DANISH EMISSION INVENTORIES FOR STATIONARY COMBUSTION PLANTS

Inventories until year 2007

NERI Technical Report no. 744 2009

NATIONAL ENVIRONMENTAL RESEARCH INSTITUTE
AARHUS UNIVERSITY

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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, particulate matter, heavy metals, dioxins, HCB and PAH. The CO_2 emission in 2007 was 10% 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 2007 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.

Keywords:	Emission, combustion, power plants, district heating, CHP, co-generation, incineration, MSW, SO_2, NO_x, NMVOC, CH_4, CO, CO_2, N_2O, PM, heavy metals, dioxin, PAH, HCB, greenhouse gas
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Preface

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 and to the United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution. This report forms part of the documentation for the inventories and covers emissions from stationary combustion plants. The results of inventories up to 2007 are included. The report updates the two reports published in 2005 and 2007.

The report has been reviewed by Annemette Geertinger from FORCE Technology. The 2005 and 2007 updates of this report were reviewed by Jan Erik Johnsson from the Technical University of Denmark and Bo Sander from Elsam Engineering.

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 (UNECE) 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. The inventories include the following pollutants relevant to stationary combustion: CO_2, CH_4, N_2O, SO_2, NO_x, NMVOC, CO, particulate matter, 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 2007 and 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 2007, 71 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 60 % of the overall fuel consumption of stationary combustion.

In 2007 the fuel consumption was 12 % higher than in 1990; the fossil fuel consumption, however, was 2 % 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 fluctu-

[1] EU Emission Trading Scheme.

ates 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), TSP, 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 and Cu. Stationary combustion plants account for less than 10 % of the national CH_4 and N_2O emission.

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

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

The greenhouse gas emission (GHG) trend follows the CO_2 emission trend closely. Both the CO_2 and the total GHG emission were lower in 2007 than in 1990: CO_2 by 10 % and GHG by 9 %. 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 3.6 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 16 % higher in 2007 than in 1990. The fluctuations follows 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 95 % since 1980 and by 87 % 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.

The NO_x emission from stationary combustion plants has decreased by 58 % since 1985 and 46 % 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 fluctuations in the emission time-series follow fluctuations in electricity import/export.

In 2007 the wood consumption in residential plants was 4.1 times the 1990 level. A change of technology (installation of modern stoves) has, however, caused decreasing emission factors for several pollutants.

The CO emission has increased by 22 % from 1990 to 2007. 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 by 104 % from 1985 and 109 % from 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 68-71 % since 2000 due to the increase of wood combustion in residential plants. The emission of PAHs has increased by 130-190 % since 1990, also a result of the increased combustion of wood in residential plants.

All the heavy metal emissions has decreased considerably since 1990 – between 34 % and 82[2] %. 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. However, the emission from residential plants is increasing due to the increasing wood combustion in the sector. This has caused a 23 % 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 ±8.5 % and the trend in GHG emission (1990-2007) is -8.5 % ± 2.1 %-age points.

[2] The estimated Zn emission in 2007 is 15% higher than in 1990. This is presumably due to insufficient emission factor update for recent years.

Sammendrag

Opgørelser over de samlede danske luftemissioner rapporteres årligt til Klimakonventionen (United Nation Framework Convention on Climate Change, UNFCCC) og Kyotoprotokollen og 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. Emissionsopgørelserne omfatter følgende stoffer af relevans for stationær forbrænding: CO_2, CH_4, N_2O, SO_2, NO_x, NMVOC, CO, partikler, 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 af 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 2007 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 2007 er 71 stationære forbrændingsanlæg defineret som punktkilder. Punktkilderne omfatter: kraftværker, decentrale kraftvarmeværker, affaldsforbrændingsanlæg, industrielle forbrændingsanlæg samt raffinaderier. Brændselsforbruget for disse anlæg svarer til 60 % af det samlede brændselsforbrug for alle stationære forbrændingsanlæg.

Variationen i årlig import/eksport af el medvirker til at brændselsforbruget til stationære forbrændingsanlæg varierer. I 2007 var brændselsforbruget 12 % højere end i 1990, mens forbruget af fossile brændsler var 2 % 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), partikler, dioxin, HCB og PAH. Endvidere udgør emissionen over 10 % for NO_x, CO, NMVOC og Cu. Stationær forbrænding bidrager med mindre end 10 % af den nationale emission af CH_4 og N_2O.

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

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.

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 2007 end i 1990 – CO_2 er 10 % lavere og drivhusgasemissionen er 9 % lavere. Emissionerne fluktuerer dog betydeligt pga. variationerne i import/eksport af el samt varierende udetemperatur.

CH_4-emissionen fra stationær forbrænding er steget med en faktor 3,6 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. Dette skyldes de ændrede afregningsregler iht. 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 16 % højere i 2007 end i 1990. Emissionen af N_2O flukturerer som følge af variationerne i import/eksport af el.

SO_2-emissionen fra stationær forbrænding er faldet med 95 % siden 1980 og 87 % siden 1990. Den store reduktion skyldes primært, at emissionen fra el- og fjernvarmeproducerende anlæg er faldet, som følge af installering af afsvovlningsanlæg samt brug af brændsler med lavere svovlindhold.

NO_x-emissionen fra stationær forbrænding er faldet med 58 % siden 1985 og 46 % siden 1990. Reduktionen skyldes primært, 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. NO_x-emissionen flukturerer som følge af variationen i import/eksport af el.

Mængden af træ forbrændt i villakedler og brændeovne var i 2007 4,1 gange så højt som i 1990. Emissionen fra nyere brændeovne mv. er lavere end for de ældre idet forbrændingsteknologien er forbedret. Stig-

ningen i emissioner er således lavere end stigningen i brændselsforbruget.

CO emissionen er steget 22 % siden 1990. Emissionen fra brændeovne er steget, men samtidig er emissionen fra halmfyrede gårdanlæg faldet.

Emissionen af NMVOC fra stationær forbrænding er øget med 104 % siden 1985 og 109 % siden 1990. Stigningen skyldes primært det øgede forbrug af træ i forbindelse med beboelse (brændeovne mv.) og idriftsættelsen af gasmotorer på decentrale kraftvarmeværker.

Emissionen af partikler er steget 68-71 % 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 130-190 % siden 1990.

Emissionen af dioxin var 55 % lavere i 2007 end i 1990. Dette fald skyldes primært installering af dioxinrensningsanlæg på affaldsforbrændingsanlæg. 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 34 % og 82[3] %. Faldet skyldes den forbedrede røggasrensning på affaldsforbrændingsanlæg og på kraftværker.

Emissionen af drivhusgasser er bestemt med en usikkerhed på ±8,5 %. Drivhusgasemissionen er siden 1990 faldet 8,5 % ± 2,1 %-point.

[3] For Zn er der beregnet en stigning på 15% siden 1990. Dette kan dog meget vel være et resultat af utilstrækkelig opdatering af emissionsfaktoren for affaldsforbrænding.

1 Introduction

The Danish atmospheric emission inventories are prepared on an annual basis and the results are reported to the United Nation Framework Convention on Climate Change (UNFCCC or Climate Convention) and to the United Nations Economic Commission for Europe (UNECE) 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. The National Environmental Research Institute (NERI), Aarhus University, is estimating the Danish greenhouse gas (GHG) emissions reported under the Kyoto Protocol, which is a protocol under the Climate Convention. NERI is responsible for preparing the estimates of NO_x, SO_2, NMVOC and NH_3 reported by the Danish EPA to the European Commission. The Danish atmospheric emission inventories are calculated by the National Environmental Research Institute (NERI), Aarhus University.

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 2007 including all emission source categories is shown in Table 1 to 4. The emission inventories reported to the LRTAP Convention and to the Climate Convention are organised in six main source categories and a number of sub categories. 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 on the NERI home page: http://www.dmu.dk/Luft/Emissioner/Home+of+Inventory/ or via 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 10.

Table 1 National greenhouse gas emission for the year 2007 (Nielsen et al. 2009a).

Pollutant	CO_2	CH_4	N_2O	HFCs, PFCs & SF_6
Unit	Gg CO_2 equivalent			
1. Energy	51 494	595	458	-
2. Industrial Processes	1 647	-	-	886
3. Solvent and Other Product Use	87	-	37	-
4. Agriculture	-	3 835	6 238	-
5. Land-Use Change and Forestry	-2 143	-0.5	0.1	-
6. Waste	-	1 319	47	-
National emission excluding LULUCF [1)]			66 641	
National emission including LULUCF [2)]			64 498	

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

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

Table 2 National emissions 2007 reported to the LRTAP Convention (Nielsen et al. 2009b).

Pollutant	NO_x	CO	NMVOC	SO_2	TSP	PM_{10}	$PM_{2.5}$
	Gg	Gg	Gg	Gg	Mg	Mg	Mg
1. Energy	167	448	74	23	37 734	34 103	31 071
2. Industrial Processes	0	0	1	0	-	-	-
3. Solvent and Other Product Use	-	-	28	-	-	-	-
4. Agriculture	-	-	2	-	14 562	9 326	1 673
5. Land-Use Change and Forestry	-	-	-	-	-	-	-
6. Waste	0	0	0	0	2	2	2
National emission	167	448	104	23	52 299	43 431	32 746

Table 3 National heavy metal (HM) emissions 2007 reported to the LRTAP Convention (Nielsen et al. 2009b).

Pollutant	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
1. Energy	6.10	0.74	1.07	6.10	0.63	1.36	9.95	8.72	1.99
2. Industrial Processes	0.07	0.00	-	0.07	-	-	0.05	-	-
3. Solvent and Other Product Use	-	-	-	-	-	-	-	-	-
4. Agriculture	-	-	-	-	-	-	-	-	-
5. Land-Use Change and Forestry	-	-	-	-	-	-	-	-	-
6. Waste	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00
National emission	6.17	0.75	1.12	6.17	0.63	1.36	9.99	8.72	1.99

Table 4 National PAH, Dioxin and hexachlorobenzene (HCB) emissions 2007 reported to the LRTAP Convention (Nielsen et al. 2009b).

Pollutant	Benzo(a)-pyrene	Benzo(b)-fluoran-thene	Benzo(k)-fluoran-thene	Indeno (1,2,3-c,d) pyrene	Dioxin	HCB
	Mg	Mg	Mg	Mg	g I-teq	kg
1. Energy	5.06	5.42	3.01	3.62	21.67	3.97
2. Industrial Processes	-	-	-	-	0.02	-
3. Solvent and Other Product Use	-	-	-	-	-	-
4. Agriculture	-	-	-	-	-	-
5. Land-Use Change and Forestry	-	-	-	-	-	-
6. Waste	0.00	0.00	0.00	0.00	0.04	0.01
7. Other	-	-	-	-	6.10	-
National emission	5.06	5.42	3.01	3.62	27.83	3.97

3 Fuel consumption data

In 2007 the total fuel consumption for stationary combustion plants was 559 PJ of which 446 PJ was fossil fuels and 114 PJ was biomass.

Fuel consumption distributed according to the stationary combustion subcategories is shown in Figure 1 and Figure 2. The majority - 59 % - 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*.

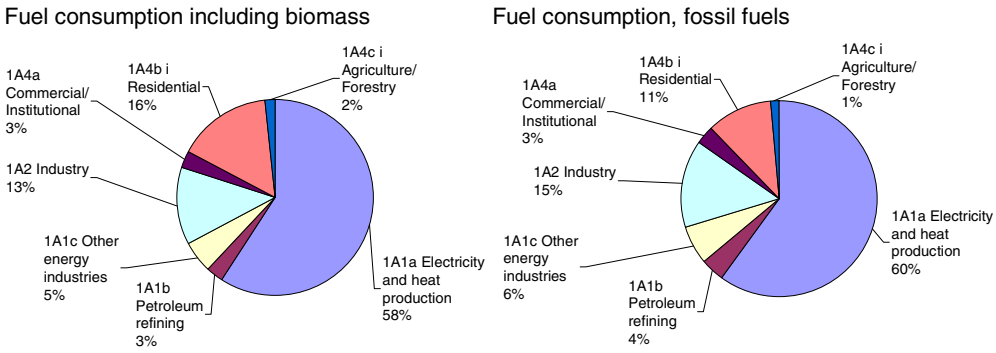


Figure 1 Fuel consumption of stationary combustion source categories, 2007 (based on DEA (2008a)).

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.

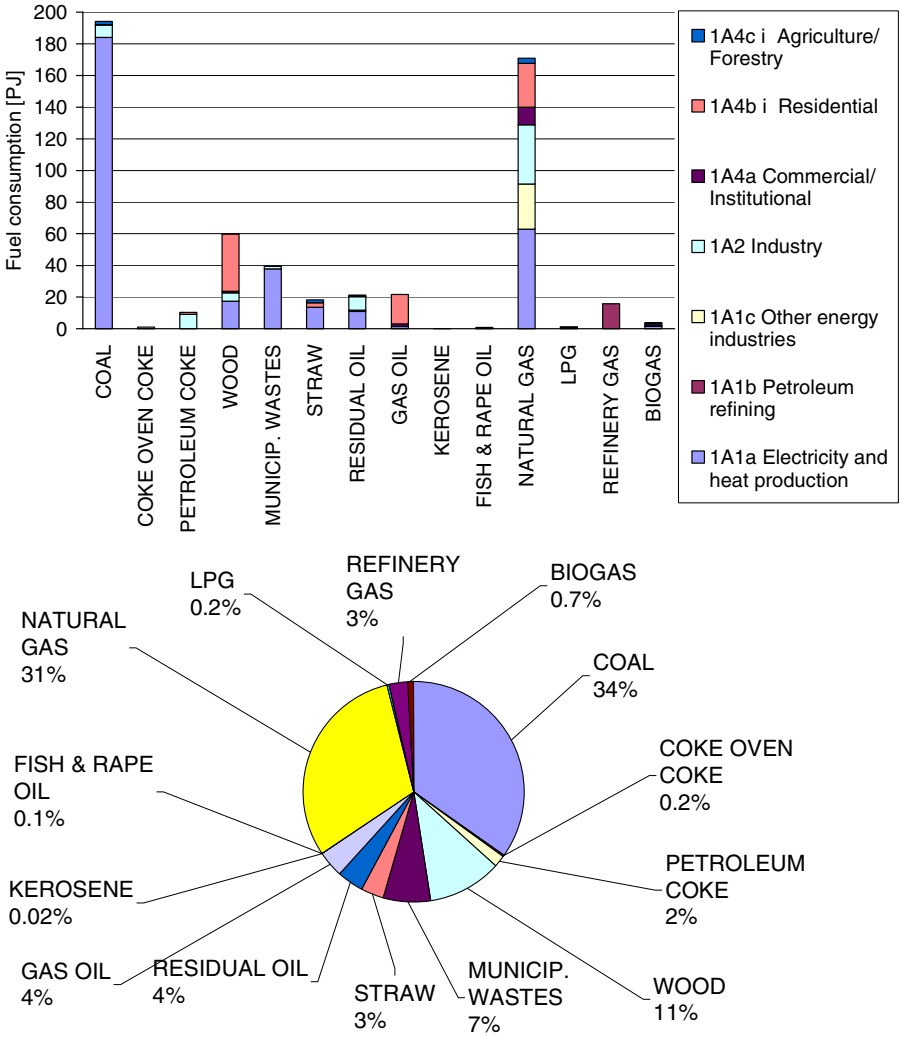


Figure 2 Fuel consumption of stationary combustion 2007, disaggregated to fuel type (based on DEA, 2008a).

Fuel consumption time-series for stationary combustion plants are presented in Figure 3[4]. The fuel consumption for stationary combustion was 12 % higher in 2007 than in 1990, while the fossil fuel consumption was 2 % lower and the biomass fuel consumption 163 % higher than in 1990.

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

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

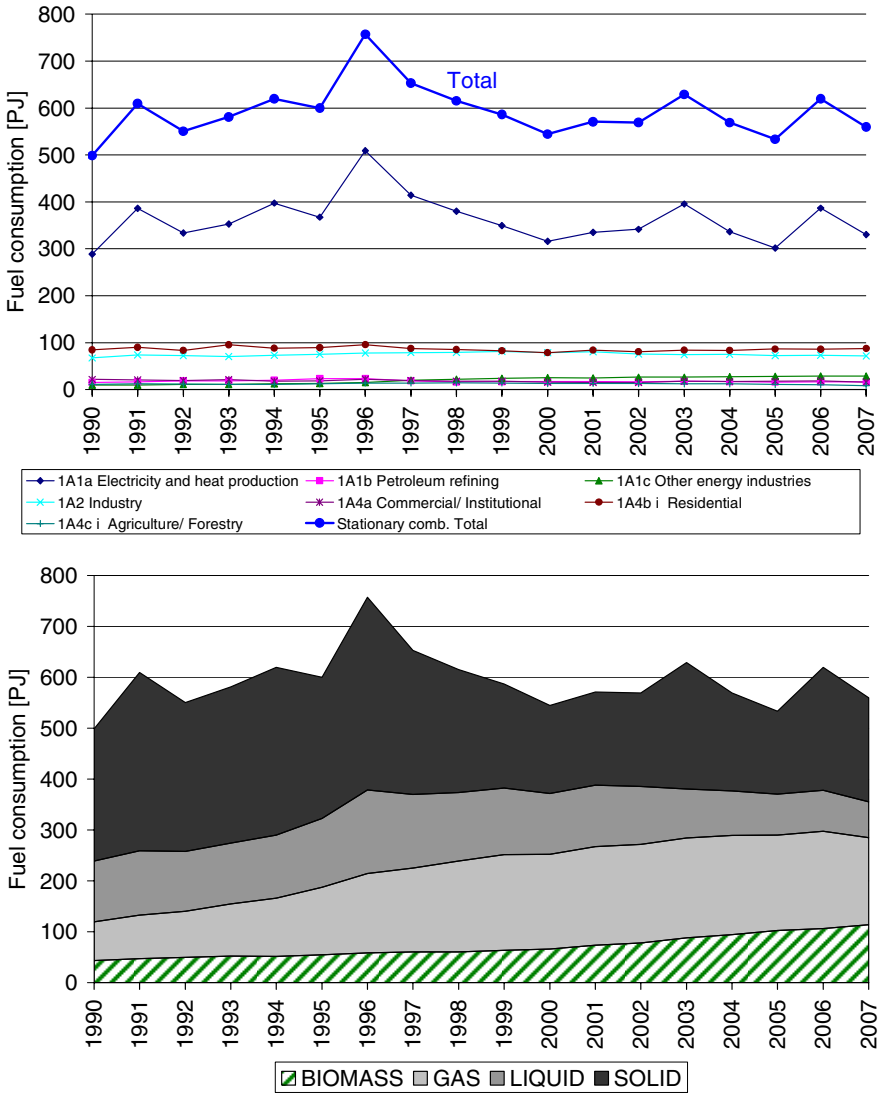
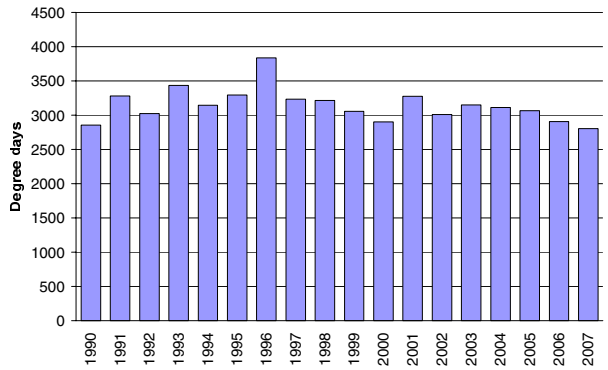


Figure 3 Fuel consumption time-series, stationary combustion (based on DEA, 2008a).

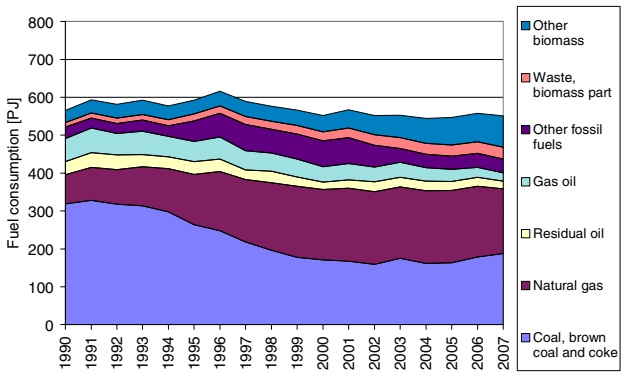
The fluctuations in the time-series for fuel consumption are mainly a result of electricity import/export, but also of outdoor temperature variations from year to year. This, in turn, leads to fluctuations in emission levels. The fluctuations in electricity trade, fuel consumption, CO_2 and NO_x emission 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 2007 the net electricity export was 3420 TJ, which is a lower export rate than in 2006. The large electricity export that occurs some years is a result of low rainfall in Norway and Sweden causing insufficient hydropower production in both countries.

To be able to follow the national energy consumption as well as for statistical and reporting purposes, the Danish Energy Agency produces a correction of the actual fuel consumption 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.

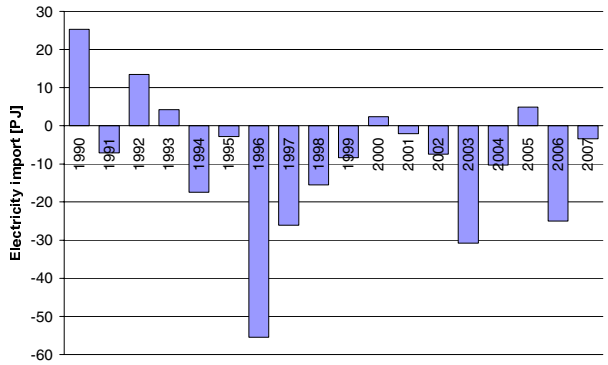
Degree days



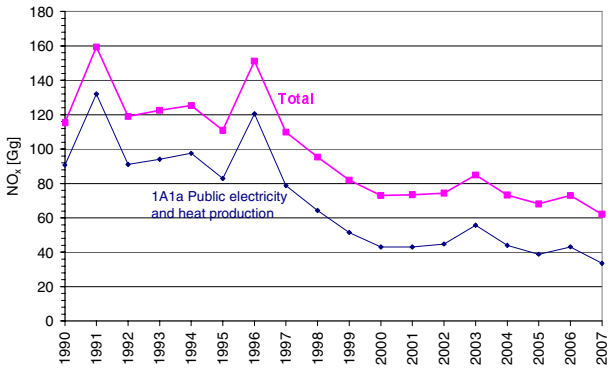
Fuel consumption adjusted for electricity trade



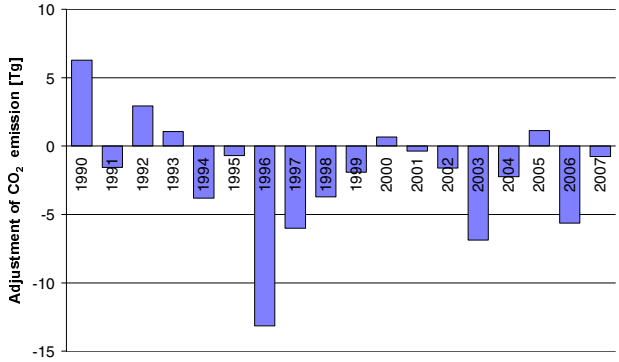
Electricity trade



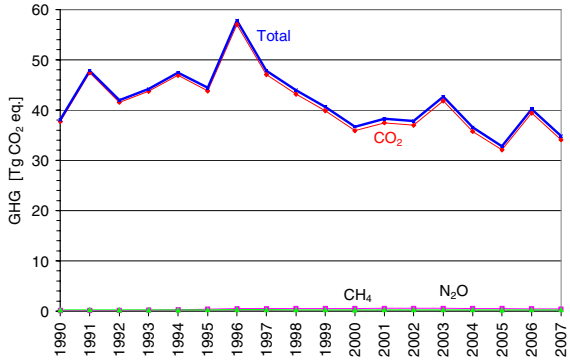
NO_x emission



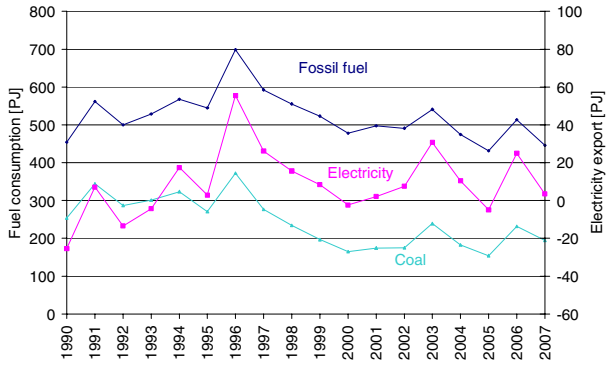
CO_2 emission adjustment as a result of electricity trade



GHG emission



Fluctuations in electricity trade compared to fuel consumption



Adjusted GHG emission, stationary combustion plants

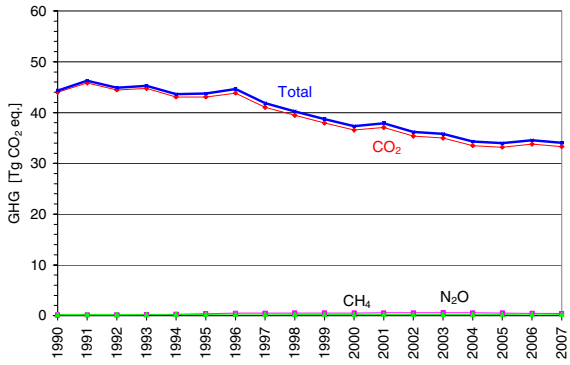


Figure 4 Comparison of time-series fluctuations for electricity trade, fuel consumption and NO_x emission (DEA 2008b).

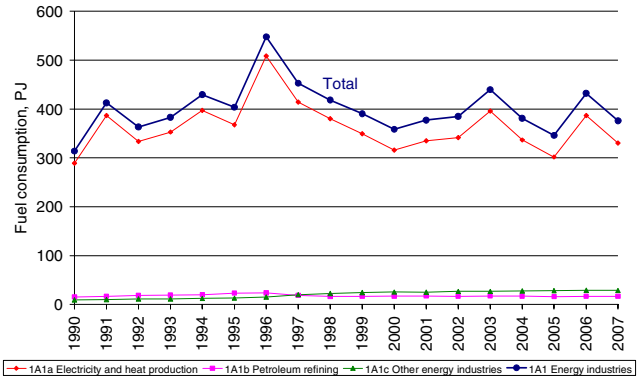
Fuel consumption time-series for the subcategories to stationary combustion are shown in Figure 5a, b and c.

Fuel consumption for *Energy Industries* fluctuates due to electricity trade as discussed above. The fuel consumption in 2007 was 20 % 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* 2007 added up to 63 PJ, which is 3.4 times the level in 1990.

The fuel consumption in *Industry* has increased 7 % since 1990 (Figure 5b). However, in recent years the fuel consumption seems to be slowly decreasing. The biomass fuel consumption in *Industry* in 2007 added up to 7 PJ which is a 19 % increase since 1990.

The fuel consumption in *Other Sectors* decreased 5 % since 1990 (Figure 5c). The biomass part of the fuel consumption has increased from 16 % in 1990 to 39 % in 2007. Wood consumption in residential plants in 2007 was 2.5 times the consumption in year 2000.

Time-series for subcategories are shown in Chapter 11.



Fuel category

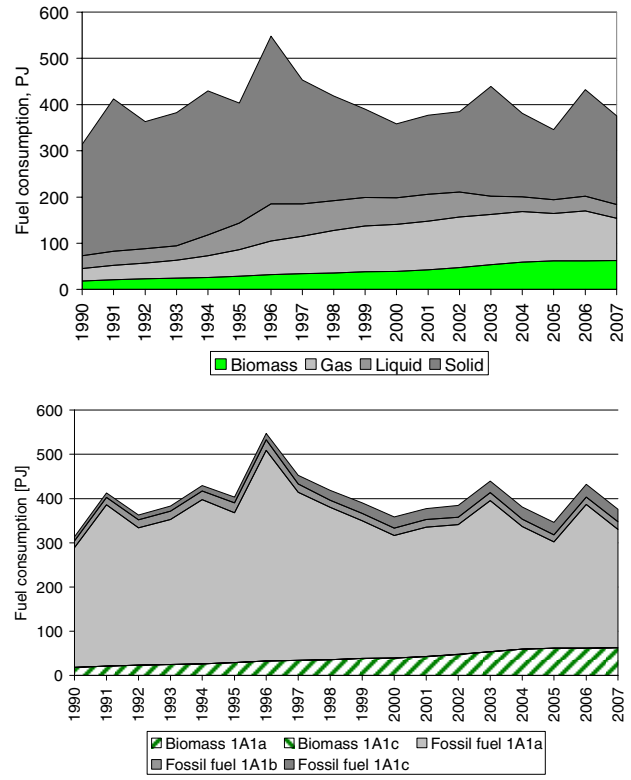
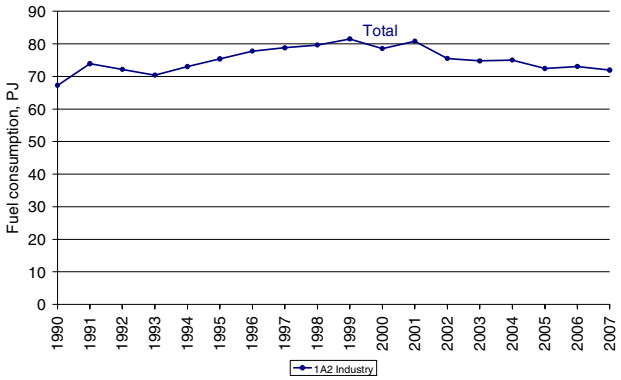
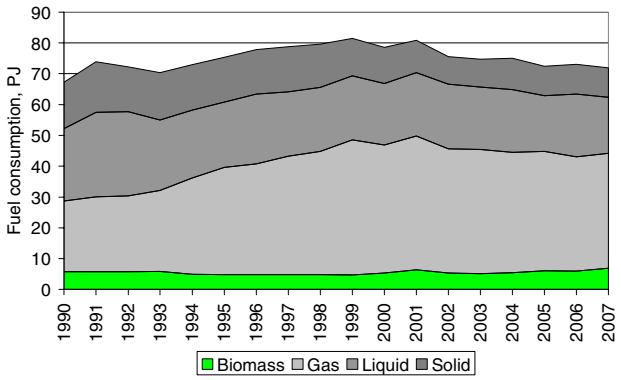


Figure 5a Fuel consumption time-series for subcategories - 1A1 Energy Industries.



Fuel category



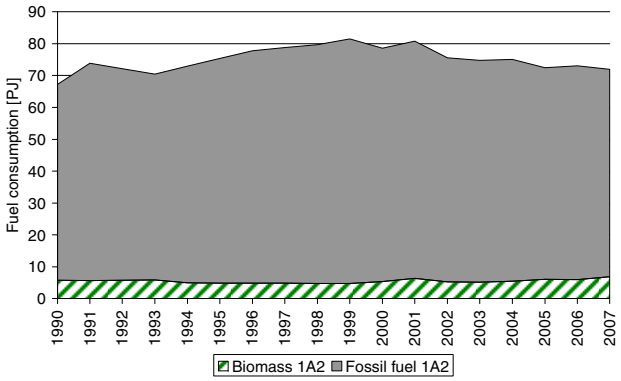
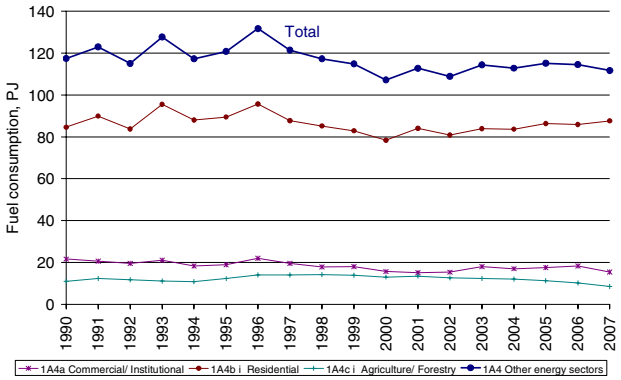
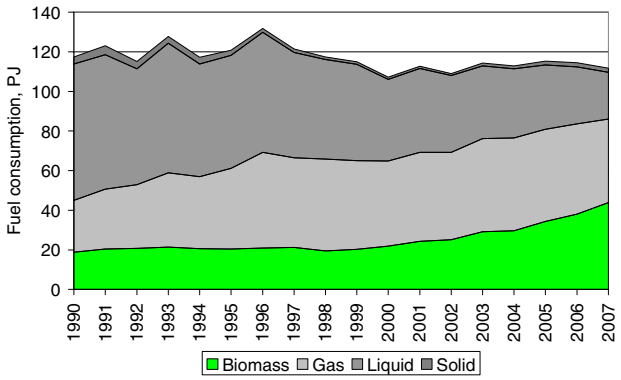


Figure 5b Fuel consumption time-series for subcategories - 1A2 Industry.



Fuel category



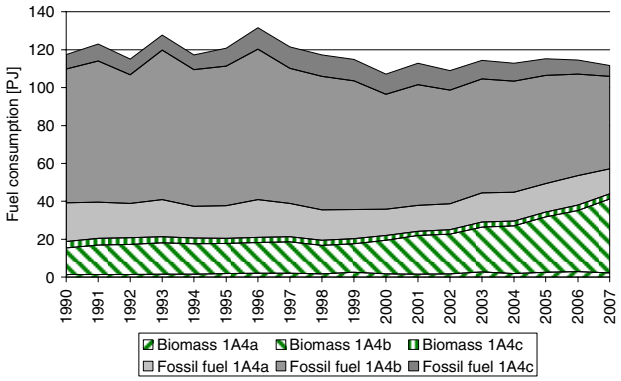


Figure 5c Fuel consumption time-series for subcategories - 1A4 Other Sectors.

4 Greenhouse gas emission

The national greenhouse gas (GHG) emission in the year 2007 was 64,498 Gg CO_2 equivalent including land-use change and forestry or 66,641 Gg CO_2 equivalent excluding land-use change and forestry. 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 6. The emission from stationary combustion accounted for 52 % of the national GHG emission (excluding Land-Use, Land-Use Change and Forestry (LULUCF)) in 2007.

The CO_2 emission from stationary combustion plants accounts for 64 % of the national CO_2 emission (not including land-use change and forestry). 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 6 Greenhouse gas emission, 2007 [1].

	CO_2	CH_4	N_2O
	Gg CO_2 equivalent		
1A1 Fuel Combustion, Energy industries	25 132	193	150
1A2 Fuel Combustion, Manufacturing Industries and Construction[1]	4 609	19	45
1A4 Fuel Combustion, Other sectors [1]	4 351	220	83
Emission from stationary combustion plants	34 082	433	278
National emission (excluding LULUCF)	53 228	5 748	6 780
		%	
Emission share for stationary combustion	64 %	8 %	4 %

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

CO_2 is the most important GHG pollutant accounting for 98.0 % of the GHG emission (CO_2 eq.) from stationary combustion. CH_4 accounts for 1.2 % and N_2O for 0.8 % of the GHG emission (CO_2 eq.) from stationary combustion (Figure 6).

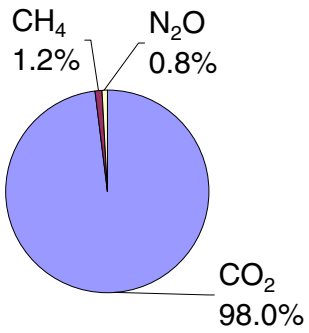


Figure 6 Stationary combustion - GHG emission (CO_2 equivalent), contribution from each pollutant.

Figure 7 depicts the time-series of GHG emission (CO_2 eq.) 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 2007 than in 1990, CO_2 by 10 % and GHG by 9 %. However, fluctuations in the GHG emission level are large.

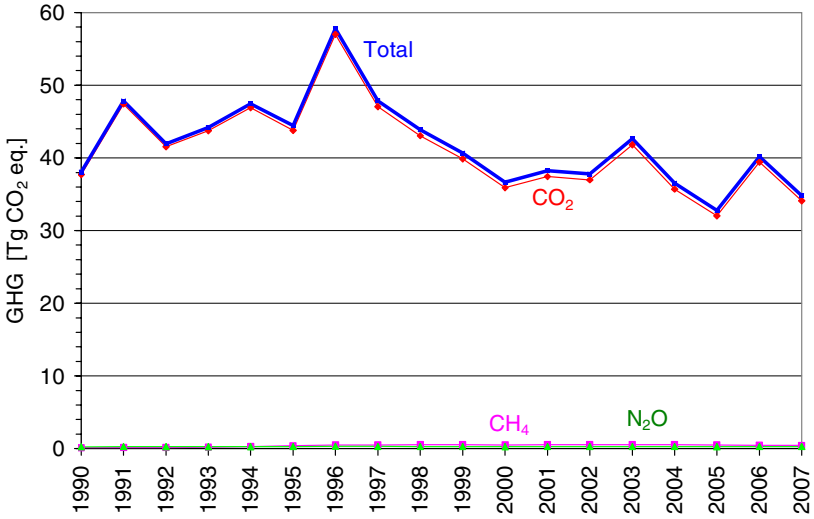


Figure 7 GHG emission time-series for stationary combustion.

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 22 % since 1990, and the CO_2 emission by 23 %. These data are included here to explain the fluctuations in the emission time-series.

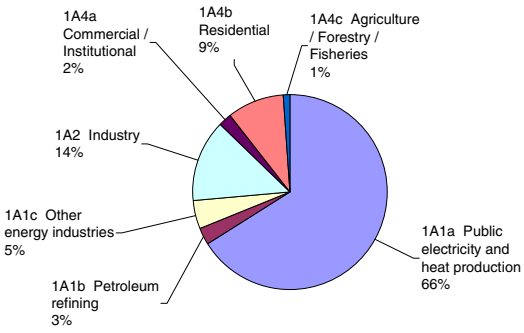
4.1 CO_2

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 64 % of the national CO_2 emission. Table 7 lists the CO_2 emission inventory for sta-

tionary combustion plants for 2007. *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 59 % (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 7 CO_2 emission from stationary combustion plants, 2007[1)].

CO_2		2007 Gg
1A1a	Public electricity and heat production	22 545
1A1b	Petroleum refining	970
1A1c	Other energy industries	1 617
1A2	Industry	4 599
1A4a	Commercial/Institutional	790
1A4b	Residential	3 136
1A4c	Agriculture/Forestry/Fisheries	425
Total		34 082

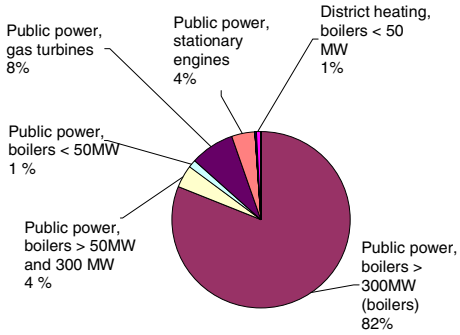


[1)] Only emission from stationary combustion plants in the categories is included.

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 8. The largest subcategory is power plant boilers >300MW.

Table 8 CO_2 emission from subcategories to 1A1a Electricity and heat production.

Sub-category ID (SNAP)	Subcategory name	2007 Gg
0101	Public power	
010100	Public power	2
010101	Combustion plants ≥ 300MW (boilers)	18 313
010102	Combustion plants ≥ 50MW and < 300 MW (boilers)	909
010103	Combustion plants <50 MW (boilers)	331
010104	Gas turbines	1 803
010105	Stationary engines	928
0102	District heating plants	
010200	District heating plants	
010201	Combustion plants ≥ 300MW (boilers)	2
010202	Combustion plants ≥ 50MW and < 300 MW (boilers)	43
010203	Combustion plants <50 MW (boilers)	197
010204	Gas turbines	1
010205	Stationary engines	17



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 2007 the CO_2 emission from biomass combustion was 12 078 Gg.

In Figure 8 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 oil and gas, the CO_2 emission share from coal combustion is higher than the fuel consumption share. Coal ac-

counts for 44 % of the fossil fuel consumption and for 54 % of the CO_2 emission. Natural gas accounts for 38 % of the fossil fuel consumption but only 28 % of the CO_2 emission.

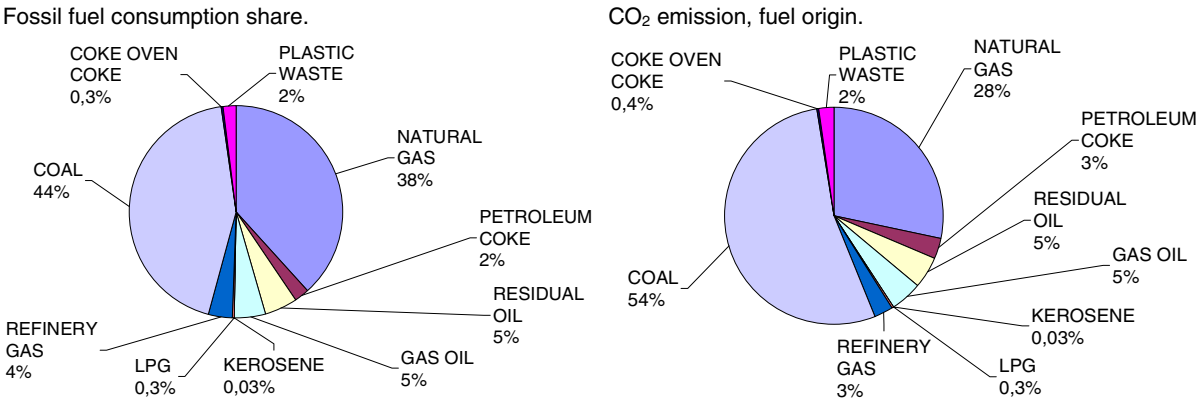


Figure 8 CO_2 emission, fuel origin.

Time-series for CO_2 emission are provided in Figure 9. Despite an increase in fuel consumption of 12 % since 1990 CO_2 emission from stationary combustion has decreased by 10 % 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 9) and in coal consumption (Figure 4). The fluctuations are a result of electricity import/export as discussed in Chapter 3.

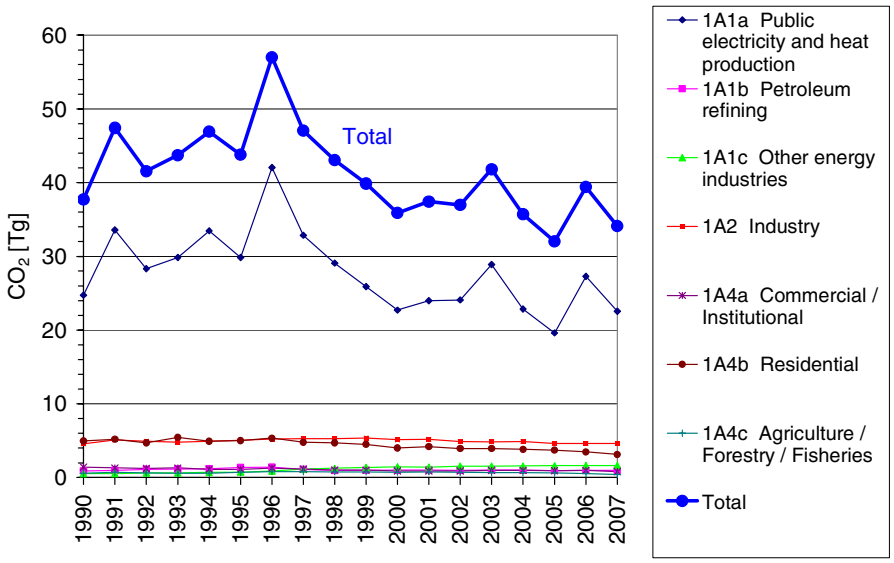


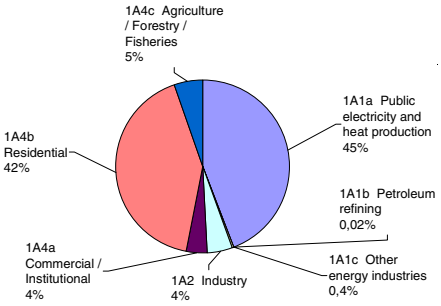
Figure 9 CO_2 emission time-series for stationary combustion plants.

4.2 CH_4

The methane (CH_4) emission from stationary combustion plants accounts for 8 % of the national CH_4 emission. Table 9 lists the CH_4 emission inventory for stationary combustion plants in 2007. *Electricity and heat production* accounts for 44 % 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 9 CH_4 emission from stationary combustion plants, 2007[1)].

CH_4	2007 Mg
1A1a Public electricity and heat production	9 101
1A1b Petroleum refining	3
1A1c Other energy industries	78
1A2 Industry	927
1A4a Commercial/Institutional	794
1A4b Residential	8 594
1A4c Agriculture/Forestry/Fisheries	1 105
Total	20 603



[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 13.7.3. A considerable number of lean-burn gas engines are in operation in Denmark and in 2007 these plants accounted for 50 % of the CH_4 emission from stationary combustion plants (Figure 10). Most engines are installed in CHP plants and the fuel used is either natural gas or biogas.

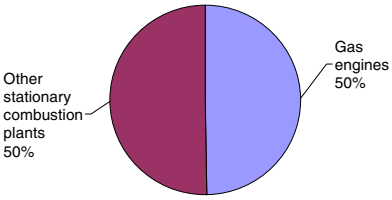


Figure 10 Gas engine CH_4 emission share, 2007.

Figure 11 shows the time-series for CH_4 emission. The CH_4 emission from stationary combustion has increased by a factor of 3.6 since 1990. This results from the considerable number of lean-burn gas engines installed in CHP plants in Denmark during the 1990s. Figure 12 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 (2007).

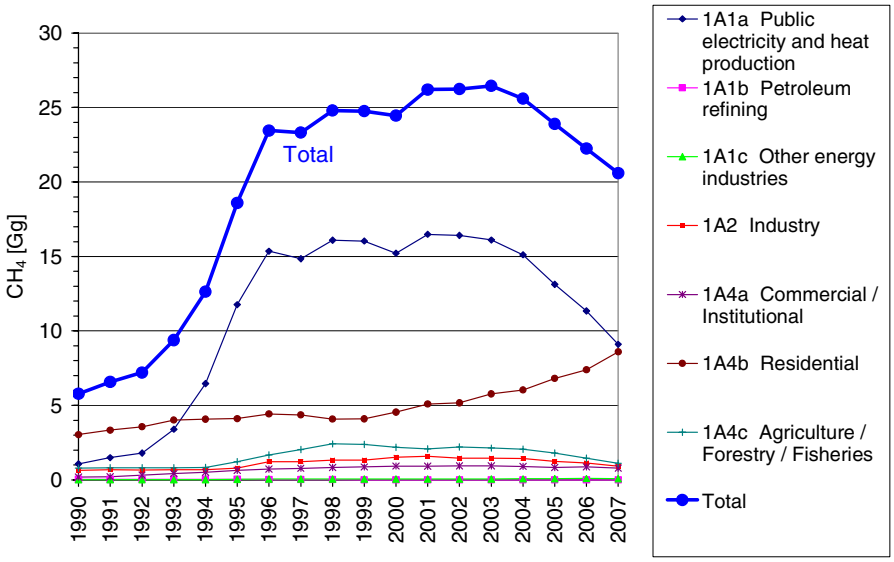


Figure 11 CH_4 emission time-series for stationary combustion plants.

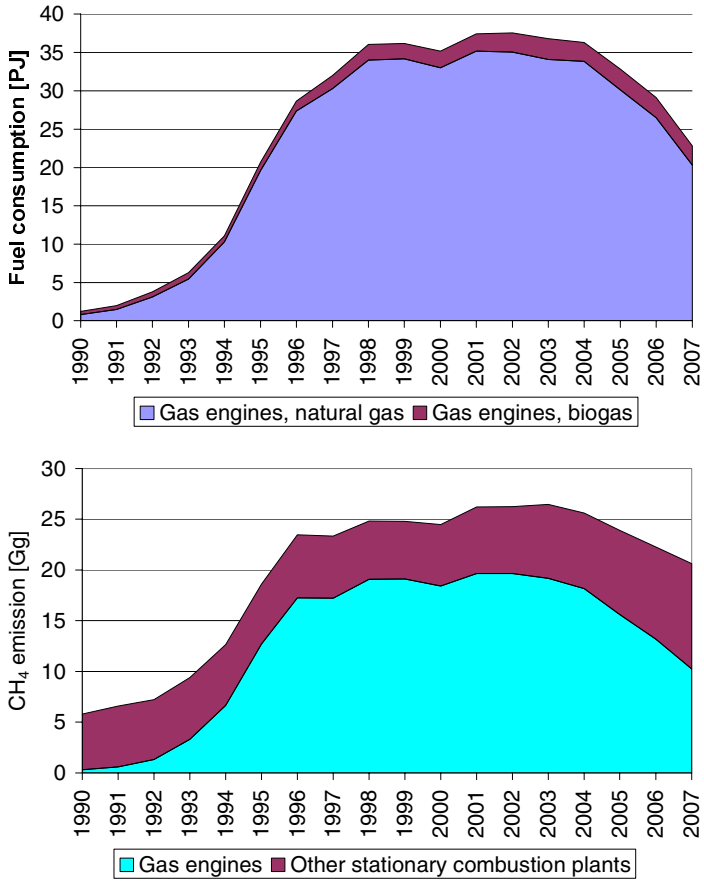


Figure 12 Fuel consumption and CH_4 emission from gas engines, time-series.

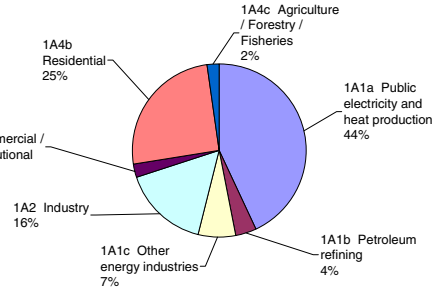
4.3 N_2O

The nitrous oxide (N_2O) emission from stationary combustion plants accounts for 4 % of the national N_2O emission. Table 10 lists the N_2O emission inventory for stationary combustion plants in the year 2007. *Electricity and heat production* accounts for 43 % of the N_2O emission from stationary combustion.

Table 10 N_2O emission from stationary combustion plants, 2007[1)].

N_2O

	2007 Mg
1A1a Public electricity and heat production	387
1A1b Petroleum refining	34
1A1c Other energy industries	62
1A2 Industry	144
1A4a Commercial/Institutional	22
1A4b Residential	227
1A4c Agriculture/Forestry/Fisheries	20
Total	897



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

Figure 13 shows time-series for N_2O emission. The N_2O emission from stationary combustion has increased by 16 % from 1990 to 2007, but again fluctuations in emission level due to electricity import/export are considerable.

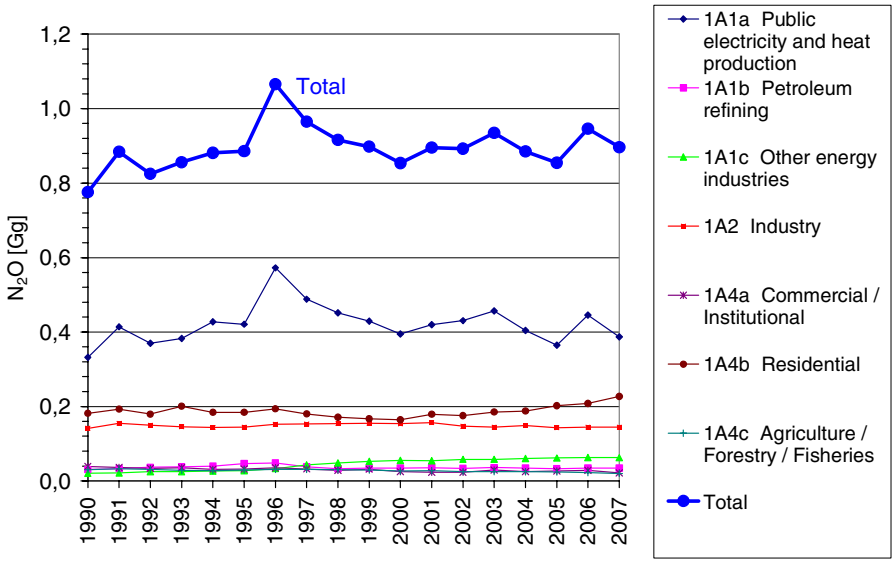


Figure 13 N_2O emission time-series for stationary combustion plants.

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 2007 are presented in Table 11. 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 reporting to the National Emissions Ceiling Directive (NECD). NECD reporting includes NH_3, however, until now NH_3 emissions have not been estimated for stationary combustion plants.

SO_2 from stationary combustion plants accounts for 88 % of the national emission. NO_x, CO and NMVOC account for 37 %, 38 % and 25 % of national emissions, respectively.

Table 11 SO_2, NO_x, NMVOC and CO emission, 2007[1].

Pollutant	NO_x	CO	NMVOC	SO_2
	Gg	Gg	Gg	Gg
1A1 Fuel consumption, Energy industries	42.5	9.3	2.7	9.1
1A2 Fuel consumption, Manufacturing Industries and Construction (Stationary combustion)	11.1	13.6	0.6	7.2
1A4 Fuel consumption, Other sectors (Stationary combustion)	8.5	147.6	23.1	4.4
Emission from stationary combustion plants	62.1	170.5	26.4	20.6
National emission	166.7	448.1	104.4	23.3
		%		
Emission share for stationary combustion	37	38	25	88

[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 88 % of the national emission. Table 12 presents the SO_2 emission inventory for the stationary combustion subcategories.

Electricity and heat production is the largest emission source accounting for 42 % of the emission. However, the SO_2 emission share is lower than the fuel consumption share for this source category, which is 59 %. 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 14 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 79 % of the emission.

The SO_2 emission from industrial plants is 35 %, 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 com-

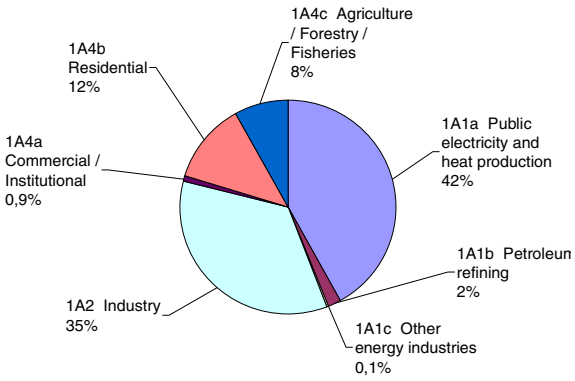
bustion, but as a result of reduced emissions from power plants the share has now increased.

The fuel origin of the SO_2 emission is shown in Figure 15. Disaggregation of total emissions from point sources using several fuels is based on emission factors. Coal accounts for 43 % of the SO_2 emission, residual oil for 25 % and petroleum coke for 9 %. The emission from residual oil and petroleum coke is remarkable compared to fuel consumption share. The emission factor for residual oil combusted in industrial plants is uncertain because knowledge of the applied flue gas cleaning technology in industrial plants is limited.

Time-series for SO_2 emission from stationary combustion are shown in Figure 16. The SO_2 emission from stationary combustion plants has decreased by 95 % since 1980 and 87 % since 1990. The large emission decrease is mainly a result of the reduced emission from *Electricity and heat production*, made possible due to installation of desulphurisation plants and due to the use of fuels with lower sulphur content. Despite the considerable reduction in emission from electricity and heat production plants, these still account for 42 % of the emission from stationary combustion, as mentioned above. The emission from other source categories also decreased considerably since 1980. Time-series for subcategories are shown in Chapter 11.

Table 12 SO_2 emission from stationary combustion plants, 2007[1)].

SO_2		2007 MG
1A1a	Public electricity and heat production	8 641
1A1b	Petroleum refining	423
1A1c	Other energy industries	10
1A2	Industry	7 157
1A4a	Commercial/Institutional	183
1A4b	Residential	2 509
1A4c	Agriculture/Forestry/Fisheries	1 680
Total		20 604



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

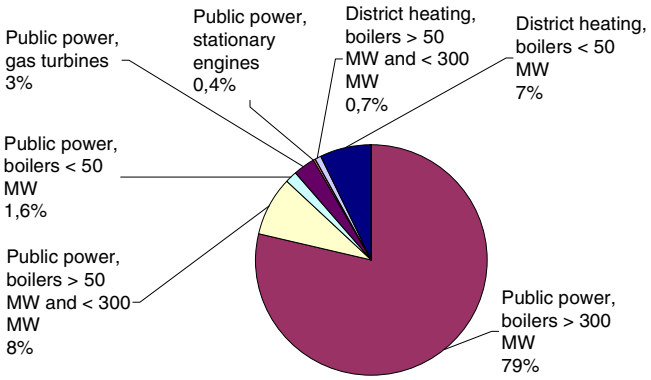
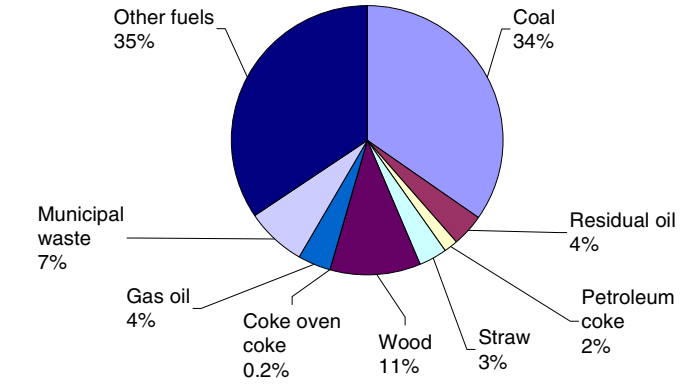


Figure 14 Disaggregated SO_2 emissions from 1A1a Energy and heat production.

