriculture / Forestry / Fisheries	0.021	99%	
1A4a	Commercial / Institutional	0.007	99%	
1A1b	Petroleum refining	0.005	100%	
1A1c	Other energy industries	0.000	100%	

Table 114 Key source analysis, Level 2008, PM_{10}.

NFR	NFR_name	Level Assessment Lx,t	Cumulative Total, %	011
1A4b	Residential	0.908	91%	KS
1A1a	Public electricity and heat production	0.029	94%	
1A2	Industry	0.028	97%	
1A4c	Agriculture / Forestry / Fisheries	0.021	99%	
1A4a	Commercial / Institutional	0.008	99%	
1A1b	Petroleum refining	0.005	100%	
1A1c	Other energy industries	0.000	100%	

Table 115 Key source analysis, Level 2008, $PM_{2.5}$.

NFR	NFR_name	Level Assessment Lx,t	Cumulative Total, %	012
1A4b	Residential	0.924	92%	KS
1A1a	Public electricity and heat production	0.025	95%	
1A4c	Agriculture / Forestry / Fisheries	0.021	97%	
1A2	Industry	0.017	99%	
1A4a	Commercial / Institutional	0.008	99%	
1A1b	Petroleum refining	0.005	100%	
1A1c	Other energy industries	0.000	100%	

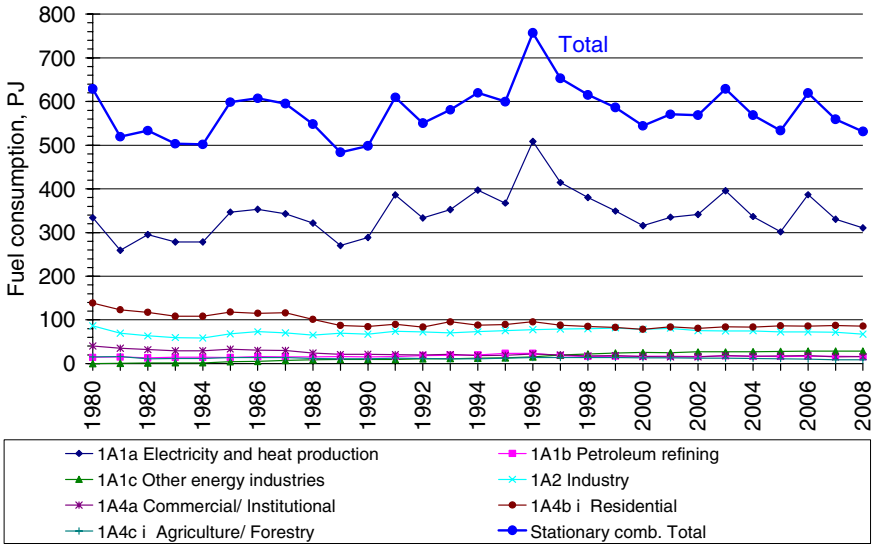
Table 116 Key source analysis, trend, SO_2, NO_x, NMVOC and CO.

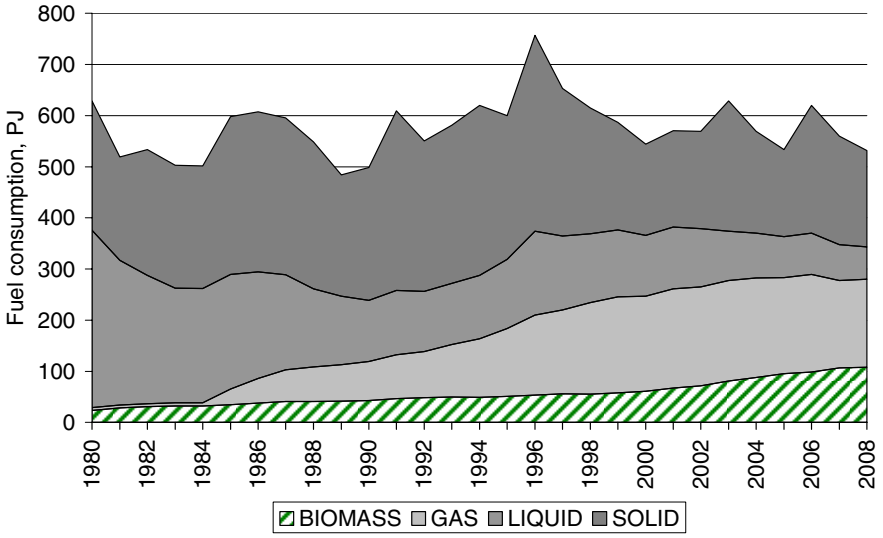
IPCC Category Code	IPCC Category	1990 SO_2	1990 NO_x	1990 NMVOC	1990 CO	2008 SO_2	2008 NO_x	2008 NMVOC	2008 CO
1A1a	Public electricity and heat production	126188	90766	462	7954	6281	24056	1838	7909
1A1b	Petroleum refining	3411	1616	58	249	316	1490	1	119
1A1c	Other energy industries	3	2376	13	61	8	7031	40	183
1A2	Industry	16708	13167	1271	15877	5383	9557	371	12879
1A4a	Commercial / Institutional	1884	1399	132	973	273	811	271	839
1A4b	Residential	6415	4939	12098	85074	2466	6702	19222	133437
1A4c	Agriculture / Forestry / Fisheries	3192	1180	826	32127	1572	715	570	9709
		157801	115442	14861	142313	16299	50361	22313	165077