Fuel consumption



SO_2 emission, fuel origin

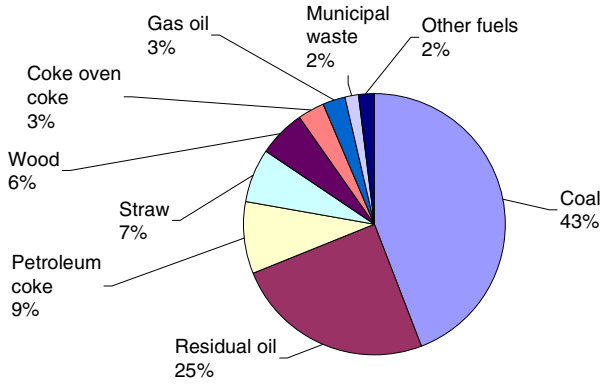


Figure 15 Fuel origin of the SO_2 emission from stationary combustion plants.

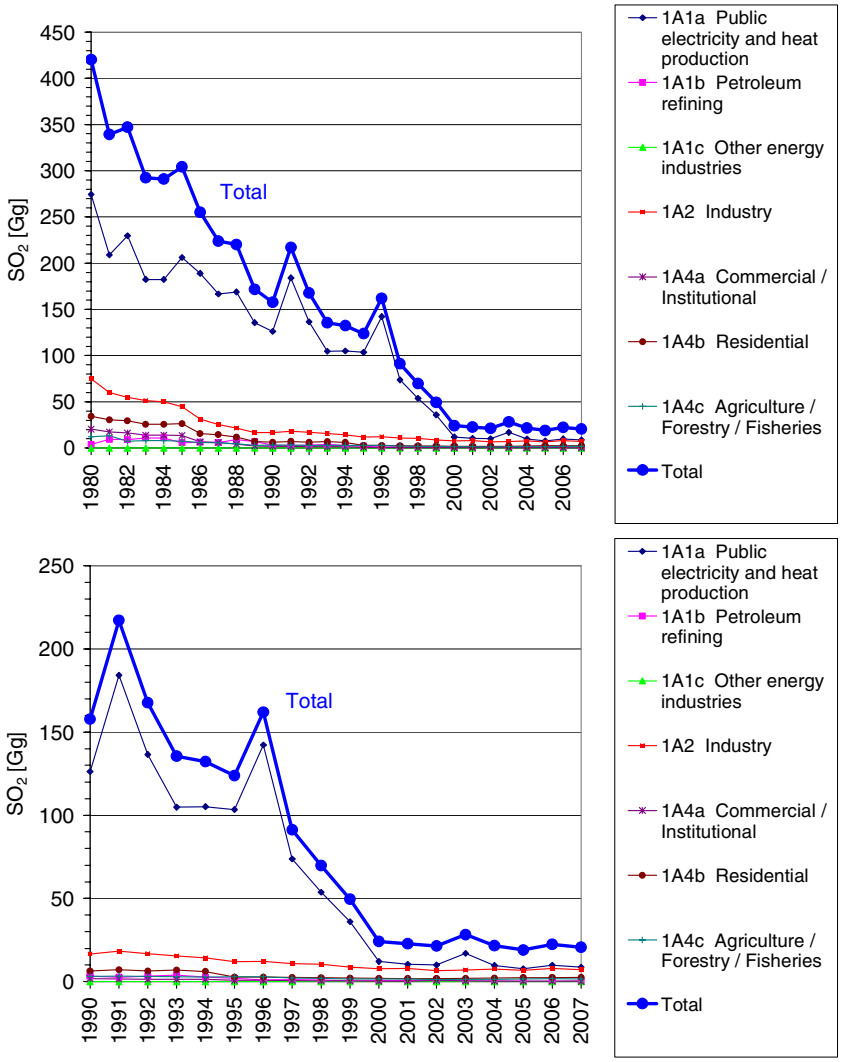


Figure 16 SO_2 emission time-series for stationary combustion.

5.2 NO_x

Stationary combustion accounts for 37 % of the national NO_x emission. Table 13 shows the NO_x emission inventory for stationary combustion subcategories.

Electricity and heat production is the largest emission source accounting for 54 % of the emission from stationary combustion plants. The emission from public power boilers > 300 MW_{th} accounts for 61 % of the emission in this subcategory.

Industrial combustion plants are also an important emission source accounting for 18 % of the emission. The main industrial emission source is cement production, which accounts for 64 % of the emission.

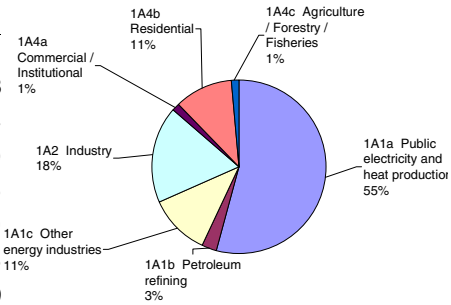
Residential plants account for 11 % of the NO_x emission. The fuel origin of this emission is mainly wood, gas oil and natural gas accounting for 65 %, 15 % and 15 % of the residential plant emission, respectively.

Figure 17 shows fuel origin of the NO_x emission. For both coal, natural gas and wood the emission share is close to the fuel consumption share.

Time-series for NO_x emission from stationary combustion are shown in Figure 18. NO_x emission from stationary combustion plants has decreased by 58 % since 1985 and 46 % since 1990. The reduced emission is largely a result of the reduced emission from electricity and heat production due to installation of low NO_x burners, selective catalytic reduction (SCR) units and selective non-catalytic reduction (SNCR) units. The fluctuations in the time-series follow the fluctuations in electricity and heat production, which, in turn, result from electricity trade fluctuations.

Table 13 NO_x emission from stationary combustion plants, 2007[1)].

	2007 MG
1A1a Public electricity and heat production	33 608
1A1b Petroleum refining	1 754
1A1c Other energy industries	7 120
1A2 Industry	11 136
1A4a Commercial/Institutional	919
1A4b Residential	6 653
1A4c Agriculture/Forestry/Fisheries	909
Total	62 100



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

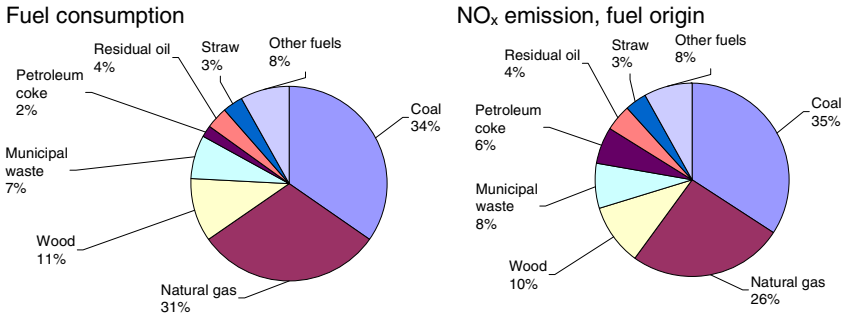


Figure 17 NO_x emissions, fuel origin.

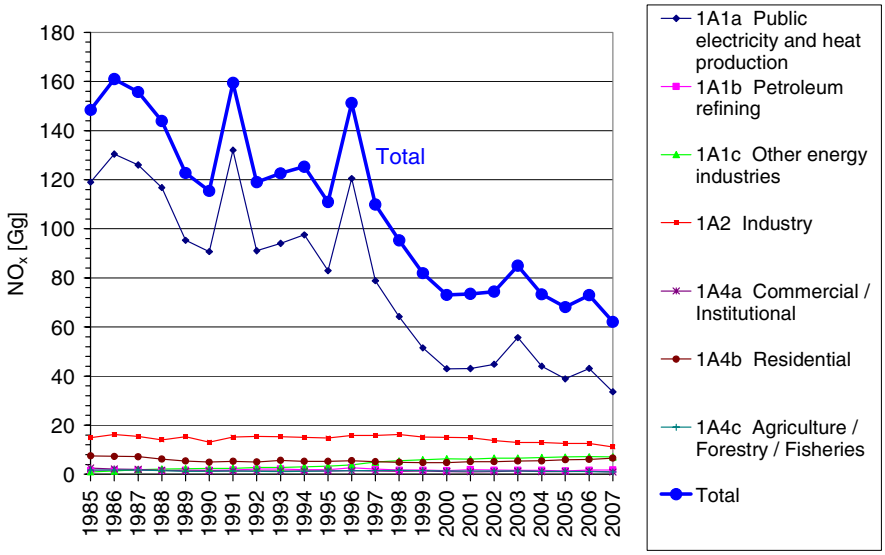


Figure 18 NO_x emission time-series for stationary combustion.

5.3 NMVOC

Stationary combustion plants account for 25 % of the national NMVOC emission. Table 14 presents the NMVOC emission inventory for the stationary combustion subcategories.

Residential plants are the largest emission source accounting for 79 % 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 10 % 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.

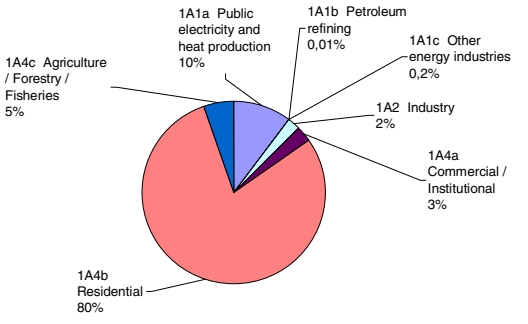
Time-series for NMVOC emission from stationary combustion are shown in Figure 20. The emission has increased by 104 % from 1985 and 109 % from 1990. The increased emission is mainly a result of the increasing wood consumption in residential plants and of the increased use of lean-burn gas engines in CHP plants as discussed in Chapter 13.7.3.

The emission from residential plants in 2007 was 2.1 times the 1990 level. The NMVOC emission from wood combustion in 2007 was 3.1 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 (43 %) over this period due to 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.

Table 14 NMVOC emission from stationary combustion plants, 2007[1)].

	2007 Mg
1A1a Public electricity and heat production	2 698
1A1b Petroleum refining	3
1A1c Other energy industries	42
1A2 Industry	571
1A4a Commercial/Institutional	732
1A4b Residential	20 957
1A4c Agriculture/Forestry/Fisheries	1 379
Total	26 382



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

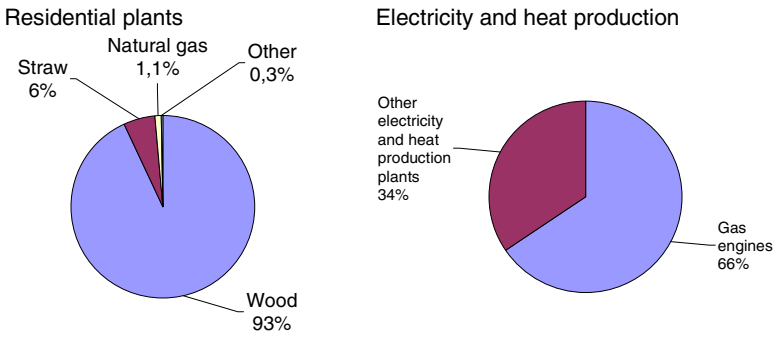


Figure 19 NMVOC emission from Residential plants and from Electricity and heat production, 2007.

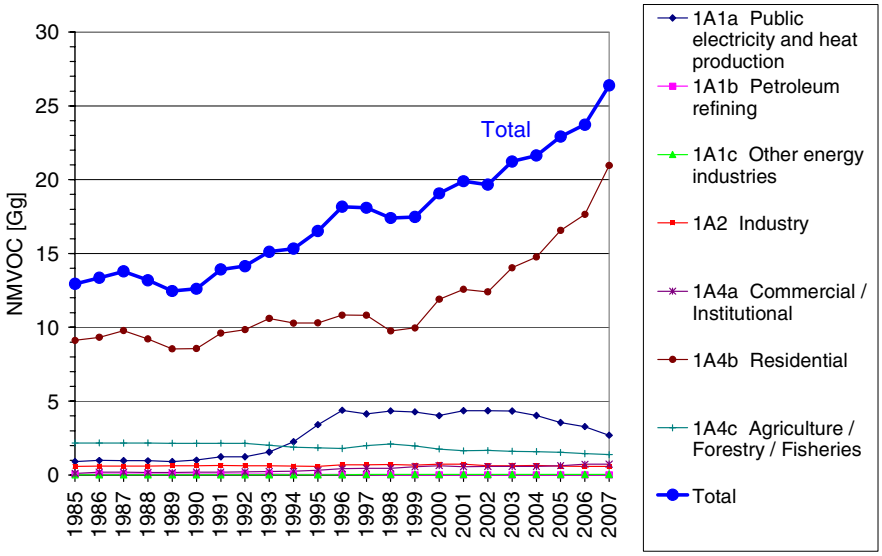


Figure 20 NMVOC emission time-series for stationary combustion.

5.4 CO

Stationary combustion accounts for 38 % of the national CO emission. Table 15 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 90 % 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.

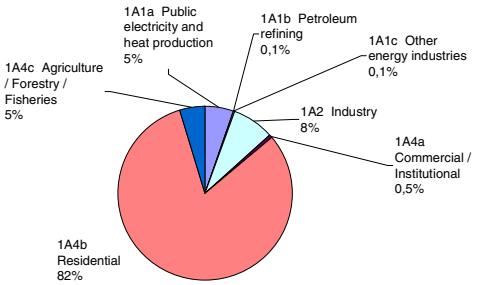
Time-series for CO emission from stationary combustion are shown in Figure 22. The emission has increased by 27 % from 1985 and 22 % from 1990. The time-series for CO from stationary combustion plants follows the time-series for CO emission from residential plants.

The consumption of wood in residential plants in 2007 was 4.1 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 2007 to be only 3.2 times the 1990 level. Both straw

consumption and CO emission factor for residential plants have decreased since 1990.

Table 15 CO emission from stationary combustion plants, 2007[1)].

	2007 Mg
1A1a Public electricity and heat production	8 854
1A1b Petroleum refining	225
1A1c Other energy industries	211
1A2 Industry	13 574
1A4a Commercial/Institutional	846
1A4b Residential	138 661
1A4c Agriculture/Forestry/Fisheries	8 096
Total	170 467



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

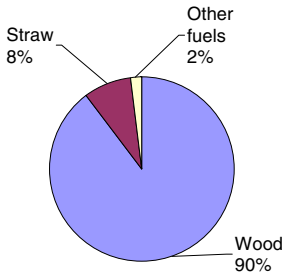


Figure 21 CO emission sources, residential plants, 2007.

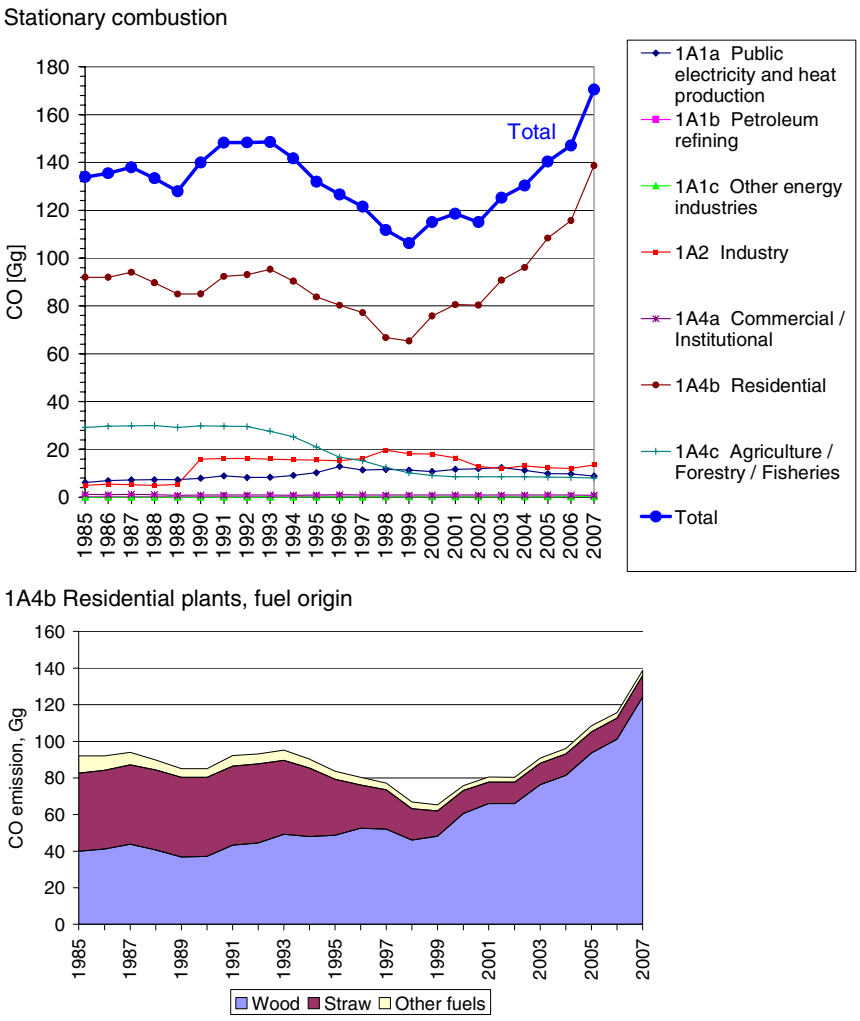


Figure 22 CO emission time-series for stationary combustion.

6 Particulate matter (PM)

The emission 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 2007 is presented in Table 16. The particulate matter (PM) emission is 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 61 % and 75 %, respectively.

Table 16 PM emissions, 2007[1)].

Pollutant	TSP	PM_{10}	$PM_{2.5}$
	Mg	Mg	Mg
1A1 Fuel combustion, Energy industries	1 124	894	742
1A2 Fuel combustion, Manufacturing Industries and Construction (Stationary combustion)[1)]	917	629	361
1A4 Fuel combustion, Other sectors (Stationary combustion)[1)]	26 278	24 887	23 544
Emission from stationary combustion plants	28 319	26 410	24 648
National emission	52 299	43 431	32 746
Emission share for stationary combustion (%)	54	61	75

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

Table 17 and Figure 23 show the PM emission inventory for the stationary combustion subcategories. Residential plants are the largest emission source accounting for 93 % 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 90 % of the $PM_{2.5}$ emission from stationary combustion is emitted from residential wood combustion. This corresponds to 68 % of the national emission. A literature review (Nielsen et al., 2003) and a Nordic Project (Sternhufvud et al., 2007) has demonstrated that the emission factor uncertainty for residential combustion of wood in stoves and boilers is extremely high.

Figure 24 shows the fuel consumption and the $PM_{2.5}$ emission of residential plants. Wood combustion accounts for 97 % of the $PM_{2.5}$ emission from residential plants in spite of a wood consumption share of 42 %.

Emission inventories for PM have only been reported for the years 2000-2007. Time-series for PM emission from stationary combustion are shown in Figure 25. The emission of TSP, PM_{10} and $PM_{2.5}$ has increased

68 %, 69 % and 71 %, respectively, since year 2000. The increase is caused by the increased wood combustion in residential plants. However, the PM emission factors has decreased for this emission source category due to installation of modern stoves and boilers. The time-series for PM emission from stationary combustion plants follows the time-series for PM emission from residential plants.

Table 17 PM emission from stationary combustion plants, 2007[1)].

		TSP Mg	PM_{10} Mg	$PM_{2.5}$ Mg
1A1a	Public electricity and heat production	1 000	779	632
1A1b	Petroleum refining	121	113	108
1A1c	Other energy industries	3	2	1
1A2	Industry	917	629	361
1A4a	Commercial/Institutional	162	160	150
1A4b	Residential	25 604	24 253	22 954
1A4c	Agriculture/Forestry/Fisheries	512	475	440
Total		28 319	26 410	24 648

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

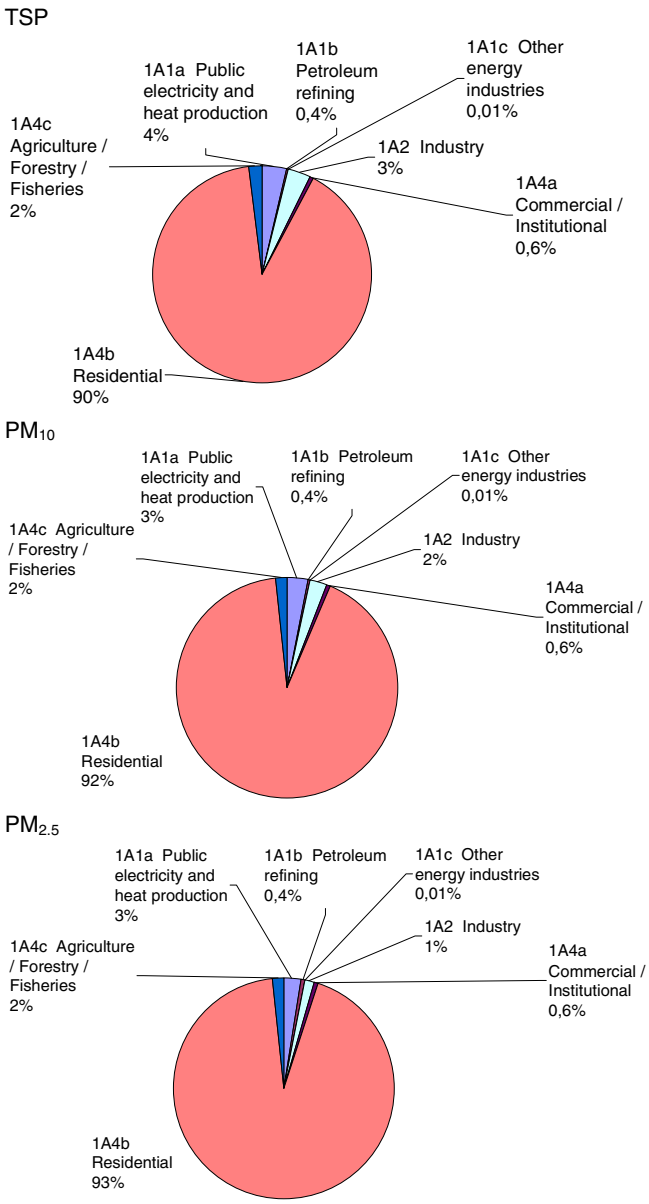


Figure 23 PM emission sources, stationary combustion plants, 2007.

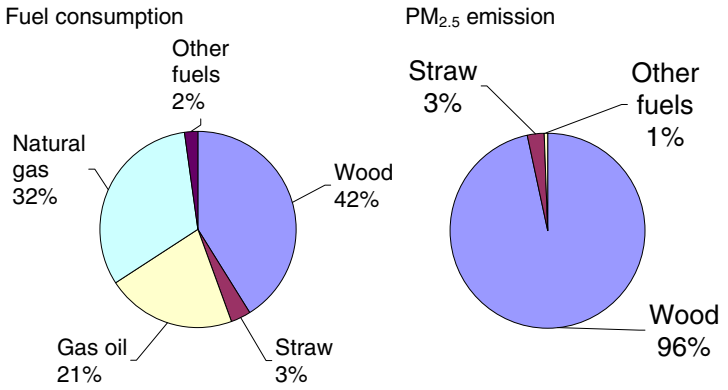


Figure 24 Fuel consumption and $PM_{2.5}$ emission from residential plants.

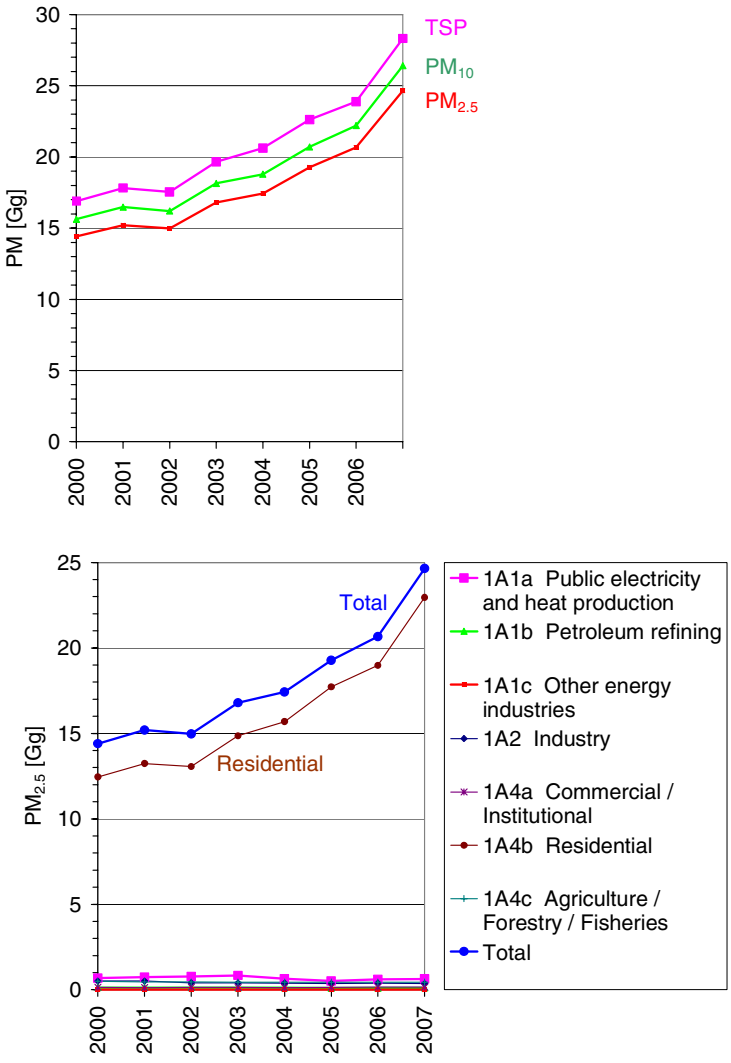


Figure 25 PM emission time-series for stationary combustion.

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 2007 emissions are presented in Table 18.

Stationary combustion plants are the most important emission sources for heavy metals. For Cu the emission share from stationary combustion plants is 12 %, but for all other heavy metals the emission share is more than 75 %, see Table 18.

Table 18 The emission of heavy metals, 2007.

Pollutant	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
1A1 Fuel combustion, Energy industries	3.57	0.25	0.49	0.36	0.66	0.73	2.33	1.24	15.55
1A2 Fuel combustion, Manufacturing Industries and Construction (Stationary combustion)	0.81	0.17	0.25	0.20	0.37	0.18	4.95	0.54	1.35
1A4 Fuel combustion, Other sectors (Stationary combustion)	0.23	0.27	0.32	0.05	0.06	0.30	0.62	0.11	5.39
Emission from stationary combustion plants	4.61	0.69	1.06	0.61	1.09	1.22	7.90	1.89	22.29
National emission	6.17	0.75	1.12	0.63	1.36	9.99	8.72	1.99	28.18
Emission share for stationary combustion, in %	75	92	95	97	80	12	91	95	79

Table 19 and Figure 26 present the heavy metal emission inventory for the stationary combustion subcategories. The source categories *Electricity and heat production* and *Industry* have the highest emission shares. *Electricity and heat production* accounts for 77 %, 34 % and 45 % of the emission of the priority metals Pb, Cd and Hg, respectively. Residential plants accounts for 37 % of the Cd emission. More than 97 % of the Cd emission from residential plants originates from wood combustion[5].

[5] The applied emission factor for Cd is 6.8 mg/GJ. This is a considerably higher emission factor than suggested in the 2007 EMEP/CORINAIR Emission inventory Guidebook (EEA 2007) which is 1.4 mg/GJ. HM emission factors from the Guidebook (EEA 2007) might be applied for residential wood combustion in future inventoies.

Table 19 Heavy metal emission from stationary combustion plants, 2007[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	348	236	633	723	482	1 802	3 546	1 232	15 547
1A1b	Petroleum refining	12	11	27	11	4	528	19	10	2
1A1c	Other energy industries	0	0	0	0	0	0	0	0	0
1A2	Industry	202	169	371	180	254	4 951	812	538	1351
1A4a	Commercial/Institutional	6	11	10	13	12	152	14	11	176
1A4b	Residential	26	252	23	275	289	27	184	88	5167
1A4c	Agriculture/Forestry/Fisheries	16	11	28	18	20	442	35	9	51
Total		610	689	1 092	1 218	1 061	7 902	4 609	1 889	22 294

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

Table 20 presents the emission share for municipal waste incineration plants.

Table 20 Heavy metal emission share for municipal waste incineration plants, 2007.

Pollutant	Emission share, %
As	30
Cd	25
Cr	37
Cu	44
Hg	21
Ni	9
Pb	70
Se	1
Zn	61

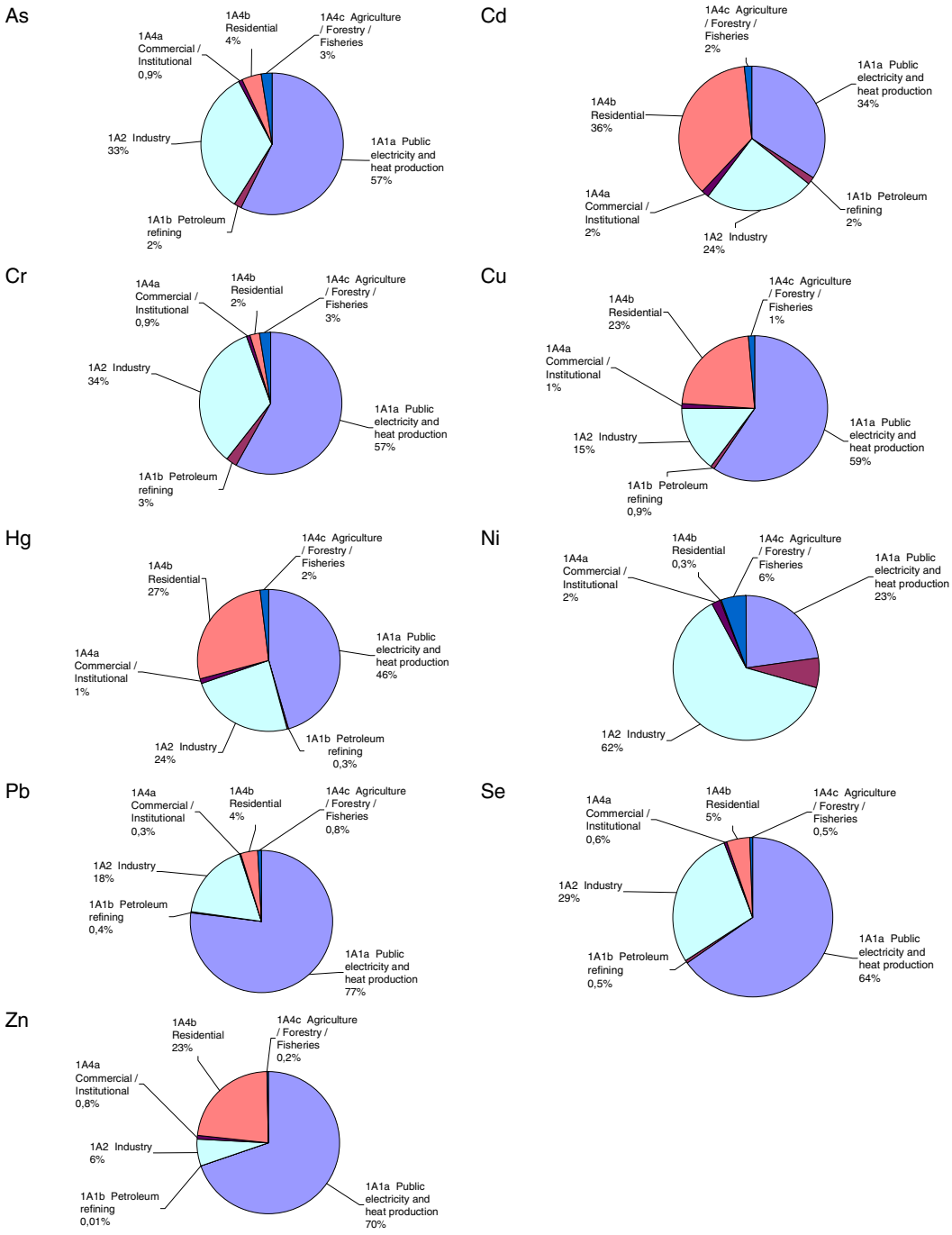


Figure 26 Heavy metal emission sources, stationary combustion plants, 2007.

Time-series for heavy metal emissions are provided in Figure 27. Emissions of all heavy metals, except Zn, have decreased considerably since 1990, see Table 21. 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 increasing Zn emission estimated in recent years might be a result of insufficient data for recent years. Emission from MSW incineration plants is the most important source of emission. For Se and Zn the same emission factor has been applied since 1995 whereas a time-series have been estimated for all other heavy metal emission factors (Nielsen

& Illerup 2003). As a part of ongoing work that will update several emission factors for CHP plants, time-series for Se and Zn emission from MSW incineration plants will be estimated. These time-series will be included in future inventories.

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 21 Decrease in heavy metal emission 1990-2007.

Pollutant	Decrease since 1990, %
As	58
Cd	34
Cr	82
Cu	66
Hg	65
Ni	63
Pb	70
Se	56
Zn	-15

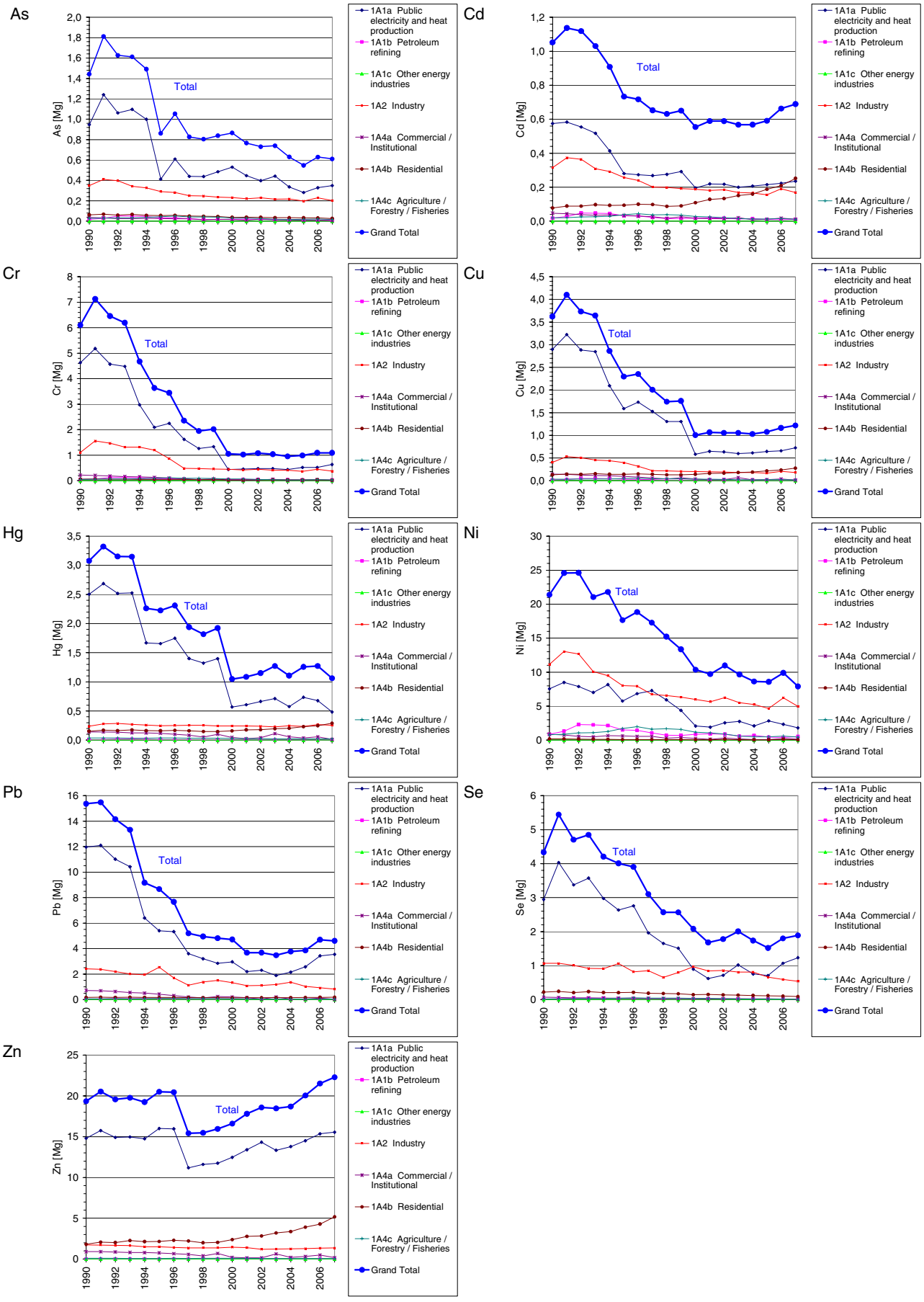


Figure 27 Heavy metal emission time-series, stationary combustion plants.

8 PAH

Emission inventories for four polycyclic aromatic hydrocarbons (PAH) are reported to the LRTAP Convention. The emission inventories for PAH are presented in Table 22. Stationary combustion plants accounted for more than 96 % of the PAH emission in 2007.

Table 22 PAH emission, 2007.

Pollutant	Benzo(a)-pyrene, Mg	Benzo(b)fluoranthene, Mg	Benzo(k)fluoranthene, Mg	Indeno(1,2,3-c,d)pyrene, Mg
1A1 Fuel combustion, Energy industries	0.01	0.03	0.01	0.01
1A2 Fuel combustion, Manufacturing Industries and Construction (Stationary combustion)	0.03	0.10	0.02	0.01
1A4 Fuel combustion, Other sectors (Stationary combustion)	4.96	5.19	2.87	3.52
Emission from stationary combustion plants	4.99	5.32	2.90	3.54
National emission	5.06	5.42	3.01	3.62
Emission share for stationary combustion (%)	99	98	97	98

Table 23 and Figure 29 present the PAH emission inventories for the stationary combustion subcategories. Residential combustion is the largest emission source accounting for more than 90 % of the emission. Combustion of wood is the predominant source, accounting for more than 98 % of the PAH emission from residential plants, see Figure 29.

Time-series for PAH emission are presented in Figure 30. The increasing (130 %-190 %) 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 30.

Table 23 PAH emission from stationary combustion plants, 2007[1)].

	Benzo(a)-Pyrene, Mg	Benzo(b)-fluoranthene, Mg	Benzo(k)-fluoranthene, Mg	Indeno(1,2,3-c,d)pyrene, Mg
1A1a Public electricity and heat production	7	28	14	6
1A1b Petroleum refining	0	0	0	0
1A1c Other energy industries	0	0	0	0
1A2 Industry	30	104	16	8
1A4a Commercial/Institutional	171	225	75	122
1A4b Residential	4 623	4 787	2 772	3 139
1A4c Agriculture/Forestry/Fisheries	162	174	24	263
Total	4 994	5 319	2 902	3 538

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

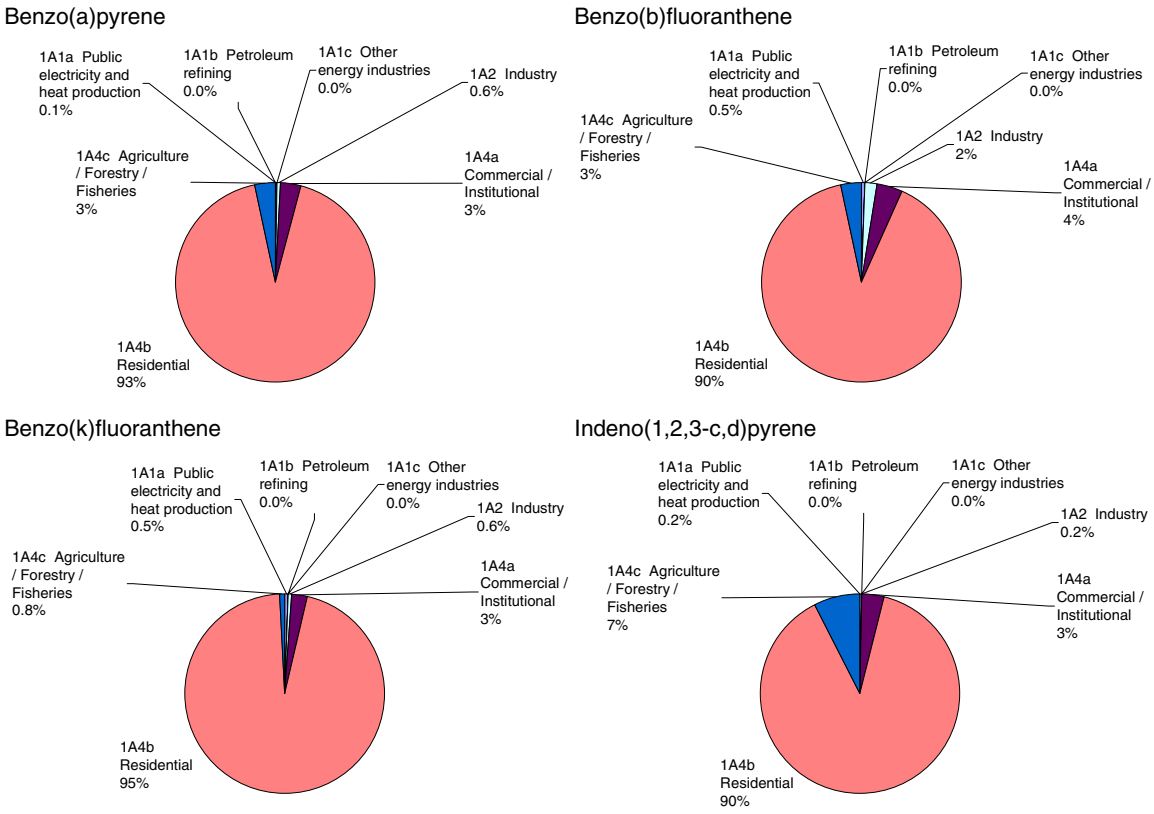


Figure 28 PAH emission sources, stationary combustion plants, 2007.

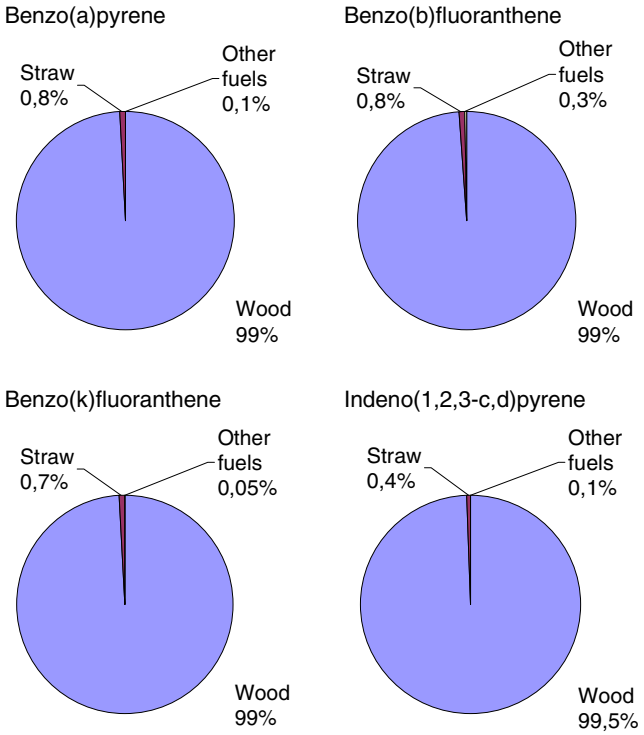
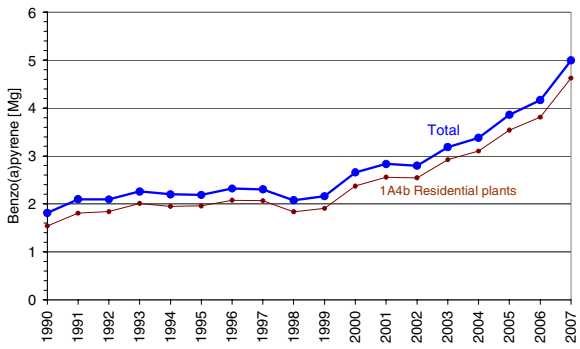
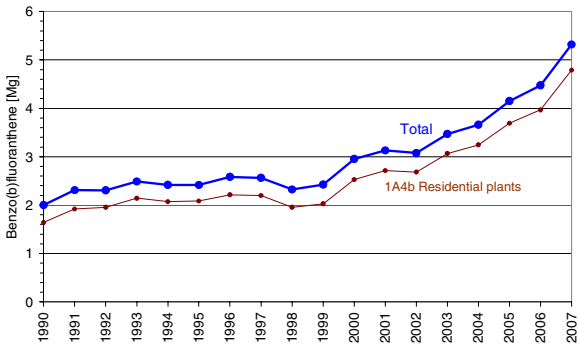


Figure 29 PAH emission from residential combustion plants (stationary), fuel origin.

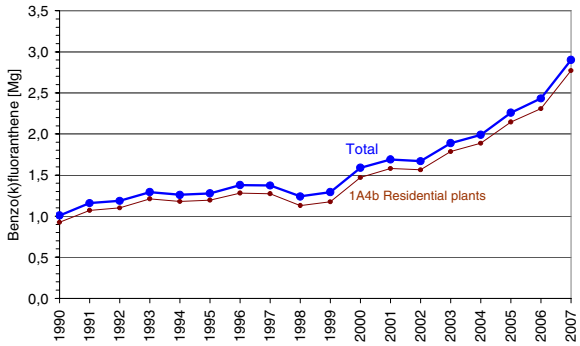
Benzo(a)pyrene



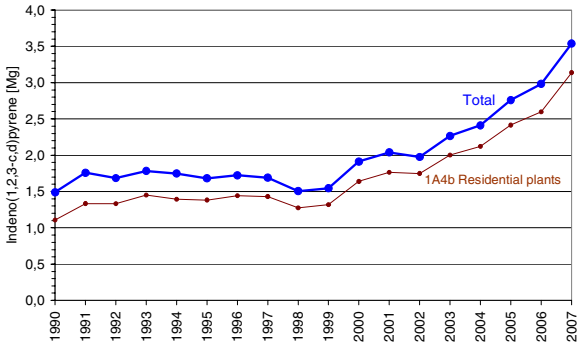
Benzo(b)fluoranthene



Benzo(k)fluoranthene



Indeno(1,2,3-c,d)pyrene



Combustion of wood in residential plants

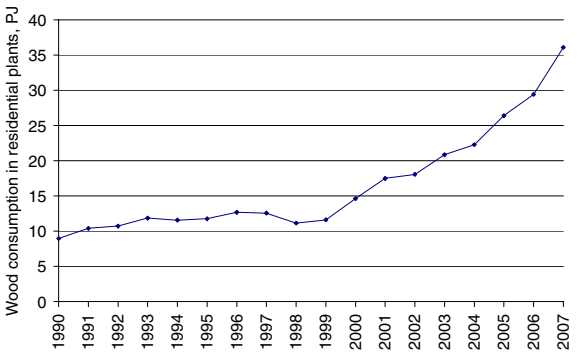


Figure 30 PAH emission time-series, stationary combustion plants. Comparison with wood consumption in residential plants.

9 Dioxin

Emission inventories for dioxin are reported to the LRTAP Convention. The emission inventory for dioxin is presented in Table 24. Stationary combustion plants accounted for 77 % of the dioxin emission in 2007.

Table 24 Dioxin emission, 2007.

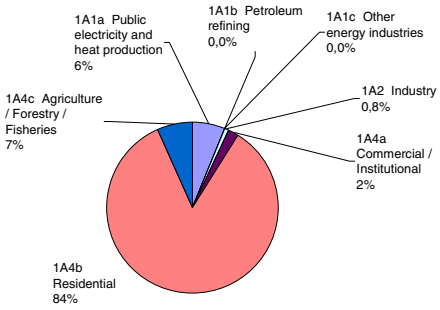
Pollutant	Dioxin, g I-teq
1A1 Fuel combustion, Energy industries	1.28
1A2 Fuel combustion, Manufacturing Industries and Construction (Stationary combustion)	0.18
1A4 Fuel combustion, Other sectors (Stationary combustion)	19.87
Emission from stationary combustion plants	21.32
National emission	27.83
Emission share for stationary combustion	77 %

Table 25 presents the dioxin emission inventories for the stationary combustion subcategories. In 2007 the emission from residential plants accounts for 84 % of the emission. Combustion of wood is the predominant source accounting for 85 % of the emission from residential plants (Figure 31).

Time-series for dioxin emission are presented in Figure 32. The dioxin emission has decreased 55 % since 1990 mainly due to installation of dioxin filters in MSW incineration plants. The emission from residential plants has increased due to increased wood consumption in this source category.

Table 25 Dioxin emission from stationary combustion plants, 2007[1)].

	Dioxin g I-teq
1A1a Public electricity and heat production	1.28
1A1b Petroleum refining	0.00
1A1c Other energy industries	0.00
1A2 Industry	0.18
1A4a Commercial/Institutional	0.45
1A4b Residential	17.97
1A4c Agriculture/Forestry/Fisheries	1.44
Total	21.32



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

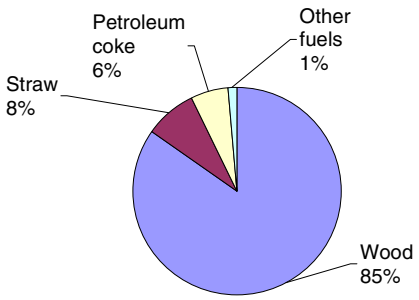


Figure 31 Dioxin emission from residential plants, fuel origin.

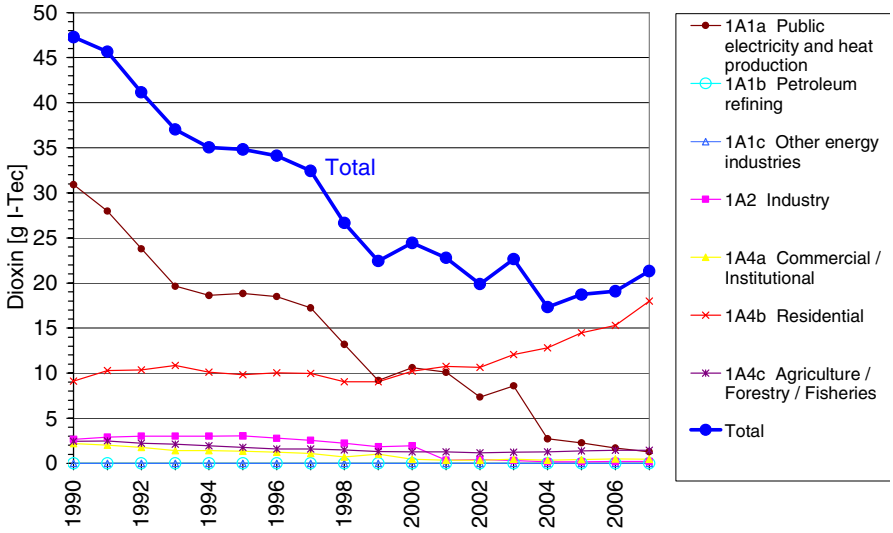


Figure 32 Dioxin emission time-series, stationary combustion plants.

10 HCB

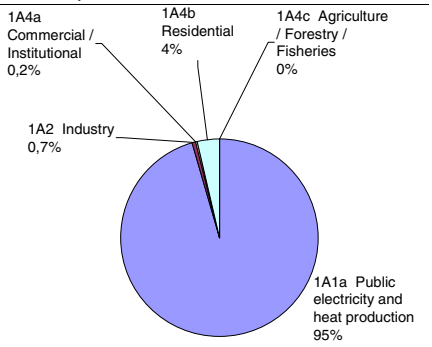
Emission inventories for hexachlorobenzene (HCB) are reported to the LRTAP Convention. In this first inventory for HCB the emission has been estimated only for stationary combustion plants and for cremation. Stationary plants accounted for more than 99 % of the estimated HCB emission in 2007.

Table 26 shows the HCB emission inventory for the stationary combustion subcategories. Public electricity and heat production account for more than 95 % of the emission. The main source is MSW incineration plants.

The increasing emission trend follows the increasing combustion of municipal waste. The installation of improved flue gas cleaning devices has not been taken into account in this first inventory for HCB and thus the apparent 132 % increase since 1990 might be misleading. The next inventory will take emission factor time-series for incineration of municipal waste into account. The time-series will be based on ongoing work that includes HCB emission measurements from MSW incineration plants and from other CHP plants.

Table 26 HCB emission from stationary combustion plants, 2007[1)].

		HCB, kg
1A1a	Public electricity and heat production	3.79
1A1b	Petroleum refining	-
1A1c	Other energy industries	-
1A2	Industry	0.03
1A4a	Commercial/Institutional	0.01
1A4b	Residential	0.14
1A4c	Agriculture/Forestry/Fisheries	0.00
Total		3.97



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

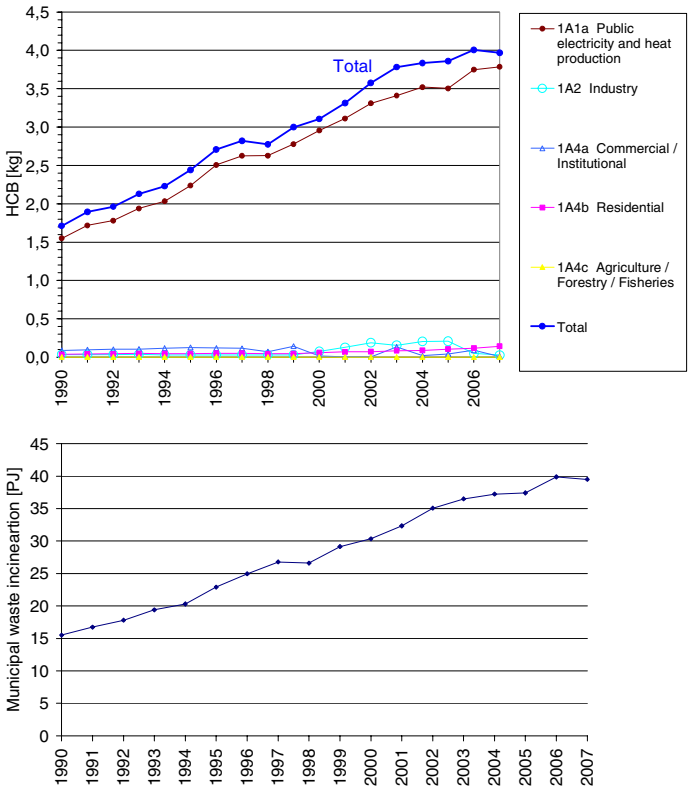


Figure 33 HCB emission time-series, stationary combustion plants. Time-series for municipal waste incineration.

11 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.

11.1 1A1 Energy industries

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

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

Figure 34 – 39 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.

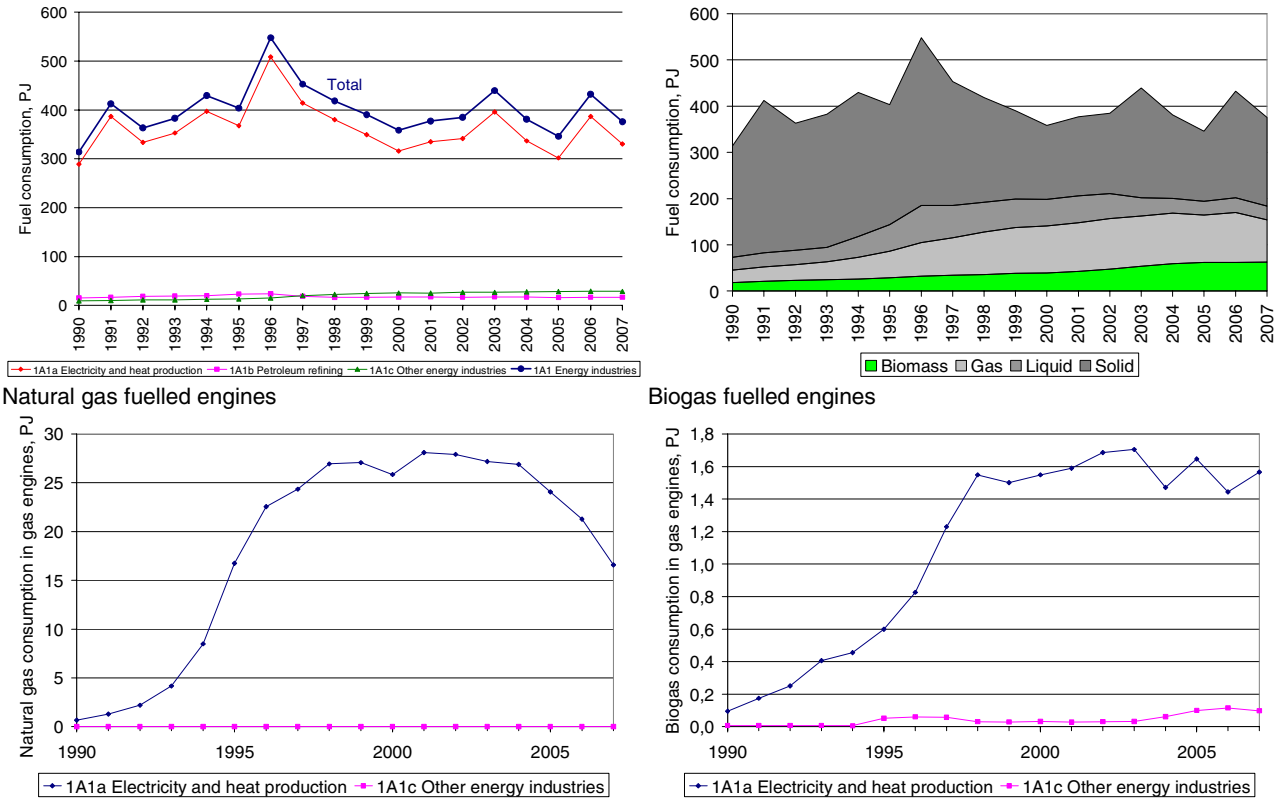


Figure 34 Time-series for fuel consumption, 1A1 Energy industries.