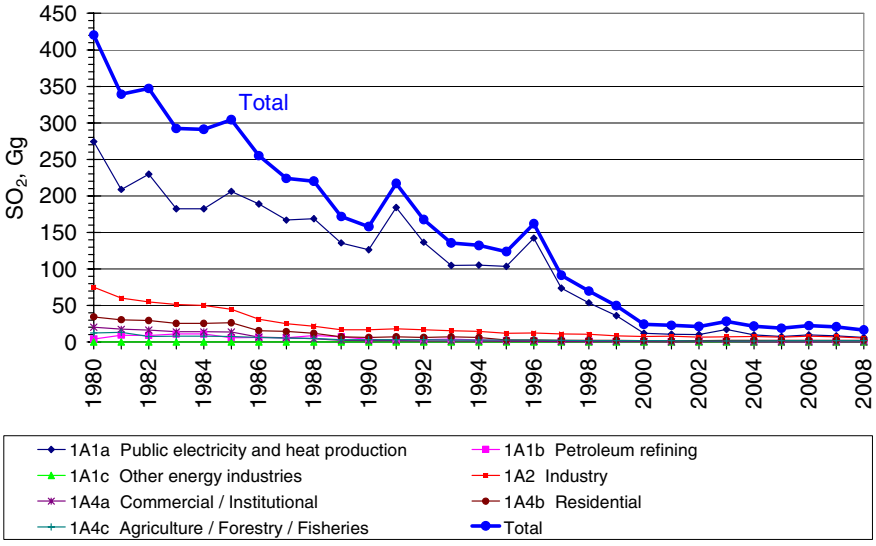
IPCC Category Code	IPCC Category	Trend Tx,t SO_2	Trend Tx,t NO_x	Trend Tx,t NMVOC	Trend Tx,t CO	% Contribution to Trend SO_2	% Contribution to Trend NO_x	% Contribution to Trend NMVOC	% Contribution to Trend CO
1A1a	Public electricity and heat production	0.043	0.135	0.077	0.009	**49.7%**	**50.0%**	**24.9%**	1.9%
1A1b	Petroleum refining	0.000	0.007	0.006	0.001	0.3%	2.5%	1.9%	0.2%
1A1c	Other energy industries	0.000	0.052	0.001	0.001	0.1%	**19.3%**	0.4%	0.2%
1A2	Industry	0.023	0.033	0.103	0.039	**26.9%**	12.3%	**33.5%**	7.9%
1A4a	Commercial / Institutional	0.000	0.002	0.005	0.002	0.6%	0.6%	1.6%	0.4%
1A4b	Residential	0.011	0.039	0.071	0.244	**13.3%**	**14.6%**	**23.1%**	**49.8%**
1A4c	Agriculture / Forestry / Fisheries	0.008	0.002	0.045	0.194	9.1%	0.6%	14.6%	**39.5%**
		0.086	0.269	0.309	0.490	100%	100%	100%	100%