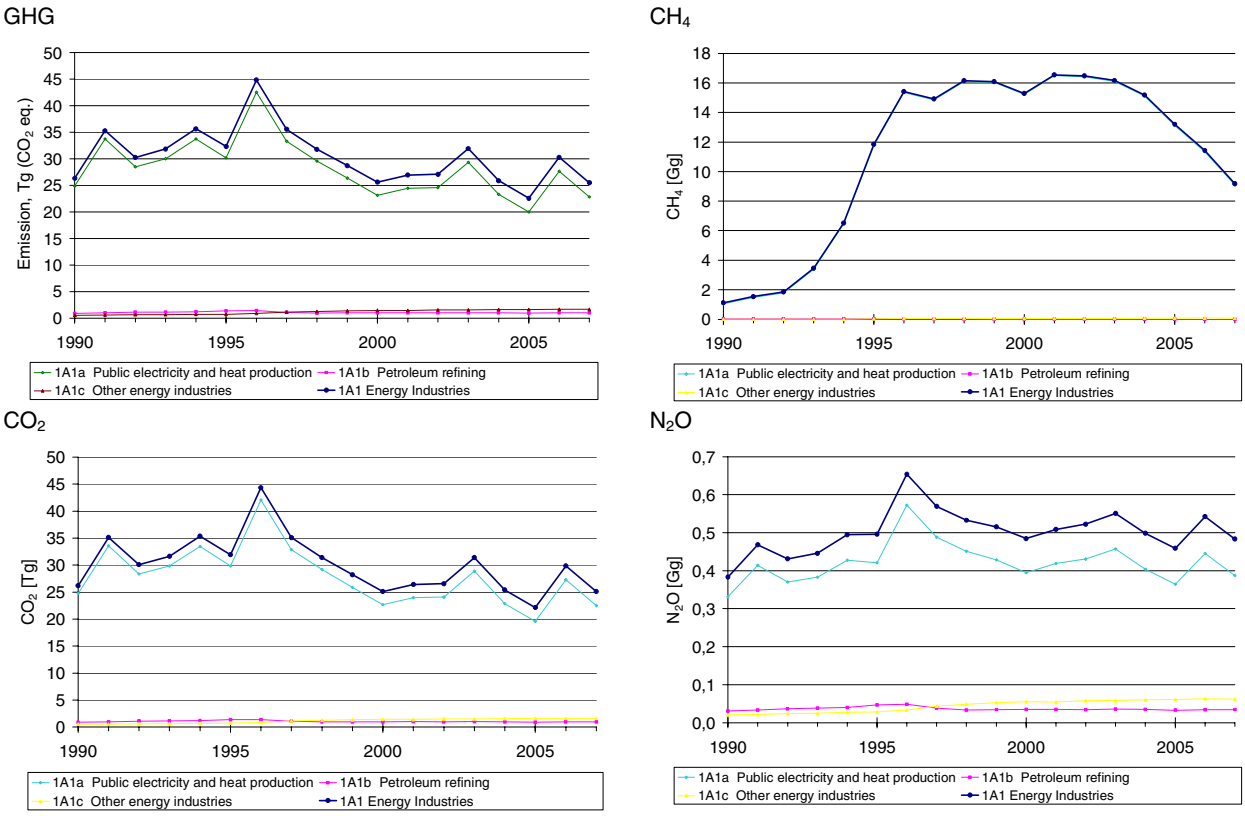


Figure 35 Time-series for greenhouse gas emission, 1A1 Energy industries.

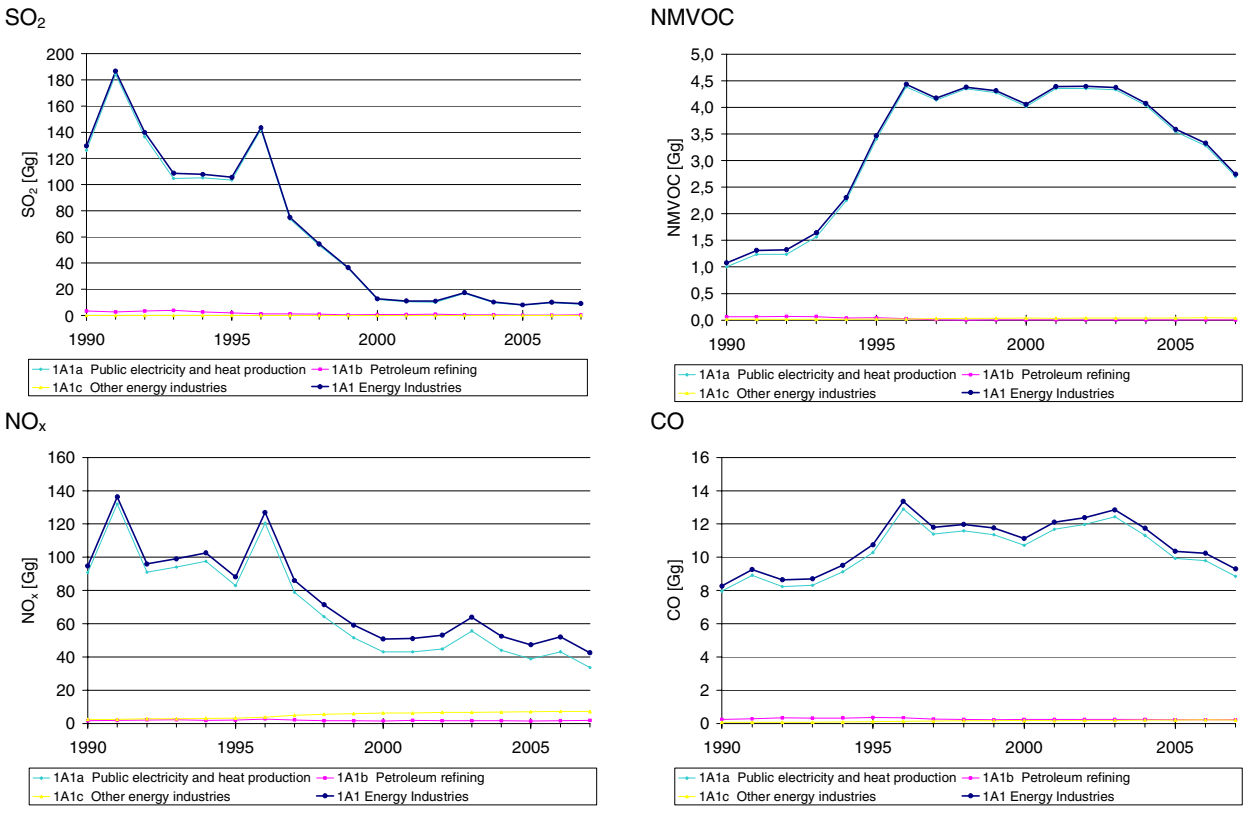


Figure 36 Time-series for SO_2, NO_x, NMVOC and CO emission, 1A1 Energy industries.

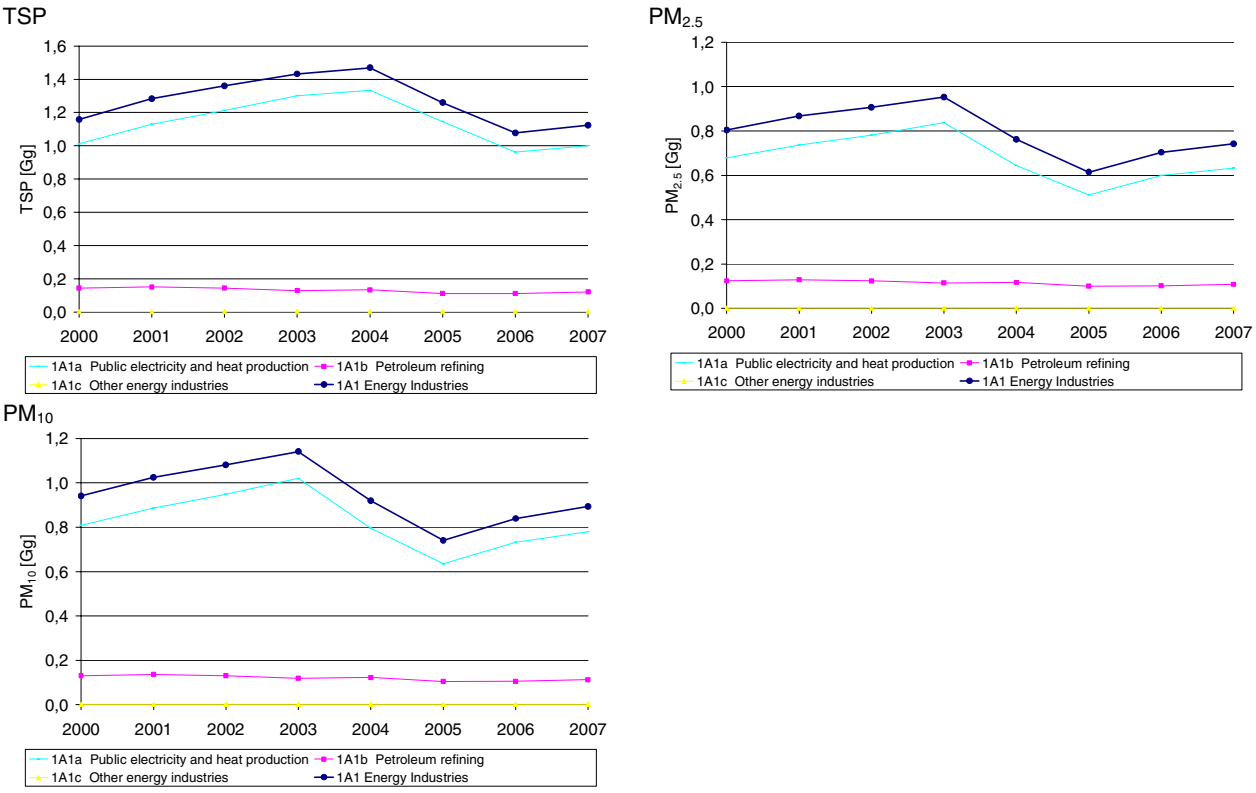


Figure 37 Time-series for PM emission, 1A1 Energy industries.

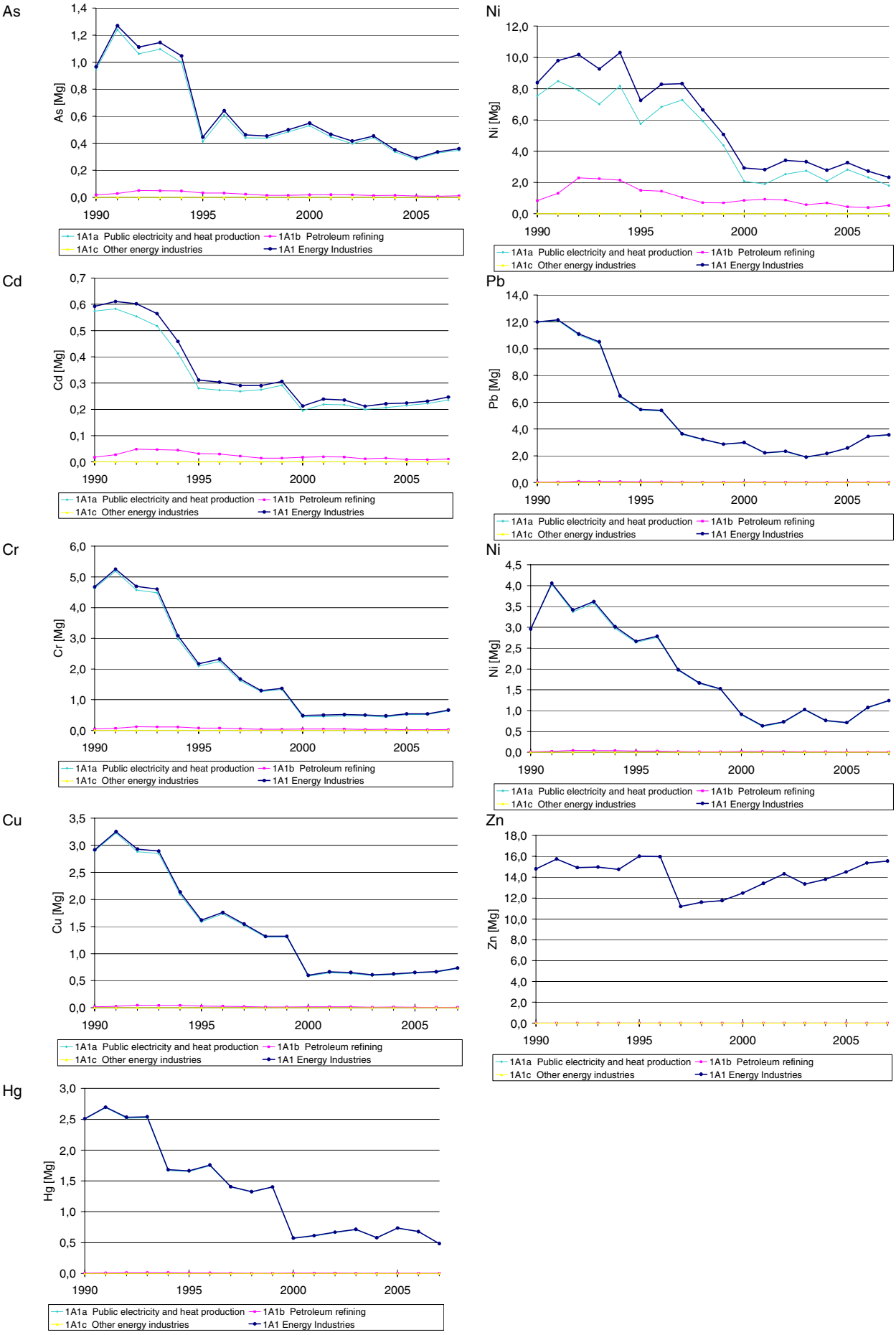


Figure 38 Time-series for HM emission, 1A1 Energy industries.

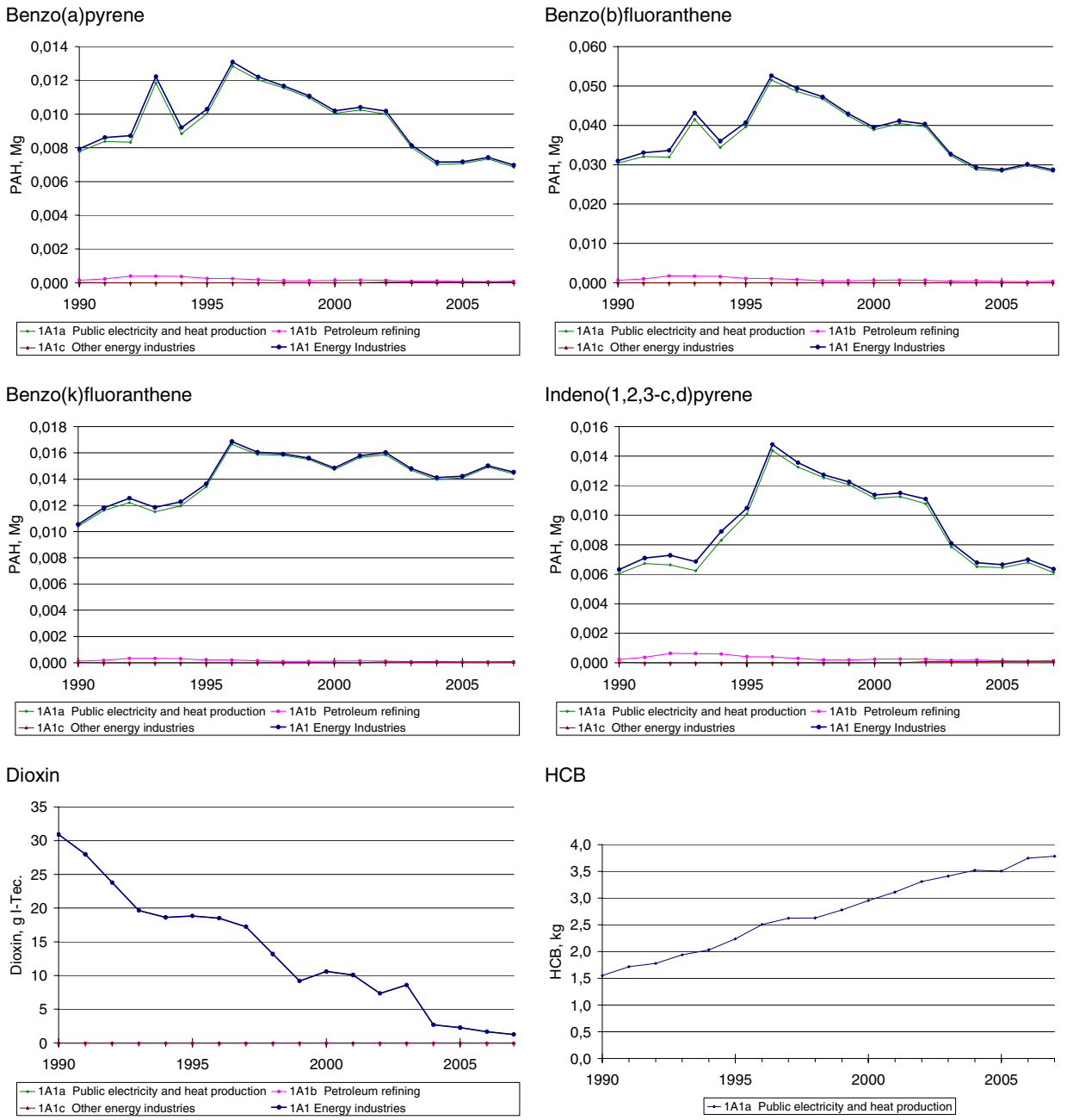


Figure 39 Time-series for PAH, dioxin and HCB emission, 1A1 Energy industries.

11.1.1 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 40 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 14 % higher in 2007 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 2007 was 22 % 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 34). The consumption of municipal waste and biomass has increased.

The CO_2 emission was 9 % lower in 2007 than in 1990. This decrease – in spite of a 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 34). The emission in 2007 was 8.5 times the 1990 emission level.

The N_2O emission was 17 % higher in 2007 than in 1990. The emission fluctuates similar to the fuel consumption.

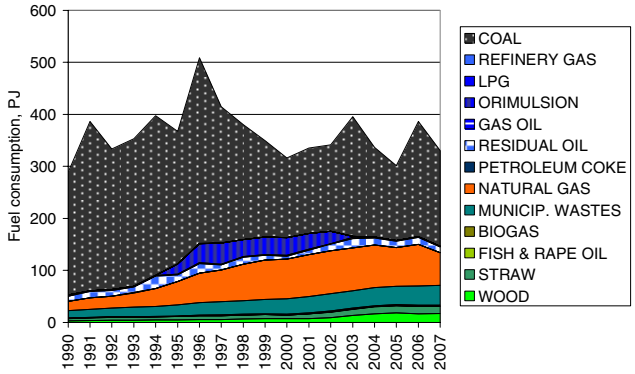
The SO_2 emission has decreased 93 % since 1990. This decrease is a result of both lower sulphur content in fuels and installation and improved performance of desulphurisation plants.

The NO_x emission has decreased 63 % 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.

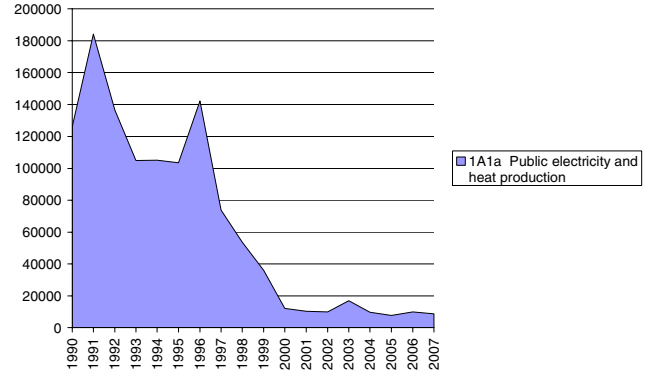
The emission of NMVOC in 2007 was 2.7 times the 1990 emission level. This is a result of the large number of gas engines that has been installed in Danish CHP plants as mentioned above.

The CO emission has increased 11 % since 1990. The fluctuations follow the fluctuations of the fuel consumption. In addition the emission from gas engines is considerable.

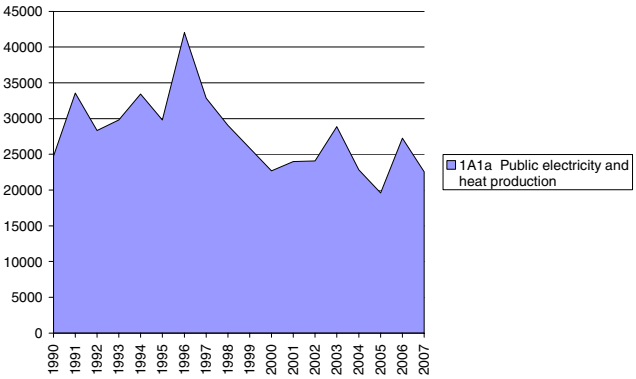
Fuel consumption, PJ



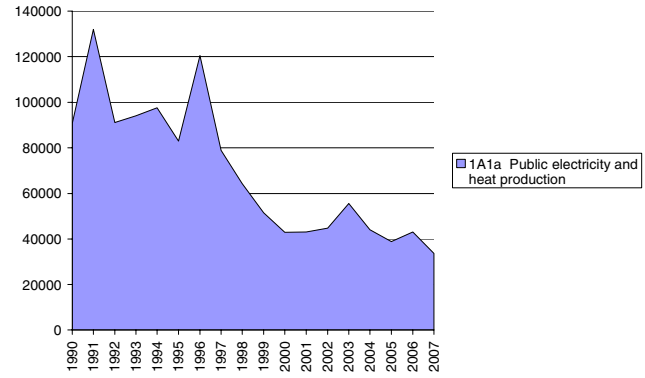
SO_2, Mg



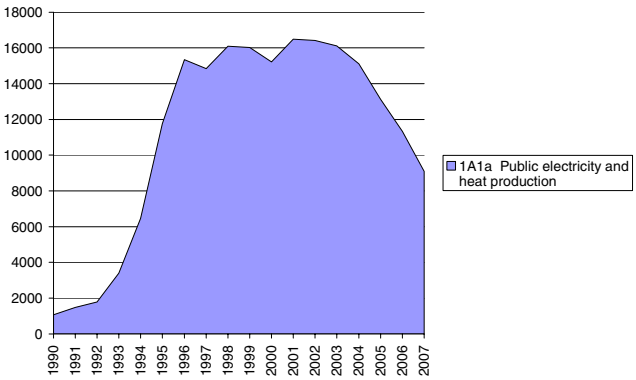
CO_2 , Gg



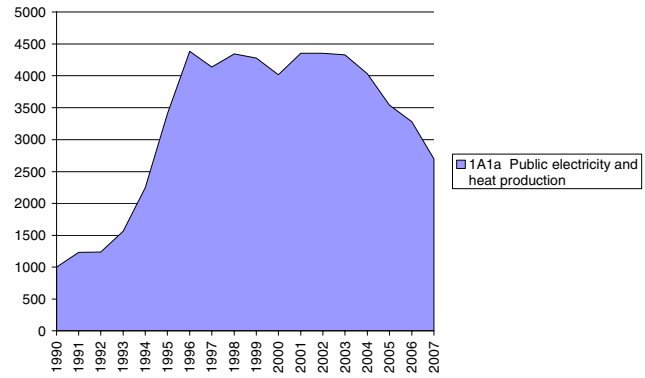
NO_x, Mg



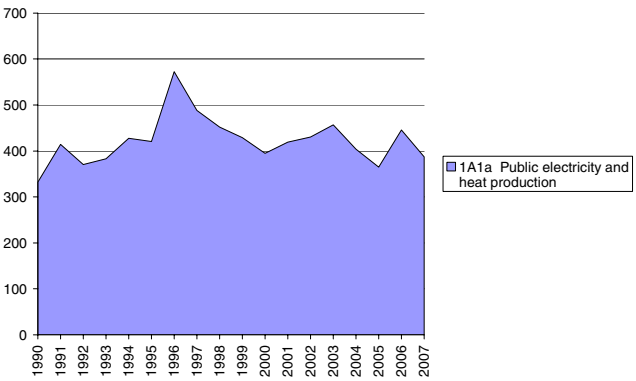
CH_4 , Mg



NMVOC, Mg



N_2O , Mg



CO , Mg

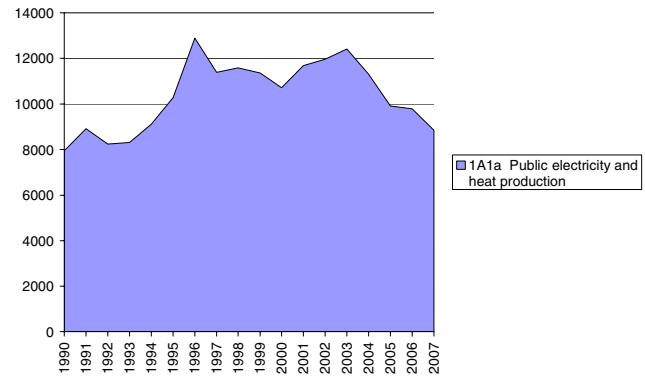


Figure 40 Time-series for 1A1a Electricity and heat production

11.1.2 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 41 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 refinery.

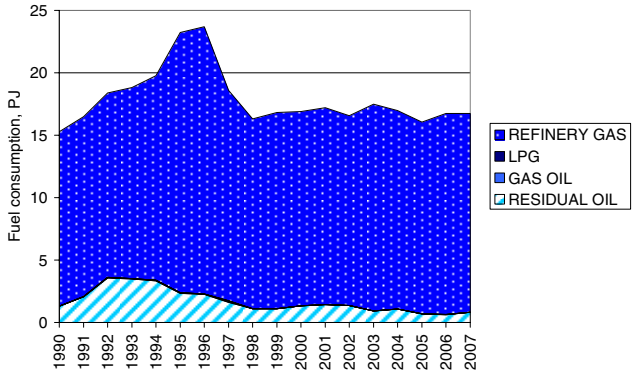
The fuel consumption has increased 10 % since 1990 and the CO_2 emission has increased 8 %.

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.

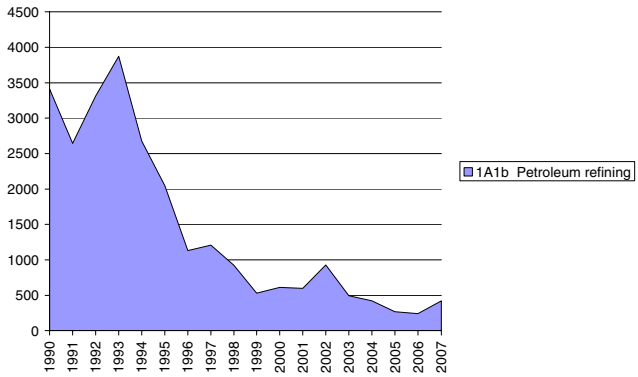
The N_2O emission has increased 12 %.

The SO_2 emission has decreased 88 % and the NO_x emission increased 9 %. In recent years data for both SO_2 and NO_x are plant specific data stated by the refineries.

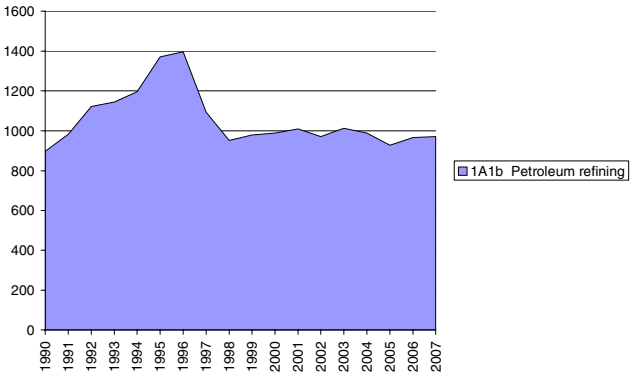
Fuel consumption, PJ



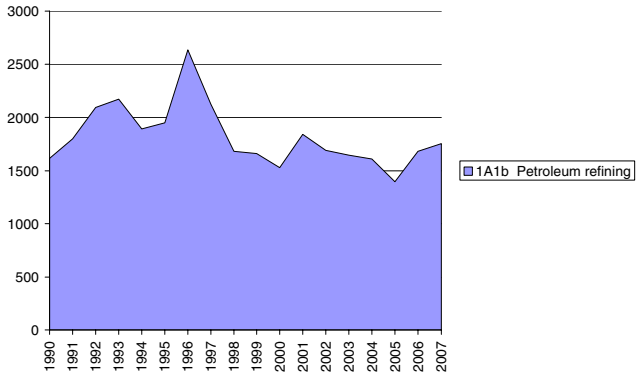
SO_2, Mg



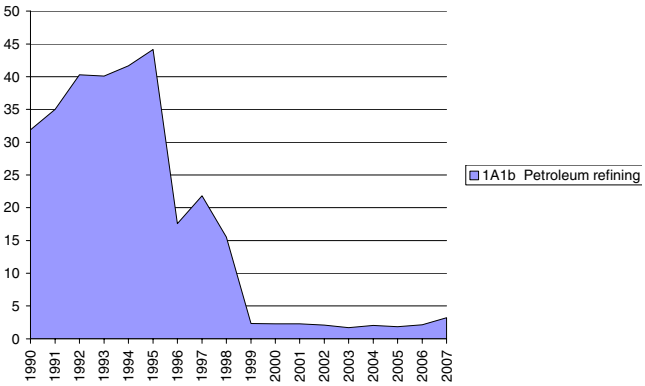
CO_2 , Gg



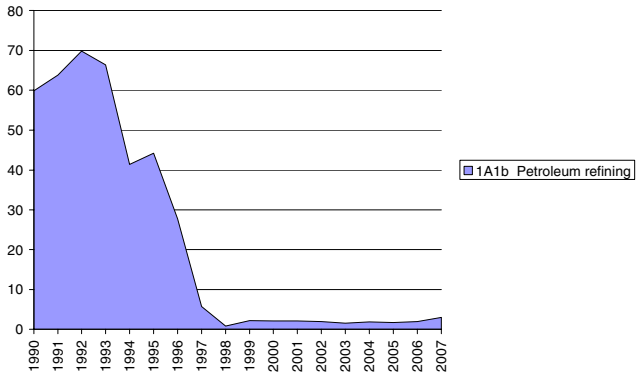
NO_x, Mg



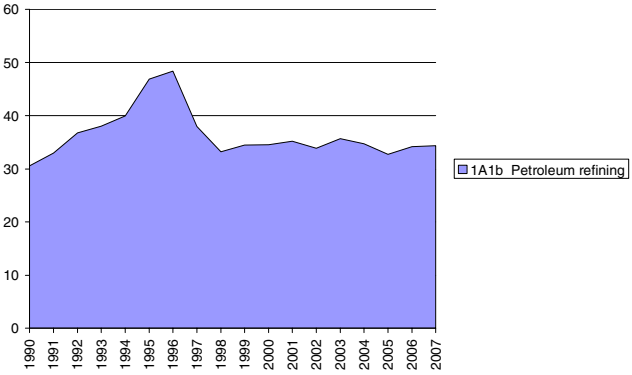
CH_4 , Mg



NMVOC, Mg



N_2O , Mg



CO , Mg

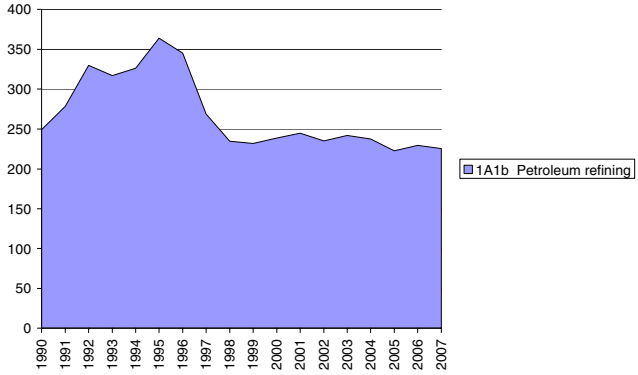


Figure 41 Time-series for 1A1b Petroleum refining.

11.1.3 1A1c Other energy industries

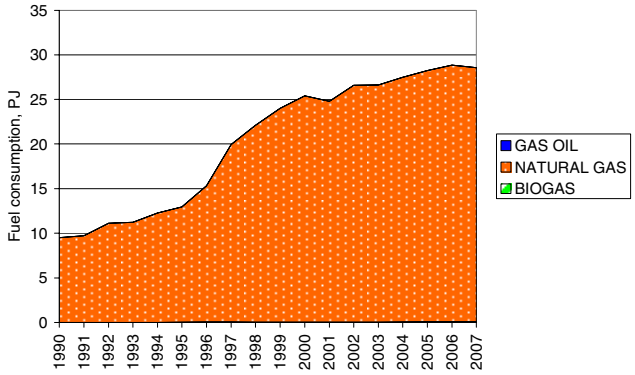
The source category *Other energy industries* comprises natural gas consumption in the off-shore industry. Gas turbines are the main plant type. Figure 42 shows the time-series for fuel consumption and emissions.

The fuel consumption in 2007 was three times the consumption in 1990. The CO_2 emission follows the fuel consumption and the emission in 2007 was also three times the emission in 1990.

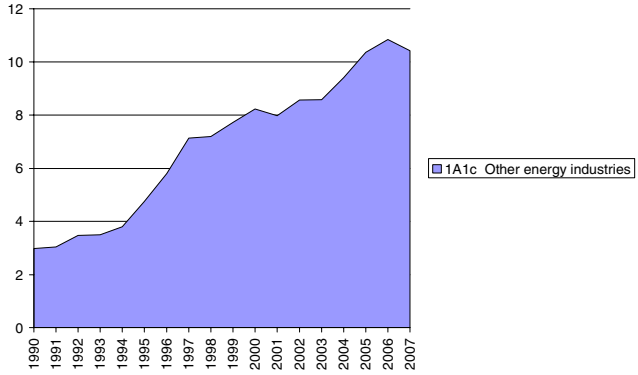
The two main sources for CH_4 emission in 2007 was off-shore gas turbines and biogas fuelled gas engines. The increase in emission from 2003 to 2006 is due to an increase in biogas consumption in gas engines. The CH_4 emission factor for biogas fuelled gas engines (323 g/GJ) is much higher than emission factors for off-shore gas turbines (1.5 g/GJ) 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.

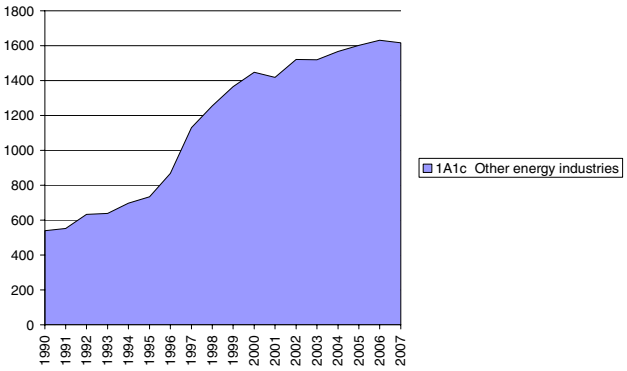
Fuel consumption, PJ



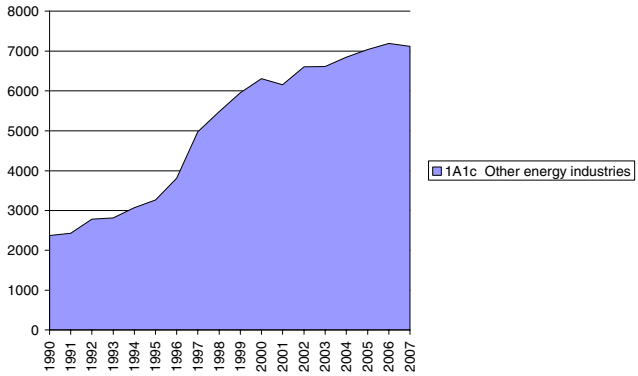
SO_2, Mg



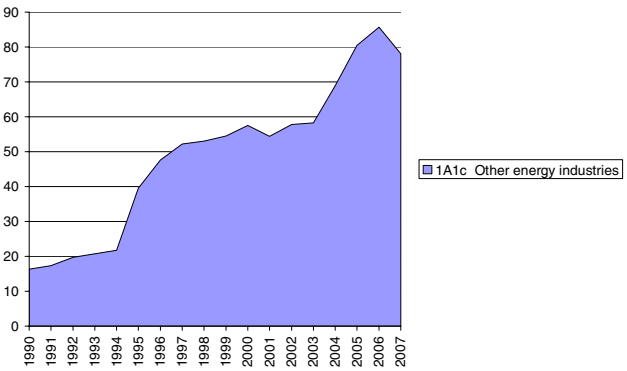
CO_2 , Gg



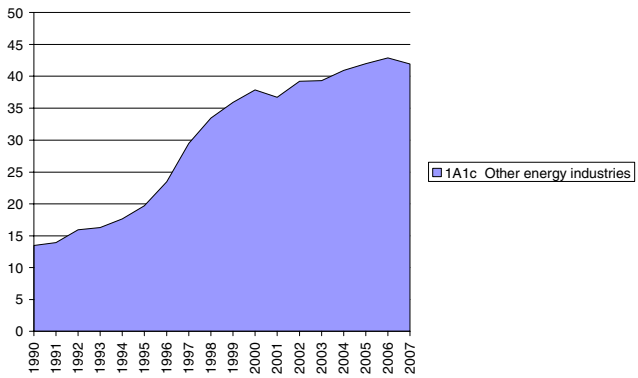
NO_x, Mg



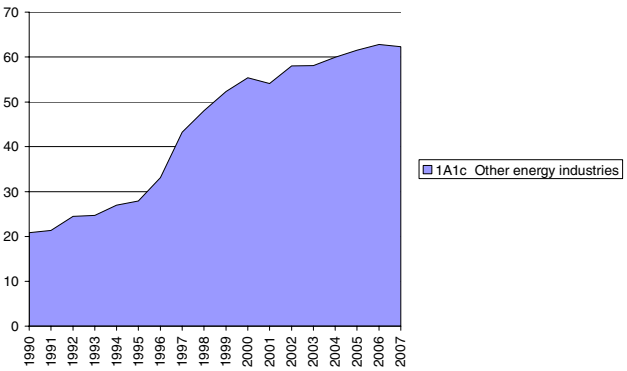
CH_4 , Mg



NMVOC, Mg



N_2O , Mg



CO , Mg

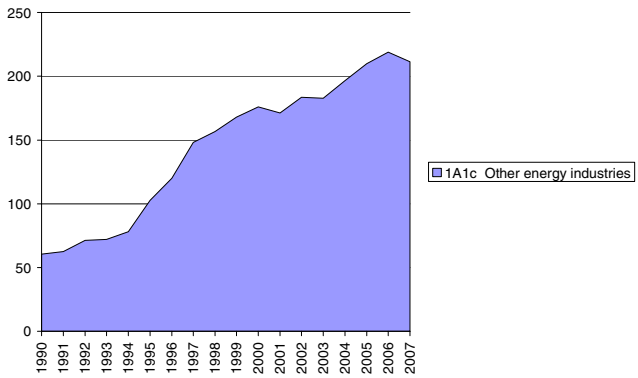


Figure 42 Time-series for 1A1c Other energy industries.

11.2 1A2 Industry

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

Figure 43-48 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 13.8.

The total fuel consumption in industrial combustion has been rather stable since 1990; the consumption has increased 7 %. However, the consumption of gas has increased whereas the consumption of coal has decreased. The consumption of residual oil has decreased, but the consumption of petroleum coke increased. The biomass part of fuel have 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 7 % increase of fuel consumption the CO_2 emission in 2007 was almost the same as in 1990 due to the change of fuels.

The CH_4 emission has increased from 1995-2000 and decreased again from 2004 onwards. In 2007 the emission was 43 % 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.

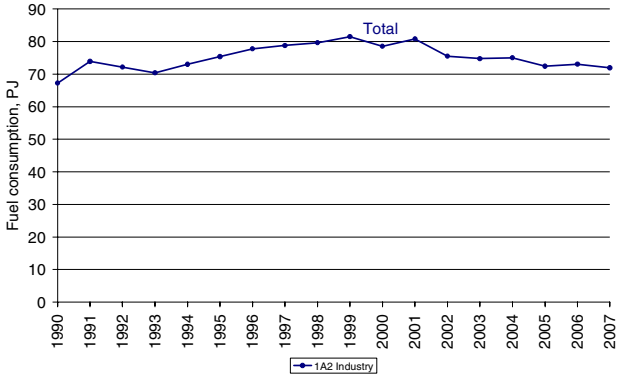
The N_2O emission follows the small fluctuations of the fuel consumption in industrial plants. In 2007 the emission was 2 % higher than in 1990.

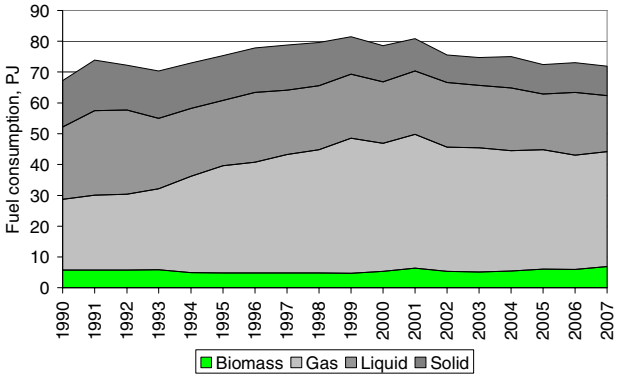
The SO_2 emission has decreased 57 % since 1990. This is mainly a result of lower consumption of residual oil in the industrial sector. Further the sulphur content of residual oil and several other fuels has decreased since 1990 due to legislation and tax laws.

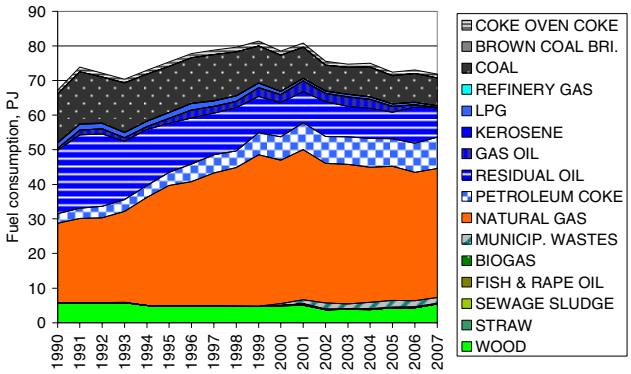
The NO_x emission fluctuations follow the fuel consumption in the cement production. However, the NO_x emission has decreased 15 % since 1990 due to the reduced emission from industrial boilers in general.

The NMVOC emission has decreased 9 % since 1990. The decrease is a result of decreased emission from boilers due to the decrease of coal consumption that has a relatively high emission of NMVOC compared to other fuels. The emission from gas engines has however increased considerably after 1995 due to the increased fuel consumption that is a result of the installation of a large number of industrial CHP plants. The NMVOC emission factor for gas engines are much higher than for emission factors for boilers regardless of the fuel.

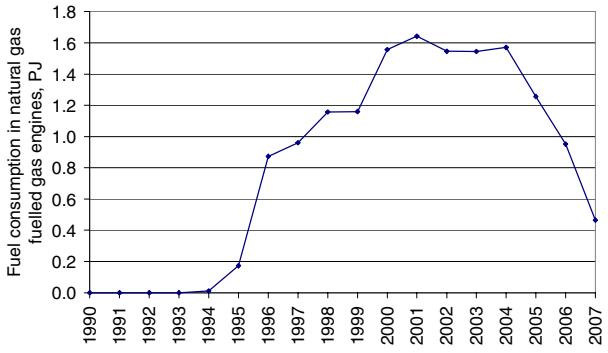
The CO emission in 2007 was 15 % lower than in 1990. The main source of emission is combustion in mineral wool production. This emission follows the fuel comsumption in the mineral wool production plants.







Fuel consumption in natural gas fuelled engines



Fuel consumption, residual oil

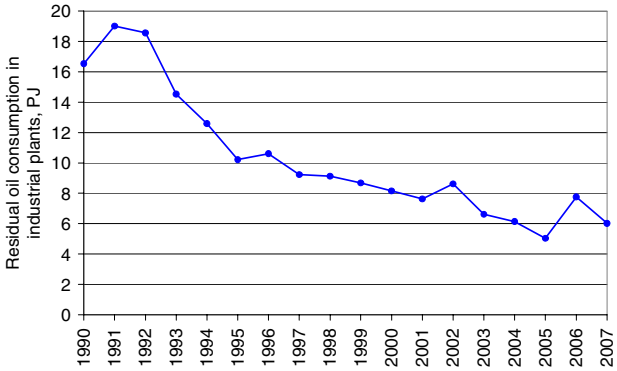


Figure 43 Time-series for fuel consumption,1A2 Industry.

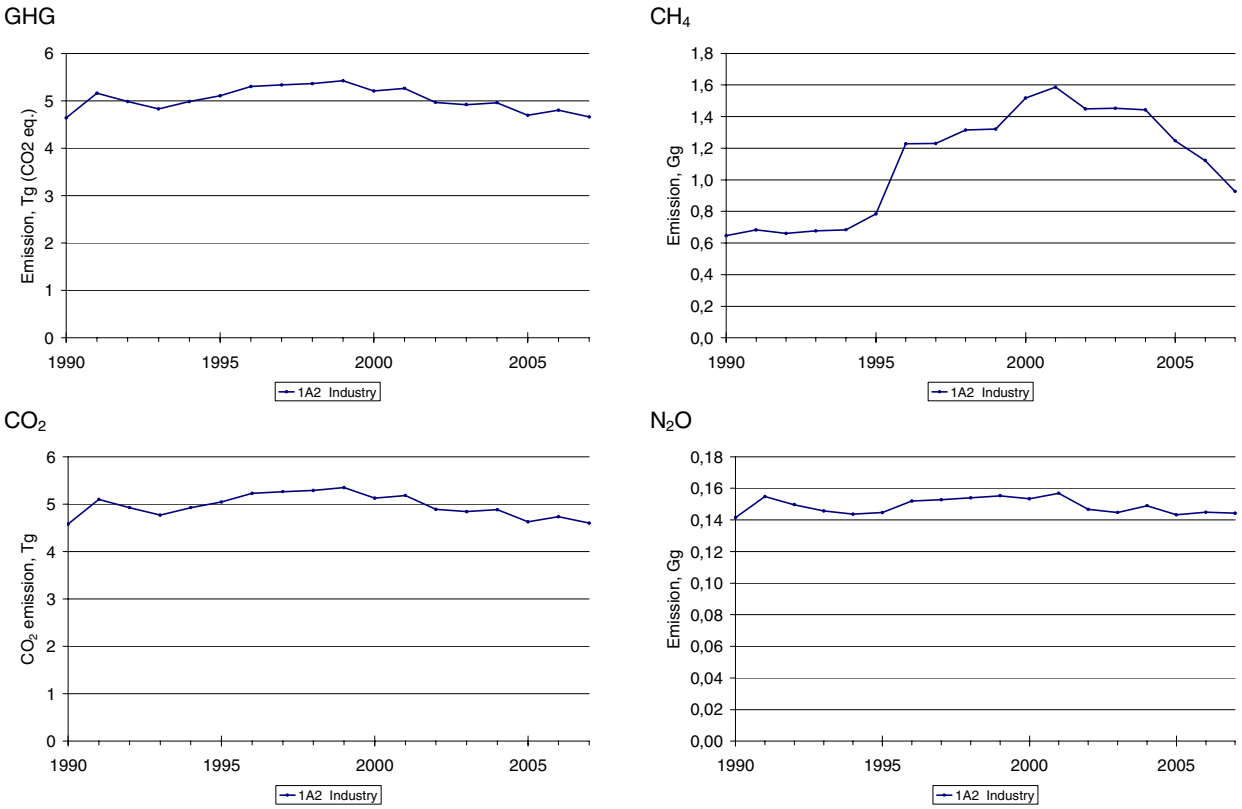


Figure 44 Time-series for greenhouse gas emission, 1A2 Industry.

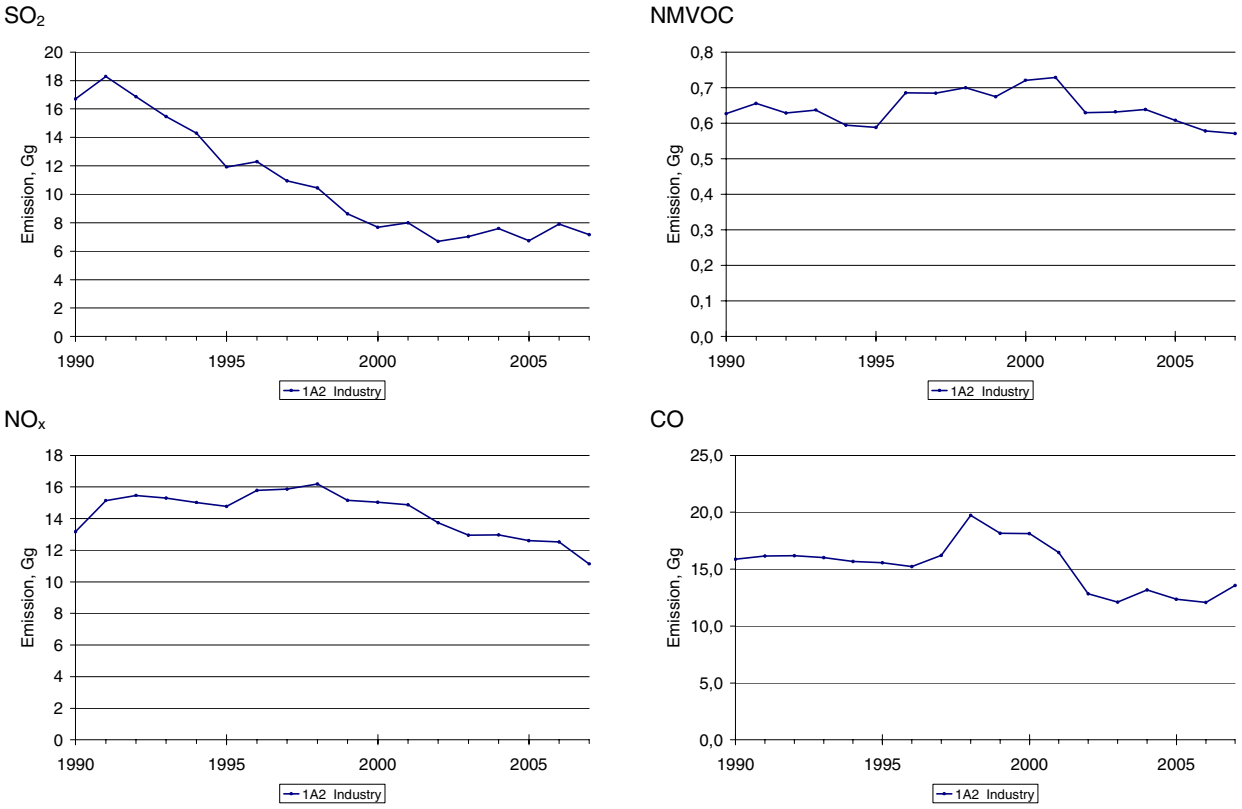
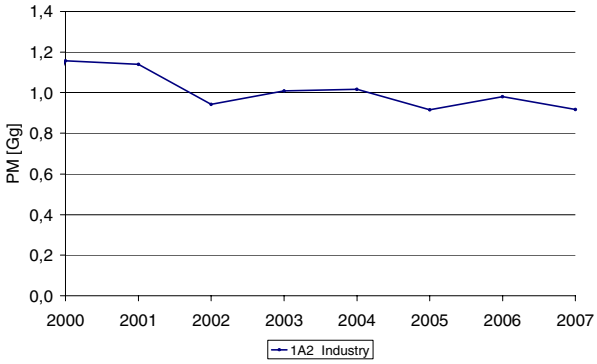
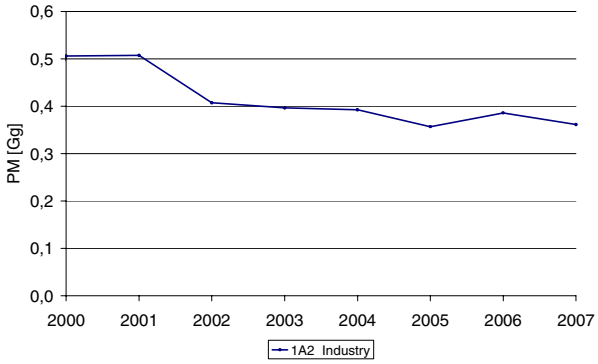


Figure 45 Time-series for SO_2, NO_x, NMVOC and CO emission, 1A2 Industry.

TSP



$PM_{2.5}$



PM_{10}

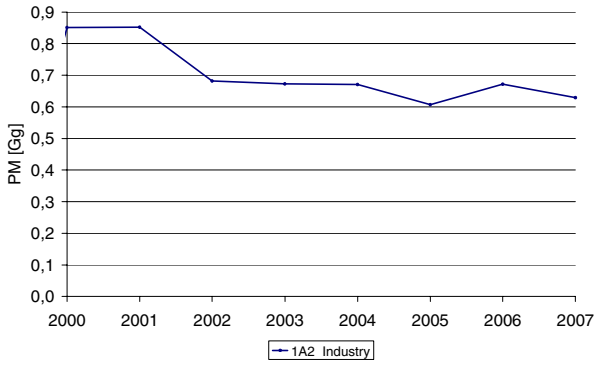


Figure 46 Time-series for PM emission, 1A2 Industry.

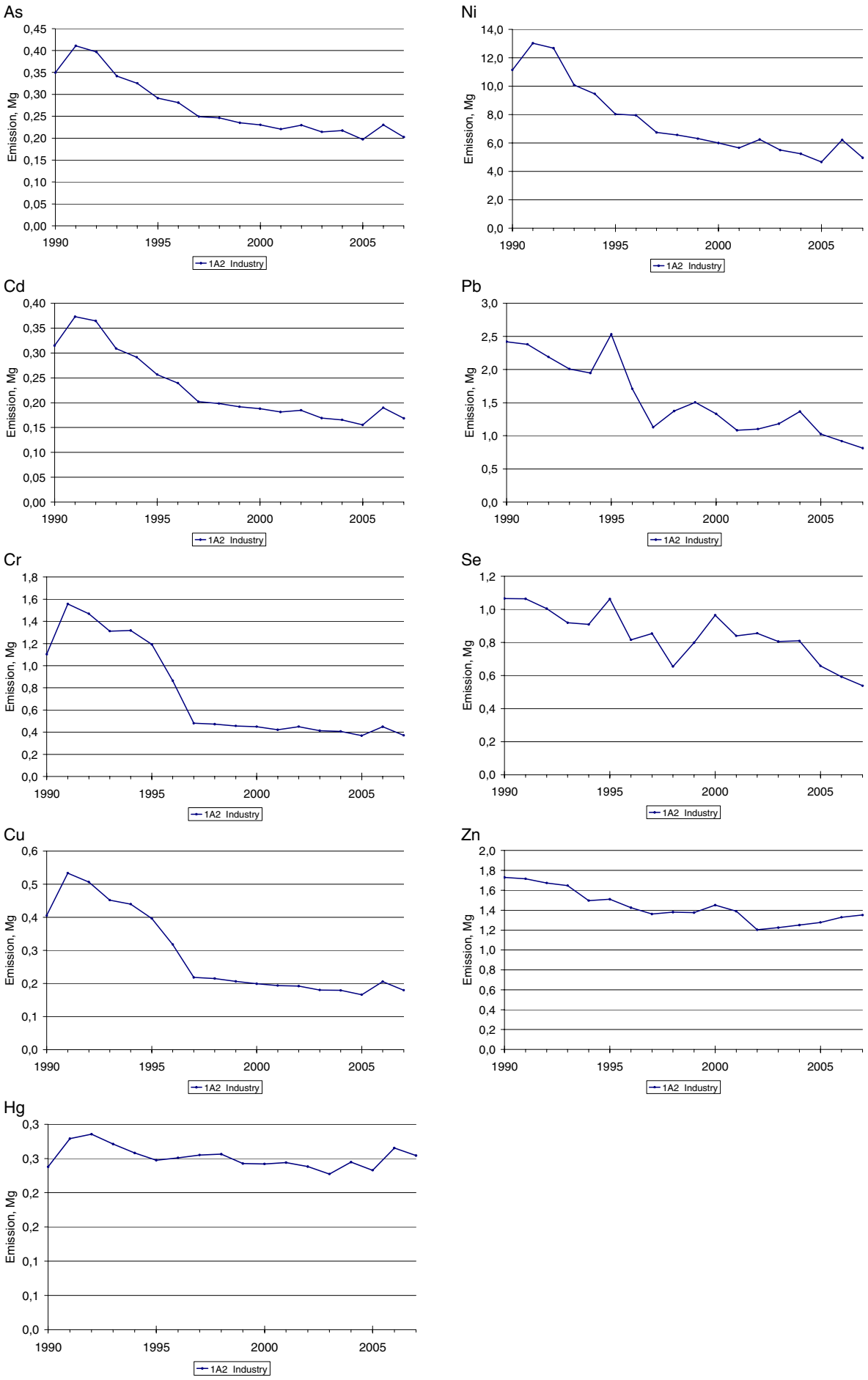


Figure 47 Time-series for HM emission, 1A2 Industry.

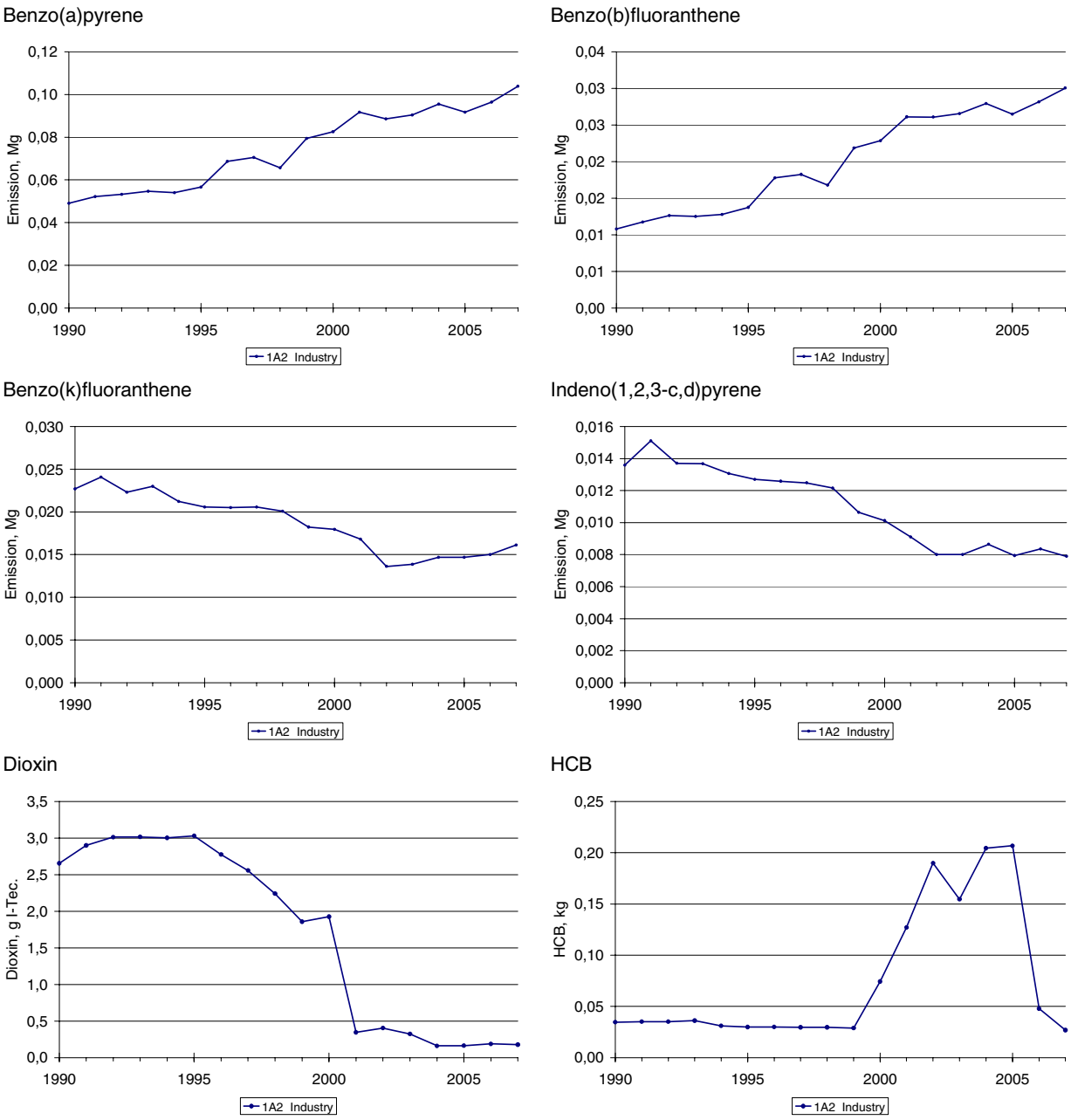


Figure 48 Time-series for PAH, dioxin and HCB emission, 1A2 Industry.

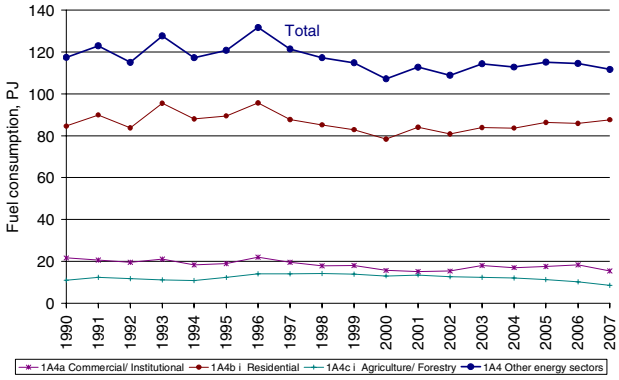
11.3 1A4 Other Sectors

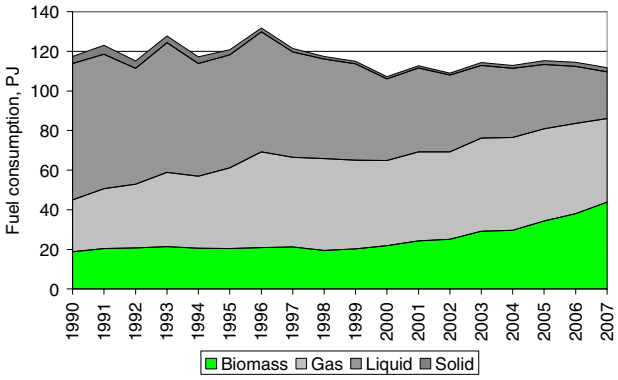
The emission source category *1A4 Other Sectors* consists of the subcategories:

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

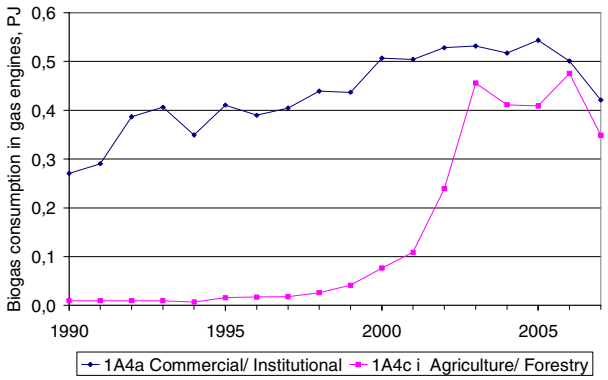
Figure 49-54 present time-series for the emission source category. Residential plants is the largest subcategory accounting for the largest part of all emissions. Time-series are discussed below for each subcategory.

1A4 Other Sectors

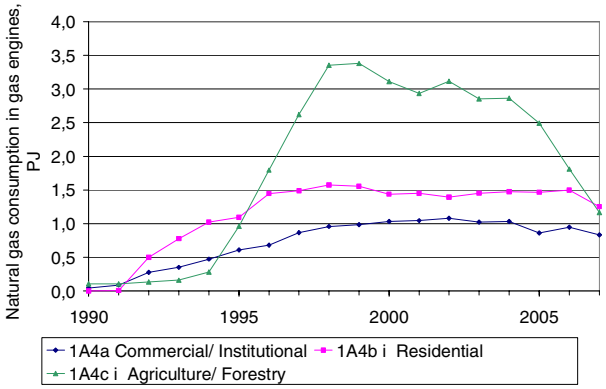




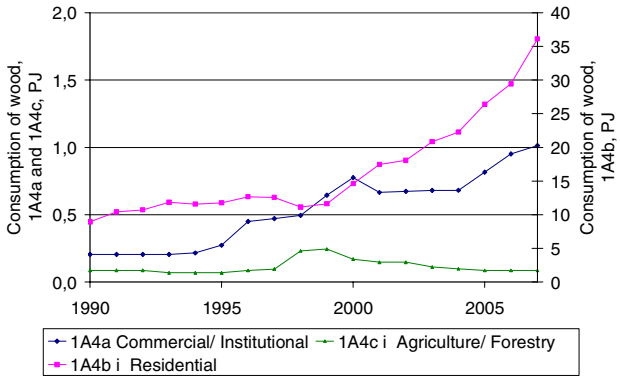
Gas engines, biogas (subsectors to Other Sectors)



Gas engines, natural gas (subsectors to Other Sectors)



Combustion of wood in Other Sectors



Combustion of straw in Other Sectors

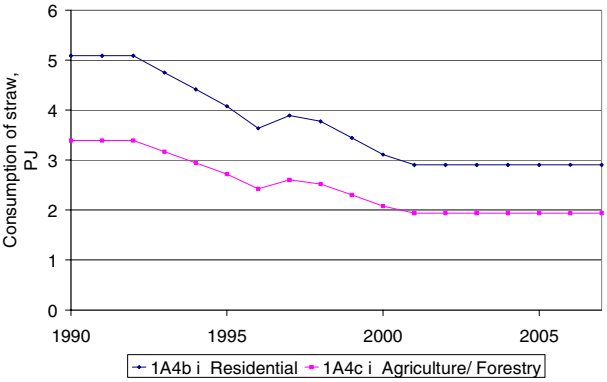


Figure 49 Time-series for fuel consumption, 1A4 Other Sectors.

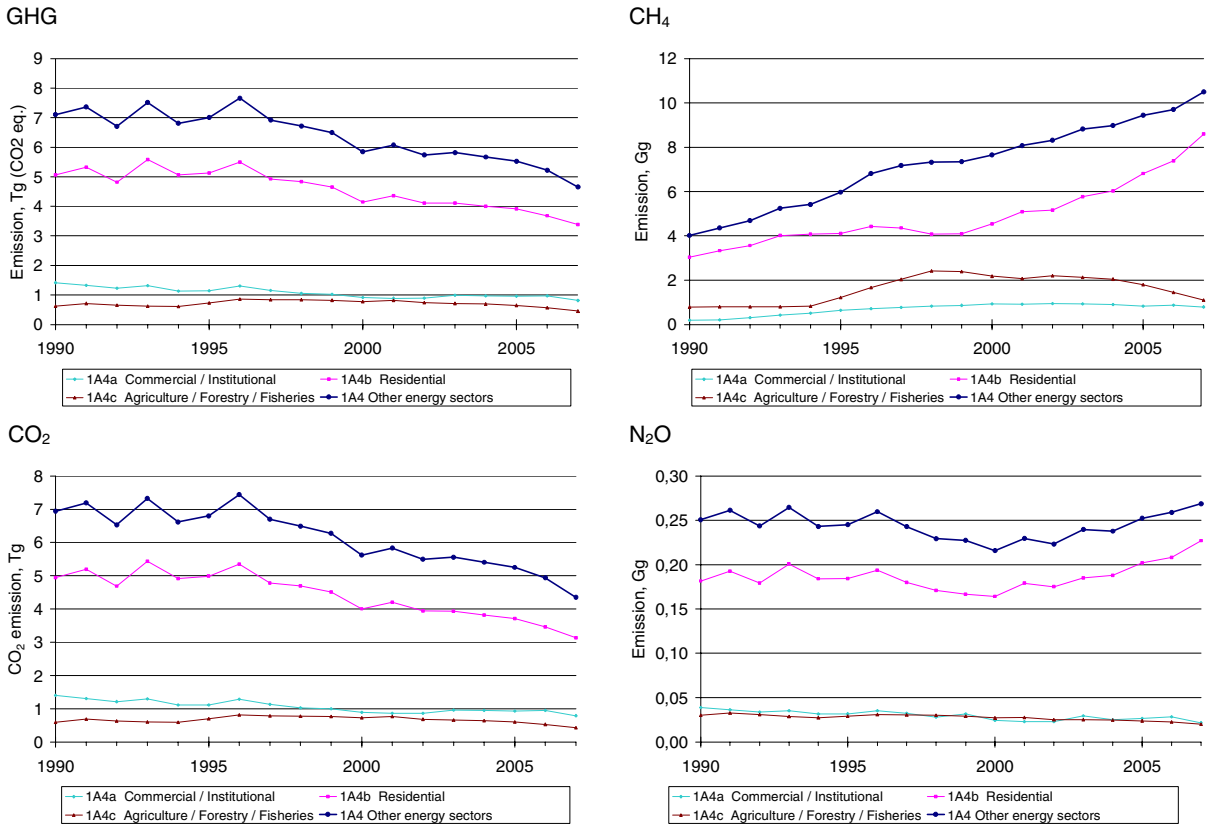


Figure 50 Time-series for greenhouse gas emission, 1A4 Other Sectors.

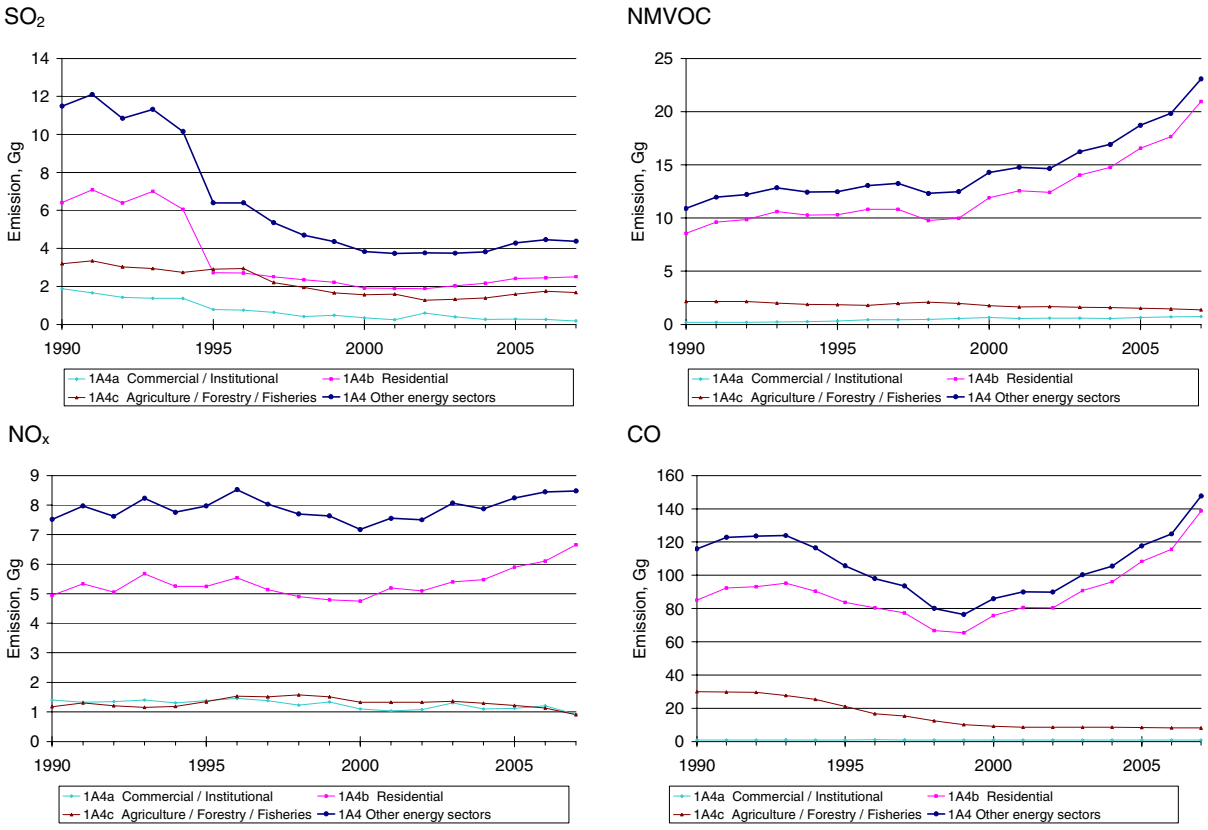


Figure 51 Time-series for SO_2, NO_x, NMVOC and CO emission, 1A4 Other Sectors.

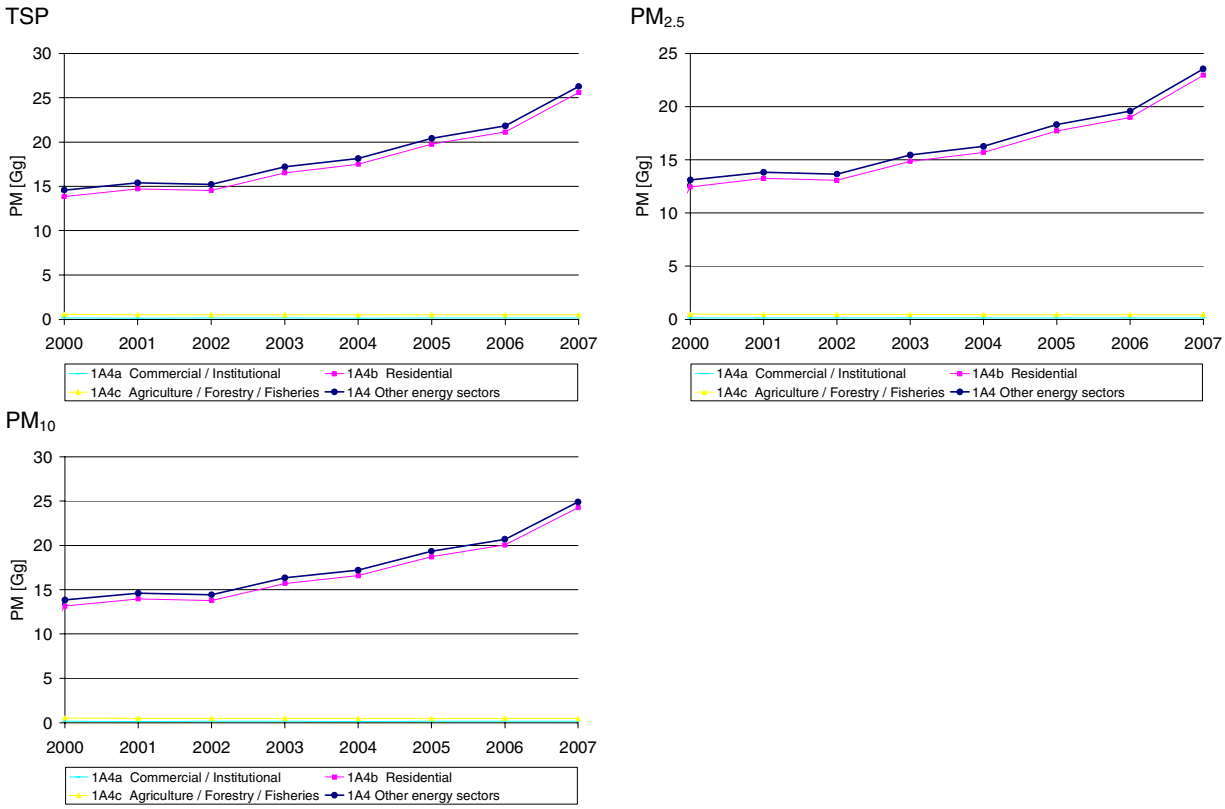
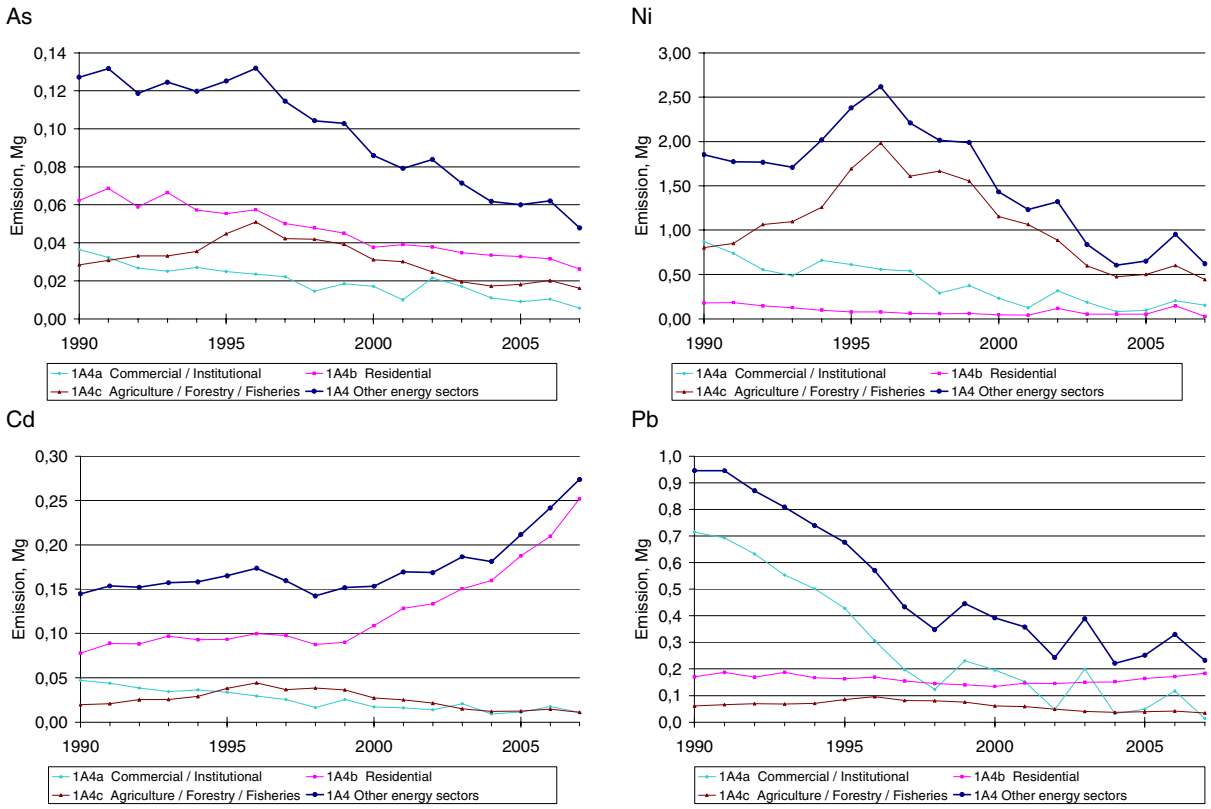


Figure 52 Time-series for PM emission, 1A4 Other Sectors.



Continued

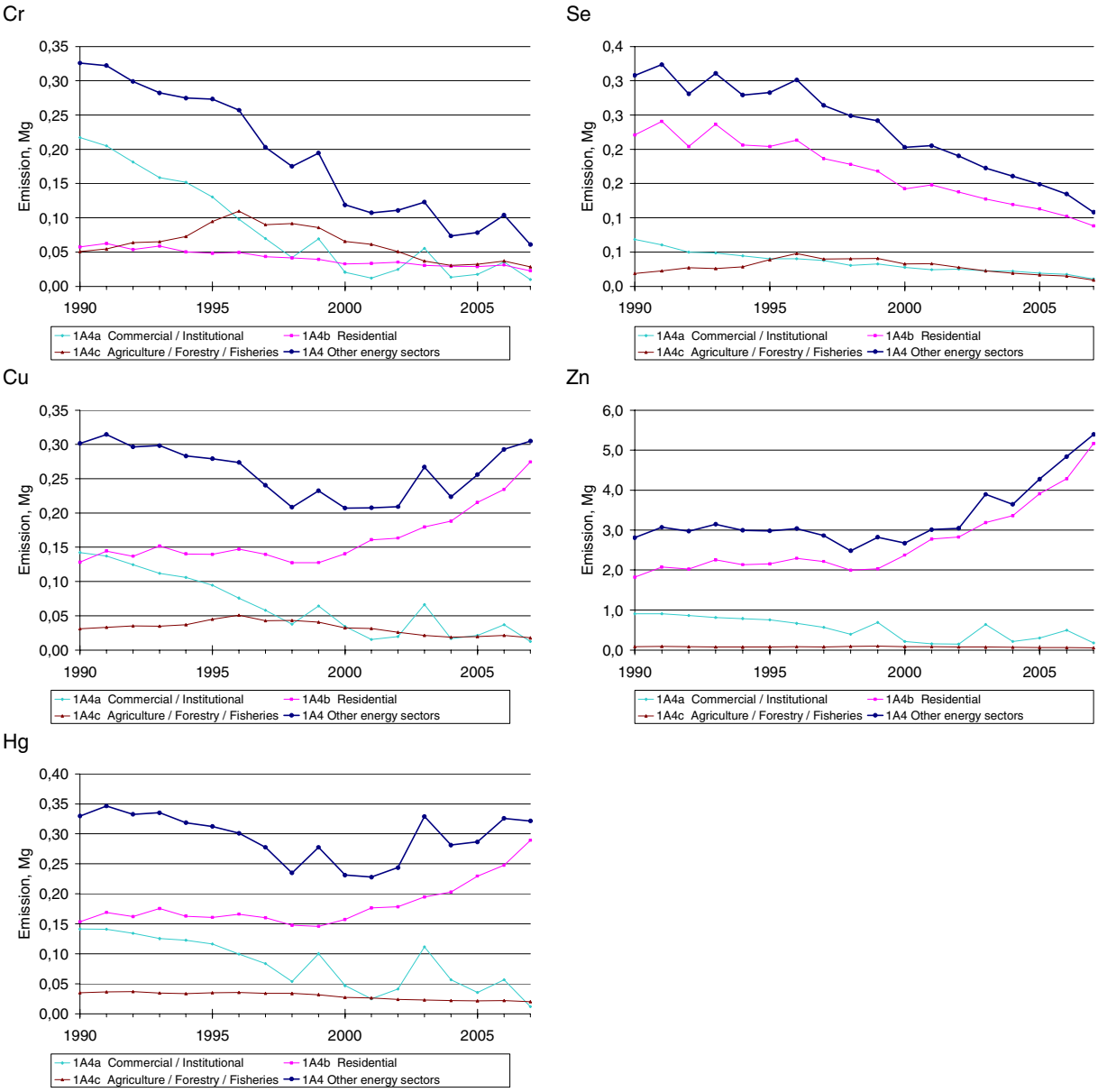


Figure 53 Time-series for HM emission, 1A4 Other Sectors.

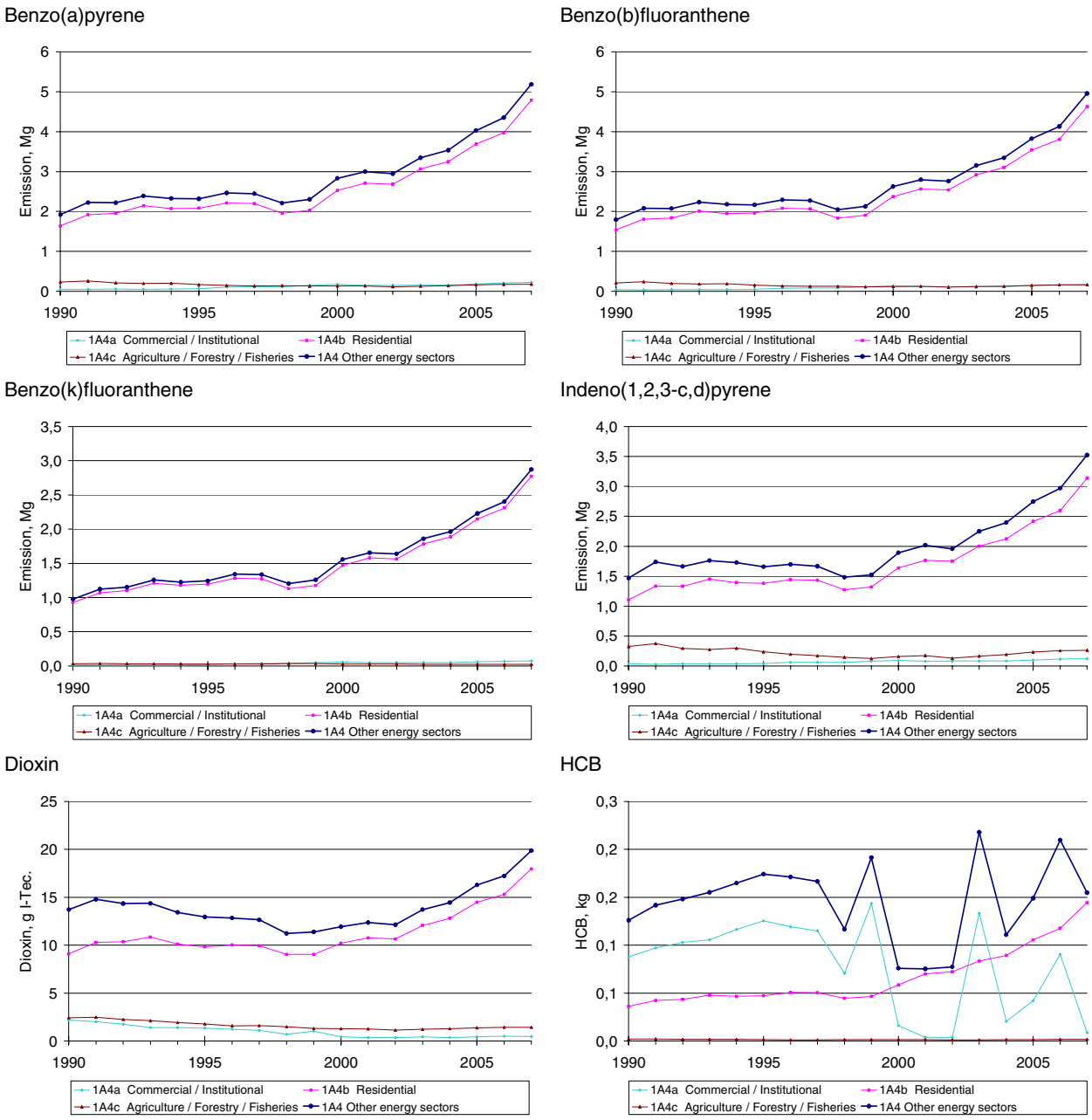


Figure 54 Time-series for PAH, dioxin and HCB emission, 1A4 Other Sectors.

11.3.1 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 55 shows the time-series for fuel consumption and emissions.

The fuel consumption in commercial/institutional plants has decreased 27 % 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 2007 was five times the consumption in 1990.

The CO_2 emission has decreased 44 % 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 2007 was four times the 1990 level. The increase is mainly a result of the increased emission from natural gas fuelled engines. The emission 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 49.

The N_2O emission in 2007 was 45 % 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 90 % 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 (Bek. 688 1998).

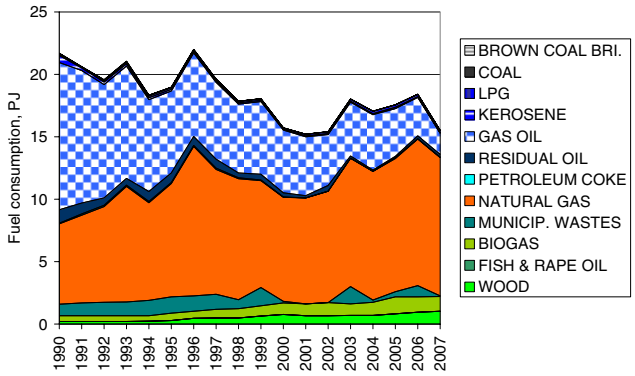
The NO_x emission was 34 % lower in 2007 than in 1990. The decrease is mainly a result of the lower fuel consumption but also the change from gas oil to natural gas has contributed to the decrease. The emission from gas engines and wood combustion has increased.

The NMVOC emission in 2007 was almost four times 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.

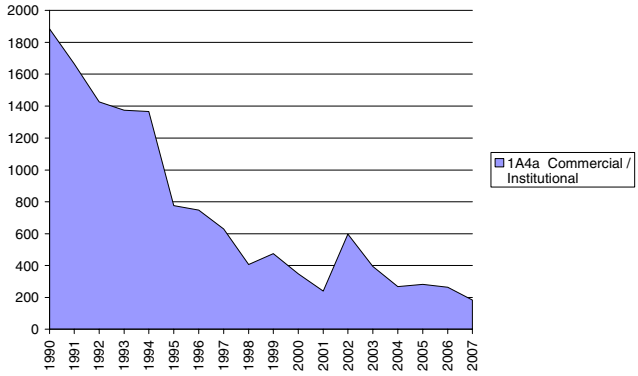
The CO emission has decreased 5 % since 1990. The emission from wood and from natural gas fuelled engines and boilers has increased whereas the emission from gas oil has decreased. This is a result of the change of fuels applied in the sector.

1A4a Commercial and institutional plants.

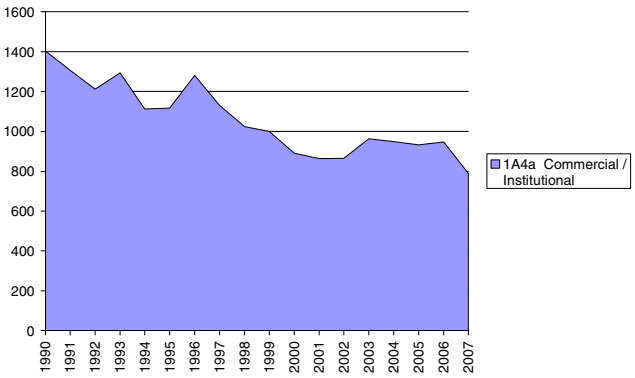
Fuel consumption, PJ



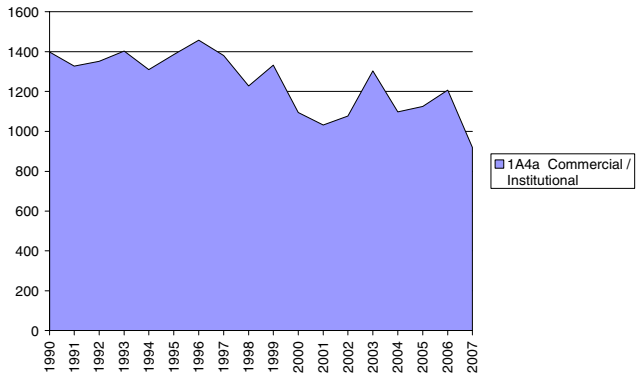
SO_2, Mg



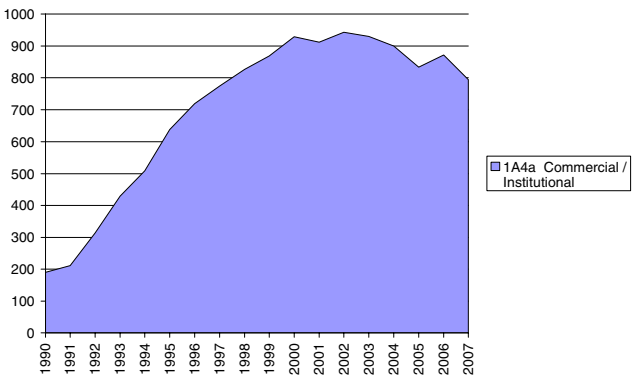
CO_2, Gg



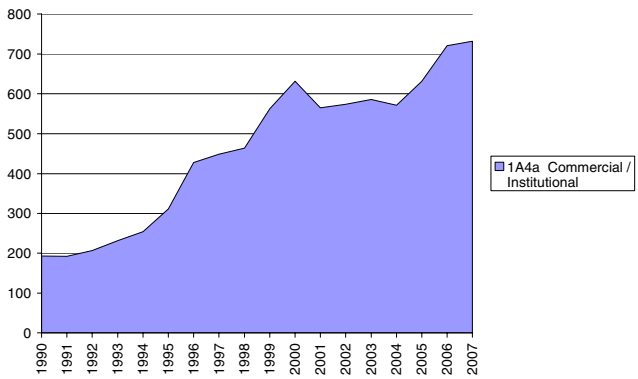
NO_x, Mg



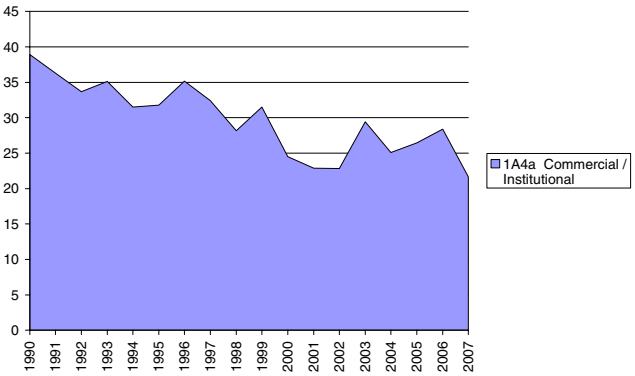
CH_4, Mg



NMVOC, Mg



N_2O, Mg



CO, Mg

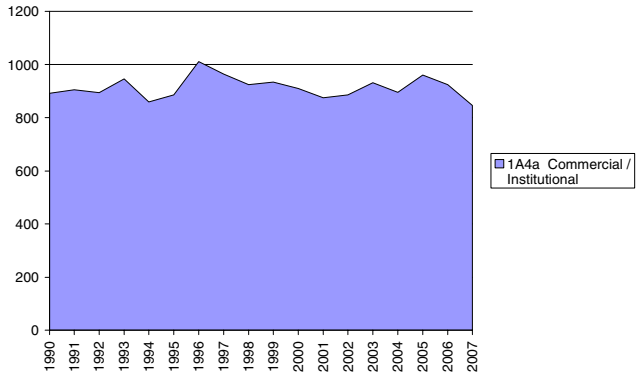


Figure 55 Time-series for 1A4a Commercial /institutional.

11.3.2 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 56 shows the time-series for fuel consumption and emissions.

For residential plants the total fuel consumption has been rather stable, and in 2007 the consumption was 4 % higher than in 1990. However, the consumption of gas oil has decreased since 1990 whereas the consumption of wood has increased considerably (four times the 1990 level). The consumption of natural gas has also increased since 1990.

The CO_2 emission has decreased by 37 % 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 25 % increase of N_2O emission since 1990 due to a higher emission factor for wood than for gas oil.

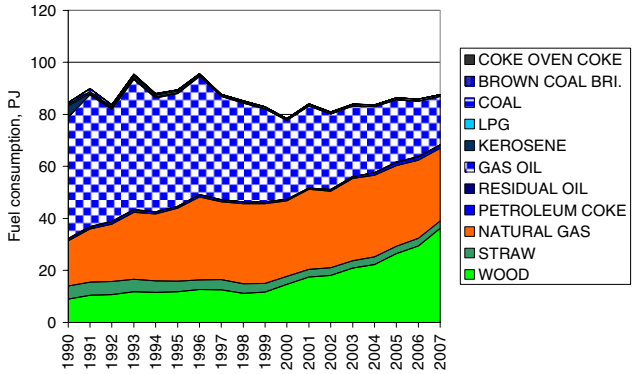
The large decrease (61 %) of SO_2 emission from residential plants is mainly a result of a change of sulphur content in gas oil since 1995. The lower sulphur content (0.05 %) is a result of Danish tax laws (Bek. 688 1998).

The NO_x emission has increased by 35 % since 1990 due to the increased emission from wood combustion. The emission factor for wood is higher than for gas oil.

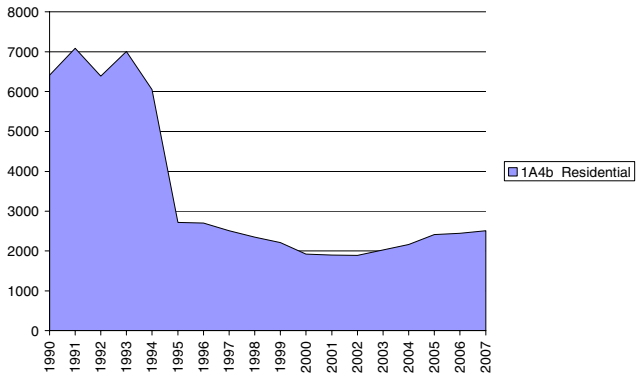
The emission of NMVOC has increased to 2.4 times the 1990 level due to the increased combustion of wood. The emission factor for wood have decreased since 1990, but not as much as the increase in consumption of wood. The emission factor for wood and straw is much higher than for other fuels.

The CO emission has increased 63 % due to the increased use of wood that is the main source of emission. The emission from combustion of straw has decreased since 1990.

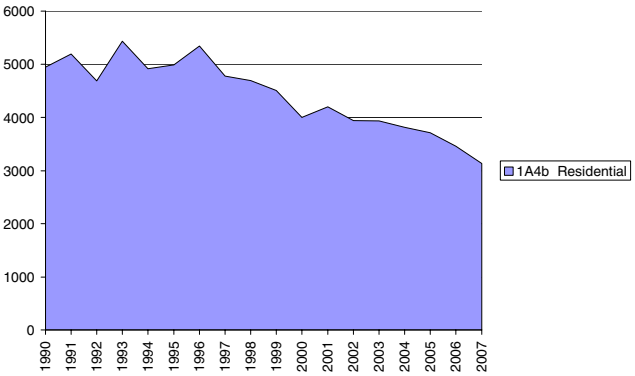
Fuel consumption, PJ



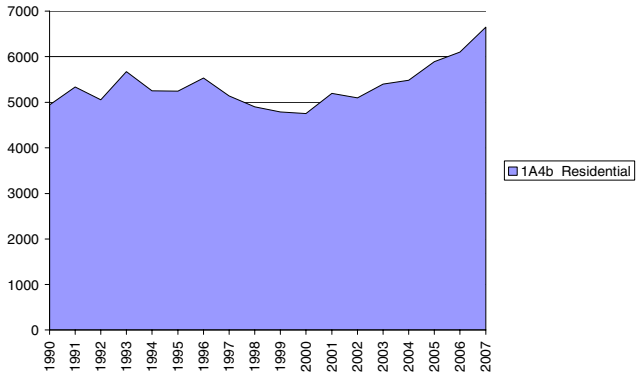
SO_2, Mg



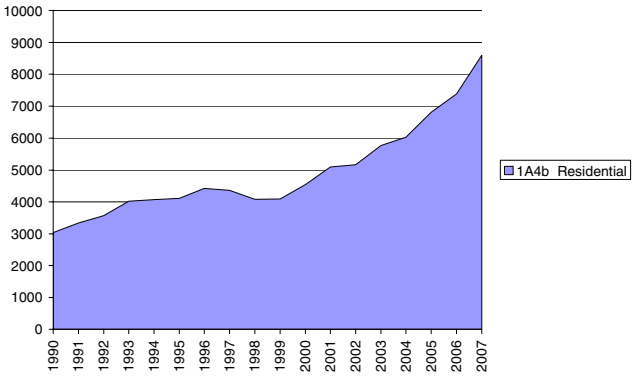
CO_2, Gg



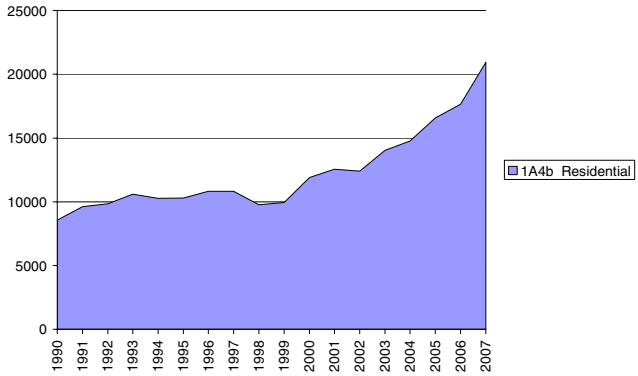
NO_x, Mg



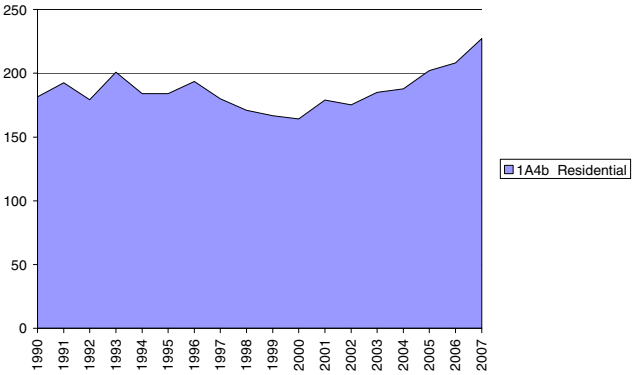
CH_4, Mg



NMVOC, Mg



N_2O, Mg



CO, Mg

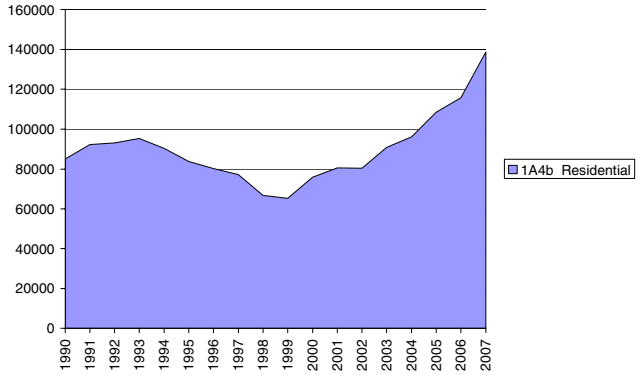


Figure 56 Time-series for 1A4b Residential plants.

11.3.3 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 57 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 49). 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 2007 was 28 % 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 2007 was 39 % higher than the emission in 1990. The emission follows the time-series for natural gas combusted in gas engines (Figure 49). 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 34 % 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.

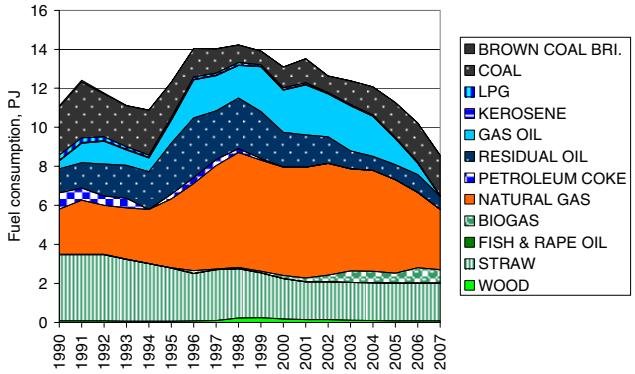
The SO_2 emission was 47 % lower in 2007 than in 1990. The emission decreased from 1990 to 2002 and increased after 2002. The main emission sources are coal, residual oil and straw and it is mainly the increase of coal combustion in the sector that has caused the increase of SO_2 emission in recent years.

The emission of NO_x was 23 % lower in 2007 than in 1990. This is in line with the decrease of fuel consumption.

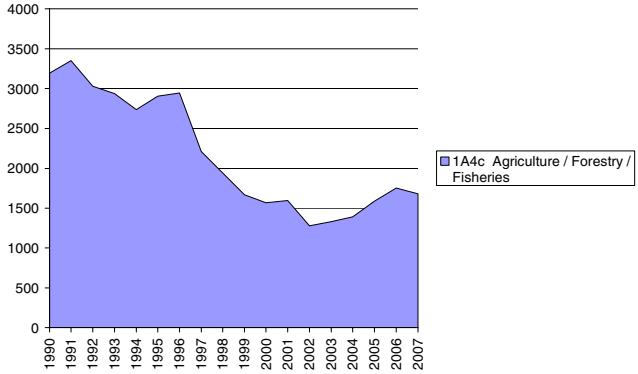
The emission of NMVOC has decreased 36 % since 1990. The major emission source is combustion of straw. The consumption of straw has decreased since 1990.

The CO emission has decreased 73 % 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.

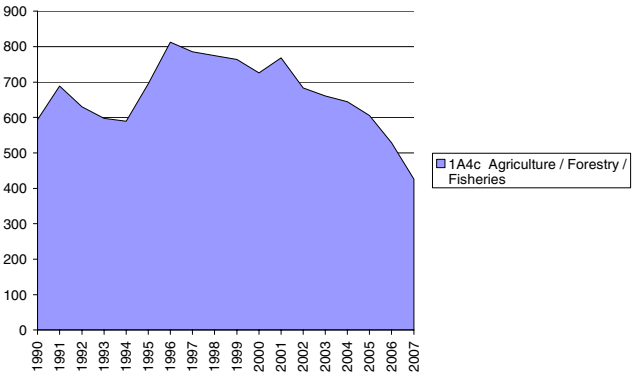
Fuel consumption, PJ



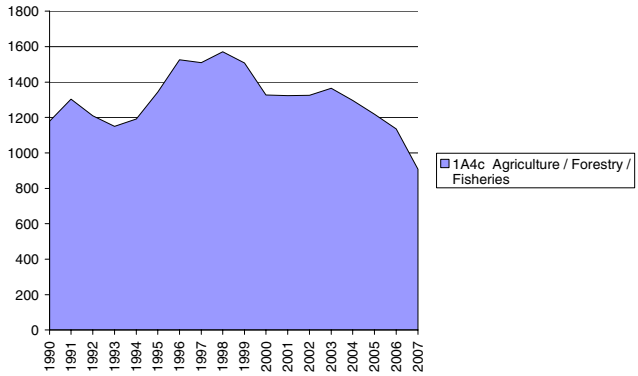
SO_2, Mg



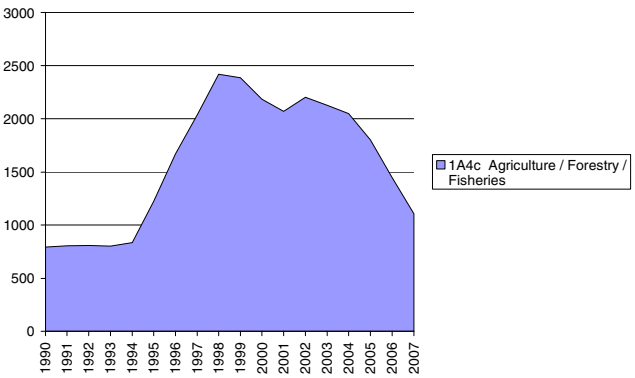
CO_2, Gg



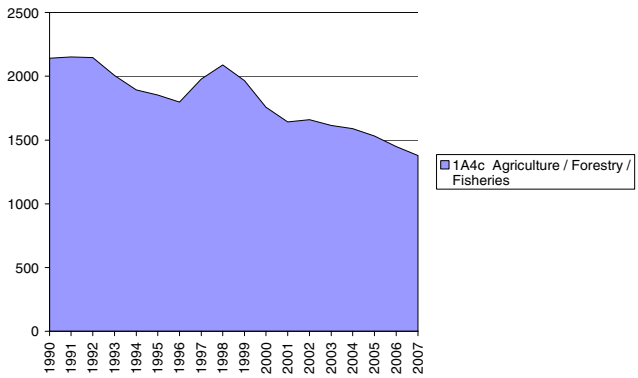
NO_x, Mg



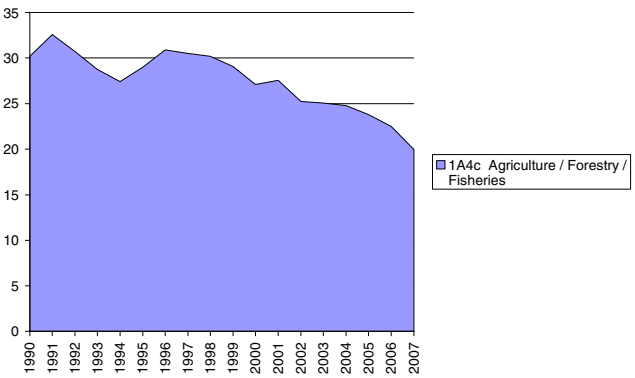
CH_4, Mg



NMVOC, Mg



N_2O, Mg



CO, Mg

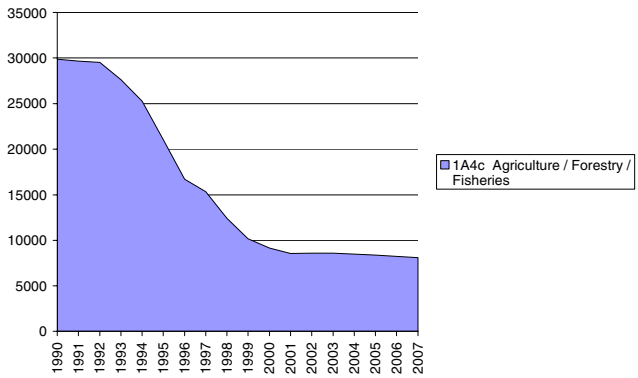


Figure 57 Time-series for 1A4c Agriculture/Forestry.

12 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 58. 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.

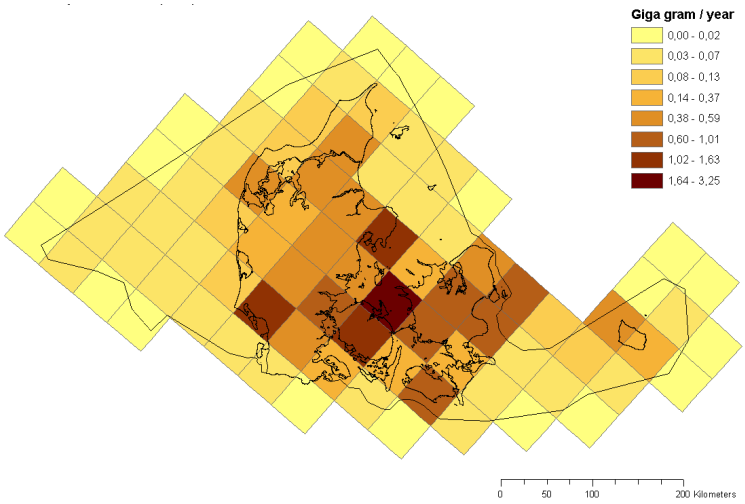


Figure 58 Gridded SO_2 emission from stationary combustion, 2005 (Jensen et al., 2008).

13 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.

13.1 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
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 subcategories 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 calcination is not part of the source category *Energy*. This emission is included in the source category *Industrial Processes*.

13.2 Tiers

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

13.3 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 2007, 71 stationary combustion plants are specified as large point sources. These point sources include:

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

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

- All centralized power plants, including smaller units.
- All units with a capacity of above 25 MW_e.
- All district heating plants with an installed effect of 50 MW_{th} or above and a significant fuel consumption.
- All waste incineration plants obliged to publish annual environmental reports accoring 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 2007 inventory was 333 PJ. This corresponds to 60 % of the overall fuel consumption for stationary combustion.

A list of the large point sources for 2007 and the fuel consumption rates is provided in Appendix 8. The number of large point sources registered in the databases increased from 1990 to 2007.

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 some of 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 legislatory requirement.
- 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.

13.4 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 13.7.

13.5 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 13.8.

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 13.7.1.

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

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

The Danish national energy statistics includes three fuels used for non-energy purposes, bitumen, white spirit and lubricants. The total consumption for non-energy purposes is relatively low, e.g. 13.2 PJ in 2007. The use of white spirit is included in the inventory in *Solvent and other product use* (Nielsen et al., 2009). The emissions associated with the use of bitumen and lubricants are included in *Industrial Processes* (Nielsen et al., 2009). The non-energy use of fuels is included in the reference approach for Climate Convention reporting.

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

Fuel consumption data are presented in Chapter 3.

13.6 Town gas

Town gas is included in the fuel category natural gas.

The consumption of town gas in Denmark is very low, e.g. 0.4 PJ in 2007. 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 pr Nm^3 and the CO_2 emission factor 56.4 kg pr GJ. This is very close to the emission factor used for natural gas of 56.78 kg pr GJ. According to the supplier both the composition and heating value will change during the year. It have not been possible to obtain a yearly average.

In earlier years the composition of natural 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 and 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 pr Nm^3. The CO_2 emission factors - derived from the few available measurements - is in the range of 52-57 kg pr 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.

13.7 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/CORINAIR Guidebook (EEA 2007) and IPCC Reference Manual (IPCC 1997).

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

13.7.1 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 and 2007.

The Danish emission inventory only includes data from plants using higher tier methods as defined in a 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 49 % of the CO_2 emission from stationary combustion.

EU ETS data for 2007 were available from 14 coal fired plants. The plant specific information accounts for roughly 85 % of the Danish coal consumption and 34 % of the total CO_2 emission from stationary combustion plants. The average CO_2 emission factor for coal for these 14 plants was 94.2 kg pr GJ (Table 31).

Table 31 EU ETS data for 14 coal fired power plants, 2007.

	Heating value, GJ pr tonne	Oxidation factor	CO_2 implied emission factor, kg pr GJ
Minimum value	23.8	0.97	93.2
Maximum value	24.9	0.998	95.1
Average	24.3	0.99	94.2

EU ETS data for 2007 based on higher tier methodologies were available from 17 units combusting residual oil and for two units combusting gas oil. Aggregated data are shown in Table 32 and Table 33.

Table 32 EU ETS data for 17 power plant units combusting residual oil.

	Heating value, GJ pr tonne	Oxidation factor	CO_2 implied emission factor, kg pr GJ
Minimum value	40.2	0.995	76.4
Maximum value	41.9	0.995	79.4
Average	40.8	0.995	78.2

Table 33 EU ETS data for 2 power plant units combusting gas oil.

	Heating value, GJ pr tonne	Oxidation factor	CO_2 implied emission factor, kg pr GJ
Minimum value	42.5	0.995	74.0
Maximum value	42.7	0.995	75.2
Average	42.6	0.995	74.8

Plant specific CO_2 emission factors have also been applied for the cement production, which is part of source category 1A2f Industry. These data also refer to EU ETS. The applied fuels are: Coal, residual oil, petroleum coke and waste (biomass and fossil).

13.7.2 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 51 % of the CO_2 emission.

The CO_2 emission factors applied for 2007 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 1990-2007.

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, because emissions from biomass are reported to the Climate Convention as a memo item.

The CO_2 emission from incineration of municipal waste (94.5 + 17.6 kg pr 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 CO_2 emission from combustion of the plastic content of the waste is reported in the fuel category, *Other fuels*. However, this split is not ap-

plied in either fuel consumption or other emissions, because it is only relevant for CO_2. Thus, the full consumption of municipal waste is included in the fuel category, *Biomass,* and the full amount of non-CO_2 emissions from municipal waste combustion is also included in the *Biomass*-category.

The CO_2 emission factors have been confirmed by the two major power plant operators, both directly (Christiansen 1996 and Andersen 1996) and indirectly, by applying the NERI emission factors in the annual environmental reports 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.

Table 34 CO_2 emission factors 2007.

Fuel	Emission factor Kg pr GJ		Reference type	IPCC fuel
	Biomass	Fossil fuel		Category
Coal		95 [1)]	Country specific	Solid
Brown coal briquettes		94.6 [2)]	IPCC 2007	Solid
Coke oven coke		108	IPCC 2007	Solid
Petroleum coke		92 [3)]	Country specific	Liquid
Wood	102		EEA 2004	Biomass
Municipal waste	94.5 [3)]	17.6 [3)]	Country specific	Biomass/Other fuels
Straw	102		Country specific	Biomass
Residual oil		78 [1)]	EEA 2004	Liquid
Gas oil		74 [1)]	EEA 2004	Liquid
Kerosene		72	EEA 2004	Liquid
Fish & rape oil	74		Country specific	Biomass
Orimulsion		80 [2)]	Country specific	Liquid
Natural gas		56.78	Country specific	Gas
LPG		65	EEA 2004	Liquid
Refinery gas		56.9	Country specific	Liquid
Biogas	83.6		Country specific	Biomass

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

[2)] Not applied in 2007.