: Key source

Appendix 15 Fuel consumption time-series 1980-2008







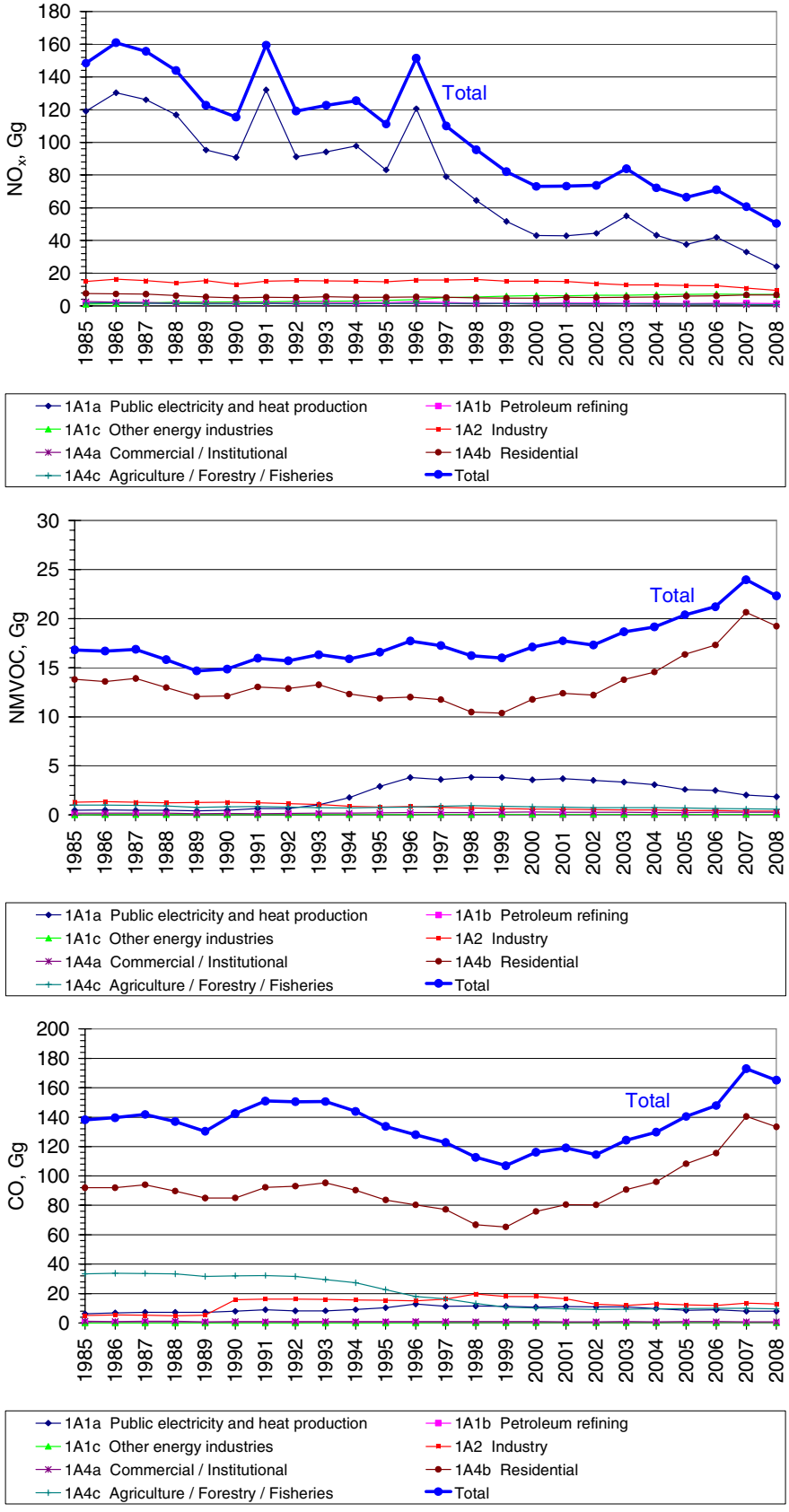


Figure 60 Time-series 1980/1985 - 2008.

Appendix 16 Source specific QA/QC

The elaboration of a formal QA/QC plan started in 2004. A first version is available from Sørensen et al. (2005). This quality manual describes the concepts of quality work and definitions of sufficient quality, critical control points and a list of Point for Measuring. The work on expanding the QC will be ongoing in future years.

Documentation concerning verification of the Danish emission inventories has been published by Fauser et al. (2007). The reference approach for the energy sector is shown is shown in chapter 16.1.

The sector reports for stationary combustion has been reviewed by external Danish experts in 2009, 2006 and 2004 (Nielsen et al. 2009; Nielsen et al. 2007; Nielsen et al. 2005).

Data storage, level 1

Table 61 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 rela-

tively low. For further comments regarding uncertainties, see Chapter 15.

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 15.

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. 2007).

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 61 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, DONG Energy and Vattenfall

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 61.

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.Transparency	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 61 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.Transparency	DS.1.7.4	Listing of external contacts for every dataset

See Table 61.

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. 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 in chapter 16.1.

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. All references are included in this report (Chapter 14.7 and Appendix 6).
- 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/operator 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 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.

NERI **National Environmental Research Institute**
DMU Danmarks Miljøundersøgelser

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DANISH EMISSION INVENTORIES FOR STATIONARY COMBUSTION PLANTS

Inventories until 2008

Emission inventories for stationary combustion plants are presented and the methodologies and assumptions used for the inventories are described. The pollutants considered are SO_2, NO_x, NMVOC, CH_4, CO, CO_2, N_2O, NH_3, particulate matter, heavy metals, dioxins, HCB and PAH. The CO_2 emission in 2008 was 16 % lower than in 1990. However, fluctuations in the emission level are large as a result of electricity import/export. The emission of CH_4 has increased due to increased use of lean-burn gas engines in combined heating and power (CHP) plants. However, the emission has decreased in recent years due to structural changes in the Danish electricity market. The N_2O emission was higher in 2008 than in 1990 but the fluctuations in the time-series are significant. A considerable decrease of the SO_2, NOx and heavy metal emissions is mainly a result of decreased emissions from large power plants and waste incineration plants. The combustion of wood in residential plants has increased considerably in recent years resulting in increased emission of PAH, particulate matter and CO. The emission of NMVOC has increased since 1990 as a result of both the increased combustion of wood in residential plants and the increased emission from lean-burn gas engines. The dioxin emission decreased since 1990 due to flue gas cleaning on waste incineration plants. However in recent years the emis-sion has increased as a result of the increased combustion of wood in residential plants.

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