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

Coal

The emission factor for coal, 95 kg pr 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 and Andersen 1996). One of the major power plant owners (Elsam[6]) reconfirmed the factor in 2001 (Christiansen 2001). The same emission factor has been applied for 1990-2007.

As mentioned above EU ETS data have been utilised for the 2006 and 2007 emission inventories. The implied emission factor for the power plants using coal was 94.2 kg pr GJ, see Chapter 13.7.1.

Brown coal briquettes

The emission factor for brown coal briquettes, 94.6 kg pr GJ, is based on a default value from the IPCC Guidelines assuming full oxidation. The default value in the IPCC Guidelines is 25.8 t C pr TJ, corresponding to

[6] Elsam was one of the tow major power plant owners. Now part of DONG Energy.

25.8·(12+2·16)/12 = 94.6 kg CO_2 pr GJ assuming full oxidation. The same emission factor has been applied for 1990-2007.

Coke oven coke

The emission factor for coke oven coke, 108 kg pr GJ, is based on a default value from the IPCC Guidelines assuming full oxidation. The default value in the IPCC guidelines is 29.5 t C pr TJ, corresponding to 29.5·(12+2·16)/12 = 108 kg CO_2 pr GJ assuming full oxidation. The same emission factor has been applied for 1990-2007.

Petroleum coke

The emission factor for petroleum coke, 92 kg pr 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 1990-2007.

Plant specific EU ETS data have been utilised for the cement production in the 2006 and 2007 emission inventories, see Chapter 13.7.1.

Wood

The emission factor for wood, 102 kg pr GJ, refers to Fenhann & Kilde (1994). The factor is based on the interval stated in a former edition of the EMEP/CORINAIR Guidebook (EEA, 2004) and the actual value is the default value from the CollectER database. The same emission factor has been applied for 1990-2007.

Municipal waste

The CO_2 emission from incineration of municipal waste 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.

The plastic content of waste was estimated to be 6.6 w/w% in 2003 (Hulgaard, 2003). The weight share, lower heating values and CO_2 emission factors for different plastic types are estimated by Hulgaard in 2003 (Table 35). The total weight share for plastic and for the various plastic types is assumed to be the same for all years (NERI assumption).

Table 35 Data for plastic waste in Danish municipal waste (Hulgaard 2003)[1)2)].

Plastic type	Mass share of plastic in municipal waste in Denmark		Lower heating value of plastic	Energy content of plastic	CO_2 emission factor for plastic	CO_2 emission factor
	kg plastic/ kg municipal waste	% of plastic	MJ pr kg plastic	MJ pr kg municipal waste	G pr MJ plastic	G pr kg municipal waste
PE	0.032	48	41	1.312	72.5	95
PS/EPS	0.02	30	37	0.74	86	64
PVC	0.007	11	18	0.126	79	10
Other (PET, PUR, PC, POM, ABS, PA etc.)	0.007	11	24	0.168	95	16
Total	0.066	100	35.5	2.346	78.7	185

Hulgaard (2003) refers to:
[1)] TNO report 2000/119, Eco-efficiency of recovery scenarios of plastic packaging, Appendices, July 2001 by P.G. Eggels, A.M.M. Ansems, B.L. van der Ven, for Association of Plastic Manufacturers in Europe.
[2)] Kost, Thomas, Brennstofftechnische Charakterisierung von Haushaltabfällen, Technische Universität Dresden, Eigenverlag des Forums für Abfallwirtschaft und Altlasten e.V., 2001.

Based on emission measurements on five municipal waste incineration plants (Jørgensen & Johansen, 2003) the total CO_2 emission factor for municipal waste incineration has been determined to 112.1 kg pr GJ. The CO_2 emission from the biomass part is the total CO_2 emission minus the CO_2 emission from the plastic part.

Thus, in 2003 the CO_2 emission factor for the plastic content of waste was estimated to be 185g pr kg municipal waste (Table 35). The CO_2 emission pr GJ of waste is calculated based on the lower heating values for waste listed in Table 36 (DEA 2008b). It has been assumed that the plastic content as a weight percentage is constant, resulting in a decreasing energy percentage since the lower heating value (LHV) is increasing. However, the increasing LHV may be a result of increasing plastic content in the municipal waste. Time-series for the CO_2 emission factor for plastic content in waste are included in Table 36.

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 plastic are assumed to be oxidised.

Table 36 CO_2 emission factor for municipal waste, plastic content and biomass content.

Year	Lower heating value of municipal waste [1] GJ pr Mg	Plastic content % of energy	CO_2 emission factor for plastic [3] G pr kg waste	CO_2 emission factor for plastic Kg pr GJ waste	CO_2 emission factor for municipal waste, total [2] Kg pr GJ waste	CO_2 emission factor for biomass content of waste Kg pr GJ waste
1990	8.20	28.6	185	22.5	112.1	89.6
1991	8.20	28.6	185	22.5	112.1	89.6
1992	9.00	26.1	185	20.5	112.1	91.6
1993	9.40	25.0	185	19.6	112.1	92.5
1994	9.40	25.0	185	19.6	112.1	92.5
1995	10.00	23.5	185	18.5	112.1	93.6
1996	10.50	22.3	185	17.6	112.1	94.5
1997	10.50	22.3	185	17.6	112.1	94.5
1998	10.50	22.3	185	17.6	112.1	94.5
1999	10.50	22.3	185	17.6	112.1	94.5
2000	10.50	22.3	185	17.6	112.1	94.5
2001	10.50	22.3	185	17.6	112.1	94.5
2002	10.50	22.3	185	17.6	112.1	94.5
2003	10.50	22.3	185	17.6	112.1	94.5
2004	10.50	22.3	185	17.6	112.1	94.5
2005	10.50	22.3	185	17.6	112.1	94.5
2006	10.50	22.3	185	17.6	112.1	94.5
2007	10.50	22.3	185	17.6	112.1	94.5

[1] DEA 2008b.
[2] Based on data from Jørgensen & Johansen (2003).
[3] From Table 35.

Plant specific EU ETS data have been utilised for cement production in the 2006 and 2007 emission inventories, see Chapter 13.7.1.

Ongoing work (DTU, 2008) will improve the CO_2 emission factor and improved time-series will be included in the 2010 emission inventory.

Straw

The emission factor for straw, 102 kg pr GJ refers to Fenhann & Kilde (1994). The factor is based on the interval stated in the EMEP/Corinair Guidebook (EEA, 2007) and the actual value is the default value from the Collecter database. The same emission factor have been applied for 1990-2007.

Residual oil

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

Plant specific EU ETS data have been utilised for some power plants and for cement production in the 2006 and 2007 emission inventories, see Chapter 13.7.1. The implied emission factor for the power plants using residual oil was 78.2 kg pr GJ.

Gas oil

The emission factor for gas oil, 74 kg pr GJ, refers to Fenhann & Kilde (1994). The factor is based on the interval stated in the EMEP/Corinair Guidebook (EEA 2007). The factor agrees with the IPCC default emission factor for gas oil (74.1 kg pr GJ assuming full oxidation). The CO_2 emission factor has been confirmed by the two major power plant op-

erators in 1996 (Christiansen, 1996 and Andersen, 1996). The same emission factor has been applied for 1990-2007.

Plant specific EU ETS data were utilised for some power plant units in the 2006 and 2007 emission inventory, see Chapter 13.7.1. The implied emission factor for the power plants using gas oil was 74.8 kg pr GJ.

Kerosene

The emission factor for kerosene, 72 kg pr GJ, refers to Fenhann & Kilde (1994). The factor agrees with the IPCC default emission factor for other kerosene (71.9 kg pr GJ assuming full oxidation). The same emission factor has been applied for 1990-2007.

Fish & rape oil

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

Orimulsion

The emission factor for orimulsion, 80 kg pr GJ, refers to the DEA (DEA 2008). The IPCC default emission factor is almost the same: 80.7 kg pr GJ assuming full oxidation. The CO_2 emission factor has been confirmed by the only major power plant operator using orimulsion (Andersen 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[7]. Only natural gas from the Danish gas fields is utilised in Denmark. The calculation is based on gas analysis carried out daily by Energinet.dk. Energinet.dk and the Danish Gas Technology Centre have calculated emission factors for 2000-2007. 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 and 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

LPG

The emission factor for LPG, 65 kg pr 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 de-

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

fault emission factor (63 kg pr GJ assuming full oxidation). The same emission factor has been applied for 1990-2007.

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 1990-2007.

Biogas

The emission factor for biogas, 83.6 kg pr GJ, is based on a biogas with 65 % (vol.) CH_4 and 35 % (vol.) CO_2. Danish Gas Technology Centre 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 1990-2007.

13.7.3 CH_4

The CH_4 emission factors applied for 2007 are presented in Table 38. In general, the same emission factors have been applied for 1990-2007. However, time-series have been estimated for both natural gas fuelled engines and biogas fuelled engines.

Emission factors for gas engines, gas turbines and CHP plants combusting wood, straw or municipal waste all refer to emission measurements carried out on Danish plants (Nielsen & Illerup 2003). For natural gas fired gas engines the emission factor refers to an updated study (Nielsen et al., 2008). Most other emission factors refer to the EMEP/CORI-NAIR Guidebook (EEA, 2004).

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 2007.

Fuel group	Fuel	CRF source category	CRF source category	SNAP	Emission factor, g pr GJ	Reference
BIOMASS	WOOD	1A1a	Electricity and heat production	010102, 010103, 010104	2	Nielsen & Illerup 2003
				010202, 010203	32	EEA 2004
		1A2	Industry	030100, 030102, 030103	32	EEA 2004
		1A4a	Commercial/Institutional	020100, 020105	200	EEA 2004
		1A4b i	Residential	020200	200	EEA 2004
		1A4c i	Agriculture/Forestry	020300	200	EEA 2004
	STRAW	1A1a	Electricity and heat production	010101, 010102, 010103, 010104	0.5	Nielsen & Illerup 2003
				010202, 010203	32	EEA 2004
		1A4b i	Residential	020200	200	EEA 2004
		1A4c i	Agriculture/Forestry	020300	200	EEA 2004
				020302	32	EEA 2004
	FISH & RAPE OIL	1A1a	Electricity and heat production	010101, 010102, 010103, 010202, 010203	1.5	EEA 2004, assuming same emission factor as for gas oil
		1A2	Industry	030105	1.5	EEA 2004, assuming same emission factor as for gas oil
		1A4a	Commercial/Institutional	020105	1.5	EEA 2004, assuming same emission factor as for gas oil
	BIOGAS	1A1a	Electricity and heat production	010102, 010103, 010203	4	EEA 2004
				010105, 010205	323	Nielsen & Illerup 2003
		1A1c	Other energy industries	010505	323	Nielsen & Illerup 2003
		1A2	Industry	030100, 030102	4	EEA 2004
				030105	323	Nielsen & Illerup 2003
		1A4a	Commercial/Institutional	020100, 020103	4	EEA 2004
				020105	323	Nielsen & Illerup 2003
		1A4c i	Agriculture/Forestry	020300	4	EEA 2004
				020304	323	Nielsen & Illerup 2003
OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010102, 010103	0.59	Nielsen & Illerup 2003
				010203	6	EEA 2004
		1A4a	Commercial/Institutional	020103	6	EEA 2004
GAS	NATURAL GAS	1A1a	Electricity and heat production	010100, 010101, 010102, 010202	6	DGC 2001
				010103, 010203	15	Gruijthuijsen & Jensen 2000
				010104 (Gas turbines)	1.5	Nielsen & Illerup 2003
				010105, 010205 (Gas engines)	465	Nielsen et al. 2008
		1A1c	Other energy industries	010504 (Gas turbines)	1.5	Nielsen & Illerup 2003
				010505 (Gas engines)	465	Nielsen et al. 2008
		1A2	Industry	030100	6	DGC 2001
				030103	15	Gruijthuijsen & Jensen 2000
				030104 (Gas turbines)	1.5	Nielsen & Illerup 2003
				030105 (Gas engines)	465	Nielsen et al. 2008
		1A4a	Commercial/Institutional	020100	6	DGC 2001
				020103	15	Gruijthuijsen & Jensen 2000
				020104 (Gas turbines)	1.5	Nielsen & Illerup 2003
				020105 (Gas engines)	465	Nielsen et al. 2008
		1A4b i	Residential	020200	6	DGC 2001
				020202	15	Gruijthuijsen & Jensen 2000
				020204 (Gas engines)	465	Nielsen et al. 2008
		1A4c i	Agriculture/Forestry	020300	6	DGC 2001
				020303 (Gas turbines)	1.5	Nielsen & Illerup 2003
				020304 (Gas engines)	465	Nielsen et al. 2008
LIQUID	PETROLEUM COKE	1A4a	Commercial/Institutional	020100	15	EEA 2004
		1A4b i	Residential	020200	15	EEA 2004
	RESIDUAL OIL	1A1a	Electricity and heat production	010101, 010102, 010104, 010202, 010203	3	EEA 2004
		1A1b	Petroleum refining	010306	3	EEA 2004
		1A2	Industry	030100, 030102	3	EEA 2004
		1A4a	Commercial/Institutional	020100	3	EEA 2004
		1A4b i	Residential	020200	3	EEA 2004
		1A4c i	Agriculture/Forestry	020300, 020302	3	EEA 2004
	GAS OIL	1A1a	Electricity and heat production	010101, 010102, 010103, 010104, 010105, 010201, 010202, 010203, 010204, 010205	1.5	EEA 2004
		1A1b	Petroleum refining	010306	1.5	EEA 2004
		1A1c	Other energy industries	010505	1.5	EEA 2004
		1A2	Industry	030100, 030102, 030104	1.5	EEA 2004
		1A4a	Commercial/Institutional	020100, 020103, 020105	1.5	EEA 2004
		1A4b i	Residential	020200	1.5	EEA 2004
		1A4c i	Agriculture/Forestry	020304	1.5	EEA 2004
	KEROSENE	1A2	Industry	030100	7	EEA 2004
		1A4a	Commercial/Institutional	020100	7	EEA 2004
		1A4b i	Residential	020200	7	EEA 2004
		1A4c i	Agriculture/Forestry	020300	7	EEA 2004
	LPG	1A2	Industry	030100	1	EEA 2004
		1A4a	Commercial/Institutional	020100, 020105	1	EEA 2004
		1A4b i	Residential	020200	1	EEA 2004
		1A4c i	Agriculture/Forestry	020300	1	EEA 2004

Fuel group	Fuel	CRF source category	CRF source category	SNAP	Emission factor, g pr GJ	Reference
Continued						
	REFINERY GAS	1A1b	Petroleum refining	010304, 010306	1.5	EEA 2004
SOLID	COAL	1A1a	Electricity and heat production	010101, 010102	1.5	EEA 2004
				010202	15	EEA 2004
		1A2	Industry	030100	15	EEA 2004
		1A4b i	Residential	020200	15	EEA 2004
		1A4c i	Agriculture/Forestry	020300	15	EEA 2004
	COKE OVEN COKE	1A2	Industry	030100	15	EEA 2004, assuming same emission factor as for coal
		1A4b i	Residential	020200	15	EEA 2004, assuming same emission factor as for coal

CHP plants

A considerable part of the electricity production in Denmark is based on decentralised CHP plants, and well-documented emission factors for these plants are, therefore, of importance. In a project carried out for the electricity transmission company in Western Denmark, Eltra, emission factors for CHP plants <25MW_e have been estimated. The work was reported in 2003 (Nielsen & Illerup, 2003).

The work included municipal waste incineration plants, CHP plants combusting wood and straw, natural gas and biogas-fuelled (reciprocating) engines, and natural gas fuelled gas turbines. CH_4 emission factors for these plants all refer to Nielsen & Illerup (2003). The estimated emission factors were based on existing emission measurements as well as on emission measurements carried out within the project. The number of emission data sets were 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.

A study conducted in 2006/2007 produced updated emission factors for natural gas powered gas engines including start/stop emissions (Nielsen et al., 2008). Ongoing work will update emission factors for all CHP plants (DGC 2008). In addition oil fuelled engines are included in this project.

Gas engines, natural gas

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

The emission factor for natural gas engines refers to the Nielsen et al. (2008). Emission factor time-series up till 2006 have been estimated. However, the full load emission factors up till year 2000 on which the time-series are based refer to Nielsen & Illerup (2003). These two references are discussed below.

Nielsen & Illerup (2003):

> *The emission factor for natural gas engines was 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 (year 2000). 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 disaggre-*

gation factor was estimated based on a number of emission measurements including both CH_4 and NMVOC.

Nielsen et al. (2008):

> *The new study calculated a start/stop correction factor. This factor was applied to the time-series estimated in Nielsen & Illerup (2003). Further a new full load emission factors for 2006 was estimated. A full load time-series for the years 2000-2006 was estimated and the same start/stop correction factors applied for all years.*

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 and, in later years, mainly pre-chamber engines were installed. As mentioned above, pre-chamber engines have a higher emission factor than open-chamber engines; therefore, the emission factor has changed during the period 1990-2006. The time-series were based on:

- Emission factors for different engine types.
- Data for year of installation for each engine and fuel consumption of each engine 1994-2002 from the DEA (DEA, 2003).
- Research concerning the CH_4 emission from gas engines carried out in 1997 (Nielsen & Wit, 1997).

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	615
1997	551
1998	542
1999	541
2000	537
2001	537
2002	537
2003	537
2004	513
2005	489
2006	465
2007	465

Gas engines, biogas

SNAP 010105, 010505, 020105, 020304 and 030105

The emission factor for biogas engines was estimated to 323 g pr GJ in 2000 and the same emission factor has been applied for 2001 - 2007. The emission factor for biogas engines was based on 18 emission measure-

ments on 13 different plants. The plants from which emission measurements were available represented 18 % of the total gas consumption in gas engines (year 2000).

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 (Nielsen & Illerup, 2003).

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	323
2002	323
2003	323
2004	323
2005	323
2006	323
2007	323

Gas turbines, natural gas
SNAP 010104, 010504, 020104, 020303 and 030104

The emission factor for gas turbines was estimated to be below 1.5 g pr GJ and the emission factor 1.5 g pr GJ has been applied for all years. The emission factor was based on emission measurements on nine plants.

CHP, wood
SNAP 010102 and, 010103 and 010104

The emission factor for CHP plants combusting wood was estimated to be below 2.1 g pr GJ and the emission factor 2 g pr GJ has been applied for all years. The emission factor was based on emission measurements on three plants.

CHP, straw
SNAP 010102 and 010103

The emission factor for CHP plants combusting straw was estimated to be below 0.5 g pr GJ and the emission factor 0.5 g pr GJ has been applied for all years. The emission factor was based on emission measurements on four plants.

CHP, municipal waste
SNAP 010102, 010103, 010104 and 010105

The emission factor for CHP plants combusting municipal waste was estimated to be below 0.59 g pr GJ and the emission factor 0.59 g pr GJ has been applied for all years. The emission factor was based on emission measurements on 16 plants.

Other stationary combustion plants

Emission factors for other plants refer to the EMEP/Corinair Guidebook (EEA 2007 and EEA 2004), the Danish Gas Technology Centre (DGC 2001) or Gruijthuijsen & Jensen (2000). The same emission factors have been applied for 1990-2007.

13.7.4 N_2O

The N_2O emission factors applied for the 2007 inventory are listed in Table 41. The same emission factors have been applied for 1990-2007.

Emission factors for gas engines, gas turbines and CHP plants combusting wood, straw or municipal waste all refer to emission measurements carried out on Danish plants (Nielsen & Illerup 2003). The emission factor for coal-powered plants in public power plants refers to research conducted by Elsam (now part of DONG Energy). Other emission factors refer to the EMEP/CORINAIR Guidebook (EEA 2007).

Table 41 N_2O emission factors 1990-2007.

Fuel group	Fuel	CRF source category	CRF source category	SNAP	Emission factor g pr G.	Reference
BIOMASS	WOOD	1A1a	Electricity and heat production	010102, 010103, 010104	0.8	Nielsen & Illerup 2003
				010202, 010203	4	EEA 2004
		1A2	Industry	all	4	EEA 2004
		1A4a	Commercial/Institutional	all	4	EEA 2004
		1A4b i	Residential	020200	4	EEA 2004
		1A4c i	Agriculture/Forestry	020300	4	EEA 2004
	STRAW	1A1a	Electricity and heat production	010101, 010102, 010103, 010104	1.4	Nielsen & Illerup 2003
				010202, 010203	4	EEA 2004
		1A4b i	Residential	020200	4	EEA 2004
		1A4c i	Agriculture/Forestry	all	4	EEA 2004
	FISH & RAPE OIL	1A1a	Electricity and heat production	all	2	EEA 2004, assuming same emission factor as gas oil
		1A2	Industry	030105	2	EEA 2004, assuming same emission factor as gas oil
		1A4a	Commercial/Institutional	020105	2	EEA 2004, assuming same emission factor as gas oil
	BIOGAS	1A1a	Electricity and heat production	010102, 010103, 010203	2	EEA 2004
				010105, 010205 (Gas engines)	0.5	Nielsen & Illerup 2003
		1A1c	Other energy industries	010505 (Gas engines)	0.5	Nielsen & Illerup 2003
		1A2	Industry	030100, 030102	2	EEA 2004
				030105 (Gas engines)	0.5	Nielsen & Illerup 2003
		1A4a	Commercial/Institutional	020100, 020103	2	EEA 2004
				020105 (Gas engines)	0.5	Nielsen & Illerup 2003
		1A4c i	Agriculture/Forestry	020300	2	EEA 2004
				020304 (Gas engines)	0.5	Nielsen & Illerup 2003
OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010102, 010103	1.2	Nielsen & Illerup 2003
				010203	4	EEA 2004
		1A4a	Commercial/Institutional	020103	4	EEA 2004
GAS	NATURAL GAS	1A1a	Electricity and heat production	010100, 010101, 010102, 010103, 010202, 010203	1	EEA 2004
				010104 (Gas turbines)	2.2	Nielsen & Illerup 2003
				010105, 010205 (Gas engines)	1.3	Nielsen et al. 2008
		1A1c	Other energy industries	010504 (Gas turbines)	2.2	Nielsen & Illerup 2003
				010505 (Gas engines)	1.3	Nielsen et al. 2008
		1A2	Industry	030100, 030103	1	EEA 2004
				030104 (Gas turbines)	2.2	Nielsen & Illerup 2003
				030105 (Gas engines)	1.3	Nielsen et al. 2008
		1A4a	Commercial/Institutional	020100, 020103	1	EEA 2004
				020104 (Gas turbines)	2.2	Nielsen & Illerup 2003
				020105 (Gas engines)	1.3	Nielsen et al. 2008
		1A4b i	Residential	020200, 020202	1	EEA 2004
				020204 (Gas engines)	1.3	Nielsen et al. 2008
		1A4c i	Agriculture/Forestry	020300	1	EEA 2004
				020303 (Gas turbines)	2.2	Nielsen & Illerup 2003
				020304 (Gas engines)	1.3	Nielsen et al. 2008
LIQUID	PETROLEUM COKE	1A4a	Commercial/Institutional	020100	3	EEA 2004
		1A4b i	Residential	020200	3	EEA 2004
	RESIDUAL OIL	1A1a	Electricity and heat production	all	2	EEA 2004
		1A1b	Petroleum refining	010306	2	EEA 2004
		1A2	Industry	all	2	EEA 2004
		1A4a	Commercial/Institutional	020100	2	EEA 2004
		1A4b i	Residential	020200	2	EEA 2004
		1A4c i	Agriculture/Forestry	all	2	EEA 2004
	GAS OIL	1A1a	Electricity and heat production	all	2	EEA 2004
		1A1b	Petroleum refining	010306	2	EEA 2004
		1A1c	Other energy industries	010505	2	EEA 2004
		1A2	Industry	all	2	EEA 2004
		1A4a	Commercial/Institutional	all	2	EEA 2004
		1A4b i	Residential	020200	2	EEA 2004
		1A4c i	Agriculture/Forestry	020304	2	EEA 2004
	KEROSENE	1A2	Industry	030100	2	EEA 2004
		1A4a	Commercial/Institutional	020100	2	EEA 2004
		1A4b i	Residential	020200	2	EEA 2004
		1A4c i	Agriculture/Forestry	020300	2	EEA 2004
	LPG	1A2	Industry	030100	2	EEA 2004
		1A4a	Commercial/Institutional	all	2	EEA 2004
		1A4b i	Residential	020200	2	EEA 2004
		1A4c i	Agriculture/Forestry	020300	2	EEA 2004
	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	0.8	Elsam 2005
				010202	3	EEA 2004
		1A2	Industry	030100	3	EEA 2004
		1A4b i	Residential	020200	3	EEA 2004
		1A4c i	Agriculture/Forestry	020300	3	EEA 2004
	COKE OVEN COKE	1A2	Industry	030100	3	EEA 2004
		1A4b i	Residential	020200	3	EEA 2004

13.7.5 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, 2004 and EEA, 2007).
- The IPCC Guidelines, Reference Manual (IPCC, 1997).
- Danish legislation:
  - Miljøstyrelsen, 2001 (Danish Environmental Protection Agency).
  - Miljøstyrelsen, 1990 (Danish Environmental Protection Agency).
  - Miljøstyrelsen, 1998 (Danish Environmental Protection Agency).
- Danish research reports including:
  - An emission measurement program for decentralised CHP plants (Nielsen & Illerup, 2003).
  - Measurement program for natural gas powered gas engines (Nielsen et al., 2008).
  - Research and emission measurements programs for biomass fuels:
    - Nikolaisen et al.; 1998).
    - Jensen & Nielsen, 1990.
    - Serup et al., 1999.
  - Research and environmental data from the gas sector:
    - Gruijthuijsen & Jensen, 2000.
    - Danish Gas Technology Centre (DGC), 2001.
- Calculations based on plant-specific emissions from a considerable number of power plants (Nielsen, 2003).
- 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.
- Additional personal communication.

Emission factor time-series have been estimated for a considerable number of the emission factors. These are provided in Appendix 6.

13.7.6 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 (Nielsen et al., 2003) referring to:

- Danish legislation:
  - Luftvejledningen (2001) (legislation from Danish Environmental Protection Agency).

    - Bek. 689 (1990) (legislation from Danish Environmental Protection Agency).
- Calculations based on plant-specific emission data from a considerable number of municipal waste incineration plants.
- Danish research reports including:
    - Danish research regarding wood combustion in residential plants (Henriksen et al., 2006).
    - An emission measurement program for decentralised CHP plants (Nielsen & Illerup, 2003).
    - An emission measurement program for large power plants (Livbjerg et al., 2001).
- Additional personal communication concerning wood and straw combustion in residential plants.

Emission factor time-series have been estimated for residential wood combustion. All other emission factors have been considered constant in 2000-2007.

13.7.7 Heavy metals

Emission factors for 2007 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).
- Emission measurement program carried out on Danish decentralised CHP plants (Nielsen & Illerup, 2003).

Time-series have been estimated for municipal waste incineration. For all other sources the same emission factors have been applied for 1990-2007.

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.

13.7.8 PAH

Emission factors 2007 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).
- An emission measurement program carried out on Danish decentralised CHP plants (Nielsen & Illerup, 2003).
- Additional information from the gas sector and the electricity production sector (Sander, 2003; Jensen, 2001).
- For residential wood combustion country specific emission factors have been aggregated based on technology distribution in the sec-

tor (Illerup et al., 2007) and guidebook emission factors (EEA, 2007).

Emission factor time-series have been estimated for residential wood combustion. All other emission factors have been considered constant from 1990 to 2007. In general, emission factors for PAH are uncertain.

13.7.9 Dioxin

Emission factors 2007 for dioxin are shown in Appendix 6.

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

The emission factor for residential wood combustion refers to technology specific emission factors from Henriksen et al. (2006) and to updated technology distribution data (Illerup et al., 2007).

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 1990-2007.

13.7.10 HCB

Emission factors 2007 for HCB are shown in Appendix 6. The HCB emission factors all refer to the EMEP/Corinair Guidebook (EEA, 2007). Time-series have not yet been estimated for HCB emission factors.

13.7.11 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.

13.8 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.

14 Uncertainty

According to the IPCC Good Practice Guidance (IPCC, 2000) uncertainty estimates should be included in the annual National Inventory Report (NIR).

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 ±8.5 % and the decrease in the GHG emission since 1990 has been estimated to be 8.5 % ± 2.1 %-age-points.

14.1 Methodology

14.1.1 Greenhouse gases

The Danish uncertainty estimates for GHGs are based on the Tier 1 approach in the IPCC Good Practice Guidance (IPC, 2000). The estimates are based on uncertainties for emission factors and fuel consumption rates, respectively. The input data required for the uncertainty calculations are:

- Emission data for the base year and the latest year.
- Uncertainty for activity rates.
- Uncertainty for emission factors.

The uncertainty levels have been estimated for the following emission source subcategories within stationary combustion:

- CO_2 emission from each of the applied fuel categories.
- CH_4 emission from gas engines.
- CH_4 emission from all other stationary combustion plants.
- N_2O emission from all stationary combustion plants.

The implementation of the EU ETS data for CO_2 have not been taken into account and thus the uncertainty of the CO_2 emission factor is likely to be overestimated.

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.

Most of the applied uncertainty estimates for activity rates and emission factors are default values from the IPCC Reference Manual. A few of the uncertainty estimates are, however, based on national estimates.

Table 42 Uncertainty rates for activity rates and emission factors.

IPCC Source category	Gas	Activity data uncertainty %	Emission factor uncertainty %
Stationary Combustion, Coal	CO_2	1[1)]	5[3)]
Stationary Combustion, BKB	CO_2	3[1)]	5[1)]
Stationary Combustion, Coke oven coke	CO_2	3[1)]	5[1)]
Stationary Combustion, Petroleum coke	CO_2	3[1)]	5[1)]
Stationary Combustion, Plastic waste	CO_2	5[4)]	5[4)]
Stationary Combustion, Residual oil	CO_2	2[1)]	2[3)]
Stationary Combustion, Gas oil	CO_2	4[1)]	5[1)]
Stationary Combustion, Kerosene	CO_2	4[1)]	5[1)]
Stationary Combustion, Orimulsion	CO_2	1[1)]	2[3)]
Stationary Combustion, Natural gas	CO_2	3[1)]	1[3)]
Stationary Combustion, LPG	CO_2	4[1)]	5[1)]
Stationary Combustion, Refinery gas	CO_2	3[1)]	5[1)]
Stationary combustion plants, gas engines	CH_4	2.2[1)]	40[2)]
Stationary combustion plants, other	CH_4	2.2[1)]	100[1)]
Stationary combustion plants	N_2O	2.2[1)]	1000[1)]

[1)] IPCC Good Practice Guidance (default value).
[2)] Kristensen (2001).
[3)] Jensen & Lindroth (2002).
[4)] NERI assumption.

14.1.2 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. Uncertainty estimates have not yet been performed for dioxin and HCB.

The uncertainty estimates are based on emission data for the base year and year 2007 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
01	10	20	50	20	50	100	100
02	20	50	50	50	500	1 000	1 000
03	10	20	50	20	50	100	100

14.2 Results

The uncertainty estimates for stationary combustion emission inventories are shown in Table 44. Detailed calculation sheets are provided in Appendix 10.

The uncertainty interval for GHG is estimated to be ±8.5 % and trend in GHG emission is -8.5 %±2.1 %-age points. The main sources of uncertainty for GHG emission are N_2O emission (all plants) and CO_2 emission from coal combustion. The main source of uncertainty in the trend in GHG emission is CO_2 emission from the combustion of coal and natural gas and N_2O emission (all plants).

The total emission uncertainty is 7 % for SO_2, 16 % for NO_x, 44 % for NMVOC and 43 % for CO. For PM, most heavy metals and PAH the uncertainty estimate are larger than 100 %.

Table 44 Danish uncertainty estimates, 2007.

Pollutant	Uncertainty Total emission, %	Trend 1990-2007, %	Uncertainty Trend, %-age points
GHG	8,5	-8.5	±2.1
CO_2	2,9	-9.6	±1.5
CH_4	54	+256	±169
N_2O	1 000	+15.2	±3.6
SO_2	7,1	-87	±0.7
NO_x	16	-46	±3
NMVOC	44	+109	±6
CO	43	+22	±4
TSP [1)]	464	+61	±48
PM_{10} [1)]	471	+69	±48
$PM_{2.5}$ [1)]	478	+71	±40
As	104	-58	±7
Cd	400	-34	±171
Cr	89	-82	±4
Cu	258	-66	±57
Hg	307	-65	±69
Ni	105	-63	±6
Pb	94	-70	±3
Se	101	-58	±5
Zn	252	+15	±112
Benzo(b)fluoranthene	975	+166	±40
Benzo(k)fluoranthene	989	+187	±64
Benzo(a)pyrene	993	+176	±11
Indeno(1,2,3-c,d)pyrene	996	+138	±23

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

15 QA/QC and verification

The elaboration of a formal QA/QC plan started in 2004. A first version is available from Sørensen et al. (2005).

The quality manual describes the concepts of quality work and definitions of sufficient quality, critical control points and a list of Point for Measuring (PM). Please see the general chapter on QA/QC.

The work on expanding the QC will be ongoing in future years.

15.1 Data storage, level 1

Table 45 List of external data sources.

Dataset	Description	AD or Emf.	Reference	Contact(s)	Data agreement/ Comment
Energiproducenttællingen.xls	Data set for all electricity and heat producing plants.	Activity data	The Danish Energy Agency (DEA)	Peter Dal	Data agreement in place
Gas consumption for gas engines and gas turbines 1990-1994		Activity data	DEA	Peter Dal	No data agreement. Historical data
Basic data (Grunddata.xls)	Data set used for IPCC reference approach	Activity data	DEA	Peter Dal	Not necessary. Published as part of national energy statistics
Energy statistics	The Danish energy statistics on SNAP level	Activity data	DEA	Peter Dal	Data agreement in place
SO_2 & NO_x data, plants>25 MW_e		Emissions	DEA	Marianne Nielsen	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 avialability of detailed information is part of a future data agreement with DEA.
Additional data	Fuel consumption and emissions from large industrial plants	AD & emissions	Aalborg Portland Statoil Shell	Henrik M. Thomsen Peder Nielsen Lis R. Rasmussen	No formal data agreement in place

Data Storage level 1	1. Accuracy	DS.1.1.1	General level of uncertainty for every dataset including the reasoning for the specific values

Since the DEA are responsible for the official Danish energy statistics as well as reporting to the IEA, NERI regards the data as being complete and in accordance with the official Danish energy statistics and IEA reporting. The uncertainties connected with estimating fuel consumption do not, therefore, influence the accordance between IEA data, the energy statistics and the dataset on SNAP level utilised by NERI. For the

remainder of the datasets, it is assumed that the level of uncertainty is relatively low. For further comments regarding uncertainties, see Chapter 14.

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 14.

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 45 for an overview of external datasets.

Danish Energy Authority

Statistic on fuel consumption from district heating and power plants

A spreadsheet from DEA is listing fuel consumption of all plants included as large point sources in the emission inventory. The statistic on fuel consumption from district heating and power plants is regarded as complete and with no significant uncertainty since the plants are bound by law to report their fuel consumption and other information.

Gas consumption for gas engines and gas turbines 1990-1994

For the years 1990-1994 DEA has estimated consumption of natural gas and biogas in gas engines and gas turbines. NERI assesses that the estimation by the DEA are the best available data.

Basic data

A spreadsheet from DEA is used for the CO_2 emission calculation in accordance with the IPCC reference approach. It is published annually on DEA's webpage; therefore, a formal data delivery agreement is not deemed necessary.

Energy statistics on SNAP level

The DEA reports fuel consumption statistics on SNAP level based on a correspondence table developed in co-operation with NERI. Both traded and non-traded fuels are included in the Danish energy statistics. Thus, for example, estimation of the annual consumption of non-traded wood is included. Petroleum coke, purchased abroad and combusted in Danish residential plants (border trade), is added to the apparent consumption of petroleum coke and the emissions are included in the inventory.

Emissions from non-energy use of fuels have been included in other source categories of the Danish inventory. The non-energy use of fuels is, however, included in the reference approach for Climate Convention reporting.

SO_2 and NO_x emission data from electricity producing plants > 25MWe

Plants larger than 25 MW_e are obligated to report emission data for SO_2 and NO_x to the DEA annually. Data are on block level and classified. The data on plant level are part of the plants annually environmental reports. NERI's QC of the data consists of a comparison with data from previous years and with data from the plants' annual environmental reports.

Emission factors from a wide range of sources

For specific references, see the chapter regarding emission factors.

Data for emission of heavy metals and particles from central power plants, Elsam and Energi E2

The two major Danish power plant operators assess heavy metal emissions from their plants using model calculations based on fuel data and type of flue gas cleaning. NERI's QC of the data consists of a comparison with data from previous years and with data from the plants' annual environmental reports.

Annual environmental reports from plants defined as large point sources

A large number of plants are obligated by law to publish an annual environmental report with information on, among other things, emissions. NERI compares the data with those from previous years and large discrepancies are checked.

Supplementing data from large industrial combustion plants

Fuel consumption and emissions from a few large industrial combustion plants are obtained directly from the plants. 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 with a detailed estimation methodology. NERI's QC of the received data consists of comparing to calculation using standard emission factors as well as comparing reported values with those for previous years.

Data Storage level 1	4.Consistency	DS.1.4.1	The origin of external data has to be preserved whenever possible without explicit arguments (referring to other PM's)

It is ensured that all external data are archived at NERI. Subsequent data processing takes place in other spreadsheets or databases. The datasets are archived annually in order to ensure that the basic data for a given report are always available in their original form.

Data Storage level 1	6.Robustness	DS.1.6.1	Explicit agreements between the external institution of data delivery and NERI about the condition of delivery

For stationary combustion a data delivery agreement is made with the DEA. Most of the other external data sources are available due to legislatory requirements. See Table 45.

Data Storage level 1	7.Transparency	DS.1.7.1	Summary of each dataset including the reasoning for selecting the specific dataset

See DS 1.3.1

Data Storage level 1	7.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 45 for general references. Much documentation already exists. However, some of the information used is classified and therefore not publicly available.

Data Storage level 1	7.Transparency	DS.1.7.4	Listing of external contacts for every dataset

See Table 45.

15.2 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.

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, 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 emission 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. However, documentation for this needs to be elaborated.

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 1.7 % (1990-2007). The reference approach is further discussed below.

Data Processing level 1	5.Correctness	DP.1.5.4	Show one-to-one correctness between external data sources and the databases at Data Storage level 2.

There is a direct line between the external datasets, the calculation process and the input data used to Data Storage level 2. During the calculation process numerous controls are conducted to ensure correctness, e.g. sum checks of the various stages in the calculation procedure.

Data Processing level 1	7.Transparency	DP.1.7.1	The calculation principle and equations used must be described.
Data Processing level 1	7.Transparency	DP.1.7.2	The theoretical reasoning for all methods must be described.
Data Processing level 1	7.Transparency	DP.1.7.3	Explicit listing of assumptions behind all methods

Where appropriate, this is included in the present report with annexes.

Data Processing level 1	7.Transparency	DP.1.7.4	Clear reference to dataset at Data Storage level 1

There is a clear line between the external data and the data processing.

Data Processing level 1	7.Transparency	DP.1.7.5	A manual log to collect information about recalculations

At present, a manual log table is not in place at this level. However, this feature will be implemented in the future. A manual log table is incorporated in the national emission database, Data Storage level 2.

15.3 Data storage, level 2

Data Storage level 2	5.Correctness	DS.2.5.1	Documentation of a correct connection between all data types at level 2 to data at level 1

To ensure a correct connection between data on level 2 and data on level 1, different controls are in place, e.g. control of sums and random tests.

Data Storage level 2	5.Correctness	DS.2.5.2	Check if a correct data import to level 2 has been made.

Data import is checked by use of sum control and random testing. The same procedure is applied every year in order to minimise the risk of data import errors.

Other QC procedures

The emission from each large point source is compared with the emission reported the previous year.

Some automated checks have been prepared for the emission databases:

- Check of units for fuel rate, emission factors and plant-specific emissions.
- Check of emission factors for large point sources. Emission factors for pollutants that are not plant-specific should be the same as those defined for area sources.
- Additional checks on database consistency.
- Most emission factor references are now incorporated in the emission database, itself.
- Annual environmental reports are kept for subsequent control of plant-specific emission data.
- QC checks of the country-specific emission factors have not been performed, but most factors are based on input from companies that have implemented some QA/QC work. The major power plant owner/operators in Denmark, DONG Energy has obtained the ISO 14001 certification for an environmental management system. The Danish Gas Technology Centre and Force Technology both run accredited laboratories for emission measurements.

Suggested QA/QC plan for stationary combustion

The following points make up the list of QA/QC tasks to be carried out directly in relation to the stationary combustion part of the Danish emission inventories. The time plan for the individual tasks has not yet been made.

Data storage level 1

A fully comprehensive list of references for emission factors and activity data.

A comparison with external data from other countries in order to evaluate discrepancies.

Data processing level 1

Documentation list of model and independent calculations to test every single mathematical relation.

15.4 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 2008b). 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 CO_2 emission from incineration of the plastic content of municipal waste is added in the reference approach while the fuel consumption is subtracted.

Three fuels are used for non-energy purposes: lube oil, bitumen and white spirit. The total consumption for non-energy purposes is relatively low – 13.2 PJ in 2007.

In 2007 the fuel consumption rates in the two approaches differ by -0.44 % and the CO_2 emission differs by -0.004 %. In the period 1990-2007 both the fuel consumption and the CO_2 emission differ by less than 1.7 %. The differences are below 1 % for all years except 1998 and 2006. According to 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 59.

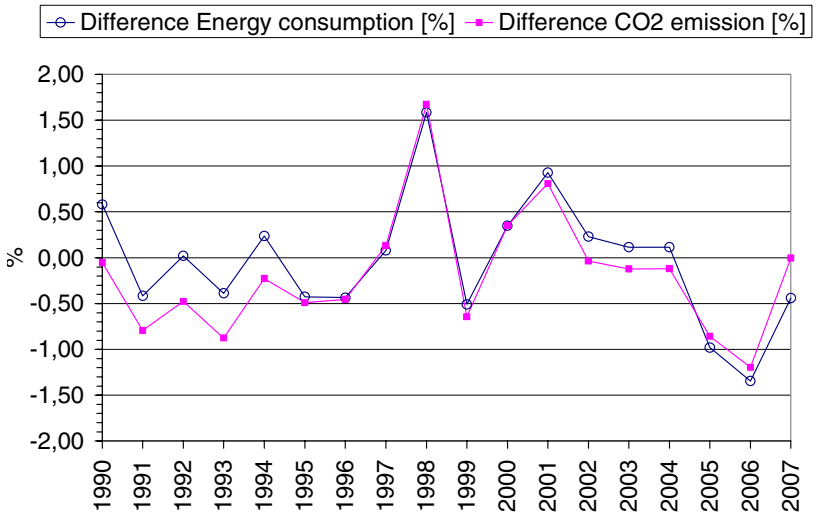


Figure 59 Comparison of the reference approach and the national approach.

15.5 External review

The 2005 and 2007 updates of this report were reviewed by Jan Erik Johnsson from the Technical University of Denmark and Bo Sander from Elsam Engineering.

This update of the report (2009) has been reviewed by Annemette Geertinger from FORCE Technology. The main recommendations for improvements are listed below.

- Some of the national referenced emission factors refer to rather old reports and might not be correct for resent years. Plant technology has developed considerably and further detection limits of the emission measurements have improved considerably.
- A time-series for NO_x-emission from MSW incineration plants should be estimated
- In the chapter concerning sectoral trend it should be clarified whether the emission developments are results of fuel consumption changes or changes of plant technology. Further the changes in plant technology should refer to relevant legislation.

Most recommendations have been included in this report but changes of emission factors will be included in the next inventory.

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.

15.6 Key source analysis

15.6.1 Greenhouse gases

The reporting of the Danish GHG emission 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.

This year (2007) the key source analysis for stationary combustion plants have been improved and now follows the Tier 1 approach of the IPCC Guidelines (IPCC 2006). Further a separate key source analysis has been estimated for stationary combustion.

The aggregation level of the key source analysis is shown in Table 46. Emission of CH_4 from gas engines have been treated as a separate source 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 46 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 2007) 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 2007. 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*.

Several of the key sources are also key sources in the Danish inventory as a whole (Nielsen et al. 2009).

Table 47 Key source analysis.

IPCC Category Code	IPCC Category	Fuel	Greenhouse gas	Identification criteria[1)]	Comments
1A1	Energy Industries	COAL	CO_2	$L1_{2007}$, $L1_{1990}$, T1	Level 2007: 50 %, Level 1990: 59 %, Trend 21 %
1A1	Energy Industries	NATURAL GAS	CO_2	$L1_{2007}$, $L1_{1990}$, T1	Trend 25 %
1A4	Other Sectors	NATURAL GAS	CO_2	$L1_{2007}$, $L1_{1990}$, T1	
1A2	Industry	NATURAL GAS	CO_2	$L1_{2007}$, $L1_{1990}$, T1	
1A4	Other Sectors	GAS OIL	CO_2	$L1_{2007}$, $L1_{1990}$, T1	Trend 16 %
1A1	Energy Industries	RESIDUAL OIL	CO_2	$L1_{2007}$, $L1_{1990}$, T1	
1A1	Energy Industries	REFINERY GAS	CO_2	$L1_{2007}$, $L1_{1990}$, T1	
1A2	Industry	PETROLEUM COKE	CO_2	$L1_{2007}$, T1	
1A2	Industry	COAL	CO_2	$L1_{2007}$, $L1_{1990}$, T1	
1A2	Industry	RESIDUAL OIL	CO_2	$L1_{2007}$, $L1_{1990}$, T1	
1A1	Energy Industries	PLASTIC WASTE	CO_2	$L1_{2007}$, $L1_{1990}$, 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.

15.6.2 Other pollutants

A first attempt key source analysis for SO_2, NO_x, NMVOC, CO and PM has been performed for stationary combustion this year. The key source analysis has been based on the EMEP/Corinair Guidebook 2008 (EEA 2008). Disaggregation to fuel types has, however, not been estimated. For these pollutants emission sources that adds 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 48 shows key sources for each pollutant.

Table 48 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	L				
1A1b Petroleum refining							
1A1c Other energy industries		L, T					
1A2 Industry	L, T	L, T	T				
1A4a Commercial/Institutional							
1A4b Residential	L		L, T	L, T	L	L	L
1A4c Agriculture/Forestry/Fisheries			T	T			

16 Recalculations since reporting in 2008

Improvements and recalculations since the 2008 emission inventory submission include:

- The national energy statistics has been updated for the years 1980-2006. This has primarily resulted in small differences; however, a larger recalculation of the residential wood consumption was made by the DEA resulting in higher emissions of a number of air pollutants in 2006.
- Data from the EU ETS have been utilised for the second time in the 2009 inventory submission. It was mainly coal and residual oil fuelled power plants where detailed information was available. One of the reports for 2007 was judged by NERI to be incorrect, and therefore not incorporated in the 2007 inventory. Following this the 2006 report for the same plant, which was also an outlier, was removed from the inventory.
- Based on the centralised review in September 2008 several improvements have been made to the NIR.
  - An improved documentation for the use of town gas has been included in the NIR.
  - An improved documentation concerning emissions from non-energy use of fuels has been incorporated.
  - The documentation for the use of EU ETS data has been improved.
  - Improved documentation for QA/QC of plant specific emission factors. (In connection with EU ETS data).
- The NMVOC emission factor for straw in residential plants has been updated to reflect the value provided in the EMEP/Corinair Guidebook (EEA, 2007). The emission factor was reduced from 600 g pr GJ to 400 g pr GJ. This change was made for the whole time-series.
- The emission factor for CO for residential wood combustion was updated based on the technology distribution of stoves and boilers together with default emission factors from the EMEP/Corinair Guidebook (EEA, 2007). This reduced the emission factor from 6000 g pr GJ to 3441 g pr GJ in 2007. Time-series for the emission factor were elaborated.
- HCB emissions were estimated for the first time. Default emission factors from the EMEP/Corinair Guidebook (EEA, 2007) were used in the calculations.

17 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. This will - on the advice of the ERT - include further QA/QC checks on plant specific emission factors.

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, 2008). More country-specific uncertainty estimates will be incorporated for greenhouse gases in future inventories.

3) Further use of EU ETS data

The use of data from the EU ETS will continue and hopefully be expanded as more companies will provide detailed information, which can be utilised in the emission inventory.

4) Emission factors for CHP plants

Updated emission factors for CHP plants will be estimated this year and will be applied in next years inventory.

5) Improved CO_2 emission factor for municipal waste

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

6) Improvements recommended in national review 2009

The improvements recommended in the national review and mentioned in Chapter 15.5 will be implemented.

18 Conclusion

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

In 2007 the fuel consumption was 12 % higher than in 1990 – the fossil fuel consumption, however, was 2 % lower than in 1990. The use of coal has decreased whereas the use of natural gas and renewable fuels has increased. The Danish fuel consumption 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), TSP, 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 and Cu. Stationary combustion plants account for less than 10 % of the national CH_4 and N_2O emission.

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

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

The greenhouse gas emission (GHG) development follows the CO_2 emission development closely. Both the CO_2 and the total GHG emission were lower in 2007 than in 1990; CO_2 by 10 % and GHG by 9 %. 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 3.6 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. 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 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 16 % higher in 2007 than in 1990. The fluctuations follows 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 95 % from 1980 and by 87 % 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.

The NO_x emission from stationary combustion plants has decreased by 58 % since 1985 and 46 % 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 fluctuations in the emission time-series follow fluctuations in electricity import/export.

Wood consumption in residential plants in 2007 is 4.1 times the 1990 level. A change of technology (installation of modern stoves) has, however, caused decreasing emission factors for several pollutants.

The CO emission has increased by 22 % from 1990 to 2007. 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 by 104 % since 1985 and 109 % 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 68-71 % since 2000 due to the increase of wood combustion in residential plants. The emission of PAHs has increased 130-190 % since 1990, also a result of the increased combustion of wood in residential plants.

All the heavy metal emissions has decreased considerably since 1990 – between 34 % and 82[8] %. 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. However, the emission from residential plants is increasing due to the increasing wood combustion in the sector. This has caused an 23 % 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 ±8.5 % and the trend in GHG emission (1990-2007) is -8.5 % ± 2.1 %-age points.

[8] The estimated Zn emission in 2007 is 15% higher than in 1990. This is presumably due to insufficient emission factor update for recent years.

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Appendix

Appendix 1: The Danish emission inventory for the year 2007 reported to the Climate Convention in 2009

Appendix 2: Emission inventory for the year 2007 reported to the LRTAP Convention in 2009

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 2007 based on SNAP sectors

Appendix 13: Description of the Danish energy statistics

Appendix 14: Key source analysis

Appendix 15: Fuel consumption time-series 1980-2007

Appendix 1 The Danish emission inventory for the year 2007 reported to the Climate Convention

Table 49 The Danish emission inventory for the year 2007 reported to the Climate Convention in 2009 (Nielsen et al. 2009a).

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Net CO_2 emissions/removals	CH_4	N_2O	$HFCs^{(1)}$		$PFCs^{(1)}$		SF_6	
					P	A	P	A	P	A
		(Gg)			CO_2 equivalent (Gg)				(Gg)	
Total National Emissions and Removals		**51.085,18**	**273,70**	**20,79**	**792,13**	**840,00**	**5,46**	**15,36**	**0,01**	**0,00**
1. Energy		**51.493,70**	**28,32**	**1,48**						
A. Fuel Combustion	Reference Approach [2]	51.125,03								
	Sectoral Approach [2]	51.127,06	22,21	1,47						
1. Energy Industries		25.132,33	9,18	0,48						
2. Manufacturing Industries and Construction		5.686,05	0,97	0,19						
3. Transport		13.985,63	1,23	0,45						
4. Other Sectors		6.148,19	10,82	0,35						
5. Other		174,87	0,01	0,01						
B. Fugitive Emissions from Fuels		366,64	6,11	0,00						
1. Solid Fuels		NA,NO	NA,NO	NA,NO						
2. Oil and Natural Gas		366,64	6,11	0,00						
2. Industrial Processes		**1.647,03**	**IE,NA,NO**	**IE,NA,NO**	**792,13**	**840,00**	**5,46**	**15,36**	**0,01**	**0,00**
A. Mineral Products		1.606,93	IE,NA	IE,NA						
B. Chemical Industry		2,16	NA,NO	NA,NO	NA	NA	NA	NA	NA	NA
C. Metal Production		NA,NO	NA,NO	NO				NO		NO
D. Other Production [3]		NE								
E. Production of Halocarbons and SF_6						NA,NO		NO		NO
F. Consumption of Halocarbons and SF_6					792,13	840,00	5,46	15,36	0,01	0,00
G. Other		37,94	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
3. Solvent and Other Product Use		**87,08**		**0,12**						
4. Agriculture			**182,60**	**19,04**						
A. Enteric Fermentation			132,69							
B. Manure Management			49,90	1,68						
C. Rice Cultivation			NO							
D. Agricultural Soils [4]			NE,NO	17,36						
E. Prescribed Burning of Savannas			NA	NA						
F. Field Burning of Agricultural Residues			NA,NO	NA,NO						
G. Other			NA	NA						
5. Land Use, Land-Use Change and Forestry		**-2.142,63**	**-0,02**	**0,00**						
A. Forest Land		-2.977,03	NO	NO						
B. Cropland		764,08	NA	NA						
C. Grassland		84,09	NA	NA						
D. Wetlands		-13,77	-0,02	0,00						
E. Settlements		NA,NE	NA,NE	NA,NE						
F. Other Land		NA,NE	NA,NE	NA,NE						
G. Other		NE	NE	NE						
6. Waste		**IE,NA,NE,NO**	**62,80**	**0,15**						
A. Solid Waste Disposal on Land		NA,NE,NO	50,62							
B. Waste-water Handling			12,18	0,15						
C. Waste Incineration		IE	IE	IE						
D. Other		NO	NO	NO						
7. Other *(please specify)* [7]		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [8]										
International Bunkers		**6.260,43**	**0,14**	**0,32**						
Aviation		2.701,41	0,05	0,09						
Marine		3.559,02	0,09	0,22						
Multilateral Operations		**NO**	**NO**	**NO**						
CO_2 Emissions from Biomass		**12.106,13**								

Appendix 2 Emission inventory for the year 2007 reported to the LRTAP Convention in 2009

Table 50 Emission inventory for the year 2007 reported to the LRTAP in 2009 (a) (Nielsen et al. 2009b).

	NO_x Gg NO_2	CO Gg	NMVOC Gg	SOx Gg SO_2	TSP Mg	PM_{10} Mg	$PM_{2.5}$ Mg
1 A 1 a Public Electricity and Heat Production	33.61	8.85	2.70	8.64	1 000.32	779.31	632.50
1 A 1 b Petroleum refining	1.75	0.23	0.00	0.42	120.72	112.50	108.39
1 A 1 c Manufacture of Solid Fuels and Other Energy Industries	7.12	0.21	0.04	0.01	3.11	1.80	1.49
1 A 2 Manufacturing Industries and Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 2 a Iron and Steel	IE	IE	IE	IE	148.26	44.48	6.67
1 A 2 b Non-ferrous Metals	IE	IE	IE	IE	38.91	34.97	16.14
1 A 2 c Chemicals	IE	IE	IE	IE	IE	IE	IE
1 A 2 d Pulp, Paper and Print	IE	IE	IE	IE	IE	IE	IE
1 A 2 e Food Processing, Beverages and Tobacco	IE	IE	IE	IE	IE	IE	IE
1 A 2 f Other (Please specify in a covering note)	21.79	20.95	2.07	7.19	1 667.42	1 487.01	1 275.93
1 A 3 a ii Civil Aviation (Domestic, LTO)	0.21	0.75	0.13	0.01	1.48	1.48	1.48
1 A 3 a ii Civil Aviation (Domestic, Cruise)	0.29	0.12	0.02	0.02	1.11	1.11	1.11
1 A 3 b Road Transportation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3 b i R.T., Passenger cars	19.25	116.62	10.41	0.04	786.15	786.15	786.15
1 A 3 b ii R.T., Light duty vehicles	10.80	11.52	1.67	0.02	1 224.06	1 224.06	1 224.06
1 A 3 b iii R.T., Heavy duty vehicles	34.21	7.69	1.52	0.02	885.26	885.26	885.26
1 A 3 b iv R.T., Mopeds & Motorcycles	0.23	19.25	3.37	0.00	61.89	61.89	61.89
1 A 3 b v R.T., Gasoline evaporation	NA	NA	3.41	NA	NA	NA	NA
1 A 3 b vi R.T., Automobile tyre and brake wear	NA	NA	NA	NA	1 660.88	1 245.08	677.95
1 A 3 b vii R.T., Automobile road abrasion	NA	NA	NA	NA	1 144.26	572.13	308.95
1 A 3 c Railways	3.56	0.63	0.23	0.00	119.99	119.99	119.99
1 A 3 d ii National Navigation	5.93	6.57	1.09	0.84	257.22	255.95	255.32
1 A 3 e Other (Please specify in a covering note)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3 e i Pipeline compressors	IE	IE	IE	IE	IE	IE	IE
1 A 3 e ii Other mobile sources and machinery	NO	NO	NO	NO	NO	NO	NO
1 A 4 a Commercial/Institutional	0.92	0.85	0.73	0.18	162.36	159.52	149.98
1 A 4 b Residential	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 4 b i Residential plants	6.65	138.66	20.96	2.51	25 603.69	24 252.61	22 954.13
1 A 4 b ii Household and gardening (mobile)	0.29	89.40	8.10	0.00	79.60	79.60	79.60
1 A 4 c Agriculture/Forestry/Fishing	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 4 c i Stationary	0.91	8.10	1.38	1.68	511.97	474.67	439.95
1 A 4 c ii Off-road Vehicles and Other Machinery	11.15	15.71	2.11	0.04	895.33	895.33	895.33
1A 4 c iii National Fishing	7.03	0.97	0.30	0.48	119.41	118.21	117.62
1 A 5 a Other, Stationary (including Military)	NO	NO	NO	NO	NO	NO	NO
1 A 5 b Other, Mobile (Including military)	0.77	0.55	0.07	0.04	20.24	20.24	20.24
1B1 Fugitive Emissions from Solid Fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 B 1 a Coal Mining and Handling	NA	NA	NA	NA	1 218.48	487.39	48.74
1 B 1 b Solid fuel transformation	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
1 B 2 Oil and natural gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 B 2 a Oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 B 2 a i Exploration Production, Transport	NA	NA	8.42	IE	NA	NA	NA
1 B 2 a iv Refining / Storage	NA	NA	3.77	0.61	NA	NA	NA
1 B 2 a v Distribution of oil products	NA	NA	0.97	NA	NA	NA	NA
1 B 2 a vi Other	NO	NO	NO	NO	NO	NO	NO
1 B 2 b Natural gas	NA	NA	0.05	NA	NA	NA	NA

	NO_x Gg NO_2	CO Gg	NMVOC Gg	SOx Gg SO_2	TSP Mg	PM_{10} Mg	$PM_{2.5}$ Mg
Continued							
1 B 2 c Venting and flaring	0.22	0.16	0.05	0.53	2.33	2.33	2.33
2 A MINERAL PRODUCTS (b)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 A 1 Cement Production	IE	IE	IE	IE	IE	IE	IE
2 A 2 Lime Production	IE	IE	IE	IE	IE	IE	IE
2 A 3 Limestone and Dolomite Use	IE	IE	IE	IE	IE	IE	IE
2 A 4 Soda Ash Production and use	IE	IE	IE	IE	IE	IE	IE
2 A 5 Asphalt Roofing	NE	0.00	0.00	NE	NE	NE	NE
2 A 6 Road Paving with Asphalt	NE	0.35	0.57	NE	NE	NE	NE
2 A 7 Other including Non Fuel Mining & Construction (Please specify in a covering note)	NE	NE	0.02	NE	NE	NE	NE
2 B Chemical Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 B 1 Ammonia Production	NO	NO	NO	NO	NO	NO	NO
2 B 2 Nitric Acid Production	0.00	NA	NA	NA	0.00	0.00	0.00
2 B 3 Adipic Acid Production	NO	NO	NO	NO	NO	NO	NO
2 B 4 Carbide Production	NO	NO	NO	NO	NO	NO	NO
2 B 5 Other (Please specify in a covering note)	0.02	NE	0.02	0.04	NE	NE	NE
2 C Metal Production	NA	NE	NE	NA	NE	NE	NE
2 D Other Production (b)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 D 1 Pulp and Paper	NE	NE	NE	NE	NE	NE	NE
2 D 2 Food and Drink	NE	NE	0.50	NE	NE	NE	NE
2 G Other (Please specify in a covering note)	NO	NO	NO	NO	NO	NO	NO
3 A Paint Application	NA	NA	11.40	NA	NA	NA	NA
3 B Degreasing and Dry Cleaning	NA	NA	4.84	NA	NA	NA	NA
3 C Chemical Products, Manufacture and Processing	NA	NA	2.18	NA	NA	NA	NA
3 D Other including products containing HMs and POPs (Please specify in a covering note)	NA	NA	9.52	NA	NA	NA	NA
4 B Manure Management (c)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 B 1 Cattle	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 B 1 a Dairy	NA	NA	NA	NA	727.91	334.84	215.14
4 B 1 b Non-Dairy	NA	NA	NA	NA	449.41	206.73	133.52
4 B 2 Buffalo	NO	NO	NO	NO	NO	NO	NO
4 B 3 Sheep	NA	NA	NA	NA	NE	NE	NE
4 B 4 Goats	NA	NA	NA	NA	NE	NE	NE
4 B 5 Camels and Llamas	NO	NO	NO	NO	NO	NO	NO
4 B 6 Horses	NA	NA	NA	NA	33.85	15.57	10.38
4 B 7 Mules and Asses	NO	NO	NO	NO	NO	NO	NO
4 B 8 Swine	NA	NA	NA	NA	8 331.05	3 748.97	611.91
4 B 9 Poultry	NA	NA	NA	NA	5 020.04	5 020.04	702.28
4 B 13 Other	NA	NA	NA	NA	NE	NE	NE
4 C Rice Cultivation	NO	NO	NO	NO	NO	NO	NO
4 D Agricultural Soils	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 D 1 Direct Soil Emission	NA	NA	1.78	NA	NE	NE	NE
4 F Field Burning of Agricultural Wastes	NO	NO	NO	NO	NO	NO	NO
4 G Other (d)	NO	NO	NO	NO	NO	NO	NO
5 B Forest and Grassland Conversion	NO	NO	NO	NO	NO	NO	NO
6 A Solid Waste Disposal on Land	NA	NA	NE	NA	NA	NA	NA
6 B Waste-Water Handling	NA	NA	NE	NA	NA	NA	NA
6 C Waste Incineration (e)	0.01	0.00	0.00	0.00	1.82	1.64	1.64
6 D Other Waste (f)	NO	NO	NO	NO	NO	NO	NO
7 Other	NA	NA	NA	NA	NA	NA	NA
National Total	**166.71**	**448.14**	**104.39**	**23.33**	**52 298.52**	**43 430.85**	**32 746.05**

	NO_x Gg NO_2	CO Gg	NMVOC Gg	SOx Gg SO_2	TSP Mg	PM_{10} Mg	$PM_{2.5}$ Mg
Continued							
Memo Items							
International Aviation (LTO)	1.04	0.70	0.14	0.07	3.58	3.58	3.58
International Aviation (Cruise)	10.56	1.26	0.38	0.79	39.95	39.95	39.95
International Navigation	89.72	9.13	2.77	26.88	2 503.86	2 478.82	2 466.30
5 E Other	NO	NO	NO	NO	NO	NO	NO
X (11 08 Volcanoes)	NO	NO	NO	NO	NO	NO	NO

Table 51 Emission inventory for the year 2007 reported to the LRTAP in 2009 (b) (Nielsen et al. 2009b).

	Pb Mg	Cd Mg	Hg Mg	As Mg	Cr Mg	Cu Mg	Ni Mg	Se Mg	Zn Mg
1 A 1 a Public Electricity and Heat Production	3.55	0.24	0.48	0.35	0.63	0.72	1.80	1.23	15.55
1 A 1 b Petroleum refining	0.02	0.01	0.00	0.01	0.03	0.01	0.53	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)	0.27	0.16	0.25	0.18	0.31	0.73	4.88	0.17	1.30
1 A 3 a ii Civil Aviation (Domestic, LTO)	1.33	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	0.04	0.00	0.00	0.02
1 A 3 b Road Transportation	-	-	-	-	-	-	-	-	-
1 A 3 b i R.T., Passenger cars	0.05	0.02	NE	NE	0.11	3.67	0.15	0.02	2.16
1 A 3 b ii R.T., Light duty vehicles	0.00	0.01	NE	NE	0.04	1.49	0.06	0.01	0.88
1 A 3 b iii R.T., Heavy duty vehicles	0.00	0.01	NE	NE	0.05	1.85	0.08	0.01	1.09
1 A 3 b iv R.T., Mopeds & Motorcycles	0.00	0.00	NE	NE	0.00	0.06	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	0.12	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	0.46	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	0.01	0.01	0.01	0.01	0.01	0.01	0.15	0.01	0.18
1 A 4 b Residential	-	-	-	-	-	-	-	-	-
1 A 4 b i Residential plants	0.18	0.25	0.29	0.03	0.02	0.27	0.03	0.09	5.17
1 A 4 b ii Household and gardening (mobile)	0.00	0.00	NE	NE	0.00	0.12	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	0.64	0.03	0.00	0.37
1A 4 c iii National Fishing	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.02	0.06
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)	0.08	0.00	-	-	0.00	0.09	0.00	0.00	0.06
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	NA	NA	NA	NA	NA	NA	NA	NA	NA
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 (Please specify in a covering note)	NE	NE	NE	NE	NE	NE	NE	NE	NE
2 B CHEMICAL INDUSTRY	-	-	-	-	-	-	-	-	-
2 B 1 Ammonia Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2 B 2 Nitric Acid Production	NA	NA	NA	NA	NA	NA	NA	NA	NA
2 B 3 Adipic Acid Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2 B 4 Carbide Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2 B 5 Other (Please specify in a covering note)	NE	NE	NE	NE	NE	NE	NE	NE	NE
2 C METAL PRODUCTION	0.07	0.00	-	NE	-	0.05	-	NE	0.63
2 D OTHER PRODUCTION (b)	-	-	-	-	-	-	-	-	-
2 D 1 Pulp and Paper	NA	NA	NA	NA	NA	NA	NA	NA	NA
2 D 2 Food and Drink	NA	NA	NA	NA	NA	NA	NA	NA	NA
2 G OTHER (Please specify in a covering note)	NO	NO	NO	NO	NO	NO	NO	NO	NO
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

	Pb Mg	Cd Mg	Hg Mg	As Mg	Cr Mg	Cu Mg	Ni Mg	Se Mg	Zn Mg
Continued									
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	-	-	-	-	-	-	-	-	-
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	NO	NO	NO	NO	NO	NO	NO	NO	NO
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)	NO	NO	NO	NO	NO	NO	NO	NO	NO
7 OTHER	NA	NA	NA	NA	NA	NA	NA	NA	NA
National Total	**6.17**	**0.75**	**1.12**	**0.63**	**1.36**	**9.99**	**8.72**	**1.99**	**28.18**
Memo Items									
International Aviation (LTO)	0.01	0.00	-	-	0.00	0.12	0.00	0.00	0.07
International Aviation (Cruise)	-	0.01	-	-	0.04	1.34	0.06	0.01	0.79
International Navigation	0.20	0.03	0.03	0.44	0.18	0.44	25.87	0.40	0.90
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 2007 reported to the LRTAP in 2009 (c) (Nielsen et al. 2009b).

	Dioxin g I-TEQ	Benzo(a)-pyrene Mg	Benzo(b)-fluoranthene Mg	Benzo(k)-fluoranthene Mg	Indeno(1,3,3-c,d)pyrene Mg
1 A 1 a Public Electricity and Heat Production	1.278	0.007	0.028	0.014	0.006
1 A 1 b Petroleum refining	0.001	0.000	0.000	0.000	0.000
1 A 1 c Manufacture of Solid fuels and Other Energy Industries	0.001	0.000	0.000	0.000	0.000
1 A 2 Manufacturing Industries and Construction	-	-	-	-	-
1 A 2 a Iron and Steel	NA	NA	NA	NA	NA
1 A 2 b NAn-ferrous Metals	0.036	NA	NA	NA	NA
1 A 2 c Chemicals	NA	NA	NA	NA	NA
1 A 2 d Pulp, Paper and Print	NA	NA	NA	NA	NA
1 A 2 e Food Processing, Beverages & Tobacco	NA	NA	NA	NA	NA
1 A 2 f Other (Please specify in a covering NAte)	0.151	0.034	0.111	0.023	0.012
1 A 3 a ii Civil Aviation (Domestic, LTO)	0.001	0.000	0.000	0.000	0.000
1 A 3 a ii Civil Aviation (Domestic, Cruise)	-	-	-	-	-
1 A 3 b Road Transportation	-	-	-	-	-
1 A 3 b i R.T., Passenger cars	0.084	0.033	0.031	0.032	0.037
1 A 3 b ii R.T., Light duty vehicles	0.020	0.020	0.019	0.017	0.019
1 A 3 b iii R.T., Heavy duty vehicles	0.046	0.004	0.023	0.034	0.006
1 A 3 b iv R.T., Mopeds & Motorcycles	0.030	0.001	0.001	0.001	0.001
1 A 3 b v R.T., GasoliNR evaporation	NA	NA	NA	NA	NA
1 A 3 b vi R.T., Automobile tyre and brake wear	NA	NA	NA	NA	NA
1 A 3 b vii R.T., Automobile road abrasion	NA	NA	NA	NA	NA
1 A 3 c Railways	0.002	0.000	0.001	0.001	0.000
1 A 3 d ii National Navigation	0.060	0.001	0.003	0.002	0.005
1 A 3 e Other (Please specify in a covering NAte)	-	-	-	-	-
1 A 3 e i PipeliNR compressors	NA	NA	NA	NA	NA
1 A 3 e ii Other mobile sources and machiNRry	NO	NO	NO	NO	NO
1 A 4 a Commercial / Institutional	0.454	0.171	0.225	0.075	0.122
1 A 4 b Residential	-	-	-	-	-
1 A 4 b i Residential plants	17.974	4.623	4.787	2.772	3.139
1 A 4 b ii Household and gardening (mobile)	0.016	0.000	0.001	0.000	0.001
1 A 4 c Agriculture / Forestry / Fishing	-	-	-	-	-
1 A 4 c i Stationary	1.441	0.162	0.174	0.024	0.263
1 A 4 c ii Off-road Vehicles and Other MachiNRry	0.013	0.004	0.008	0.008	0.004
1A 4 c iii National Fishing	0.062	0.001	0.003	0.002	0.006
1 A 5 a Other, Stationary (including Military)	NO	NO	NO	NO	NO
1 A 5 b Other, Mobile (Including military)	0.001	0.000	0.000	0.000	0.000
1B1 Fugitive Emissions from Solid Fuels	-	-	-	-	-
1 B 1 a Coal Mining and Handling	NA	NA	NA	NA	NA
1 B 1 b Solid fuel transformation	NO	NO	NO	NO	NO
1 B 1 c Other (Please specify in a covering NAte)	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
1 B 2 a iv Refining / Storage	NA	NA	NA	NA	NA
1 B 2 a v Distribution of oil products	NA	NA	NA	NA	NA
1 B 2 a vi Other	NA	NA	NA	NA	NA
1 B 2 b Natural gas	NA	NA	NA	NA	NA
1 B 2 c Venting and flaring	0.000	-	-	-	-
2 A MINRRAL PRODUCTS (a)	-	-	-	-	-
2 A 1 Cement Production	NA	NA	NA	NA	NA
2 A 2 Lime Production	0.017	NA	NA	NA	NA
2 A 3 LimestoNR and Dolomite Use	NA	NA	NA	NA	NA
2 A 4 Soda Ash Production and use	NA	NA	NA	NA	NA
2 A 5 Asphalt Roofing	NA	NA	NA	NA	NA
2 A 6 Road Paving with Asphalt	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
2 B CHEMICAL INDUSTRY	-	-	-	-	-
2 B 1 Ammonia Production	NO	NO	NO	NO	NO
2 B 2 Nitric Acid Production	NA	NA	NA	NA	NA
2 B 3 Adipic Acid Production	NO	NO	NO	NO	NO
2 B 4 Carbide Production	NO	NO	NO	NO	NO
2 B 5 Other (Please specify in a covering NAte)	NA	NA	NA	NA	NA
2 C METAL PRODUCTION	-	NA	NA	NA	NA
2 D OTHER PRODUCTION (a)	NA	NA	NA	NA	NA
2 D 1 Pulp and Paper	NA	NA	NA	NA	NA
2 D 2 Food and Drink	NA	NA	NA	NA	NA
2 G OTHER (Please specify in a covering NAte)	NO	NO	NO	NO	NO
3 A PAINT APPLICATION	NA	NA	NA	NA	NA

	Dioxin g I-TEQ	Benzo(a)-pyrene Mg	Benzo(b)-fluoranthene Mg	Benzo(k)-fluoranthene Mg	Indeno(1,3,3-c,d)pyrene Mg
Continued					
3 B DEGREASING AND DRY CLEANING	NA	NA	NA	NA	NA
3 C CHEMICAL PRODUCTS, MANUFACTURE AND PROCESSING	NA	NA	NA	NA	NA
3 D OTHER including products containing HMs and POPs (Please specify in a covering NAte)	NA	NA	NA	NA	NA
4 B MANURE MANAGEMENT (b)	-	-	-	-	-
4 B 1 Cattle	NA	NA	NA	NA	NA
4 B 1 a Dairy	NA	NA	NA	NA	NA
4 B 1 b NAn-Dairy	NA	NA	NA	NA	NA
4 B 2 Buffalo	NO	NO	NO	NO	NO
4 B 3 Sheep	NA	NA	NA	NA	NA
4 B 4 Goats	NA	NA	NA	NA	NA
4 B 5 Camels and Llamas	NO	NO	NO	NO	NO
4 B 6 Horses	NA	NA	NA	NA	NA
4 B 7 Mules and Asses	NO	NO	NO	NO	NO
4 B 8 SwiNR	NA	NA	NA	NA	NA
4 B 9 Poultry	NA	NA	NA	NA	NA
4 B 13 Other	NA	NA	NA	NA	NA
4 C RICE CULTIVATION	NO	NO	NO	NO	NO
4 D AGRICULTURAL SOILS	NA	NA	NA	NA	NA
4 D 1 Direct Soil Emission	NA	NA	NA	NA	NA
4 F FIELD BURNING OF AGRICULTURAL WASTES	NO	NO	NO	NO	NO
4 G OTHER (c)	NO	NO	NO	NO	NO
5 B FOREST AND GRASSLAND CONVERSION	NO	NO	NO	NO	NO
6 A SOLID WASTE DISPOSAL ON LAND	NA	NA	NA	NA	NA
6 B WASTEWATER HANDLING	NA	NA	NA	NA	NA
6 C WASTE INCINRRATION (d)	0.040	0.000	0.000	0.000	0.000
6 D OTHER WASTE (e)	NA	NA	NA	NA	NA
7 OTHER	6.100	NA	NA	NA	NA
National Total	**27.826**	**5.062**	**5.417**	**3.005**	**3.621**
International Aviation (LTO)	0.000	0.000	0.000	0.000	0.000
International Aviation (Cruise)	-	-	-	-	-
International MariNR (b)	0.604	0.004	0.014	0.006	0.020
5 E Other	NO	NO	NO	NO	NO
X (11 08 VolcaNAes)	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. It is not possible based on the Danish energy statistics to split the residential fuel consumption between stoves/fireplaces/cooking and residential boilers.

Appendix 4 Fuel rate

Table 54 Fuel consumption rate of stationary combustion plants 2007, GJ.

Fuel	Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
BIOGAS		184000	194000	204000	206000	206000	294000	345000	342000	354000	636024
BROWN COAL BRI.		383652	496548	816696	705377	705377	813099	458600	346801	196980	129096
COAL		245685136	195559902	238414633	232978427	232978427	301615024	305999044	300365510	280931543	231283239
COKE OVEN COKE		3539672	2815351	2948292	2540081	2540081	1960469	1586536	1521648	1254520	1029996
FISH & RAPE OIL		0	0	0	0	0	0	0	1972000	1860000	1302000
GAS OIL		147197854	121178671	107794483	99564640	99564760	109917912	102702376	101129151	83419659	71248190
KEROSENE		3925475	3570724	3610152	3554263	3554263	4611382	3886360	3004737	1946503	1765091
LPG		6380545	5590787	5601509	5638966	5638966	5026008	4868737	4382052	3569668	2938175
MUNICIP. WASTES (Biomass part)		7594876	8037744	8483273	8975864	8975864	9875897	10255844	10243613	10326833	10798089
NAPHTA		0	0	0	0	0	0	102000	0	0	0
NATURAL GAS		5041410	5500530	5664046	6280155	6280155	30402888	48497000	62192141	67423123	71714632
ORIMULSION		0	0	0	0	0	0	0	0	0	0
PETROLEUM COKE		1142772	2626233	6100737	7229662	7229662	8626648	9746749	8198313	5900762	4550111
PLASTIC WASTE		3043695	3221178	3399726	3597135	3597135	3957829	4110095	4105193	4138545	4327403
REFINERY GAS		11029056	11672336	10580745	11858275	11858275	11520000	13168000	13253000	13619000	14632000
RESIDUAL OIL		177766285	138192247	117465966	96628813	95487233	84783983	74195436	55385455	44542849	38303077
SEWAGE SLUDGE		0	0	0	0	0	0	0	0	0	0
STRAW		4840100	6646800	7419890	8318650	8318650	9892190	10273990	10830790	11258300	11658740
WOOD		11331423	13996790	14975670	14998693	14998693	15008206	17025334	17967540	17629153	17595257
Grand Total		629085951	519299841	533479818	503075001	501933541	598305535	607221101	595239944	548371438	483911120
Continued	Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
BIOGAS		752001	910000	898999	1077001	1279488	1753645	1985110	2390005	2635029	2612573
BROWN COAL BRI.		115931	166823	95324	128246	91500	74609	56053	54331	47745	37607
COAL		253443653	344299909	286838436	300798816	323397473	270346013	371908020	276277338	234284903	196471581
COKE OVEN COKE		1275912	1449734	1181054	1154538	1226146	1272909	1226000	1253015	1346306	1422574
FISH & RAPE OIL		744000	744000	744000	800000	245419	250912	60409	13751	13619	27148
GAS OIL		61449256	64998154	56102476	62025402	53930105	53698269	58018611	51071033	48425146	47555370
KEROSENE		5086021	943393	783765	771272	649577	580777	539748	436636	417009	255606
LPG		2596144	2548699	2315050	2370506	2398317	2638278	2869571	2362592	2412781	2176932
MUNICIP. WASTES (Biomass part)		11064760	11953565	13158042	14565777	15242992	17532500	19377316	20788826	20649637	22627957
NAPHTA		0	0	0	0	0	0	0	0	0	0
NATURAL GAS		76092457	86106669	90466659	102475053	114585627	132698559	156276599	164489313	178706886	187876815
ORIMULSION		0	0	0	0	0	19913113	36766527	40488416	32580001	34190632
PETROLEUM COKE		4459523	4403568	4814028	6179382	4308897	4849824	6381422	6523131	5797915	7283513
PLASTIC WASTE		4434273	4790468	4639209	4844130	5069352	5373824	5575124	5981235	5941188	6510378
REFINERY GAS		14169000	14537000	14865000	15405000	16359999	20837864	21476000	16945381	15225340	15723812
RESIDUAL OIL		32118474	38252201	38505343	32823098	46228742	33008720	37766205	26579997	29985354	23696332
SEWAGE SLUDGE		0	0	0	0	0	0	0	0	0	0
STRAW		12481150	13306150	13880150	13366000	12662374	13053145	13545634	13911770	13903701	13668183
WOOD		18246813	20042437	21030660	22220198	21939961	21844810	23389205	23459225	22937838	24402569
Grand Total		498529367	609452770	550318195	581004419	619615969	599727770	757217553	653025995	615310399	586539582

Continued	Year	2000	2001	2002	2003	2004	2005	2006	2007
BIOGAS		2870670	3020152	3331898	3545061	3451790	3930140	3978152	3914004
BROWN COAL BRI.		25748	32903	18922	3056	0	0	0	0
COAL		164707937	174308632	174654028	238978034	182496587	154007923	231965884	194145940
COKE OVEN COKE		1187177	1109591	1068454	995409	1143051	979704	1010558	1122307
FISH & RAPE OIL		49046	191475	126772	258882	650447	731501	970010	835389
GAS OIL		41260017	43667641	38673521	38955371	35918638	31852171	26797658	21809088
KEROSENE		169963	286786	256128	338430	214577	280244	221223	118877
LPG		1885313	1609877	1477458	1554215	1668540	1671309	1719997	1387805
MUNICIP. WASTES (Biomass part)		23570138	25102244	27224180	28339868	28910923	29057059	30961566	30669611
NAPHTA		0	0	0	0	0	0	0	0
NATURAL GAS		186121970	193826826	193608713	196322338	194677694	187700819	191122163	170874742
ORIMULSION		34148181	30243677	23846404	1921399	18719	0	0	0
PETROLEUM COKE		7291583	8313464	8281655	8716515	9380530	9340778	9719587	10415098
PLASTIC WASTE		6781457	7222265	7832775	8153774	8318075	8360120	8908073	8824074
REFINERY GAS		15556268	15755428	15197000	16554512	15890576	15347072	16115632	15916264
RESIDUAL OIL		18835569	21090663	26160841	28430623	24499899	21939523	26094472	21185578
SEWAGE SLUDGE		40162	375148	64508	55369	58266	58000	0	0
STRAW		12219993	13698193	15651212	16718510	17938819	18483159	18624816	18330862
WOOD		27521693	30866936	31630227	39002025	43649055	49797489	51475513	59935629
Grand Total		544242885	570721900	569104696	628843391	568886186	533537010	619685304	559485267

Table 55a Detailed fuel consumption data for stationary combustion plants, GJ. 1980 - 1989

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	54000	54000	54000	56000	56000	94000	100000	97000	115000	164000
				010200						10000	40000	40000	34000	30000
		1A2	Industry	030100	7450	7450	7450	7450	7450	24016	24016	24016	33016	281024
		1A4	Commercial/ Institutional	020100	122550	132550	142550	142550	142550	165984	180984	180984	171984	161000
	FISH & RAPE OIL	1A1	Electricity and heat production	010200								1972000	1860000	1302000
	STRAW	1A1	Electricity and heat production	010100						73000	87000	58000		58000
				010200	290000	290000	304000	551000	551000	1436000	1740000	2262000	2683000	3074000
		1A4	Residential	020200	2730060	3814080	4269534	4660590	4660590	5029914	5068194	5106474	5145180	5116044
			Agriculture/ Forestry	020300	1820040	2542720	2846356	3107060	3107060	3353276	3378796	3404316	3430120	3410696
	WOOD	1A1	Electricity and heat production	010200							1290000	1702000	2031000	2762000
		1A2	Industry	030100	3709983	4250630	4423950	4780933	4780933	5279585	5555307	5480090	5580343	5695287
		1A4	Commercial/ Institutional	020100							164500	164500	164500	163660
			Residential	020200	7621440	9746160	10551720	10217760	10217760	9626280	9921760	10550320	9782680	8887160
			Agriculture/ Forestry	020300						102341	93767	70630	70630	87150
GAS	NATURAL GAS	1A1	Electricity and heat production	010100						3176000	5562000	3510000	5959000	6510000
				010200					296000	296000	6082000	12317000	15041000	13816000	11291000
			Other energy industries	010504	16770	813809	1265871	1572063	1572063	4150764	5210296	7390844	8805412	9131489
		1A2	Industry	030100	414300	429624	391352	351783	351783	5035350	8977161	14819847	17190071	21887005
				030106						150079	1873	344246	267688	224467
		1A4	Commercial/ Institutional	020100	368827	340568	319207	340958	340958	3287471	3667103	5022400	5338558	5256417
			Residential	020200	4241513	3916529	3687616	3719351	3719351	8273262	11809577	14758786	14548404	15519244
			Agriculture/ Forestry	020300						247962	951990	1305018	1497990	1895010
LIQUID	GAS OIL	1A1	Electricity and heat production	010100	249000	345000	297000	382000	382000	117000	231000	416000	400000	317000
				010200	287000	295000	389000	330000	330000	886000	732000	739000	707000	2952000
			Petroleum refining	010306							4376	1291		
		1A2	Industry	030100	6106649	2874404	1070466	780127	780199	3571846	2875401	2196046	860461	882118
				030106							1578	1722	1148	6062
		1A4	Commercial/ Institutional	020100	24694233	21725557	18298990	17880378	17880378	18637788	17960927	18062384	13819090	12177486
			Residential	020200	113249342	94406114	87068425	79681730	79681730	84840836	79360398	78460412	67097827	54285165
			Agriculture/ Forestry	020300	2611630	1532596	670602	510405	510453	1864442	1536696	1252296	534133	628359
	KEROSENE	1A2	Industry	030100	167388	183779	166135	178524	178524	435905	269735	190391	102834	61109
		1A4	Commercial/ Institutional	020100	1145042	1008749	996521	977758	977758	1440849	987734	686497	592512	464477
			Residential	020200	2343867	2042724	2029444	2083633	2083633	2487618	2454195	1978348	1184828	1207419
			Agriculture/ Forestry	020300	269178	335472	418052	314348	314348	247010	174696	149501	66329	32086
	LPG	1A1	Electricity and heat production	010200	2000	2000	153000	141000	141000	63000	23000	12000	10000	10000
		1A2	Industry	030100	3657492	2962409	2723401	2774825	2774825	1972661	1986874	2122492	1942927	1694084
		1A4	Commercial/ Institutional	020100	941705	854373	935095	903310	903310	1160205	1006688	214281	166954	119794
			Residential	020200	1162932	1186199	1336178	1421242	1421242	1774281	1800370	1791181	1240784	839996
			Agriculture/ Forestry	020300	616416	585806	453835	398589	398589	55861	51805	242098	209003	274301
	NAPHTA	1A1	Electricity and heat production	010100							102000			
	PETROLEUM COKE	1A1	Electricity and heat production	010200								165000	63000	
		1A2	Industry	030100	1142772	2626233	5661137	6988667	6988667	419787	1501743	450651	50303	
				030311						6765224,2	6818598	5458138	3921232	3820223
		1A4	Commercial/ Institutional	020100			104185	55404	55404	176296	35840	296153	273456	54969
			Residential	020200			335415	178369	178369	826871	698983	1111949	889851	674919
			Agriculture/ Forestry	020300				7222	7222	438470	691585	716422	702920	
	REFINERY GAS	1A1	Petroleum refining	010300							68000	137000	205000	332000
				010306	10925750	11561850	10468246	11728803	11728803	11390365	12959444	12952720	13224720	14092052
		1A2	Industry	030100	103306	110486	112499	129472	129472	129635	140556	163280	189280	207948
	RESIDUAL OIL	1A1	Electricity and heat production	010100	47677000	24956000	18017000	8518000	8518000	13348000	14292000	10464000	12960000	10783000
				010200	48997000	43678000	40823000	34724000	34724000	25102000	15665000	11530000	5426000	3035000
			Petroleum refining	010306	3301237	3591874	2527344	2501548	2501548	2824864	2740332	2179863	1606062	1653370
		1A2	Industry	030100	50678043	40700051	35663413	33703630	32562050	29888272	29389732	21333832	17169929	16598817
				030311						376030	1330136	2122576	2652323,3	2627054

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Continued		1A4	Commercial/ Institutional	020100	12482064	10468810	10333734	8304005	8304005	7737174	5611058	4214252	2574042	1534841
			Residential	020200	4847152	4675534	4888421	3527418	3527418	2960584	2541824	1296954	461006	366761
			Agriculture/ Forestry	020300	9783789	10121978	5213054	5350212	5350212	2547058	2625354	2243978	1693487	1704234
OTHER 1	MUNICIP. WASTES	1A1	Electricity and heat production	010100									138497	187756
				010200	7126864	7545209	7950704	8415453	8415453	9272133	9631225	9631225	9574113	9973183
		1A2	Industry	030100	38958	38495	53542	53542	53542	45494	44932	32701	33109	26766
		1A4	Commercial/ Institutional	020100	429054	454040	479027	506869	506869	558270	579687	579687	581115	610385
SOLID	BROWN COAL BRI.	1A2	Industry	030100	1800	17712	7704	29138	29138	76706	42282	37092	5270	
		1A4	Commercial/ Institutional	020100									640	378
			Residential	020200	381852	478836	808992	664882	664882	604240	276459	246519	149401	93348
			Agriculture/ Forestry	020300				11357	11357	132153	139859	63190	41669	35370
	COAL	1A1	Electricity and heat production	010100	226186000	177693000	221810000	216542000	216542000	271286000	276468000	272137000	253755000	206802000
				010200	102000	1704000	2583000	5222000	5222000	12092000	11344000	9343000	8486000	6800000
		1A2	Industry	030100	17652466	13258986	11441768	8011574	8011574	9837282	8966069	10254124	10359675	9108605
				030106	367632	412336	456783	374368	374368					
				030311						2757638	3790266	4158286	4185618,7	5476723
		1A4	Commercial/ Institutional	020100							10030	34348	169951	15332
			Residential	020200	1115764	1484028	927394	991143	991143	1001884	900472	306671	301556	435641
			Agriculture/ Forestry	020300	261274	1007552	1195688	1837342	1837342	4640220	4520207	4132081	3673742	2644938
	COKE OVEN COKE	1A2	Industry	030100	2470372	1529561	1344284	1493325	1493325	1307228	1120620	1089014	1055919	906593
		1A4	Residential	020200	1069300	1285790	1604008	1046756	1046756	653241	465916	432634	198601	123403
	PLASTIC WASTE	1A1	Electricity and heat production	010100									55503,4	75244,3
				010200	2856136,3	3023790,9	3186295,7	3372546,8	3372546,8	3715866,8	3859775,1	3859775,1	3836887,1	3996817
		1A2	Industry	030100	15612,7631	15427,0842	21457,2139	21457,2139	21457,2139	18232,0086	18006,8479	13105,0966	13268,7458	10726,4612
		1A4	Commercial/ Institutional	020100	171946,1	181959,6	191973,1	203131	203131	223730,2	232313,2	232313,2	232885,4	244615,5

Table 55b Detailed fuel consumption data for stationary combustion plants, GJ. 1990 - 1999

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	141178	218984	29049	41826						
				010101					16910	419	24075	19550		
				010102					9835		94326	40561	50269	29597
				010103					54324	118012	79237	111449	86924	103711
				010104			78865	89233	199961	169040	6536			
				010105	94822	175016	251085	405941	415191	599387	826301	1229745	1548936	1500477
				010200	30000	30000	53000	53000						
				010203					45538	43775	54145	33623	31287	25003
				010205					40607					
			Other energy industries	010505	6803	6803	6803	6803	5946	51779	60257	57462	31144	29028
		1A2	Industry	030100					13014	126131	96199	117439	73558	32726
				030102					6534	16370	16478	19080	16361	16116
				030104						1052	1265	1137		
				030105									381	269
		1A4	Commercial/ Institutional	020100	199072	179112	83895	64492	112893	169712	173026	271951	225094	292653
				020103							14474	39396	71226	74379
				020104						27092				
				020105	270479	290438	386655	406059	349088	410626	389678	404594	439292	436918
			Agriculture/ Forestry	020300					2750	4455	132108	26121	34614	30392
				020304	9647	9647	9647	9647	6897	15795	17005	17897	25943	41304
	FISH & RAPE OIL	1A1	Electricity and heat production	010103					33707	24000	21799	188	5212	6974
				010200	744000	744000	744000	800000						
				010203					211712	226912	38610	13563	8407	20174
	STRAW	1A1	Electricity and heat production	010100	479000	985000	1487000	1643000						
				010101					100254	82215	610290	740153	1013770	1339800
				010102					621557	1286955,5	1704388	1845052	1751934,5	1819429
				010103					1126908	1297258	1361686	1174181	1180826	1058038

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Continued				010200	3524000	3843000	3915000	3806000						
				010201					22040					
				010202					57304	179930	114376	95990	136488	141564
				010203					3378461	3409001	3699694	3564019	3525786	3565456
		1A2	Industry	030100									446	446
				030103						3085				
		1A4	Residential	020200	5086890	5086890	5086890	4750200	4413510	4076820	3633120	3891945	3773190	3442590
			Agriculture/ Forestry	020300	3391260	3391260	3391260	3166800	2942340	2717880	2422080	2594630	2515460	2295060
				020302								5800	5800	5800
	WOOD	1A1	Electricity and heat production	010100			172000	515000						
				010101					42966				263719	
				010102					1053223	865377	861821,3	1001257	1371873	2377322
				010103					623575	671570	578451	644712	575350	732058
				010104					78890	4410				
				010105										1674
				010200	3217000	3648000	4096000	3751000						
				010201					8537					
				010202					44	43575	164768	190941	207278	193907
				010203					3337730	3490933	3857403	3795439	3971995	3928219
		1A2	Industry	030100	5783743	5690367	5750550	5821715	4464819	4254327	4097885	4166034	4273637	4250138
				030102									1776	1496
				030103					481414	412555	623748	523545	412235	413749
		1A4	Commercial/ Institutional	020100	204488	204488	204488	204488	216160	273035	449435	471415	492803	642041
				020105									2096	2057
			Residential	020200	8954432	10412432	10720472	11859632	11564240	11760665	12668890	12569082	11134265	11615182
			Agriculture/ Forestry	020300	87150	87150	87150	68363	68363	68363	86804	96800	230244	230875
				020304									567	13851
GAS	NATURAL GAS	1A1	Electricity and heat production	010100								5511	21264	16787
										10453815,7				
				010101	4005027,63	4394781	3279455	4422200	8437973,09	2	12217008	14600070	20808855	21307826
				010102					295111	299964	1346036	5620044	5987198	2416146
				010103					2487008	1775265	1558418	1138214	958646	716525
				010104	1859206	2396900	4806049	7327221	7776734	8547638,05	14500108,5	12220262	13002948	21614378
				010105	677767	1291319	2199496	4168579	8358415	16419956	22162423	24109208	26700713	26833951
				010200	11033000	13655000	12350000	11420000						
				010202					1072469	1017168	844253	660506	539227	282207
				010203					6160497	5525191	3803076	2420020	1988837	1873511
				010205					131795	338556	377124	230400	235829	226189
			Other energy industries	010502						399247,39	390587,25	417415	413342	409043
				010504	9482284	9703068	11118697	11235480	12267791	12506433	14849859	19454575	21636547	23561526
				010505	1760	3520	3520	3520	2570	4494	7551	4939	15340	13883
		1A2	Industry	030100	22280195	23780869	23887554	25535326	29248293	30317635	29252137	29423362	29114015	31167462
				030102					862925	2661778,52	2464664,75	2971625	2961903	3100115
				030103					300216	64308	146812	169825	131608	126872
				030104	506337	608907	664092	729919	761202	909952	2562511	3366152	5106083	6501018
				030105	187	187	187	187	11210	172920	873431	960232	1157405	1160055
				030106	136059	24239	37695	70154	53489	24415	15283	5288	31735	38608
				030315								924066	903336	1005440
				030318						624960	590400	620640	671040	686880
		1A4	Commercial/ Institutional	020100	6376293	6934201	7382035	8908566	7343015	8436587	11247402	9106736	8661696	7525335
				020103					2177			2434	49460	10801
				020104					11946	25798	31397	25514	22995	30739
				020105	45985	88875	278287	350372	473892	609395	681480	866185	959184	985839
			Residential	020200	17362132	20432645	21439693	24903983	24736624	26947401	30412122	28361811	29137977	28981613
				020202							25676	24503	18059	31289
				020204		7932	499046	776351	1022812	1094868	1448246	1488432	1575546	1554382
			Agriculture/ Forestry	020300	2222000	2680002	2385006	2462538	2485322	2559680	2666407	2644836	2476128	2241939
				020303							5959	26127	65805	77171

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Continued				020304	104224	104224	135847	160657	282141	961133	1796227	2620381	3354165	3379285
LIQUID	GAS OIL	1A1	Electricity and heat production	010100	239170	416396	641323	245263						
				010101					12386	51300	41614	194854	108730	258004
				010102					42898	30019	153012	113506	82184,29	158532
				010103					59149	40405	78104	41727	44468	61232
				010104	43987	43987	43987	43987	43987	75632	81094	54042	146795	60385
				010105	16843	32617	34690	34750	116493	136913	99083	100449	133710	108002
				010200	1941000	813000	744000	947000						
				010201					27268	7000				
				010202					174046	360676	799818,1	514978	418139	257831
				010203					843648	444369	554844	509625	652349	296296
				010205					717					1055
			Petroleum refining	010306		40029	44476	29125	49319	33321	21879	87482		
		1A2	Industry	030100	537931	1369948	1430556	951740	812691	1460371	2251856	1895198	1799389	2477807
				030102						3438			440	1327
				030103					1678	1453	11390	1015	1623	64
				030104								244	377	6787
				030105			1447	1578	1578					
				030106	6098	6636	8644	2762	9433	7030	6743	8178	15603	70265
				030315								1040	603	4950
		1A4	Commercial/ Institutional	020100	11794783	10622868	9062255	9007046	7156617	6556065	6619841	6093376	5442142	5781168
				020102					190782		215		75	
				020103					72		57796	58202	53618	39101
				020105			1361	1485	733	20330	1754	294	21	66
			Residential	020200	46463224	50638393	42913606	49967084	43678618	43287857	45295557	39595464	37849748	35675468
			Agriculture/ Forestry	020300	406220	1014280	1176131	793582	707992	1182090	1940156	1799028	1675132	2297030
				020302								7		
				020304							3855	2324		
	KEROSENE	1A2	Industry	030100	69635	45692	38315	35461	30485	24464	30937	27840	16078	8909
		1A4	Commercial/ Institutional	020100	569083	209843	206978	188910	154647	124344	103314	96459	127964	117233
			Residential	020200	4404777	659635	512024	520836	437788	410845	382564	287211	251843	118954
			Agriculture/ Forestry	020300	42526	28223	26448	26065	26657	21124	22933	25126	21124	10510
	LPG	1A1	Electricity and heat production	010100		1000	1000	3000						
				010103						736				
				010200	9000	13000	10000							
				010203					2732					9
			Petroleum refining	010306			4600		8004	15042	20654	18492		
		1A2	Industry	030100	1576175	1689355	1588914	1450676	1557782	1737694	1920315	1596586	1623548	1355035
		1A4	Commercial/ Institutional	020100	82757	77097	76519	122201	125183	131001	137989	128417	116413	109573
				020103									9	
				020105									803	771
			Residential	020200	669665	521639	442269	672725	588599	628367	653211	510109	545681	624403
			Agriculture/ Forestry	020300	258547	246608	191748	121904	116017	125438	137402	108988	126327	87141
	ORIMULSION	1A1	Electricity and heat production	010101						19913113	36766527	40488416	32580001	34190632
	PETROLEUM COKE	1A1	Electricity and heat production	010100				1239000						
		1A2	Industry	030100	300247		56107	122868		98156	110026	33598	25842	38999
				030311	2499251,6	2991306	3234048	3230651,8	3469025	3707398	4966161,2	5229890	4774684	6398880
		1A4	Commercial/ Institutional	020100	62023	104190	90150	96354	91988	70415	90528	97770	70544	50434
			Residential	020200	760877	697484	961122	990337	747884	734273	928841	839269	725791	705961
			Agriculture/ Forestry	020300	837124	610588	472601	500171		239582	285866	322604	201054	89239
	REFINERY GAS	1A1	Electricity and heat production	010101							35204	40077		
			Petroleum refining	010300	458000	926000	1526000	15917						
				010304				2067083	2355000	2289700	5069590	4081532	2996106	4172606
				010306	13520108	13485940	13236820	13213580	14004999,1	18548163,6	16336521,6	12771044	12202506	11551206
		1A2	Industry	030100	190892	125060	102180	108420			34684	52728	26728	
	RESIDUAL OIL	1A1	Electricity and heat production	010100	774830	364138	1742448	741228						
				010101	7171572,6	10052580	8691120	8420050	22142391,6	11174240,6	16072213,3	7736420	11557361	7213503

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Continued				010102	42264,6	16950	27100	24390	180489,8	253891,4	443478,7	420683	510374,3	762923
				010103					252297	173028	201180	159318	115535	101551
				010104					320163	347198	237194	302167	355440	118177
				010105	9332	9332	9332	9332	11554	4323	4888	2415	5984	4136
				010200	2006000	2236000	1141000	879000						
				010202					134116	172981	171394,6	140565	102376	135957
				010203					858909	938696	1201058	874538	779146	961623
			Petroleum refining	010306	1309202	2038140	3568653	3490237	3336716,8	2333786,8	2244019,4	1622382	1106086	1089501
		1A2	Industry	030100	16531282	19002497	18556701	14527324	12587628	10217307	10610245	9222966	9120750	8682720
				030102					741775	911132,6	788577,5	789663	663124	695536
				030103					200248	207326	165590	122783	121633	135661
				030104								54439		
				030311	1762853,4	2152997	2366678	2397243,2	2618777	2840310,6	1771379	1863965	2538540	885967
		1A4	Commercial/ Institutional	020100	1070494	865011	600545	517393	718786	677072	717757	729305	383913	450237
				020103					87533	78081				
			Residential	020200	216927	218605	167748	129878	95249	62794	66254	45933	43266	50365
			Agriculture/ Forestry	020300	1223716	1295951	1634018	1687023	1942109	2616552	3070976	2492455	2563430	2396266
				020302									9051	1105
				020304									9345	11104
OTHER 1	MUNICIP. WASTES	1A1	Electricity and heat production	010100	706761	2543626	4123983	6328376						
				010101									1000234	992599
				010102					3834792	4995773	5554764	8411444	9097581	13153372
				010103					2183493	2874282	3884840	2387483	1519789	3136573
				010104					1249720	1551907	2478787	2349269	2179406	1904688
				010200	9685481	8668174	8214696	7383481						
				010201					5238,0014					
				010202					2605709	2834481	3607994	3610341	3585970	
				010203					4434078	4255022	2872498	3089449	2685494	2264007
		1A2	Industry	030100	20012,7587	20012,7587	27541	29197	19763	21826	21699	18527	22407	27403
		1A4	Commercial/ Institutional	020100	652505	721753	791822	824723	887274	975541	949284	916117	551310	1143612
				020103					22925	23668	7451	6196	7446	5703
SOLID	BROWN COAL BRI.	1A2	Industry	030100	4374	6680	3806	17714	2745	2031	1464	1025		
		1A4	Commercial/ Institutional	020100	1025	1720		8217	769	622	421	309		
			Residential	020200	50600	66685	39107	80209	75963	62403	47324	48550	43847	37607
			Agriculture/ Forestry	020300	59932	91738	52411	22106	12023	9553	6844	4447	3898	
	COAL	1A1	Electricity and heat production	010100	8523090	12892052	10175750	8221270						
						30310524			295430107,					
				010101	219780959	8	252745120	269458670	5	244510483	347251766	252648133	211429498	176640613
				010102	2118950,9	2653700	2250130	2269060	8604698,5	8380812,5	9032904,5	8671429	9022776	8238010
				010103					837469	526213	149470	38928	24300	33747
				010104					272428	269521	301136	74422		
				010105					20360					
				010200	6017000	6635000	5173000	3581000						
				010201					153003	20286				
				010202					1112251	789684	199724	64713	17914	371
				010203					377837	316754	228340	48919	48071	6562
		1A2	Industry	030100	8850301	8977254	6751419	7698631	5866929	4832666	4460978	4494493	4676030	3714901
				030102					614624	1051344	1449890	1466575	1405667	1411682
				030103					190179	182609	192925	192444		
				030311	5018873,4	6048697	6577274	6602369	6913652	7224933,5	7067608,6	7209034	6627624	5638061
		1A4	Commercial/ Institutional	020100	87539	9010	95877	75870	90286	66064	41260	43062	2306	
			Residential	020200	589051	1125243	866285	785646	618696	376644	85595	86470	127147	79262
			Agriculture/ Forestry	020300	2457889	2853705	2203581	2106300	2294953	1797999	1446423	1238716	903570	708372
	COKE OVEN COKE	1A2	Industry	030100	1169318	1351052	1077654	1073318	1163151	286685	303658	295421	319382	380768
				030318						937440	885600	930960	1006560	1030320
		1A4	Residential	020200	106594	98682	103400	81220	62995	48784	36742	26634	20364	11486

fuel_type	fuel_gr_abbr	NFR	nfr_name	snap_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Continued	PLASTIC WASTE	1A1	Electricity and heat production	010100	283239	1019374	1454017	2104624						
				010101									287781	285585
				010102					1275334	1531236	1598183	2420090	2617501	3784408
				010103					726163	880986	1117722	686912	437264	902436
				010104					415618	475670	713181	675917	627046	548005
				010200	3881519	3473826	2896304	2455519						
				010201					1742					
				010202					866579	868786	1038070	1038745	1031734	
				010203					1474638	1304191	826458	888877	772654	651386
		1A2	Industry	030100	8020	8020	9710	9710	6573	6690	6243	5330	6447	7884
		1A4	Commercial/ Institutional	020100	261495	289247	279178	274277	295080	299010	273122	263580	158620	329033
				020103					7624	7255	2144	1783	2142	1641

Table 55c Detailed fuel consumption data for stationary combustion plants, GJ. 2000 - 2007

fuel_gr_abbr	NFR	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007
BIOGAS	1A1	Electricity and heat production	010102	25771	23338	20466	21787	16857	17439	16560	15827
			010103	134968	123991	90125	97272	78245	69932	105259	108688
			010105	1548734	1589322	1686300	1704661	1435085	1535656	1287413	1417509
			010203	21733	11129	12650	17130	23466	40546	17297	17601
			010205					36380	110366	155450	148721
		Other energy industries	010505	32507	28627	31216	31791	61257	100137	115743	98052
	1A2	Industry	030100	32593	27929	37953	33614	45593	142521	136853	145385
			030102	15755	59220	71672	95546	112700	48144	51665,74	34543,46
			030105	1487	23805	18459	14205	16947		103779	73148
	1A4	Commercial/ Institutional	020100	310904	354917	424989	321897	426323	473892	578066	657955
			020103	86680	84512	74286	85295	101260	354647	137540	101606,4
			020105	506512	504222	528119	531465	517152	543650	501074	421085
		Agriculture/ Forestry	020300	76487	80321	96277	134632	169187	84327	296083	325166
			020304	76539	108819	239386	455766	411338	408883	475369	348717
FISH & RAPE OIL	1A1	Electricity and heat production	010101								24669
			010102					521	1765		30122
			010103				2168	54570	151598	254209	276943
			010105					1819			
			010202				18807	4662	21230	23554	33200
			010203	48900	190810	126336	237665	588875	556556	691920	469419
	1A2	Industry	030100						193	5	
			030105			334	242		159	322	140
	1A4	Commercial/ Institutional	020105								896
		Agriculture/ Forestry	020304	146	665	102					
SEWAGE SLUDGE	1A2	Industry	030311	40162	375148	64508	55369	58266	58000		
STRAW	1A1	Electricity and heat production	010101	1119600	1587710	2643060	3191917	4366424	4088038	4421693	4473730
			010102	1826796	1746166	1640945	1712033	1815157	1765236	1488982,78	1448163
			010103	640340	1905033	1754340	1927521	1336411	1393993	1357693	1258569,5
			010104		101730	1215692	1706623	2476858	3118372	3174908,55	3098655
			010202	150510	97600			95414	95677	81998	88091
			010203	3290636	3418313	3555625	3338866	3007005	3180273	3257991	3122243
	1A2	Industry	030105	386	91						
	1A4	Residential	020200	3111555	2901450	2901450	2901450	2901450	2901450	2904930	2901450
		Agriculture/ Forestry	020300	2074370	1934300	1934300	1934300	1934300	1934300	1936620	1934300
			020302	5800	5800	5800	5800	5800	5820		5660
WOOD	1A1	Electricity and heat production	010101		920	65930	304980	231380	1246768	694801	621639
			010102	2274825	2186568	3175531	5854505	5626990	5965503	6354629,61	6086336,5
			010103	669817	747047	780122,8	446474	1061917	1078638	1128621	897366

fuel_gr_abbr	NFR	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007
Continued			010104			120031	1656898	4488031	4478887	2608712,53	3758121
			010105	53468	60394	61748	369				
			010202	179937	249689	164347	196112	620370	416918	600053	581146
			010203	3882223	4297719	4650874	5066279	4798365	5017547	5312447	5394838
	1A2	Industry	030100	4450170	4596137	3313464	3534374	3425751	3763358	3784171	4178948
			030102	955	950					8586	1062759
			030103	439542	430608	410827	294774	342172	527045	521165	146610
	1A4	Commercial/ Institutional	020100	775926	665349	672399	680509	681209	816284	951627	1012405
			020105		97	796		110	145	338	1171
		Residential	020200	14624521	17483859	18067157	20855031	22274480	26399876	29423842	36107769
		Agriculture/ Forestry	020300	170093	147164	147000	111720	98280	86520	86520	86520
			020304	216	435						
NATURAL GAS	1A1	Electricity and heat production	010100	14558	11364	2	1188	1521		6126	27109
			010101	23541558,1	20514966	19246614	20165293	19287200	18925039	20812861,93	13886528
			010102	1589836	4250088	2893467,75	1877463	1581768	2007214	1080451,51	1469274,71
			010103	683789	733694	657392,37	1057907	837246	1651123	2238105,61	3195651,95
			010104	22973677,54	25003004,9	30030786,36	29928352	30713112	25116344	31959340,2	25440821,83
			010105	25639911	27865345	27701651	27012113	26392308	23502420	20418631	16283549
			010202	217700	286968	291201	278471	428248	319699	122889	251259
			010203	1427019	1768484	1482319	1849960	1611725	2256093	2136355	2140919
			010205	203414	228049	207211	171691	473922	552369	852803	302166
		Other energy industries	010502	340513,76	352650,31	379362,15	322830,99	360596,14	324727	379490,91	348025,1
			010504	25015663	24413386	26179968	26247274	27066780	27790542	28342254	28130892
			010505	13889	11887	11473	12396	12395	9150	7553	4708
	1A2	Industry	030100	28607521	30958244	29348181	28370078	26869444	27736761	27625245	29221598
			030102	2690206	2869051,5	1190135,91	2273628	2295787	2199817	2292944,76	1572608,78
			030103	116411	117965	14707	118562	124427	189988	130672	171882
			030104	6756339	6138931	6724144	6526151	6632596	5965285,12	4710799,26	4395576,71
			030105	1556394	1641970	1545466	1543942	1570267	1256372	951540	465230
			030106	50809	53712	25558	17229	22029	2196	2899	
			030315	1101274	1089048	1016242	945777	911205	874446	827157	833656
			030318	629280	588960	524160	552240	606880	557280	556560	631440
	1A4	Commercial/ Institutional	020100	7233923	7323256	7623549	9215179	9200426	9744985	10727760	10220750
			020103	43211	67208	165296	11053	50446	36133	24575	17402
			020104	23335	31001	42862	33669	22070	13397	39915	23970
			020105	1033132	1044813	1079590	1023163	1033012	861729	946464	832242
		Residential	020200	27568914	29262248	28081591	30023311	29857726	29523597	28541836	26639574
			020202	55319	69007	30105	63281	63692	17611	26392	21346
			020204	1439173	1450266	1392257	1451228	1475531	1466761	1499188	1254324
		Agriculture/ Forestry	020300	2383877	2687167	2543009	2319515	2257935	2248231	2008129	1897025
			020303	61906	59503	64374	53821	53805	57534	42023	29343
			020304	3109418	2934589	3116038	2855572	2863595	2493976	1811203	1165871
GAS OIL	1A1	Electricity and heat production	010101	135602,22	122718	92395	956997	220146	186474,23	476346,34	562765
			010102	278595	366847	279069,26	114717	138782	116061	93879,89	136248,24
			010103		34258	36567	16629	14604	22221	50943	4459,11
			010104	103191	40026	75242	79241	80590	125545	80601,32	96640
			010105	68733	84634	66390	63501	106919	72995	59934,03	46404
			010201					92649	52791	20717	25406
			010202	694229	830045	166763	256178	418842	178478	163714	304245
			010203	233116	354842	306816	1125856	492537	366718	301272	246371,4
			010204						7924	5882	7689
			010205					5416	574	865	865
		Petroleum refining	010306				3085	9469	2403	9613,01	8429,15

fuel_gr_abbr	NFR	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007
Continued		Other energy industries	010505			151	116	114	172	98	69
	1A2	Industry	030100	2184437	3010994	2369234	2665880	2551498	1693595	664764	1600
			030102	3138	5071	222	3574	2830	3313	13021,16	10626,28
			030103	82107	19	165				7	
			030104	51		896,7			1848	83	225
			030105	103	511						
			030106	8070	9828	7066	6887	8716	9218	7353	
			030315	1650	2009	681	933	3802	6851	554	338
	1A4	Commercial/ Institutional	020100	4957566	4685349	4031236	4288708	4411382	3754635	3028642	1674929
			020103	71306	44010	43889,5	29646	19369	47991	31510,04	15852,76
			020105	1277	673	743	727	756	1538	803	1191
		Residential	020200	30275667	31506271	28997757	27027087	25290533	23863456	21196989	18660380
		Agriculture/ Forestry	020300	2156405	2566813	2193392	2309294	2049684	1335297	590044	
			020304	4774	2723	4846	6315		2073	22	4355
KEROSENE	1A2	Industry	030100	7552	25543	65146	48233	19836	13433	19279	13781
	1A4	Commercial/ Institutional	020100	63008	79642	69668	74131	76734	100870	58700	15253
		Residential	020200	91190	159051	110143	205243	110525	158320	136284	85737
		Agriculture/ Forestry	020300	8213	22550	11171	10823	7482	7621	6960	4106
LPG	1A1	Electricity and heat production	010101							108	
			010203	246					20		
	1A2	Industry	030100	1019122	761460	677846	730090	749425	739902	774840	492647
	1A4	Commercial/ Institutional	020100	121621	119345	136552	169985	214880	217661	210757	198786
			020105					21	9	90	1
		Residential	020200	650995	648947	607682	596053	650748	667241	688592	669326
		Agriculture/ Forestry	020300	93329	80125	55378	58087	53466	46476	45610	27045
ORIMULSION	1A1	Electricity and heat production	010101	34148181	30243677	23846404	1921399	18719			
PETROLEUM COKE	1A1	Electricity and heat production	010102					7130	1840		
	1A2	Industry	030100	285426	127929	223785	229902	180642	162602	163186	
			030311	6474742,8	7656728	7543476	7714392	8187958	7796337	8283791	9109000
	1A4	Commercial/ Institutional	020100	12070	12086	5355	9003		65455	8770	13757
		Residential	020200	513190	513393	509008	762464	1004800	1314544	1263840	1292341
		Agriculture/ Forestry	020300	6154	3328	31	754				
REFINERY GAS	1A1	Petroleum refining	010304	3907567	3978922	3855200	3804097	3796653	3219243	3533411	4357769
			010306	11648701	11776506	11341800	12750415	12093923	12127828, 6	12582220,6	11558494, 9
RESIDUAL OIL	1A1	Electricity and heat production	010101	4045724	5950549	5018057	7329328	5577981	5460921	4346080,41	5501698
			010102	513002	253635	278953	334256	595816	591328	884042,22	809557
			010103	108599	117384	120150	106040	17155			
			010104	117319	1767903	6694775	9358988	7484444	6336347	8396895,81	4501300
			010105	17206	533	656	5900	1681			
			010202	58729	86854	122795	83920	34421	26790	29550	56287
			010203	617493	611104	547566	323210	187263	259996	101773	85136
		Petroleum refining	010306	1322995	1442929	1362640	907082	1071635	690601,34	619384,48	821943
	1A2	Industry	030100	8156730	7629109	8617100	6610417	6144393	5040765	7764097	6016926
			030102	714098,55	791893,05	808652	1644621	1690130	1898209,2	1606035,2	1416846,5
			030103	140375	89987						
			030105		22	10	787	302	4949	28	
			030311	858853,2	501846	591804	587464	817378	694301	978754	1056000
	1A4	Commercial/ Institutional	020100	343022	173185	478286	170881	107544	120604	252003	234478
		Residential	020200	35611	26881	148870	47430	44417	48504	195015	12702
		Agriculture/ Forestry	020300	1778526	1640210	1365228	910801	720074	759139	903812	640319
			020302	3269	2069	1964	6081	5265	7068	17002	32385
			020304	4017	4570	3335	3417				
MUNICIP. WASTES	1A1	Electricity and heat production	010101	955850	2181401	2719649	111391				

fuel_gr_abbr	NFR	nfr_name	snap_id	2000	2001	2002	2003	2004	2005	2006	2007
Continued			010102	14215671	13902384	14757024	17491557	19197071	19296004	20140016	20535244
			010103	6493126	6479050	6462180	6094679	6123453	6316218	6453597	6603369
			010104	323810			485641			51654	
			010105							574864	
			010203	1083773	1704601	1887340	1996005	1947214	1625738	1656643	2216483
	1A2	Industry	030100							201302	
			030102				3574	2775	3100	3363	
			030311	392349	824971	1388207	1092163	1496111	1500333	1174173	1276681
	1A4	Commercial/ Institutional	020100	94866			1006750	85396	181613	564074	
			020103	10693	9838	9780	58107	58903	134052	141879	37834
BROWN COAL BRI.	1A4	Residential	020200	25748	32903	18922	3056				
COAL	1A1	Electricity and heat production	010101	146911420	15899046 2	161608390	225396935	167930883	140018854	218346519,5	180898293
			010102	6224846	4970502	4684578	4578267	4511500	4048151	3288908	3050071
			010103	35480	24354	15476	33831	23637			
			010202	371	1494	363	371	636	3519		19257
			010203	3551	439				375		
	1A2	Industry	030100	3667193	3554471	2126818	2826288	3338374	2724083	2526876	2716428
											1372444,2
			030102	1063375	997380,5	998228,9	1569871	1498728	1498977	1430721,7	6
			030311	5708047	4522597	4348589	3368675	3754171	3916553	4364609	4030000
	1A4	Commercial/ Institutional	020100					1298			
		Residential	020200	14442	12906	15370	318	292	7738	3975	6572
		Agriculture/ Forestry	020300	1079212	1234026	856215	1203478	1437068	1786868	2004275	2052875
			020304						2805		
COKE OVEN COKE	1A2	Industry	030100	238247	223280	279401	276382	302127	240691	245771	206436
			030102								37065
			030318	943920	883440	786240	693360	814320	738720	764640	876960
	1A4	Residential	020200	5010	2871	2813	25667	26604	293	147	1846
PLASTIC WASTE	1A1	Electricity and heat production	010101	275011	627619	782481	32049				
			010102	4090047	3999909	4245801	5032565	5523265	5551729	5794563	5908275
			010103	1868163	1864113	1859259	1753524	1761803	1817264	1856790	1899881
			010104	93165			139726			14861	
			010105							165396	
			010203	311816	490437	543014	574279	560241	467748	476639	637713
	1A2	Industry	030100							57917	
			030102				1028	798	892	968	
			030311	112884	237355	399406	314230	430452	431667	337826	367319
	1A4	Commercial/ Institutional	020100	27294			289656	24569	52253	162292	
			020103	3077	2831	2814	16718	16947	38568	40821	10886

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 pr tonne	42.40	42.40	42.40	42.70	42.70	42.70	42.70	43.00	43.00	43.00
Crude Oil, Golf	GJ pr tonne	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80
Crude Oil, North Sea	GJ pr tonne	42.70	42.70	42.70	42.70	42.70	42.70	42.70	43.00	43.00	43.00
Refinery Feedstocks	GJ pr tonne	41.60	41.60	41.60	41.60	41.60	41.60	41.60	42.70	42.70	42.70
Refinery Gas	GJ pr tonne	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00
LPG	GJ pr tonne	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00
Naphtha (LVN)	GJ pr tonne	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50
Motor Gasoline	GJ pr tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
Aviation Gasoline	GJ pr tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
JP4	GJ pr tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
Other Kerosene	GJ pr tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
JP1	GJ pr tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
Gas/Diesel Oil	GJ pr tonne	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70
Fuel Oil	GJ pr tonne	40.40	40.40	40.40	40.40	40.40	40.40	40.70	40.65	40.65	40.65
Orimulsion	GJ pr tonne	27.60	27.60	27.60	27.60	27.60	28.13	28.02	27.72	27.84	27.58
Petroleum Coke	GJ pr tonne	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40
Waste Oil	GJ pr tonne	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90
White Spirit	GJ pr tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
Bitumen	GJ pr tonne	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80
Lubricants	GJ pr tonne	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90
Natural Gas	GJ pr 1000 Nm^3	39.00	39.00	39.00	39.30	39.30	39.30	39.30	39.60	39.90	40.00
Town Gas	GJ pr 1000 m^3							17.00	17.00	17.00	17.00
Electricity Plant Coal	GJ pr tonne	25.30	25.40	25.80	25.20	24.50	24.50	24.70	24.96	25.00	25.00
Other Hard Coal	GJ pr tonne	26.10	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50
Coke	GJ pr tonne	31.80	29.30	29.30	29.30	29.30	29.30	29.30	29.30	29.30	29.30
Brown Coal Briquettes	GJ pr tonne	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30
Straw	GJ pr tonne	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
Wood Chips	GJ pr Cubic metre	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Firewood, Hardwood	GJ pr m^3	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40
Firewood, Conifer	GJ pr m^3	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60
Wood Pellets	GJ pr tonne	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50
Wood Waste	GJ pr tonne	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
Wood Waste	GJ pr Cubic metre	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Biogas	GJ pr 1000 m^3								23.00	23.00	23.00
Waste Combustion	GJ pr tonne	8.20	8.20	9.00	9.40	9.40	10.00	10.50	10.50	10.50	10.50
Bioethanol	GJ pr tonne	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70
Biodiesel	GJ pr tonne	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60
Fish Oil	GJ pr tonne	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20

Continued		2000	2001	2002	2003	2004	2005	2006	2007
Crude Oil, Average	GJ pr tonne	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Crude Oil, Golf	GJ pr tonne	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80
Crude Oil, North Sea	GJ pr tonne	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Refinery Feedstocks	GJ pr tonne	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70
Refinery Gas	GJ pr tonne	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00
LPG	GJ pr tonne	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00
Naphtha (LVN)	GJ pr tonne	44.50	44.50	44.50	44.50	44.50	44.50	44.50	44.50
Motor Gasoline	GJ pr tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
Aviation Gasoline	GJ pr tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
JP4	GJ pr tonne	43.80	43.80	43.80	43.80	43.80	43.80	43.80	43.80
Other Kerosene	GJ pr tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
JP1	GJ pr tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
Gas/Diesel Oil	GJ pr tonne	42.70	42.70	42.70	42.70	42.70	42.70	42.70	42.70
Fuel Oil	GJ pr tonne	40.65	40.65	40.65	40.65	40.65	40.65	40.65	40.65
Orimulsion	GJ pr tonne	27.62	27.64	27.71	27.65	27.65	27.65	27.65	27.65
Petroleum Coke	GJ pr tonne	31.40	31.40	31.40	31.40	31.40	31.40	31.40	31.40
Waste Oil	GJ pr tonne	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90
White Spirit	GJ pr tonne	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
Bitumen	GJ pr tonne	39.80	39.80	39.80	39.80	39.80	39.80	39.80	39.80
Lubricants	GJ pr tonne	41.90	41.90	41.90	41.90	41.90	41.90	41.90	41.90
Natural Gas	GJ pr 1000 Nm^3	40.15	39.99	40.06	39.94	39.77	39.67	39.54	39.59
Town Gas	GJ pr 1000 m^3	17.01	16.88	17.39	16.88	17.58	17.51	17.20	17.14
Electricity Plant Coal	GJ pr tonne	24.80	24.90	25.15	24.73	24.60	24.40	24.80	24.40
Other Hard Coal	GJ pr tonne	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50
Coke	GJ pr tonne	29.30	29.30	29.30	29.30	29.30	29.30	29.30	29.30
Brown Coal Briquettes	GJ pr tonne	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30
Straw	GJ pr tonne	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
Wood Chips	GJ pr Cubic metre	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Firewood, Hardwood	GJ pr m^3	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30
Firewood, Conifer	GJ pr m^3	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40
Wood Pellets	GJ pr tonne	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50
Wood Waste	GJ pr tonne	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
Wood Waste	GJ pr Cubic metre	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Biogas	GJ pr 1000 m^3	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
Waste Combustion	GJ pr tonne	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.50
Bioethanol	GJ pr tonne	26.70	26.70	26.70	26.70	26.70	26.70	26.70	26.70
Biodiesel	GJ pr tonne	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60
Fish Oil	GJ pr tonne	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20

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 [1)]
Fish Oil	Fish & Rape oil	Biomass
Biogas	Biogas	Biomass
Biogas, other	Biogas	Biomass
Biogas, landfill	Biogas	Biomass
Biogas, sewage sludge	Biogas	Biomass

[1)] CO_2 from plastic part included in Other fuels.

Appendix 6 Emission factors

Table 58 CO_2 emission factors 2007.

Fuel	Emission factor		Reference type	IPCC fuel
	Biomass kg/GJ	Fossil fuel kg/GJ		Category
Coal		95 [1)]	Country specific	Solid
Brown coal briquettes		94.6 [2)]	IPCC reference manual	Solid
Coke oven coke		108	IPCC reference manual	Solid
Petroleum coke		92 [3)]	Country specific	Liquid
Wood	102		Corinair	Biomass
Municipal waste	94.5 [3)]	17.6 [3)]	Country specific	Biomass/Other fuels
Straw	102		Country specific	Biomass
Residual oil		78 [1)]	Corinair	Liquid
Gas oil		74 [1)]	Corinair	Liquid
Kerosene		72	Corinair	Liquid
Fish & rape oil	74		Country specific	Biomass
Orimulsion		80 [2)]	Country specific	Liquid
Natural gas		56.78	Country specific	Gas
LPG		65	Corinair	Liquid
Refinery gas		56.9	Country specific	Liquid
Biogas	83.6		Country specific	Biomass

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

[2)] Not applied in 2007.

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

Time-series for natural gas and municipal waste are shown below. All other emission factors are the same for 1990-2007.

Table 59 CO_2 emission factors, time-series.

Year	Natural gas, kg pr GJ	Municipal waste, plastic part, Kg pr GJ	Municipal waste biomass part, kg pr GJ
1990	56.9	22.5	+89.6
1991	56.9	22.5	+89.6
1992	56.9	20.5	+91.6
1993	56.9	19.6	+92.5
1994	56.9	19.6	+92.5
1995	56.9	18.5	+93.6
1996	56.9	17.6	+94.5
1997	56.9	17.6	+94.5
1998	56.9	17.6	+94.5
1999	56.9	17.6	+94.5
2000	57.1	17.6	+94.5
2001	57.25	17.6	+94.5
2002	57.28	17.6	+94.5
2003	57.19	17.6	+94.5
2004	57.12	17.6	+94.5
2005	56.96	17.6	+94.5
2006	56.78	17.6	+94.5
2007	56.78	17.6	+94.5

Table 60 CH_4 emission factors and references 2007.

Fuel group	Fuel	CRF sector	CRF sector	SNAP	Emission factor. g/GJ	Reference
BIOMASS	WOOD	1A1a	Electricity and heat production	010102, 010103, 010104	2	Nielsen & Illerup 2003
				010202, 010203	32	EEA 2004
		1A2	Industry	030100, 030102, 030103	32	EEA 2004
		1A4a	Commercial/ Institutional	020100, 020105	200	EEA 2004
		1A4b i	Residential	020200	200	EEA 2004
		1A4c i	Agriculture/ Forestry	020300	200	EEA 2004
	STRAW	1A1a	Electricity and heat production	010101, 010102, 010103, 010104	0.5	Nielsen & Illerup 2003
				010202, 010203	32	EEA 2004
		1A4b i	Residential	020200	200	EEA 2004
		1A4c i	Agriculture/ Forestry	020300	200	EEA 2004
				020302	32	EEA 2004
	FISH & RAPE OIL	1A1a	Electricity and heat production	010101, 010102, 010103, 010202, 010203	1.5	EEA 2004, assuming same emission factor as for gas oil
		1A2	Industry	030105	1.5	EEA 2004, assuming same emission factor as for gas oil
		1A4a	Commercial/ Institutional	020105	1.5	EEA 2004, assuming same emission factor as for gas oil
	BIOGAS	1A1a	Electricity and heat production	010102, 010103, 010203	4	EEA 2004
				010105, 010205	323	Nielsen & Illerup 2003
		1A1c	Other energy industries	010505	323	Nielsen & Illerup 2003
		1A2	Industry	030100, 030102	4	EEA 2004
				030105	323	Nielsen & Illerup 2003
		1A4a	Commercial/ Institutional	020100, 020103	4	EEA 2004
				020105	323	Nielsen & Illerup 2003
		1A4c i	Agriculture/ Forestry	020300	4	EEA 2004
				020304	323	Nielsen & Illerup 2003
OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010102, 010103	0.59	Nielsen & Illerup 2003
				010203	6	EEA 2004
		1A4a	Commercial/ Institutional	020103	6	EEA 2004
GAS	NATURAL GAS	1A1a	Electricity and heat production	010100, 010101, 010102, 010202	6	DGC 2001
				010103, 010203	15	Gruijthuijsen & Jensen 2000
				010104 (Gas turbines)	1.5	Nielsen & Illerup 2003
				010105, 010205 (Gas engines)	465	Nielsen et al. 2008
		1A1c	Other energy industries	010504 (Gas turbines)	1.5	Nielsen & Illerup 2003
				010505 (Gas engines)	465	Nielsen et al. 2008
		1A2	Industry	030100	6	DGC 2001
				030103	15	Gruijthuijsen & Jensen 2000
				030104 (Gas turbines)	1.5	Nielsen & Illerup 2003
				030105 (Gas engines)	465	Nielsen et al. 2008
		1A4a	Commercial/ Institutional	020100	6	DGC 2001
				020103	15	Gruijthuijsen & Jensen 2000
				020104 (Gas turbines)	1.5	Nielsen & Illerup 2003
				020105 (Gas engines)	465	Nielsen et al. 2008
		1A4b i	Residential	020200	6	DGC 2001
				020202	15	Gruijthuijsen & Jensen 2000
				020204 (Gas engines)	465	Nielsen et al. 2008
		1A4c i	Agriculture/ Forestry	020300	6	DGC 2001
				020303 (Gas turbines)	1.5	Nielsen & Illerup 2003
				020304 (Gas engines)	465	Nielsen et al. 2008
LIQUID	PETROLEUM COKE	1A4a	Commercial/ Institutional	020100	15	EEA 2004
		1A4b i	Residential	020200	15	EEA 2004
	RESIDUAL OIL	1A1a	Electricity and heat production	010101, 010102, 010104, 010202, 010203	3	EEA 2004
		1A1b	Petroleum refining	010306	3	EEA 2004
		1A2	Industry	030100, 030102	3	EEA 2004
		1A4a	Commercial/ Institutional	020100	3	EEA 2004
		1A4b i	Residential	020200	3	EEA 2004
		1A4c i	Agriculture/ Forestry	020300, 020302	3	EEA 2004
	GAS OIL	1A1a	Electricity and heat production	010101, 010102, 010103, 010104, 010105, 010201, 010202, 010203, 010204, 010205	1.5	EEA 2004
		1A1b	Petroleum refining	010306	1.5	EEA 2004
		1A1c	Other energy industries	010505	1.5	EEA 2004
		1A2	Industry	030100, 030102, 030104	1.5	EEA 2004
		1A4a	Commercial/ Institutional	020100, 020103, 020105	1.5	EEA 2004
		1A4b i	Residential	020200	1.5	EEA 2004
		1A4c i	Agriculture/ Forestry	020304	1.5	EEA 2004
	KEROSENE	1A2	Industry	030100	7	EEA 2004

Fuel group	Fuel	CRF sector	CRF sector	SNAP	Emission factor. g/GJ	Reference
Continued		1A4a	Commercial/ Institutional	020100	7	EEA 2004
		1A4b i	Residential	020200	7	EEA 2004
		1A4c i	Agriculture/ Forestry	020300	7	EEA 2004
	LPG	1A2	Industry	030100	1	EEA 2004
		1A4a	Commercial/ Institutional	020100, 020105	1	EEA 2004
		1A4b i	Residential	020200	1	EEA 2004
		1A4c i	Agriculture/ Forestry	020300	1	EEA 2004
	REFINERY GAS	1A1b	Petroleum refining	010304, 010306	1.5	EEA 2004
SOLID	COAL	1A1a	Electricity and heat production	010101, 010102	1.5	EEA 2004
				010202	15	EEA 2004
		1A2	Industry	030100	15	EEA 2004
		1A4b i	Residential	020200	15	EEA 2004
		1A4c i	Agriculture/ Forestry	020300	15	EEA 2004
	COKE OVEN COKE	1A2	Industry	030100	15	EEA 2004, assuming same emission factor as for coal
		1A4b i	Residential	020200	15	EEA 2004, assuming same emission factor as for coal

Time-series for CH_4 emission factors for gas engines are shown below. All other CH_4 emission factors are the same for 1990-2007.

Table 61 CH_4 emission factors, time-series.

Year	Natural gas fuelled engines Emission factor, g pr GJ	Biogas fuelled engines Emission factor, g pr GJ
1990	266	239
1991	309	251
1992	359	264
1993	562	276
1994	623	289
1995	632	301
1996	615	305
1997	551	310
1998	542	314
1999	541	318
2000	537	323
2001	537	323
2002	537	323
2003	537	323
2004	513	323
2005	489	323
2006	465	323
2007	465	323

Table 62 N_2O emission factors and references 2007.

Fuel group	Fuel	CRF sector	CRF sector	SNAP	Emission factor, g/GJ	Reference
BIO-MASS	WOOD	1A1a	Electricity and heat production	010102, 010103, 010104 010202, 010203	0.8 4	Nielsen & Illerup 2003 EEA 2004
		1A2	Industry	all	4	EEA 2004
		1A4a	Commercial/ Institutional	all	4	EEA 2004
		1A4b i	Residential	020200	4	EEA 2004
		1A4c i	Agriculture/ Forestry	020300	4	EEA 2004
	STRAW	1A1a	Electricity and heat production	010101, 010102, 010103, 010104 010202, 010203	1.4 4	Nielsen & Illerup 2003 EEA 2004
		1A4b i	Residential	020200	4	EEA 2004
		1A4c i	Agriculture/ Forestry	all	4	EEA 2004
	FISH & RAPE OIL	1A1a	Electricity and heat production	all	2	EEA 2004, assuming same emission factor as gas oil
		1A2	Industry	030105	2	EEA 2004, assuming same emission factor as gas oil
		1A4a	Commercial/ Institutional	020105	2	EEA 2004, assuming same emission factor as gas oil
	BIOGAS	1A1a	Electricity and heat production	010102, 010103, 010203 010105, 010205 (Gas engines)	2 0.5	EEA 2004 Nielsen & Illerup 2003
		1A1c	Other energy industries	010505 (Gas engines)	0.5	Nielsen & Illerup 2003
		1A2	Industry	030100, 030102 030105 (Gas engines)	2 0.5	EEA 2004 Nielsen & Illerup 2003
		1A4a	Commercial/ Institutional	020100, 020103 020105 (Gas engines)	2 0.5	EEA 2004 Nielsen & Illerup 2003
		1A4c i	Agriculture/ Forestry	020300 020304 (Gas engines)	2 0.5	EEA 2004 Nielsen & Illerup 2003
OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010102, 010103 010203	1.2 4	Nielsen & Illerup 2003 EEA 2004
		1A4a	Commercial/ Institutional	020103	4	EEA 2004
GAS	NATURAL GAS	1A1a	Electricity and heat production	010100, 010101, 010102, 010103, 010202, 010203 010104 (Gas turbines) 010105, 010205 (Gas engines)	 1 2.2 1.3	EEA 2004 Nielsen & Illerup 2003 Nielsen et al. 2008
		1A1c	Other energy industries	010504 (Gas turbines) 010505 (Gas engines)	2.2 1.3	Nielsen & Illerup 2003 Nielsen et al. 2008
		1A2	Industry	030100, 030103 030104 (Gas turbines) 030105 (Gas engines)	1 2.2 1.3	EEA 2004 Nielsen & Illerup 2003 Nielsen et al. 2008
		1A4a	Commercial/ Institutional	020100, 020103 020104 (Gas turbines) 020105 (Gas engines)	1 2.2 1.3	EEA 2004 Nielsen & Illerup 2003 Nielsen et al. 2008
		1A4b i	Residential	020200, 020202 020204 (Gas engines)	1 1.3	EEA 2004 Nielsen et al. 2008
		1A4c i	Agriculture/ Forestry	020300 020303 (Gas turbines) 020304 (Gas engines)	1 2.2 1.3	EEA 2004 Nielsen & Illerup 2003 Nielsen et al. 2008
LIQUID	PETROLEUM COKE	1A4a	Commercial/ Institutional	020100	3	EEA 2004
		1A4b i	Residential	020200	3	EEA 2004
	RESIDUAL OIL	1A1a	Electricity and heat production	all	2	EEA 2004
		1A1b	Petroleum refining	010306	2	EEA 2004
		1A2	Industry	all	2	EEA 2004
		1A4a	Commercial/ Institutional	020100	2	EEA 2004
		1A4b i	Residential	020200	2	EEA 2004
		1A4c i	Agriculture/ Forestry	all	2	EEA 2004
	GAS OIL	1A1a	Electricity and heat production	all	2	EEA 2004
		1A1b	Petroleum refining	010306	2	EEA 2004
		1A1c	Other energy industries	010505	2	EEA 2004
		1A2	Industry	all	2	EEA 2004
		1A4a	Commercial/ Institutional	all	2	EEA 2004
		1A4b i	Residential	020200	2	EEA 2004
		1A4c i	Agriculture/ Forestry	020304	2	EEA 2004
	KEROSENE	1A2	Industry	030100	2	EEA 2004
		1A4a	Commercial/ Institutional	020100	2	EEA 2004
		1A4b i	Residential	020200	2	EEA 2004
		1A4c i	Agriculture/ Forestry	020300	2	EEA 2004
	LPG	1A2	Industry	030100	2	EEA 2004
		1A4a	Commercial/ Institutional	all	2	EEA 2004
		1A4b i	Residential	020200	2	EEA 2004
		1A4c i	Agriculture/ Forestry	020300	2	EEA 2004

Fuel group	Fuel	CRF sector	CRF sector	SNAP	Emis-sion factor, g/GJ	Reference
Continued						
	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 010202	0.8 3	Elsam 2005 EEA 2004
		1A2	Industry	030100	3	EEA 2004
		1A4b i	Residential	020200	3	EEA 2004
		1A4c i	Agriculture/ Forestry	020300	3	EEA 2004
	COKE OVEN COKE	1A2	Industry	030100	3	EEA 2004
		1A4b i	Residential	020200	3	EEA 2004

The same N_2O emission factors have been applied for 1990-2007.

Table 63 SO_2, NO_x, NMVOC and CO emission factors and references 2007.

Fuel	IPCC sector	SNAP	SO_2		NO_x		NMVOC		CO	
			g/GJ	Ref.	g/GJ	Ref.	g/GJ	Ref.	g/GJ	Ref.
COAL	1A1a	010101, 010102	40	18	98	18	1.5	1	10	3
COAL	1A1a, 1A2, 1A4c	010202, 030100, 020300	574	19	95	4	15	1	10	1
COAL	1A4b	020200	574	19	95	4	15	1	2000	32
COKE OVEN COKE	1A2	030100	574	29	95	29	15	29	10	29
COKE OVEN COKE	1A4b	020200	574	29	95	29	15	29	2000	29
PETROLEUM COKE	1A4a, 1A4b	020100, 020200	605	20	50	1	1.5	1	1000	1
WOOD AND SIMIL.	1A1a	010102, 010103, 010104	1.74	31	69	31	3.3	31	79	31
WOOD AND SIMIL.	1A1a, 1A2	010202, 010203, 030100, 030102, 030103	25	22, 21	90	22, 21, 4	48	1	240	4
WOOD AND SIMIL.	1A4a, 1A4c	020100, 020105, 020300	25	22, 21	90	22, 21, 4	600	1	240	4
WOOD AND SIMIL.	1A4b	020200	25	22, 21	120	22	540	39	3441	39
MUNICIP. WASTES	1A1a	010102, 010103	23.9	31	124	31	0.98	31	7.4	31
MUNICIP. WASTES	1A1a, 1A4a	010203, 020103	67	9	164	9	9	1	10	9
STRAW	1A1a	010101, 010102, 010103, 010104	47.1	31	131	31	0.8	31	63	31
STRAW	1A1a, 1A4c	010202, 010203, 020302	130	5	90	4, 28	50	1	325	4, 5
STRAW	1A4c	020300	130	5	90	4, 28	600	1	4000	1,6,7
STRAW	1A4b	020200	130	5	90	4, 28	400	41	4000	1,6,7
RESIDUAL OIL	1A1a	010101, 010102, 010104	206	18	98	18	3	1	15	3
RESIDUAL OIL	1A1a, 1A4a, 1A4b, 1A4c	010202, 010203, 020100, 020200, 020300, 020302	344	25, 10, 24	142	4	3	1	30	1
RESIDUAL OIL	1A1b	010306	537	33	142	4	3	1	30	1
RESIDUAL OIL	1A2	030100, 030102	344	25, 10, 24	130	28	3	1	30	1
GAS OIL	1A1a	010101, 010102	23	27	249	18	1.5	1	15	3
GAS OIL	1A1a, 1A2	Gas turbines: 010104, 010204, 030104	23	27	350	9	2	1	15	3
GAS OIL	1A1a, 1A1c, 1A4a, 1A4c	Engines: 010105, 010205, 010505, 020105, 020304	23	27	700	1	100	1	100	1
GAS OIL	1A1a	010103	23	27	65	28	1.5	1	15	3
GAS OIL	1A1a, 1A1b, 1A2f	010201, 010202, 010203, 010306, 030100, 030102	23	27	65	28	1.5	1	30	1
GAS OIL	1A4a, 1A4c	020100, 020103	23	27	52	4	3	1	30	1
GAS OIL	1A4b	020200	23	27	52	4	3	1	43	1
KEROSENE	all	all	5	30	50	1	3	1	20	1
FISH & RAPE OIL	1A1a	010101, 010102, 010103	1	37	220	38	1.5	15	15	15
FISH & RAPE OIL	1A1a	010202, 010203	1	37	65	15	1.5	15	15	15
FISH & RAPE OIL	1A2, 1A4c	030105, 020105	1	37	700	15	100	15	100	15
NATURAL GAS	1A1a	010100, 010101, 010102	0.3	17	97	9	2	14	15	3
NATURAL GAS	1A1a, 1A2f, 1A4a, 1A4c	Gas turbines: 010104, 030104, 020104, 020303	0.3	17	124	31	1.4	31	6.2	31
NATURAL GAS	1A1a, 1A1c, 1A2, 1A4a, 1A4b, 1A4c	Gas engines: 010105, 010205, 010505, 030105, 020105, 020204, 020304	0.3	17	148	40	105	40	115	40
NATURAL GAS	1A1a, 1A2	010103, 010202, 010203, 030100, 030103	0.3	17	42	36	2	14	28	4
NATURAL GAS	1A1c	010504	0.3	17	250	1, 8, 32	1.4	31	6.2	31
NATURAL GAS	1A4a, 1A4c	020100, 020103, 020300	0.3	17	30	1, 4, 11	2	14	28	4
NATURAL GAS	1A4b	020200, 020202	0.3	17	30	1, 4, 11	4	11	20	11
LPG	1A2	030100	0.13	23	96	32	2	1	25	1
LPG	1A4a, 1A4c	020100, 020105, 020300	0.13	23	71	32	2	1	25	1
LPG	1A4b	020200	0.13	23	47	32	2	1	25	1
REFINERY GAS	1A1b	010304, 010306	1	2	170	9	1.4	35	6.2	35
BIOGAS	1A1a, 1A2, 1A4a, 1A4c	010102, 010103, 010203, 030100, 020100, 020103, 020300	25	26	28	4	4	1	36	4
BIOGAS	1A1a, 1A1c, 1A2, 1A4a, 1A4c	Gas engines: 010105, 010205, 010505, 030105, 020105, 020304	19.2	31	540	31	14	31	273	31
BIOGAS	1A2	030102	25	26	59	4	4	1	36	4

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

						1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
						Data																	
pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_E	nfr_name	snap_id																		
SO2	LIQUID	GAS OIL	1A1a	Electricity and heat production	010101					94	23	23	23	23	23	23	23	23	23	23	23	23	23
					010102					94	23	23	23	23	23	23	23	23	23	23	23	23	23
					010103					94	23	23	23	23	23		23	23	23	23	23	23	23
					010104	94	94	94	94	94	23	23	23	23	23	23	23	23	23	23	23	23	23
					010105	94	94	94	94	94	23	23	23	23	23	23	23	23	23	23	23	23	23
					010201					94	23									23	23	23	23
					010202					94	23	23	23	23	23	23	23	23	23	23	23	23	23
					010203					94	23	23	23	23	23	23	23	23	23	23	23	23	23
					010205					94					23					23	23	23	23
			1A1b	Petroleum refining	010306		94	94	94	94	23	23	23						23	23	23	23	23
			1A2	Industry	030100	94	94	94	94	94	23	23	23	23	23	23	23	23	23	23	23	23	23
					030103					94	23	23	23	23	23	23	23	23				23	
					030105			94	94	94						23	23						
					030106	94	94	94	94	94	23	23	23	23	23	23	23	23	23	23	23	23	
			1A4a	Commercial/ Institutional	020100	94	94	94	94	94	23	23	23	23	23	23	23	23	23	23	23	23	23
					020102					94		23		23									
					020103					94		23	23	23	23	23	23	23	23	23	23	23	23
					020105			94	94	94	23	23	23	23	23	23	23	23	23	23	23	23	23
			1A4b i	Residential	020200	94	94	94	94	94	23	23	23	23	23	23	23	23	23	23	23	23	23
			1A4c i	Agriculture/ Forestry	020300	94	94	94	94	94	23	23	23	23	23	23	23	23	23	23	23	23	
		ORIMULSION	1A1a	Electricity and heat production	010101							147	149				10	12	12	12			
		PETROLEUM COKE	1A2	Industry	030100	787		787	787		787	787	787	787	787	787	605	605	605	605	605	605	
			1A4a	Commercial/ Institutional	020100	787	787	787	787	787	787	787	787	787	787	787	605	605	605		605	605	605
			1A4b i	Residential	020200	787	787	787	787	787	787	787	787	787	787	787	605	605	605	605	605	605	605
			1A4c i	Agriculture/ Forestry	020300	787	787	787	787		787	787	787	787	787	787	605	605	605				
		REFINERY GAS	1A1b	Petroleum refining	010306	190	190	190	190												1	1	1
		RESIDUAL OIL	1A1a	Electricity and heat production	010100	446	470	490	475														
					010101						351	408	344	369	369	403	315	290	334	349	283	308	206
					010102	446	470	490	475	1564	351	408	344	369	369	403	315	290	334	349	283	308	206
					010103					1564	351	408	344	369	369	403	315	290	334	349			
					010104					1564	351	408	344	369	369	403	315	290	334	349	283	308	206
					010105	446	470	490	475	1564	351	408	344	369	369	403	315	290	334	349			
					010202					495	495	495	344	344	344	344	344	344	344	344	344	344	344
					010203					495	495	495	344	344	344	344	344	344	344	344	344	344	344
			1A1b	Petroleum refining	010306	643	38	222	389				537	537	537	537	537	537	537	537	537	537	537
			1A2	Industry	030100	495	495	495	495	495	495	495	344	344	344	344	344	344	344	344	344	344	344
					030102					495	495	495	344	344	344	344	344	344	344	344	344	344	344
					030103					495	495	495	344	344	344	344	344						
			1A4a	Commercial/ Institutional	020100	495	495	495	495	495	495	495	344	344	344	344	344	344	344	344	344	344	344
			1A4b i	Residential	020200	495	495	495	495	495	495	495	344	344	344	344	344	344	344	344	344	344	344
			1A4c i	Agriculture/ Forestry	020300	495	495	495	495	495	495	495	344	344	344	344	344	344	344	344	344	344	344
	OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010100	138	116	95	73														
					010102					52	30			26	25	23,9	23,9	23,9	23,9	23,9	23,9	23,9	23,9
					010103					52	30	29	28	26	25	23,9	23,9	23,9	23,9	23,9	23,9	23,9	23,9
					010104					52	30	29	28	26	25	23,9			23,9			23,9	
					010200	138	131	124	117														
					010202					110	103												
					010203					110	103	95	88	81	74	67	67	67	67	67	67	67	67
			1A2	Industry	030100	138	131	124	117	110	103	95	88	81	74							67	
			1A4a	Commercial/ Institutional	020100	138	131	124	117	110	103	95	88	81	74	67			67	67	67	67	
					020103					110	103	95	88	81	74	67	67	67	67	67	67	67	67
	SOLID	COAL	1A1a	Electricity and heat production	010100	506	571	454	386														
					010101	506	571	454	386	343	312	420	215	263	193	64	47	45	61	42	41	37	40
					010102	506	571	454	386	343	312	420	215	263	193	64	47	45	61	42	41	37	40
					010103					343	312	420	215	263	193	64	47	45	61	42			
					010104					343	312	420	215										

						1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
						Data																	
pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_E	nfr_name	snap_id																		
NOX	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105	711	696	681	665	650	635	616	597	578	559	540	540	540	540	540	540	540	540
					010205					650										540	540	540	540
			1A1c	Other energy industries	010505	711	696	681	665	650	635	616	597	578	559	540	540	540	540	540	540	540	540
			1A2	Industry	030105									578	559	540	540	540	540	540		540	540
			1A4a	Commercial/ Institutional	020105	711	696	681	665	650	635	616	597	578	559	540	540	540	540	540	540	540	540
			1A4c i	Agriculture/ Forestry	020304	711	696	681	665	650	635	616	597	578	559	540	540	540	540	540	540	540	540
		FISH & RAPE OIL	1A1a	Electricity and heat production	010200	100	95	90	85														
					010203					80	75	70	65	65	65	65	65	65	65	65	65	65	65
		WOOD	1A1a	Electricity and heat production	010202					130	130	130	130	130	90	90	90	90	90	90	90	90	90
					010203					130	130	130	130	130	90	90	90	90	90	90	90	90	90
			1A2	Industry	030100	130	130	130	130	130	130	130	130	130	90	90	90	90	90	90	90	90	90
					030102									130	90	90	90					90	90
					030103					130	130	130	130	130	90	90	90	90	90	90	90	90	90
			1A4a	Commercial/ Institutional	020100	130	130	130	130	130	130	130	130	130	90	90	90	90	90	90	90	90	90
					020105									130	90		90	90		90	90	90	90
			1A4c i	Agriculture/ Forestry	020300	130	130	130	130	130	130	130	130	130	90	90	90	90	90	90	90	90	90
					020304									130	90	90	90						
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010100								115	115	115	115	115	115	115	97		97	97
					010101					115			115				115	115	115	97	97	97	97
					010102					115	115			115	115	115	115	115	115	97	97	97	97
					010104	161	157	153	149	145	141	138	134	131	127	124	124	124	124	124	124	124	124
					010105	276	241	235	214	199	194	193	170	167	167	168	168	168	168	161	154	148	148
					010205					199	194	193	170	167	167	168	168	168	168	161	154	148	148
			1A1c	Other energy industries	010505	276	241	235	214	199	194	193	170	167	167	168	168	168	168	161	154	148	148
			1A2	Industry	030104	161				145	141	138	134	131	127	124	124	124	124	124	124	124	124
					030105	276	241	235	214	199	194	193	170	167	167	168	168	168	168	161	154	148	148
			1A4a	Commercial/ Institutional	020104					145	141	138	134	131	127	124	124	124	124	124	124	124	124
					020105	276	241	235	214	199	194	193	170	167	167	168	168	168	168	161	154	148	148
			1A4b i	Residential	020204		241	235	214	199	194	193	170	167	167	168	168	168	168	161	154	148	148
			1A4c i	Agriculture/ Forestry	020303							138	134	131	127	124	124	124	124	124	124	124	124
					020304	276	241	235	214	199	194	193	170	167	167	168	168	168	168	161	154	148	148
	LIQUID	GAS OIL	1A1a	Electricity and heat production	010103					80	75	65	65	65	65		65	65	65	65	65	65	65
					010200	100	95	90	85														
					010201					80	75									65	65	65	65
					010202					80	75	70	65	65	65	65	65	65	65	65	65	65	65
					010203					80	75	70	65	65	65	65	65	65	65	65	65	65	65
			1A1b	Petroleum refining	010306		95	90	85	80	75	70	65						65	65	65	65	65
			1A2	Industry	030100	100	95	90	85	80	75	70	65	65	65	65	65	65	65	65	65	65	65
					030102						75			65	65	65	65	65	65	65	65	65	65
					030103					80	75	70	65	65	65	65	65	65				65	
					030106	100	95	90	85	80	75	70	65	65	65	65	65	65	65	65	65	65	
		ORIMULSION	1A1a	Electricity and heat production	010101							139	138				88	86	86	86			
		PETROLEUM COKE	1A2	Industry	030100	200		200	200		200	200	200	200	200	95	95	95	95	95	95	95	
		REFINERY GAS	1A1b	Petroleum refining	010306	100	100	100	100												170	170	170
		RESIDUAL OIL	1A1a	Electricity and heat production	010100	342	384	294	289														
					010101						239	250	200	177	152	129	122	130	144	131	127	109	98
					010102	342	384	294	289	267	239	250	200	177	152	129	122	130	144	131	127	109	98
					010103					267	239	250	200	177	152	129	122	130	144	131			
					010104					267	239	250	200	177	152	129	122	130	144	131	127	109	98
					010105	342	384	294	289	267	239	250	200	177	152	129	122	130	144	131			
	SOLID	BROWN COAL BRI.	1A4b i	Residential	020200	200	200	200	200	200	200	200	200	200	200	95	95	95	95				
		COAL	1A1a	Electricity and heat production	010100	342	384	294	289														
					010101	342	384	294	289	267	239	250	200	177	152	129	122	130	144	131	127	109	98
					010102	342	384	294	289	267	239	250	200	177	152	129	122	130	144	131	127	109	98
					010103					267	239	250	200	177	152	129	122	130	144	131			
					010104					267	239	250	200										
					010202					200	200	200	200	200	200	95	95	95	95	95	95		95
					010203					200	200	200	200	200	200	95	95				95		
			1A2	Industry	030100	200	200	200	200	200	200	200	200	200	200	95	95	95	95	95	95	95	95
			1A4a	Commercial/ Institutional	020100	200	200	200	200	200	200	200	200	200						95			
			1A4b i	Residential	020200	200	200	200	200	200	200	200	200	200	200	95	95	95	95	95	95	95	95
			1A4c i	Agriculture/ Forestry	020300	200	200	200	200	200	200	200	200	200	200	95	95	95	95	95	95	95	95
		COKE OVEN COKE	1A2	Industry	030100	200	200	200	200	200	200	200	200	200	200	95	95	95	95	95	95	95	95
			1A4b i	Residential	020200	200	200	200	200	200	200	200	200	200	200	95	95	95	95	95	95	95	95

						1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
						Data																	
pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_E	nfr_name	snap_id																		
NMVOC	BIOMASS	WOOD	1A4b i	Residential	020200	703	703	703	703	703	703	703	703	703	703	703	630	602	599	594	570	549	540
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010105	60	69	81	127	140	142	138	124	122	122	121	121	121	121	115	110	105	105
					010205					140	142	138	124	122	122	121	121	121	121	115	110	105	105
			1A1c	Other energy industries	010505	60	69	81	127	140	142	138	124	122	122	121	121	121	121	115	110	105	105
			1A2	Industry	030105	60	69	81	127	140	142	138	124	122	122	121	121	121	121	115	110	105	105
			1A4a	Commercial/ Institutional	020105	60	69	81	127	140	142	138	124	122	122	121	121	121	121	115	110	105	105
			1A4b i	Residential	020204		69	81	127	140	142	138	124	122	122	121	121	121	121	115	110	105	105
			1A4c i	Agriculture/ Forestry	020304	60	69	81	127	140	142	138	124	122	122	121	121	121	121	115	110	105	105
	LIQUID	REFINERY GAS	1A1b	Petroleum refining	010306	4	4	4	4												1,4	1,4	1,4

						1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
						Data																	
pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_E	nfr_name	snap_id																		
CO	BIOMASS	BIOGAS	1A1a	Electricity and heat production	010105	230	234	239	243	248	252	256	260	265	269	273	273	273	273	273	273	273	273
					010205					248										273	273	273	273
			1A1c	Other energy industries	010505	230	234	239	243	248	252	256	260	265	269	273	273	273	273	273	273	273	273
			1A2	Industry	030105									265	269	273	273	273	273	273		273	273
			1A4a	Commercial/ Institutional	020105	230	234	239	243	248	252	256	260	265	269	273	273	273	273	273	273	273	273
			1A4c i	Agriculture/ Forestry	020304	230	234	239	243	248	252	256	260	265	269	273	273	273	273	273	273	273	273
		STRAW	1A1a	Electricity and heat production	010200	600	554	508	463														
					010202					417	371	325	325	325	325	325	325			325	325	325	325
					010203					417	371	325	325	325	325	325	325	325	325	325	325	325	325
			1A4b i	Residential	020200	8500	8500	8500	8500	8500	7500	6500	5500	4500	4000	4000	4000	4000	4000	4000	4000	4000	4000
			1A4c i	Agriculture/ Forestry	020300	8500	8500	8500	8500	8500	7500	6500	5500	4500	4000	4000	4000	4000	4000	4000	4000	4000	4000
		WOOD	1A1a	Electricity and heat production	010200	400	373	347	320														
					010202					293	267	240	240	240	240	240	240	240	240	240	240	240	240
					010203					293	267	240	240	240	240	240	240	240	240	240	240	240	240
			1A2	Industry	030100	400	373	347	320	293	267	240	240	240	240	240	240	240	240	240	240	240	240
					030103					293	267	240	240	240	240	240	240	240	240	240	240	240	240
			1A4a	Commercial/ Institutional	020100	400	373	347	320	293	267	240	240	240	240	240	240	240	240	240	240	240	240
			1A4b i	Residential	020200	4146	4146	4146	4146	4146	4146	4146	4146	4146	4146	4146	3779	3656	3659	3657	3546	3436	3441
			1A4c i	Agriculture/ Forestry	020300	400	373	347	320	293	267	240	240	240	240	240	240	240	240	240	240	240	240
	GAS	NATURAL GAS	1A1a	Electricity and heat production	010105	189	211	212	227	226	222	221	182	182	182	183	183	183	183	160	137	115	115
					010205					226	222	221	182	182	182	183	183	183	183	160	137	115	115
			1A1c	Other energy industries	010505	189	211	212	227	226	222	221	182	182	182	183	183	183	183	160	137	115	115
			1A2	Industry	030105	189	211	212	227	226	222	221	182	182	182	183	183	183	183	160	137	115	115
			1A4a	Commercial/ Institutional	020105	189	211	212	227	226	222	221	182	182	182	183	183	183	183	160	137	115	115
			1A4b i	Residential	020204		211	212	227	226	222	221	182	182	182	183	183	183	183	160	137	115	115
			1A4c i	Agriculture/ Forestry	020304	189	211	212	227	226	222	221	182	182	182	183	183	183	183	160	137	115	115
	LIQUID	REFINERY GAS	1A1b	Petroleum refining	010306	15	15	15	15												6,2	6,2	6,2
	OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010200	100	85	70	55														
					010202					40	25												
					010203					40	25	10	10	10	10	10	10	10	10	10	10	10	10
			1A2	Industry	030100	100	85	70	55	40	25	10	10	10	10							10	
			1A4a	Commercial/ Institutional	020100	100	85	70	55	40	25	10	10	10	10	10			10	10	10	10	
					020103					40	25	10	10	10	10	10	10	10	10	10	10	10	10
	SOLID	COAL	1A4a	Commercial/ Institutional	020100	10	10	10	10	10	10	10	10	10						2000			

Table 65 PM emission factors and references 2007.

Fuel	IPCC sector	SNAP	TSP, g/GJ	Ref.	PM_{10} g/GJ	Ref.	$PM_{2.5}$ g/GJ	Ref.
COAL	1A1a	010101, 010102	3	12	2.6	12	2.1	12
COAL	1A1a	010202	6	9	6	9	5	9
COAL	1A2, 1A4b, 1A4c	030100, 020200, 020300	17	6	12	14	7	14
COKE OV.COKE	1A2, 1A4b	030100, 020200	17	16	12	16	7	16
PETROLEUM COKE	1A4a, 1A4b	020100, 020200	100	9	60	9	30	9
WOOD AND SIMIL.	1A1a	010102, 010103, 010104	7.9	3	1.94	3	1.23	3
WOOD AND SIMIL.	1A1a, 1A2f	010202, 010203, 030100, 030102, 030103	19	1	13	2	10	2
WOOD AND SIMIL.	1A4a, 1A4c	020100, 020105, 020300	143	1	143	9	135	9
WOOD AND SIMIL.	1A4b	020200	684	17	649	17	615	17
MUNICIP. WASTES	1A1a	010102, 010103	2.02	3	1.126	3	1.084	3
MUNICIP. WASTES	1A1a, 1A2, 1A4a	010203, 020103	6	10	5	11	4	11
STRAW	1A1a	010101, 010102, 010103, 010104	3.97	3	0.133	3	0.102	3
STRAW	1A1a, 1A4c	010202, 010203, 020302	21	1	15	2	12	2
STRAW	1A4b, 1A4c	020200, 020300	234	4	222	5	211	5
RESIDUAL OIL	1A1a	010101, 010102, 010104, 010202, 010203	3	9	3	9	2.5	9
RESIDUAL OIL	1A1b	010306	50	9	40	9	35	9
RESIDUAL OIL	1A2, 1A4a, 1A4b, 1A4c	030100, 030102, 020100, 020200, 020300, 020302	14	6	10.5	13	7	13
GAS OIL	all	all	5	9	5	9	5	9
KEROSENE	all	all	5	9	5	9	5	9
FISH & RAPE OIL	all	all	3	15	3	15	3	15
NATURAL GAS	1A1a, 1A1c, 1A2, 1A4a, 1A4b, 1A4c	010100, 010101, 010102, 010103, 010202, 010203, 030100, 030103, 020100, 020103, 020200, 020202, 020300	0.1	9	0.1	9	0.1	9
NATURAL GAS	1A1a, 1A1c, 1A2f, 1A4a, 1A4c	Gas turbines: 010104, 010504, 030104, 020104, 020303	0.1	3	0.061	3	0.051	3
NATURAL GAS	1A1a, 1A1c, 1A2, 1A4a, 1A4b, 1A4c	Gas engines: 010105, 010205, 010505, 030105, 020105, 020204, 020304	0.76	3	0.189	3	0.161	3
LPG	all	all	0.2	9	0.2	9	0.2	9
REFINERY GAS	1A1b	010304, 010306	5	9	5	9	5	9
BIOGAS	1A1a, 1A1c, 1A2, 1A4a, 1A4c	Gas engines: 010105, 010205, 010505, 030105, 020105, 020304	2.63	3	0.451	3	0.206	3
BIOGAS	1A1a, 1A2, 1A4a, 1A4c	010102, 010103, 010203, 030100, 030102, 020100, 020103, 020300	1.5	6	1.5	7	1.5	7

1. Danish legislation, Miljøstyrelsen 2001. Luftvejledningen, Begrænsning af luftforurening fra virksomheder, Vejledning fra Miljøstyrelsen nr 2 2001.
2. Particulate size distribution for wood and straw combustion in power plants refers to the TNO CEPMEIP emission factor database 2001 (wood). Available on the internet at: http://www.air.sk/tno/cepmeip/ (25-02-2009).
3. Nielsen, M. & Illerup, J.B: 2003. Emissionsfaktorer og emissionsopgørelse for decentral kraftvarme. Eltra PSO projekt 3141. Kortlægning af emissioner fra decentrale kraftvarmeværker. Delrapport 6. Danmarks Miljøundersøgelser. 116 s. – Faglig rapport fra DMU nr. 442.(In Danish, whith an english summary). Available on the Internet at :http://www.dmu.dk/1_viden/2_Publikationer/3_fagrapporter/rapporter/FR442.pdf (25-02-2009).
4. German, L., 2003. The Danish Technological Institute, Personal communication, rough estimate.
5. Particulate size distribution for wood and straw combustion in residential plants refers to the TNO CEPMEIP emission factor database 2001 (wood). Available on the internet at: http://www.air.sk/tno/cepmeip/ (25-02-2009).
6. Danish legislation. Miljøstyrelsen 1990, Bekendtgørelse 689, 15/10/1990, Bekendtgørelse om begrænsning af emissioner af svovldioxid, kvælstofoxider og støv fra store fyringsanlæg. (and Bekendtgørelse 518/1995).
7. All TSP emission is assumed to be <2,5µm (NERI assumption).
8. -
9. The TNO CEPMEIP emission factor database 2001. Available on the internet at: http://www.air.sk/tno/cepmeip/ (25-02-2009).
10. Implied emission factor calculation based on annual environmental reports of a large number of municipal waste incineration plants, 2000.

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). The emission factor should have been 5 g/GJ. The error will be corrected in the next inventory.
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. (2007) "Brændeovne og små kedler - partikelemissioner og reduktionstiltag". Miljøprojekt nr. 1164 2007. Miljøstyrelsen. Available on the internet at: http://www2.mst.dk/common/Udgivramme/Frame.asp?pg=http://www2.mst.dk/Udgiv/publikationer/2007/978-87-7052-451-3/html/default.htm.

Table 66 PM emission factors, time-series.

						2000	2001	2002	2003	2004	2005	2006	2007
Pollutant	Fuel type	Fuel	CRF	CRF name	SNAP								
TSP	BIOMASS	WOOD	1A4b i	Residential	020200	883	791	756	750	744	713	687	684
PM_{10}	BIOMASS	WOOD	1A4b i	Residential	020200	839	751	718	713	707	677	653	649
$PM_{2,5}$	BIOMASS	WOOD	1A4b i	Residential	020200	795	712	680	675	670	642	619	615

Table 67 HM emission factors and references 2007.

Fuel	IPCC sector	SNAP	As, mg/GJ	Ref.	Cd, mg/GJ	Ref.	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	0.9	2	2.34	2	2.6	2	0.72	2	2.34	2	3.62	2	-	-	136	1
WOOD AND SIMIL.	1A1a 1A2 1A4a 1A4b 1A4c	010202, 010203, 030100, 030102, 030103, 020100, 020105, 020200, 020300	-	-	6.8	1	-	-	6.8	1	6.8	1	-	-	3.4	1	-	-	136	1
MUNICIP. WASTES	1A1a	010102, 010103	6.74	2	4.73	2	2.43	2	10.03	2	7.39	2	4.71	2	123	2	-	-	359.5	1
MUNICIP. WASTES	1A1a 1A4a	010203, 020103	3.53	1	9.21	1	32.97	1	31.8	1	58.7	1	55.4	1	137.57	1			359.5	1
STRAW	1A1a	010101, 010102, 010103, 010104	2	2	0.72	2	1.52	2	1.66	2	0.53	2	1.62	2	6.12	2	-	-	8.39	1
STRAW	1A1a, 1A4b, 1A4c	010202, 010203, 020200, 020300, 020302			0.62	1	0.62	1	1.06	1	6.8	1	0.53	1	3.22	1	-	-	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	all	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
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

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 (NERI assumption).

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 2007 for large point sources, mg pr 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 1990-2007.

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

						1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
						Data																	
pol_abbr	fuel_type	fuel_gr_abbr	nfr_id_E	nfr_name	snap_id																		
As	OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010100	7.82	7.207	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							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	3.53			3.53	3.53	3.53	3.53	
Cd	OTHER 1	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	4.73	4.73	4.73	4.73	4.73	4.73	4.73	4.73
					010103					18.686	15.527	12.369	9.21	9.21	9.21	4.73	4.73	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							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	9.21			9.21	9.21	9.21	9.21	
Cr	OTHER 1	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	2.43	2.43	2.43	2.43	2.43	2.43	2.43	2.43
					010103					98.597	76.721	54.846	32.97	32.97	32.97	2.43	2.43	2.43	2.43	2.43	2.43	2.43	2.43
					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							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	32.97			32.97	32.97	32.97	32.97	
Cu	OTHER 1	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	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03
					010103					71.096	57.997	44.899	31.8	31.8	31.8	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03
					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							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	31.8			31.8	31.8	31.8	31.8	
Hg	OTHER 1	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	7.39	7.39	7.39	7.39	7.39	7.39	7.39	7.39
					010103					7.39	79.763	69.231	58.7	58.7	58.7	7.39	7.39	7.39	7.39	7.39	7.39	7.39	7.39
					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							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	58.7			58.7	58.7	58.7	58.7	
Ni	OTHER 1	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	4.71	4.71	4.71	4.71	4.71	4.71	4.71	4.71
					010103					113.926	94.417	74.909	55.4	55.4	55.4	4.71	4.71	4.71	4.71	4.71	4.71	4.71	4.71
					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							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	55.4			55.4	55.4	55.4	55.4	
Pb	OTHER 1	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	123	123	123	123	123	123	123	123
					010103					388.297	304.721	221.146	137.57	137.57	137.57	123	123	123	123	123	123	123	123
					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							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	137.57			137.57	137.57	137.57	137.57	
Zn	OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010100	804.88	741.254	677.629	614.003														
					010102					550.377	486.751			359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5
					010103					550.377	486.751	423.126	359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5
					010104					550.377	486.751	423.126	359.5	359.5	359.5	359.5			359.5			359.5	
					010200	804.88	741.254	677.629	614.003														
					010202					550.377	486.751												
					010203					550.377	486.751	423.126	359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5
			1A2	Industry	030100	804.88	741.254	677.629	614.003	550.377	486.751	423.126	359.5	359.5	359.5							359.5	
			1A4a	Commercial/ Institutional	020100	804.88	741.254	677.629	614.003	550.377	486.751	423.126	359.5	359.5	359.5	359.5			359.5	359.5	359.5	359.5	
					020103					550.377	486.751	423.126	359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5	359.5

Table 70 PAH emission factors 2007.

Fuel	IPCC id	SNAP	Benzo(a)-pyrene		Benzo(b)-fluoranthene		Benzo(k)-fluoranthene		Indeno(1,2,3-c,d)-pyrene	
			µg pr GJ	Ref.	µg pr GJ	Ref.	µg pr GJ	Ref.	µg pr GJ	Ref.
COAL	1A1a	010101, 010102, 010202	0.14	4	0.29	4	0.29	4	0.28	4
COAL	1A2	030100	23	4	929	4	929	4	698	4
COAL	1A4b, 1A4c	020200, 020300	59 524	4	63 492	4	1 984	4	119 048	4
COKE OV.COKE	1A2	030100	23	4 (9)	929	4 (9)	929	4 (9)	698	4 (9)
COKE OV.COKE	1A4b	020200	59 524	4 (9)	63 492	4 (9)	1 984	4 (9)	119 048	4 (9)
PETROLEUM COKE	1A4a, 1A4b	020100, 020200	3184	5	9 554	5	-	-	-	-
WOOD AND SIMIL.	1A1a	010102, 010103, 010104	3	8	2	8	2	8	2	8
WOOD AND SIMIL.	1A1a, 1A2	010202, 010203, 030100, 030102, 030103	6.46	4	1 292.52	4	1 292.52	4	11.56	4
WOOD AND SIMIL.	1A4a, 1A4c	020100, 020105, 020300	168 707	4	221 769	4	73 469	4	119 728	4
WOOD AND SIMIL.	1A4b	020200	125 594	10	130 661	10	76 327	10	86 045	10
MUNICIP. WASTES	1A1a	010102, 010103	0.8	8	1.7	8	0.8	8	0.9	8
MUNICIP. WASTES	1A1a, 1A4a	010203, 020103	67	5	571	5	1	5	1	5
STRAW	1A1a	010101, 010102	1.6	1	1.4	1	1	1	1.6	1
STRAW	1A1a	010103, 010104	21	8	157	8	90	8	23	8
STRAW	1A1a	010202, 010203	1 529	2	3 452	2	1 400	2	1 029	2
STRAW	1A4b, 1A4c	020200, 020300, 020302	12 956	2	12 828	2	6 912	2	4 222	2
RESIDUAL OIL	1A1a, 1A1b	010101, 010102, 010104, 010202, 010203, 010306	109.6	4	475.41	4	93.21	4	177.28	4
RESIDUAL OIL	1A2 1A4a 1A4b 1A4c	030100, 030102, 020100, 020200, 020300, 020302, 020304	80	4	42	4	66	4	160	4
GAS OIL	1A1a, 1A1b 1A1c	010101, 010102, 010103, 010104, 010105, 010201, 010202, 010203, 010205, 010306, 010505	109.6	4	475.41	4	93.21	4	177.28	4
GAS OIL	1A2 1A4a 1A4b 1A4c	030100, 030102, 030104, 020100, 020103, 020105, 020200, 020304	80	4	42	4	66	4	160	4

Continued										
FISH & RAPE OIL	1A1a	010101, 010102, 010103, 010202, 010203	109.6	3	475.41	3	93.21	3	177.28	3
FISH & RAPE OIL	1A2, 1A4c	030105, 020105	80	3	42	3	66	3	160	3
NATURAL GAS	1A1a, 1A1c, 1A2, 1A4a, 1A4c	Gas turbines: 010104, 010504, 030104, 020104, 020303	1	8	1	8	2	8	3	8
NATURAL GAS	1A1a, 1A1c, 1A2f, 1A4a, 1A4b, 1A4c	Gas engines: 010105, 010205, 010505, 030105, 020105, 020204, 020304	3	8	42	8	24	8	6	8
NATURAL GAS	1A4b	020202	0.133	6	0.663	6	0.265	6	2.653	6
BIOGAS	1A1a, 1A1c, 1A2, 1A4a, 1A4c	Gas engines: 010105, 010205, 010505, 030105, 020105, 020304	1	8	1	8	0.4	8	1.1	8

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3. Same emission factors as for gas oil is assumed (NERI assumption).
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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 2007) emission factors. Technology distribution based on: (Illerup, J. B., Henriksen, T. C., Lundhede, T., Breugel C. v., Jensen, N. Z. (2007) "Brændeovne og små kedler - partikelemissioner og reduktionstiltag". Miljøprojekt nr. 1164 2007. Miljøstyrelsen. Available on the Internet at: http://www2.mst.dk/common/Udgivramme/Frame.asp?pg=http://www2.mst.dk/Udgiv/publikationer/2007/978-87-7052-451-3/html/default.htm.

Time-series have been estimated for the PAH emission factors for residential wood combustion. All other emission factors are constant in 1990-2007. The time-series for residential wood combustion are shown below.

Table 71 PAH emission factors time-series for residential wood combustion, µg pr GJ.

pol_abbr	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Benzo(a)pyrene	158978	158978	158978	158978	158978	158978	158978	158978	158978	158978
Benzo(b)flouranthene	169294	169294	169294	169294	169294	169294	169294	169294	169294	169294
Benzo(k)flouranthene	98916	98916	98916	98916	98916	98916	98916	98916	98916	98916
Indeno(1,2,3-c,d)pyrene	110462	110462	110462	110462	110462	110462	110462	110462	110462	110462
Continued	2000	2001	2002	2003	2004	2005	2006	2007		
Benzo(a)pyrene	158978	143819	138366	137886	137246	132394	127943	126833		
Benzo(b)flouranthene	169294	152421	145960	144786	143466	137800	133097	131168		
Benzo(k)flouranthene	98916	89076	85286	84566	83767	80458	77736	76191		
Indeno(1,2,3-c,d)pyrene	110462	99570	95544	95023	94398	90846	87681	86474		

Table 72 Dioxin and HCB emission factors 2007.

fuel_type	fuel_gr_abbr	nfr_id_EA	nfr_name	snap_id	Dioxin, ng pr GJ	HCB, ng pr GJ
BIOMASS	WOOD	1A1a	Electricity and heat production	010102	1	4 000
				010103	1	4 000
				010104	1	4 000
				010202	1	4 000
				010203	1	4 000
		1A2	Industry	030100	1	4 000
				030102	1	4 000
				030103	1	4 000
		1A4a	Commercial/ Institutional	020100	400	4 000
				020105	400	4 000
		1A4b i	Residential	020200	422	4 000
		1A4c i	Agriculture/ Forestry	020300	400	4 000
	STRAW	1A1a	Electricity and heat production	010101	22	
				010102	22	
				010103	22	
				010104	22	
				010202	22	
				010203	22	
		1A4b i	Residential	020200	500	
		1A4c i	Agriculture/ Forestry	020300	400	
				020302	400	
	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	
		1A4a	Commercial/ Institutional	020105	10	
	BIOGAS	1A1a	Electricity and heat production	010102	0.025	
				010103	0.025	
				010105	0.025	
				010203	0.025	
				010205	0.025	
		1A1c	Other energy industries	010505	0.025	
		1A2	Industry	030100	0.025	
				030102	0.025	
				030105	0.025	
		1A4a	Commercial/ Institutional	020100	2	
				020103	2	
				020105	2	
		1A4c i	Agriculture/ Forestry	020300	2	
				020304	2	
OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010102	61	95 238
				010103	61	95 238
				010203	61	95 238
		1A4a	Commercial/ Institutional	020103	61	95 238
GAS	NATURAL GAS	1A1a	Electricity and heat production	010100	0.025	
				010101	0.025	
				010102	0.025	
				010103	0.025	
				010104	0.025	
				010105	0.025	

Continued				010202	0.025
				010203	0.025
				010205	0.025
		1A1c	Other energy industries	010504	0.025
				010505	0.025
		1A2	Industry	030100	0.025
				030103	0.025
				030104	0.025
				030105	0.025
		1A4a	Commercial/ Institutional	020100	2
				020103	2
				020104	2
				020105	2
		1A4b i	Residential	020200	2
				020202	2
				020204	2
		1A4c i	Agriculture/ Forestry	020300	2
				020303	2
				020304	2
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
				010104	0.882
				010202	0.882
				010203	0.882
		1A1b	Petroleum refining	010306	0.882
		1A2	Industry	030100	0.882
				030102	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	0.882
				010201	0.882
				010202	0.882
				010203	0.882
				010204	0.882
				010205	0.882
		1A1b	Petroleum refining	010306	0.882
		1A1c	Other energy industries	010505	0.882
		1A2	Industry	030100	0.882
				030102	0.882
				030104	0.882
		1A4a	Commercial/ Institutional	020100	10
				020103	10
				020105	10
		1A4b i	Residential	020200	10
		1A4c i	Agriculture/ Forestry	020304	10
	KEROSENE	1A2	Industry	030100	0.882
		1A4a	Commercial/ Institutional	020100	10

Continued		1A4b i	Residential	020200	10	
		1A4c i	Agriculture/ Forestry	020300	10	
	LPG	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
				010202	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.

Pollutant	Fuel type	Fuel	nfr_id_EA	nfr_name	SNAP	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
DIOXIN	BIOMASS	WOOD	1A4b i	Residential	020200	537	537	537	537	537	537	537	537	537	537	537
	OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010100	2095	1746	1396	1047							
					010102					947	847			548	448	129
					010103					947	847	747	648	548	448	129
					010104					947	847	747	648	548	448	129
					010200	2095	1746	1396	1047							
					010202					947	847					
					010203					947	847	747	648	548	448	129
			1A2	Industry	030100	2095	1746	1396	1047	947	847	747	648	548	448	
					030102											
			1A4a	Commercial/ Institutional	020100	2095	1746	1396	1047	947	847	747	648	548	448	341
					020103					947	847	747	648	548	448	129

Continued

Pollutant	Fuel type	Fuel	nfr_id_EA	nfr_name	SNAP	2001	2002	2003	2004	2005	2006	2007
DIOXIN	BIOMASS	WOOD	1A4b i	Residential	020200	485	465	462	459	442	427	422
	OTHER 1	MUNICIP. WASTES	1A1a	Electricity and heat production	010100							
					010102	112	95	78	61	61	61	61
					010103	112	95	78	61	61	61	61
					010104			78			61	
					010200							
					010202							
					010203	112	95	78	61	61	61	61
			1A2	Industry	030100						61	
					030102			78	61	61	61	
			1A4a	Commercial/ Institutional	020100			78	61	61	61	
					020103	112	95	78	61	61	61	61

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 2007.

Pollutant	Implied Emission factor	Unit
SO_2	8	g/GJ
NO_x	109	g/GJ
TSP	1.1	g/GJ
PM_{10}	0.9	g/GJ
$PM_{2.5}$	0.7	g/GJ
As	5	mg/GJ
Cd	4	mg/GJ
Cr	7	mg/GJ
Cu	12	mg/GJ
Hg	5	mg/GJ
Ni	16	mg/GJ
Pb	80	mg/GJ
Se	0.2	mg/GJ
Zn	361	mg/GJ

Table 75 Implied emission factors for power plants combusting coal, 2007.

Pollutant	Implied Emission factor	Unit
SO_2	26	g/GJ
NO_x	109	g/GJ
TSP	3,4	g/GJ
PM_{10}	2.7	g/GJ
$PM_{2.5}$	2.2	g/GJ
As	0.71	mg/GJ
Cd	0.06	mg/GJ
Cr	1.06	mg/GJ
Cu	0.61	mg/GJ
Hg	0.98	mg/GJ
Ni	1.17	mg/GJ
Pb	0.93	mg/GJ
Se	6.71	mg/GJ
Zn	3.26	mg/GJ

Appendix 8 Large point sources

Table 76 Large point sources, fuel consumption in 2007 (1A1, 1A2 and 1A4).

nfr_id_EA	nfr_name	snap_id	lps_id	lps_name	part_id	fuel_gr_abbr	lpsrat_val
1A1a	Electricity and heat production	010101	001	Amagervaerket	02	WOOD	452553
1A1a	Electricity and heat production	010101	001	Amagervaerket	02	STRAW	881728
1A1a	Electricity and heat production	010101	001	Amagervaerket	02	RESIDUAL OIL	43800
1A1a	Electricity and heat production	010101	001	Amagervaerket	03	COAL	14149700
1A1a	Electricity and heat production	010101	001	Amagervaerket	03	RESIDUAL OIL	104900
1A1a	Electricity and heat production	010101	003	H.C.Oerstedsvaerket	03	RESIDUAL OIL	532318
1A1a	Electricity and heat production	010101	003	H.C.Oerstedsvaerket	03	GAS OIL	22309
1A1a	Electricity and heat production	010101	003	H.C.Oerstedsvaerket	03	FISH & RAPE OIL	4774
1A1a	Electricity and heat production	010101	003	H.C.Oerstedsvaerket	03	NATURAL GAS	5116528
1A1a	Electricity and heat production	010101	004	Kyndbyvaerket	21	GAS OIL	281923
1A1a	Electricity and heat production	010101	004	Kyndbyvaerket	22	RESIDUAL OIL	571067
1A1a	Electricity and heat production	010101	004	Kyndbyvaerket	26	RESIDUAL OIL	112637
1A1a	Electricity and heat production	010101	004	Kyndbyvaerket	26	GAS OIL	137425
1A1a	Electricity and heat production	010101	004	Kyndbyvaerket	28	RESIDUAL OIL	46803
1A1a	Electricity and heat production	010101	004	Kyndbyvaerket	28	GAS OIL	3886
1A1a	Electricity and heat production	010101	007	Stigsnaesvaerket	01	COAL	1264509
1A1a	Electricity and heat production	010101	007	Stigsnaesvaerket	01	RESIDUAL OIL	158297
1A1a	Electricity and heat production	010101	007	Stigsnaesvaerket	02	COAL	7999900
1A1a	Electricity and heat production	010101	007	Stigsnaesvaerket	02	RESIDUAL OIL	200877
1A1a	Electricity and heat production	010101	007	Stigsnaesvaerket	03	RESIDUAL OIL	99095
1A1a	Electricity and heat production	010101	007	Stigsnaesvaerket	03	GAS OIL	6152
1A1a	Electricity and heat production	010101	008	Asnaesvaerket	02	COAL	4539556
1A1a	Electricity and heat production	010101	008	Asnaesvaerket	02	RESIDUAL OIL	286726
1A1a	Electricity and heat production	010101	008	Asnaesvaerket	04	COAL	2132827
1A1a	Electricity and heat production	010101	008	Asnaesvaerket	04	RESIDUAL OIL	191138
1A1a	Electricity and heat production	010101	008	Asnaesvaerket	05	COAL	26551311
1A1a	Electricity and heat production	010101	008	Asnaesvaerket	05	RESIDUAL OIL	837640
1A1a	Electricity and heat production	010101	010	Avedoerevaerket	01	COAL	14002300
1A1a	Electricity and heat production	010101	010	Avedoerevaerket	01	RESIDUAL OIL	308000
1A1a	Electricity and heat production	010101	011	Fynsvaerket+Odense kraftvarmevaerk	03	COAL	7122500
1A1a	Electricity and heat production	010101	011	Fynsvaerket+Odense kraftvarmevaerk	03	RESIDUAL OIL	440810
1A1a	Electricity and heat production	010101	011	Fynsvaerket+Odense kraftvarmevaerk	07	COAL	11378390
1A1a	Electricity and heat production	010101	011	Fynsvaerket+Odense kraftvarmevaerk	07	RESIDUAL OIL	240930
1A1a	Electricity and heat production	010101	012	Studstrupvaerket	03	COAL	8030230
1A1a	Electricity and heat production	010101	012	Studstrupvaerket	03	STRAW	411680
1A1a	Electricity and heat production	010101	012	Studstrupvaerket	03	RESIDUAL OIL	195700
1A1a	Electricity and heat production	010101	012	Studstrupvaerket	04	COAL	16341090
1A1a	Electricity and heat production	010101	012	Studstrupvaerket	04	STRAW	1371740
1A1a	Electricity and heat production	010101	012	Studstrupvaerket	04	RESIDUAL OIL	334880
1A1a	Electricity and heat production	010101	014	Nordjyllandsvaerket	02	COAL	7155700
1A1a	Electricity and heat production	010101	014	Nordjyllandsvaerket	02	RESIDUAL OIL	97500
1A1a	Electricity and heat production	010101	014	Nordjyllandsvaerket	03	COAL	21953100
1A1a	Electricity and heat production	010101	014	Nordjyllandsvaerket	03	RESIDUAL OIL	116500
1A1a	Electricity and heat production	010101	018	Skaerbaekvaerket	03	GAS OIL	111070
1A1a	Electricity and heat production	010101	018	Skaerbaekvaerket	03	NATURAL GAS	8770000
1A1a	Electricity and heat production	010101	019	Enstedvaerket	03	COAL	19364700
1A1a	Electricity and heat production	010101	019	Enstedvaerket	03	RESIDUAL OIL	257310
1A1a	Electricity and heat production	010101	019	Enstedvaerket	04	WOOD	169086
1A1a	Electricity and heat production	010101	019	Enstedvaerket	04	STRAW	1808582
1A1a	Electricity and heat production	010101	019	Enstedvaerket	04	FISH & RAPE OIL	9820
1A1a	Electricity and heat production	010101	020	Esbjergvaerket	03	COAL	18912480
1A1a	Electricity and heat production	010101	020	Esbjergvaerket	03	RESIDUAL OIL	324770
1A1a	Electricity and heat production	010102	005	Masnedoevaerket	12	WOOD	86491
1A1a	Electricity and heat production	010102	005	Masnedoevaerket	12	STRAW	464757
1A1a	Electricity and heat production	010102	011	Fynsvaerket+Odense kraftvarmevaerk	08	MUNICIP. WASTES	2882000
1A1a	Electricity and heat production	010102	011	Fynsvaerket+Odense kraftvarmevaerk	08	GAS OIL	20000
1A1a	Electricity and heat production	010102	022	Oestkraft	05	RESIDUAL OIL	19218
1A1a	Electricity and heat production	010102	022	Oestkraft	06	COAL	590631
1A1a	Electricity and heat production	010102	022	Oestkraft	06	WOOD	29147
1A1a	Electricity and heat production	010102	022	Oestkraft	06	RESIDUAL OIL	29904
1A1a	Electricity and heat production	010102	025	Horsens Kraftvarmevaerk	01	WOOD	8657
1A1a	Electricity and heat production	010102	025	Horsens Kraftvarmevaerk	01	MUNICIP. WASTES	920885
1A1a	Electricity and heat production	010102	026	Herningvaerket	01	WOOD	2713530
1A1a	Electricity and heat production	010102	026	Herningvaerket	01	RESIDUAL OIL	111850
1A1a	Electricity and heat production	010102	026	Herningvaerket	01	NATURAL GAS	799604
1A1a	Electricity and heat production	010102	027	I/S Vestforbraending	01	MUNICIP. WASTES	2003946

nfr_id_EA	nfr_name	snap_id	lps_id	lps_name	part_id	fuel_gr_abbr	lpsrat_val
Continued							
1A1a	Electricity and heat production	010102	027	I/S Vestforbraending	01	GAS OIL	21449
1A1a	Electricity and heat production	010102	027	I/S Vestforbraending	02	MUNICIP. WASTES	676001
1A1a	Electricity and heat production	010102	027	I/S Vestforbraending	02	NATURAL GAS	13707
1A1a	Electricity and heat production	010102	027	I/S Vestforbraending	03	MUNICIP. WASTES	2772242
1A1a	Electricity and heat production	010102	027	I/S Vestforbraending	03	NATURAL GAS	25548
1A1a	Electricity and heat production	010102	028	Amagerforbraending	01	MUNICIP. WASTES	4390281
1A1a	Electricity and heat production	010102	029	Energi Randers Produktion	01	COAL	1932510
1A1a	Electricity and heat production	010102	029	Energi Randers Produktion	01	WOOD	1114443
1A1a	Electricity and heat production	010102	029	Energi Randers Produktion	01	BIOGAS	15827
1A1a	Electricity and heat production	010102	029	Energi Randers Produktion	02	GAS OIL	62920
1A1a	Electricity and heat production	010102	030	Grenaa Kraftvarmevaerk	01	COAL	526930
1A1a	Electricity and heat production	010102	030	Grenaa Kraftvarmevaerk	01	WOOD	8991
1A1a	Electricity and heat production	010102	030	Grenaa Kraftvarmevaerk	01	STRAW	563406
1A1a	Electricity and heat production	010102	030	Grenaa Kraftvarmevaerk	01	RESIDUAL OIL	17780
1A1a	Electricity and heat production	010102	030	Grenaa Kraftvarmevaerk	01	GAS OIL	5129
1A1a	Electricity and heat production	010102	037	Maabjergvaerket	02	WOOD	336000
1A1a	Electricity and heat production	010102	037	Maabjergvaerket	02	MUNICIP. WASTES	1895000
1A1a	Electricity and heat production	010102	037	Maabjergvaerket	02	STRAW	420000
1A1a	Electricity and heat production	010102	037	Maabjergvaerket	02	NATURAL GAS	107604
1A1a	Electricity and heat production	010102	038	Soenderborg Kraftvarmevaerk	01	WOOD	2455
1A1a	Electricity and heat production	010102	038	Soenderborg Kraftvarmevaerk	01	MUNICIP. WASTES	714200
1A1a	Electricity and heat production	010102	039	I/S Kara Affaldsforbraendings-anlaeg	01	MUNICIP. WASTES	2145623
1A1a	Electricity and heat production	010102	039	I/S Kara Affaldsforbraendings-anlaeg	01	NATURAL GAS	8756
1A1a	Electricity and heat production	010102	042	I/S Nordforbraending	01	WOOD	149075
1A1a	Electricity and heat production	010102	042	I/S Nordforbraending	01	MUNICIP. WASTES	1334739
1A1a	Electricity and heat production	010102	046	Affaldscenter aarhus - For-braendsanlaegget	01	MUNICIP. WASTES	2499357
1A1a	Electricity and heat production	010102	053	Svendborg Kraftvarmevaerk	01	MUNICIP. WASTES	503126
1A1a	Electricity and heat production	010102	053	Svendborg Kraftvarmevaerk	01	NATURAL GAS	2235
1A1a	Electricity and heat production	010102	054	Kommunekemi	01	MUNICIP. WASTES	450250
1A1a	Electricity and heat production	010102	054	Kommunekemi	01	RESIDUAL OIL	234078
1A1a	Electricity and heat production	010102	054	Kommunekemi	01	GAS OIL	6743
1A1a	Electricity and heat production	010102	054	Kommunekemi	02	MUNICIP. WASTES	475829
1A1a	Electricity and heat production	010102	054	Kommunekemi	02	RESIDUAL OIL	190526
1A1a	Electricity and heat production	010102	054	Kommunekemi	02	GAS OIL	6887
1A1a	Electricity and heat production	010102	054	Kommunekemi	03	MUNICIP. WASTES	509324
1A1a	Electricity and heat production	010102	054	Kommunekemi	03	RESIDUAL OIL	172791
1A1a	Electricity and heat production	010102	054	Kommunekemi	03	GAS OIL	6169
1A1a	Electricity and heat production	010102	085	L90 Affaldsforbraending	01	MUNICIP. WASTES	2270717
1A1a	Electricity and heat production	010102	085	L90 Affaldsforbraending	01	GAS OIL	6951
1A1a	Electricity and heat production	010102	087	Koege Kraftvarmevaerk	07	WOOD	1637548
1A1a	Electricity and heat production	010102	087	Koege Kraftvarmevaerk	07	RESIDUAL OIL	33410
1A1a	Electricity and heat production	010103	036	Kolding Forbraendingsanlaeg	01	WOOD	2232
1A1a	Electricity and heat production	010103	036	Kolding Forbraendingsanlaeg	01	MUNICIP. WASTES	662760
1A1a	Electricity and heat production	010103	047	I/S Reno Nord	01	MUNICIP. WASTES	1930173
1A1a	Electricity and heat production	010103	047	I/S Reno Nord	01	GAS OIL	4459
1A1a	Electricity and heat production	010103	051	AVV Forbraendingsanlaeg	01	MUNICIP. WASTES	865788
1A1a	Electricity and heat production	010103	052	Affaldsforbraendingsanlaeg I/S REFA	01	MUNICIP. WASTES	1232994
1A1a	Electricity and heat production	010103	058	I/S Reno Syd	01	MUNICIP. WASTES	660849
1A1a	Electricity and heat production	010103	059	I/S Kraftvarmevaerk Thisted	01	MUNICIP. WASTES	539270
1A1a	Electricity and heat production	010103	059	I/S Kraftvarmevaerk Thisted	01	STRAW	10078
1A1a	Electricity and heat production	010103	060	Knudmosevaerket	01	MUNICIP. WASTES	500890
1A1a	Electricity and heat production	010103	060	Knudmosevaerket	01	NATURAL GAS	38413
1A1a	Electricity and heat production	010103	061	Kavo I/S Energien+Slagelse Kraftvarmevaerk	01	MUNICIP. WASTES	220271
1A1a	Electricity and heat production	010103	061	Kavo I/S Energien+Slagelse Kraftvarmevaerk	02	MUNICIP. WASTES	484726
1A1a	Electricity and heat production	010103	061	Kavo I/S Energien+Slagelse Kraftvarmevaerk	02	STRAW	405282
1A1a	Electricity and heat production	010103	065	Haderslev Kraftvarmevaerk	01	MUNICIP. WASTES	614900
1A1a	Electricity and heat production	010103	065	Haderslev Kraftvarmevaerk	01	NATURAL GAS	15940
1A1a	Electricity and heat production	010103	066	Frederiskhavn Affaldskraftvar-mevaerk	01	MUNICIP. WASTES	397630
1A1a	Electricity and heat production	010103	067	Vejen Kraftvarmevaerk	01	WOOD	2100
1A1a	Electricity and heat production	010103	067	Vejen Kraftvarmevaerk	01	MUNICIP. WASTES	393000
1A1a	Electricity and heat production	010104	002	Svanemoellevaerket	07	GAS OIL	20536
1A1a	Electricity and heat production	010104	002	Svanemoellevaerket	07	NATURAL GAS	4279718
1A1a	Electricity and heat production	010104	004	Kyndbyvaerket	51	GAS OIL	12539
1A1a	Electricity and heat production	010104	004	Kyndbyvaerket	52	GAS OIL	12685
1A1a	Electricity and heat production	010104	005	Masnedoevaerket	31	GAS OIL	17123
1A1a	Electricity and heat production	010104	010	Avedoerevaerket	02	WOOD	3758121
1A1a	Electricity and heat production	010104	010	Avedoerevaerket	02	STRAW	2510576
1A1a	Electricity and heat production	010104	010	Avedoerevaerket	02	RESIDUAL OIL	4501300
1A1a	Electricity and heat production	010104	010	Avedoerevaerket	02	NATURAL GAS	8442481

nfr_id_EA	nfr_name	snap_id	lps_id	lps_name	part_id	fuel_gr_abbr	lpsrat_val
Continued							
1A1a	Electricity and heat production	010104	025	Horsens Kraftvarmevaerk	02	NATURAL GAS	651396
1A1a	Electricity and heat production	010104	031	Hilleroed Kraftvarmevaerk	01	NATURAL GAS	2873789
1A1a	Electricity and heat production	010104	032	Helsingoer Kraftvarmevaerk	01	NATURAL GAS	1352468
1A1a	Electricity and heat production	010104	038	Soenderborg Kraftvarmevaerk	02	NATURAL GAS	1042438
1A1a	Electricity and heat production	010104	040	Viborg Kraftvarme	01	NATURAL GAS	2109698
1A1a	Electricity and heat production	010104	048	Silkeborg Kraftvarmevaerk	01	NATURAL GAS	2997034
1A1a	Electricity and heat production	010104	069	DTU	01	NATURAL GAS	1191908
1A1a	Electricity and heat production	010104	070	Naestved Kraftvarmevaerk	01	NATURAL GAS	86196
1A1a	Electricity and heat production	010104	072	Hjoerring Varmeforsyning	01	NATURAL GAS	154080
1A1a	Electricity and heat production	010105	004	Kyndbyvaerket	41	GAS OIL	1479
1A1a	Electricity and heat production	010105	032	Helsingoer Kraftvarmevaerk	02	NATURAL GAS	9812
1A1a	Electricity and heat production	010203	036	Kolding Forbraendingsanlaeg	05	MUNICIP. WASTES	567630
1A1a	Electricity and heat production	010203	036	Kolding Forbraendingsanlaeg	05	GAS OIL	3694
1A1a	Electricity and heat production	010203	050	Fasan+Naestved Kraftvarmevaerk	01	MUNICIP. WASTES	1290377
1A1a	Electricity and heat production	010203	055	I/S Faelles Forbraending	01	MUNICIP. WASTES	330000
1A1a	Electricity and heat production	010203	068	Bofa I/S	01	MUNICIP. WASTES	219488
1A1a	Electricity and heat production	010203	086	Hammel Fjernvarme	01	MUNICIP. WASTES	320870
1A1a	Electricity and heat production	010203	086	Hammel Fjernvarme	01	FISH & RAPE OIL	6517
1A1a	Electricity and heat production	010203	088	Skagen Forbraendingen	01	MUNICIP. WASTES	125832
1A1b	Petroleum refining	010304	017	Shell Raffinaderi	05	REFINERY GAS	2299437
1A1b	Petroleum refining	010306	009	Statoil Raffinaderi	01	GAS OIL	7024
1A1b	Petroleum refining	010306	009	Statoil Raffinaderi	01	REFINERY GAS	7052384
1A1b	Petroleum refining	010306	017	Shell Raffinaderi	01	RESIDUAL OIL	792504
1A1b	Petroleum refining	010306	017	Shell Raffinaderi	01	REFINERY GAS	4506111
1A1c	Other energy industries	010502	024	Nybro Gasbehandlingsanlaeg	01	NATURAL GAS	348025
1A2	Industry	030100	081	Haldor Topsoee	02	GAS OIL	1600
1A2	Industry	030100	081	Haldor Topsoee	02	NATURAL GAS	516600
1A2	Industry	030100	081	Haldor Topsoee	02	LPG	200
1A2	Industry	030102	023	Danisco Grindsted	01	COAL	547050
1A2	Industry	030102	023	Danisco Grindsted	01	RESIDUAL OIL	12718
1A2	Industry	030102	023	Danisco Grindsted	01	NATURAL GAS	8571
1A2	Industry	030102	033	DanSteel	01	NATURAL GAS	1407236
1A2	Industry	030102	034	Dalum Papir	01	WOOD	1062759
1A2	Industry	030102	034	Dalum Papir	01	GAS OIL	4161
1A2	Industry	030102	034	Dalum Papir	01	NATURAL GAS	156801
1A2	Industry	030102	082	Danisco Sugar Nakskov	02	COAL	616998
1A2	Industry	030102	082	Danisco Sugar Nakskov	02	RESIDUAL OIL	595766
1A2	Industry	030102	082	Danisco Sugar Nakskov	02	GAS OIL	3372
1A2	Industry	030102	082	Danisco Sugar Nakskov	02	BIOGAS	30314
1A2	Industry	030102	083	Danisco Sugar Nykoebing	02	COAL	208396
1A2	Industry	030102	083	Danisco Sugar Nykoebing	02	COKE OVEN COKE	37065
1A2	Industry	030102	083	Danisco Sugar Nykoebing	02	RESIDUAL OIL	808362
1A2	Industry	030104	071	Maricogen	01	NATURAL GAS	1315454
1A2	Industry	030311	045	Aalborg Portland	01	COAL	4030000
1A2	Industry	030311	045	Aalborg Portland	01	PETROLEUM COKE	9109000
1A2	Industry	030311	045	Aalborg Portland	01	MUNICIP. WASTES	1644000
1A2	Industry	030311	045	Aalborg Portland	01	RESIDUAL OIL	1056000
1A2	Industry	030315	078	Rexam Glass Holmegaard A/S	01	GAS OIL	338
1A2	Industry	030315	078	Rexam Glass Holmegaard A/S	01	NATURAL GAS	833656
1A2	Industry	030318	075	Rockwool A/S Hedehusene	01	NATURAL GAS	46800
1A2	Industry	030318	076	Rockwool A/S Vamdrup	01	COKE OVEN COKE	470880
1A2	Industry	030318	076	Rockwool A/S Vamdrup	01	NATURAL GAS	313920
1A2	Industry	030318	077	Rockwool A/S Doense	01	COKE OVEN COKE	406080
1A2	Industry	030318	077	Rockwool A/S Doense	01	NATURAL GAS	270720
1A4a	Commercial/ Institutional	020103	049	Rensningsanlaegget Lynetten	01	MUNICIP. WASTES	48720
1A4a	Commercial/ Institutional	020103	049	Rensningsanlaegget Lynetten	01	GAS OIL	15853
1A4a	Commercial/ Institutional	020103	049	Rensningsanlaegget Lynetten	01	BIOGAS	101606

Table 77 Large point sources, plant specific emissions (IPCC 1A1, 1A2 and 1A4)[1)].

LPS_id	LPS name	LPS part	Sector (IPCC)	Sector (SNAP)	SO_2	NO_x	CO_2	NMVOC	CO	TSP	PM_{10} 2)	$PM_{2.5}$ 2)	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
001	Amagervaerket	02	1A1a	010101	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x
001	Amagervaerket	03	1A1a	010101	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x
002	Svanemoellevaerket	05	1A1a	010101	x	x															
002	Svanemoellevaerket	07	1A1a	010104	x	x															
003	H.C.Oerstedsvaerket	03	1A1a	010101	x	x							x	x	x	x	x	x	x	x	x
003	H.C.Oerstedsvaerket	07	1A1a	010101	x	x							x	x	x	x	x	x	x	x	x
003	H.C.Oerstedsvaerket	08	1A1a	010101	x	x							x	x	x	x	x	x	x	x	x
004	Kyndbyvaerket	21	1A1a	010101	x	x				x	x	x	x	x	x	x	x	x	x	x	x
004	Kyndbyvaerket	22	1A1a	010101	x	x				x	x	x	x	x	x	x	x	x	x	x	x
004	Kyndbyvaerket	26	1A1a	010101	x	x				x	x	x	x	x	x	x	x	x	x	x	x
004	Kyndbyvaerket	28	1A1a	010101	x	x				x	x	x	x	x	x	x	x	x	x	x	x
004	Kyndbyvaerket	41	1A1a	010105						x	x	x	x	x	x	x	x	x	x	x	x
004	Kyndbyvaerket	51	1A1a	010104	x	x				x	x	x	x	x	x	x	x	x	x	x	x
004	Kyndbyvaerket	52	1A1a	010104	x	x				x	x	x	x	x	x	x	x	x	x	x	x
005	Masnedoevaerket	12	1A1a	010102	x	x				x	x	x									
005	Masnedoevaerket	31	1A1a	010104	x	x															
007	Stigsnaesvaerket	01	1A1a	010101	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x
007	Stigsnaesvaerket	02	1A1a	010101	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x
007	Stigsnaesvaerket	03	1A1a	010101			x														
008	Asnaesvaerket	02	1A1a	010101	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x
008	Asnaesvaerket	03	1A1a	010101	x	x				x	x	x	x	x	x	x	x	x	x	x	x
008	Asnaesvaerket	04	1A1a	010101	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x
008	Asnaesvaerket	05	1A1a	010101	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x
009	Statoil Raffinaderi	01	1A1b	010306	x	x															
010	Avedoerevaerket	01	1A1a	010101	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x
010	Avedoerevaerket	02	1A1a	010104	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x
011	Fynsvaerket	03	1A1a	010101	x	x				x	x	x	x	x	x	x	x	x	x	x	x
011	Fynsvaerket	07	1A1a	010101	x	x				x	x	x	x	x	x	x	x	x	x	x	x
011	Fynsvaerket	08	1A1a	010102	x	x			x	x	x	x	x	x	x	x	x	x	x		
012	Studstrupvaerket	03	1A1a	010101	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x
012	Studstrupvaerket	04	1A1a	010101	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x
014	Nordjyllandsvaerket	02	1A1a	010101	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x
014	Nordjyllandsvaerket	03	1A1a	010101	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x
017	Shell Raffinaderi	01	1A1b	010306	x	x															
017	Shell Raffinaderi	05	1A1b	010304	x	x															
018	Skaerbaekvaerket	03	1A1a	010101	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x
019	Enstedvaerket	03	1A1a	010101	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x
019	Enstedvaerket	04	1A1a	010101	x	x				x	x	x	x	x	x	x	x	x	x	x	x
020	Esbjergvaerket	03	1A1a	010101	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x
022	Oestkraft	05	1A1a	010102	x	x															
022	Oestkraft	06	1A1a	010102	x	x															
023	Danisco Ingredients	01	1A2f	030102	x	x															
024	Dansk Naturgas Behandling-sanlaeg	01	1A1c	010502		x															
025	Horsens Kraftvarmevaerk	01	1A1a	010102	x	x			x	x	x	x	x	x	x	x	x	x	x		
025	Horsens Kraftvarmevaerk	02	1A1a	010104		x															
026	Herningvaerket	01	1A1a	010102	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x
027	Vestforbraendingen	01	1A1a	010102	x	x				x	x	x					x				
027	Vestforbraendingen	02	1A1a	010102	x	x				x	x	x					x				
028	Amagerforbraendingen	01	1A1a	010102	x	x		x	x	x	x	x		x			x		x		
029	Randersvaerket	01	1A1a	010102	x	x	x			x	x	x									
029	Randersvaerket	02	1A1a	010102			x														
030	Grenaavaerket	01	1A1a	010102	x	x	x		x	x	x	x	x	x	x	x	x	x	x		
031	Hilleroedvaerket	01	1A1a	010104	x	x															
032	Helsingoervaerket	01	1A1a	010104	x	x															
032	Helsingoervaerket	02	1A1a	010105	x	x															
033	Staalvalsevaerket	01	1A2f	030102		x				x	x	x									
034	Stora Dalum	01	1A2f	030102		x															
035	Assens Sukkerfabrik	01	1A2f	030102	x					x	x	x									
036	Kolding Kraftvarmevaerk	01	1A1a	010103	x			x	x	x	x	x									
036	Kolding Kraftvarmevaerk	03	1A1a	010103	x	x		x	x	x	x	x									
037	Maabjergvaerket	02	1A1a	010102	x	x			x	x	x	x	x	x	x	x	x	x	x		
038	Soenderborg Kraftvarmevaerk	01	1A1a	010102	x	x			x	x	x	x	x	x	x	x	x	x	x		
038	Soenderborg Kraftvarmevaerk	02	1A1a	010104		x															
039	Kara Affaldsforbraendingsanlaeg	01	1A1a	010102	x				x	x	x	x									
040	Viborg Kraftvarmevaerk	01	1A1a	010104	x	x															
042	Nordforbraendingen	01	1A1a	010102	x	x			x	x	x	x							x		
045	Aalborg Portland	01/ 03	1A2f	030311	x	x	x		x	x	x	x									
046	Aarhus Nord	01	1A1a	010102	x	x		x		x	x	x							x		
047	Reno Nord	01	1A1a	010103	x	x			x												

LPS_id	LPS name	LPS part	Sector (IPCC)	Sector (SNAP)	SO_2	NO_x	CO_2	NMVOC	CO	TSP	PM_{10} 2)	$PM_{2.5}$ 2)	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Continued																					
048	Silkeborg Kraftvarmevaerk	01	1A1a	010104	x	x															
049	Rensningsanlægget Lynetten	01	1A4a	020103	x					x	x	x	x	x	x	x	x	x	x		
050	I/S Fasan	01	1A1a	010203	x	x			x	x	x	x									
051	AVV Forbrændingsanlæg	01	1A1a	010103	x				x	x	x	x									
052	I/S REFA Kraftvarmeværk	01	1A1a	010103																	
053	Svendborg Kraftvarmeværk	01	1A1a	010102	x	x		x	x	x	x	x									
054	Kommunekemi	01	1A1a	010102	x				x	x	x	x					x				
054	Kommunekemi	02	1A1a	010102	x				x	x	x	x					x				
054	Kommunekemi	03	1A1a	010102	x				x	x	x	x					x				
058	I/S Reno Syd	01	1A1a	010103	x				x	x	x	x									
059	I/S Kraftvarmeværk Thisted	01	1A1a	010103	x				x	x	x	x									
060	Knudmoseværket	01	1A1a	010103	x				x	x	x	x									
061	Kavo I/S Energien	01	1A1a	010103	x			x	x	x	x	x					x				
061	Kavo I/S Energien	02	1A1a	010103	x	x															
065	Haderslev Kraftvarmeværk	01	1A1a	010103	x	x			x	x	x	x	x	x	x	x	x	x	x		
066	Frederiskhavn Affaldskraftvar-meværk	01	1A1a	010103	x	x			x	x	x	x	x	x	x	x	x	x	x		
067	Vejen Kraftvarmeværk	01	1A1a	010103	x	x			x	x	x	x	x	x	x	x	x	x	x		
068	Bofa I/S	01	1A1a	010203	x				x	x	x	x							x		
069	DTU	01	1A1a	010104	x	x															
070	Næstved Kraftvarmeværk	01	1A1a	010104		x			x												
071	Maricogen	01	1A2f	030104	x	x															
072	Hjørring KVV	01	1A1a	010104	x	x															
076	Rockwool A/S Vamdrup	01	1A2f	030318	x			x	x	x	x	x									
077	Rockwool A/S Doense	01	1A2f	030318	x			x	x	x	x	x									
078	Rexam Glass Holmegaard A/S	01	1A2f	030315		x			x	x	x	x							x	x	x
080	Saint-Gobain Isover A/S	01	1A2f	030316						x	x	x									
081	Haldor Topsøe	02	1A2f	0301						x	x	x									
082	Danisco Sugar Nakskov	02	1A2f	030102						x	x	x									
083	Danisco Sugar Nykøbing	02	1A2f	030102						x	x	x									
085	L90 Affaldsforbrænding	01	1A1a	010102	x	x			x	x	x	x									
086	Hammel Fjernvarme	01	1A1a	010203	x	x			x	x	x	x									
087	Koege Kraftvarmevaerk	01	1A1a	010102	x	x		x	x	x	x	x									
088	Skagen Forbraending	01	1A1a	010203	x			x	x	x	x	x									
Total					**10 493**	**36 413**	**16 641**	**21**	**12 373**	**1 219**	**987**	**725**	**141**	**24**	**264**	**167**	**240**	**923**	**337**	**1 225**	**474**
Share of total emission from stationary combustion, %					**51**	**59**	**49**	**0**	**7**	**4**	**4**	**3**	**23**	**3**	**24**	**14**	**23**	**12**	**7**	**65**	**2**

1) Emission of the pollutants marked with "x" is 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, 2008).

Degree Days		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Actual Degree Days	Degree days	2857	3284	3022	3434	3148	3297	3837	3236	3217	3056
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	52. 7	62. 8	56. 7	58. 9	62. 7	59. 6	73.0	63. 2	59. 4	56. 5
Adjusted CO_2 emission	1,000,000 tonnes	60.8	61.5	60.8	59.7	59.6	59.1	58.5	57.7	56.2	55.4

Continued

Degree Days		2000	2001	2002	2003	2004	2005	2006	2007
Actual Degree Days	Degree days	2902	3279	3011	3150	3113	3068	2908	2807
Normal Degree Days	Degree days	3 304	3 289	3 273	3 271	3 261	3 224	3 188	3136
Net electricity import	TJ	2394	-2071	-7453	-30760	-10340	4932	-24971	-3420
Actual CO_2 emission	1 000 000 tonnes	52. 5	53. 9	53. 1	58. 2	52. 8	49. 4	57. 3	52. 6
Adjusted CO_2 emission	1,000,000 tonnes	54.2	53.6	52.2	51.7	50.9	51.0	52.4	52.7

Appendix 10 Uncertainty estimates 2007

Table 79 Uncertainty estimation, GHG.

IPCC Source category	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Gg CO_2 eq	Gg CO_2 eq	%	%	%	%	%	%	%	%	%
Stationary Combustion, Coal	CO_2	24077	18302	1	5	5.099	2.681	-0.097	0.481	-0.485	0.680	0.835
Stationary Combustion, BKB	CO_2	11	0	3	5	5.831	0.000	0.000	0.000	-0.001	0.000	0.001
Stationary Combustion, Coke	CO_2	138	121	3	5	5.831	0.020	0.000	0.003	-0.001	0.014	0.014
Stationary Combustion, Petroleum coke	CO_2	410	970	3	5	5.831	0.163	0.016	0.025	0.078	0.108	0.133
Stationary Combustion, Plastic waste	CO_2	349	728	5	5	7.071	0.148	0.011	0.019	0.054	0.135	0.146
Stationary Combustion, Residual oil	CO_2	2505	1655	2	2	2.828	0.135	-0.017	0.043	-0.033	0.123	0.127
Stationary Combustion, Gas oil	CO_2	4547	1614	4	5	6.403	0.297	-0.067	0.042	-0.334	0.240	0.411
Stationary Combustion, Kerosene	CO_2	366	9	4	5	6.403	0.002	-0.009	0.000	-0.043	0.001	0.043
Stationary Combustion, Natural gas	CO_2	4320	9702	3	1	3.162	0.881	0.151	0.255	0.151	1.082	1.092
Stationary Combustion, LPG	CO_2	169	90	4	5	6.403	0.017	-0.002	0.002	-0.008	0.013	0.016
Stationary Combustion, Refinery gas	CO_2	806	906	3	5	5.831	0.152	0.004	0.024	0.022	0.101	0.103
Stationary combustion plants, gas engines	CH_4	7	215	2.2	40	40.060	0.248	0.005	0.006	0.220	0.018	0.221
Stationary combustion plants, other	CH_4	115	217	2.2	100	100.024	0.623	0.003	0.006	0.293	0.018	0.294
Stationary combustion plants	N_2O	240	277	2.2	1000	1000.002	7.954	0.001	0.007	1.498	0.023	1.498
Total		38060	34806				71.867					4.507
Total uncertainties				Overall uncertainty in the year (%):			8.477			Trend uncertainty (%):		2.123

Table 80 Uncertainty estimation, CO_2.

IPCC Source category	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Gg CO_2	Gg CO_2	%	%	%	%	%	%	%	%	%
Stationary Combustion, Coal	CO_2	24077	18302	1	5	5.099	2.681	-0.097	0.481	-0.485	0.680	0.835
Stationary Combustion, BKB	CO_2	11	0	3	5	5.831	0.000	0.000	0.000	-0.001	0.000	0.001
Stationary Combustion, Coke	CO_2	138	121	3	5	5.831	0.020	0.000	0.003	-0.001	0.014	0.014
Stationary Combustion, Petroleum coke	CO_2	410	970	3	5	5.831	0.163	0.016	0.025	0.078	0.108	0.133
Stationary Combustion, Plastic waste	CO_2	349	728	5	5	7.071	0.148	0.011	0.019	0.054	0.135	0.146
Stationary Combustion, Residual oil	CO_2	2505	1655	2	2	2.828	0.135	-0.017	0.043	-0.033	0.123	0.127
Stationary Combustion, Gas oil	CO_2	4547	1614	4	5	6.403	0.297	-0.067	0.042	-0.334	0.240	0.411
Stationary Combustion, Kerosene	CO_2	366	9	4	5	6.403	0.002	-0.009	0.000	-0.043	0.001	0.043
Stationary Combustion, Natural gas	CO_2	4320	9702	3	1	3.162	0.881	0.151	0.255	0.151	1.082	1.092
Stationary Combustion, LPG	CO_2	169	90	4	5	6.403	0.017	-0.002	0.002	-0.008	0.013	0.016
Stationary Combustion, Refinery gas	CO_2	806	906	3	5	5.831	0.152	0.004	0.024	0.022	0.101	0.103
Total	CO_2	37698	34097				8.486					2.135
Total uncertainties		Overall uncertainty in the year (%):					2.913		Trend uncertainty (%):			1.461

Table 81 Uncertainty estimation, CH_4.

IPCC Source category	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg CH_4	Mg CH_4	%	%	%	%	%	%	%	%	%
Stationary combustion plants, gas engines	CH_4	312	10253	2.2	40	40.060	19.968	1.581	1.774	63.235	5.519	63.475
Stationary combustion plants, other	CH_4	5468	10318	2.2	100	100.024	50.168	-1.567	1.785	-156.691	5.553	156.789
Total	CH_4	5780	20571				2915.533					28611.969
Total uncertainties		Overall uncertainty in the year (%):					53.996		Trend uncertainty (%):			169.151

Table 82 Uncertainty estimation, N_2O.

IPCC Source category	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Gg N_2O	Gg N_2O	%	%	%	%	%	%	%	%	%
Stationary combustion plants	N_2O	0.775	0.893	2.200	1000	1000.002	1000.002	0.000	1.152	0.000	3.583	3.583
Total	N_2O	0.775	0.893				1000005					12.839
Total uncertainties		Overall uncertainty in the year (%):					1000.002		Trend uncertainty (%):			3.583

Table 83 Uncertainty estimation, SO_2.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg SO_2	Mg SO_2	%	%	%	%	%	%	%	%	%
01	SO_2	129601	9074	2	10	10.198	4.492	-0.049	0.058	-0.493	0.163	0.519
02	SO_2	11491	4372	2	20	20.100	4.265	0.018	0.028	0.364	0.078	0.372
03	SO_2	16708	7157	2	10	10.198	3.543	0.031	0.045	0.315	0.128	0.340
Total	SO_2	157800	20604				50.913					0.524
Total uncertainties			Overall uncertainty in the year (%):					7.135		Trend uncertainty (%):		0.724

Table 84 Uncertainty estimation, NO_x.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg NO_x	Mg NO_x	%	%	%	%	%	%	%	%	%
01	NO_x	94738	42482	2	20	20.100	13.750	-0.073	0.3681	-1.459	1.041	1.792
02	NO_x	7518	8481	2	50	50.040	6.834	0.038	0.0735	1.920	0.208	1.932
03	NO_x	13167	11136	2	20	20.100	3.605	0.035	0.0965	0.701	0.273	0.753
Total	NO_x	115423	62100				248.764					7.510
Total uncertainties			Overall uncertainty in the year (%):					15.772		Trend uncertainty (%):		2.740

Table 85 Uncertainty estimation, NMVOC.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg NMVOC	Mg NMVOC	%	%	%	%	%	%	%	%	%
01	NMVOC	1075	2743	2	50	50.040	5.204	0.039	0.2177	1.956	0.616	2.051
02	NMVOC	10901	23067	2	50	50.040	43.753	0.019	1.8303	0.973	5.177	5.267
03	NMVOC	627	571	2	50	50.040	1.083	-0.059	0.0453	-2.937	0.128	2.940
Total	NMVOC	12603	26382				1942.589					40.596
Total uncertainties			Overall uncertainty in the year (%):				44.075			Trend uncertainty (%):		6.372

Table 86 Uncertainty estimation, CO.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg CO	Mg CO	%	%	%	%	%	%	%	%	%
01	CO	8262	9291	2	20	20.100	1.095	-0.006	0.066	-0.110	0.188	0.218
02	CO	115829	147602	2	50	50.040	43.328	0.046	1.055	2.315	2.983	3.775
03	CO	15877	13574	2	20	20.100	1.601	-0.041	0.097	-0.822	0.274	0.867
Total	CO	139967	170467				1881.075					15.053
Total uncertainties			Overall uncertainty in the year (%):				43.371			Trend uncertainty (%):		3.880

Table 87 Uncertainty estimation, TSP.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg TSP	kg TSP	%	%	%	%	%	%	%	%	%
01	TSP	1158	1124	2	50	50.040	1.986	-0.042	0.064	-2.124	0.181	2.132
02	TSP	15226	26278	2	500	500.004	463.961	0.096	1.498	47.930	4.237	48.117
03	TSP	1157	917	2	50	50.040	1.621	-0.054	0.052	-2.707	0.148	2.711
Total	TSP	17540	28319				215266.425					2327.157
Total uncertainties				Overall uncertainty in the year (%):			463.968			Trend uncertainty (%):		48.241

Table 88 Uncertainty estimation, PM_{10}.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg PM_{10}	kg PM_{10}	%	%	%	%	%	%	%	%	%
01	PM_{10}	941	894	2	50	50.040	1.693	-0.045	0.057	-2.229	0.162	2.235
02	PM_{10}	13834	24887	2	500	500.004	471.174	0.096	1.593	47.773	4.505	47.985
03	PM_{10}	851	629	2	50	50.040	1.192	-0.052	0.040	-2.588	0.114	2.590
Total	PM_{10}	15626	26410				222009.605					2314.217
Total uncertainties				Overall uncertainty in the year (%):			471.179			Trend uncertainty (%):		48.106

Table 89 Uncertainty estimation, $PM_{2.5}$.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg $PM_{2.5}$	kg $PM_{2.5}$	%	%	%	%	%	%	%	%	%
01	$PM_{2.5}$	804	742	2	50	50.040	1.507	-0.044	0.052	-2.198	0.146	2.203
02	$PM_{2.5}$	13094	23544	2	500	500.004	477.612	0.078	1.635	39.137	4.623	39.410
03	$PM_{2.5}$	506	361	2	50	50.040	0.734	-0.035	0.025	-1.749	0.071	1.751
Total	$PM_{2.5}$	14403	24648				228116.378					1561.035
Total uncertainties					Overall uncertainty in the year (%):			477.615		Trend uncertainty (%):		39.510

Table 90 Uncertainty estimation, As.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg As	kg As	%	%	%	%	%	%	%	%	%
01	As	965	360	2	100	100.020	58.998	-0.033	0.250	-3.348	0.706	3.422
02	As	127	48	2	1000	1000.002	78.499	-0.004	0.033	-4.093	0.094	4.094
03	As	349	202	2	100	100.020	33.171	0.038	0.140	3.771	0.397	3.792
Total	As	1442	610				10743.155					42.849
Total uncertainties					Overall uncertainty in the year (%):			103.649		Trend uncertainty (%):		6.546

Table 91 Uncertainty estimation, Cd.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Cd	kg Cd	%	%	%	%	%	%	%	%	%
01	Cd	592	247	2	100	100.020	35.802	-0.134	0.235	-13.357	0.663	13.373
02	Cd	145	274	2	1000	1000.002	397.383	0.170	0.260	170.038	0.737	170.039
03	Cd	315	169	2	100	100.020	24.472	-0.036	0.160	-3.584	0.453	3.613
Total	Cd	1052	689				159794.071					29105.206
Total uncertainties				Overall uncertainty in the year (%):				399.743		Trend uncertainty (%):		170.602

Table 92 Uncertainty estimation, Cr.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Cr	kg Cr	%	%	%	%	%	%	%	%	%
01	Cr	4674	660	2	100	100.020	60.467	-0.029	0.108	-2.863	0.306	2.879
02	Cr	326	61	2	1000	1000.002	55.813	0.000	0.010	0.437	0.028	0.438
03	Cr	1104	371	2	100	100.020	33.971	0.028	0.061	2.836	0.172	2.841
Total	Cr	6103	1092				7925.310					16.550
Total uncertainties				Overall uncertainty in the year (%):				89.024	Trend uncertainty (%):			4.068

Table 93 Uncertainty estimation, Cu.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Cu	kg Cu	%	%	%	%	%	%	%	%	%
01	Cu	2915	734	2	100	100.020	60.238	-0.068	0.203	-6.761	0.573	6.785
02	Cu	301	305	2	1000	1000.002	250.248	0.056	0.084	56.139	0.238	56.140
03	Cu	405	180	2	100	100.020	14.752	0.012	0.050	1.195	0.140	1.203
Total	Cu	3622	1218				66470.520					3199.131
Total uncertainties				Overall uncertainty in the year (%):				257.819		Trend uncertainty (%):		56.561

Table 94 Uncertainty estimation, Hg.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Hg	kg Hg	%	%	%	%	%	%	%	%	%
01	Hg	2509	486	2	100	100.020	45.767	-0.123	0.158	-12.252	0.447	12.261
02	Hg	330	321	2	1000	1000.002	302.854	0.067	0.104	67.458	0.296	67.459
03	Hg	238	254	2	100	100.020	23.962	0.056	0.083	5.595	0.234	5.600
Total	Hg	3076	1061				94389.409					4732.388
Total uncertainties				Overall uncertainty in the year (%):				307.229		Trend uncertainty (%):		68.792

Table 95 Uncertainty estimation, Ni.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emis-sion factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Ni	kg Ni	%	%	%	%	%	%	%	%	%
01	Ni	8384	2330	2	100	100.020	29.489	-0.036	0.109	-3.584	0.308	3.597
02	Ni	1852	621	2	1000	1000.002	78.637	-0.003	0.029	-2.948	0.082	2.949
03	Ni	11142	4951	2	100	100.020	62.666	0.039	0.232	3.873	0.655	3.928
Total	Ni	21377	7902				10980.437					37.066
Total uncertainties				Overall uncertainty in the year (%):				104.788		Trend uncertainty (%):		6.088

Table 96 Uncertainty estimation, Pb.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Pb	kg Pb	%	%	%	%	%	%	%	%	%
01	Pb	11994	3565	2	100	100.020	77.365	-0.002	0.232	-0.218	0.656	0.692
02	Pb	945	232	2	1000	1000.002	50.351	-0.003	0.015	-3.358	0.043	3.359
03	Pb	2422	812	2	100	100.020	17.619	0.006	0.053	0.555	0.150	0.574
Total	Pb	15361	4609				8830.946					12.090
Total uncertainties				Overall uncertainty in the year (%):				93.973		Trend uncertainty (%):		3.477

Table 97 Uncertainty estimation, Se.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Se	kg Se	%	%	%	%	%	%	%	%	%
01	Se	2961	1074	2	100	100.020	59.642	-0.036	0.248	-3.585	0.701	3.653
02	Se	308	135	2	1000	1000.002	74.787	0.002	0.031	1.551	0.088	1.554
03	Se	1065	593	2	100	100.020	32.897	0.034	0.137	3.446	0.387	3.467
												27.777507
Total	Se	4334	1802				10232.599					1
Total uncertainties				Overall uncertainty in the year (%):				101.156		Trend uncertainty (%):		5.270

Table 98 Uncertainty estimation, Zn.

SNAP		Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		kg Zn	kg Zn	%	%	%	%	%	%	%	%	%
01	Zn	14801	15549	2	100	100.020	69.758	-0.078	0.804	-7.763	2.274	8.089
02	Zn	2810	5394	2	1000	1000.002	241.965	0.111	0.279	111.269	0.789	111.272
03	Zn	1729	1351	2	100	100.020	6.060	-0.033	0.070	-3.317	0.198	3.323
Total	Zn	19340	22294				63450.086					12457.992
Total uncertainties				Overall uncertainty in the year (%):				251.893		Trend uncertainty (%):		111.615

Table 99 Uncertainty estimation, Benzo(b)fluoranthene.

SNAP	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
	Input data	Input data	Input data	Input data							
	kg	kg	%	%	%	%	%	%	%	%	%
01	31	29	2	100	100.020	0.540	-0.027	0.014	-2.680	0.041	2.681
02	1921	5187	2	1000	1000.002	975.075	0.040	2.592	39.600	7.331	40.273
03	49	104	2	100	100.020	1.954	-0.013	0.052	-1.317	0.147	1.325
Total	2001	5319				950776.319					1630.863
Total uncertainties			Overall uncertainty in the year (%):				975.078		Trend uncertainty (%):		40.384

Table 100 Uncertainty estimation, Benzo(k)fluoranthene.

SNAP	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
	Input data	Input data	Input data	Input data							
	kg	kg	%	%	%	%	%	%	%	%	%
01	11	15	2	100	100.020	0.501	-0.016	0.014	-1.562	0.041	1.562
02	976	2871	2	1000	1000.002	989.432	0.064	2.843	63.619	8.042	64.125
03	23	16	2	100	100.020	0.556	-0.049	0.016	-4.861	0.045	4.861
Total	1010	2902				978976.440					4138.132
Total uncertainties			Overall uncertainty in the year (%):				989.432		Trend uncertainty (%):		64.328

Table 101 Uncertainty estimation, Benzo(a)pyrene.

SNAP	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
	Input data	Input data	Input data	Input data							
	kg	kg	%	%	%	%	%	%	%	%	%
01	8	7	2	100	100.020	0.140	-0.008	0.004	-0.823	0.011	0.823
02	1792	4957	2	1000	1000.002	992.589	0.008	2.737	8.009	7.741	11.138
03	11	30	2	100	100.020	0.602	0.000	0.017	0.014	0.047	0.049
Total	1811	4994				985232.725					124.737
Total uncertainties			Overall uncertainty in the year (%):				992.589		Trend uncertainty (%):		11.169

Table 102 Uncertainty estimation, Indeno(1,2,3-c,d)pyrene.

SNAP	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
	Input data	Input data	Input data	Input data							
	kg	kg	%	%	%	%	%	%	%	%	%
01	6	6	2	100	100.020	0.179	-0.006	0.004	-0.582	0.012	0.582
02	1469	3523	2	1000	1000.002	995.979	0.022	2.367	21.988	6.694	22.984
03	14	8	2	100	100.020	0.223	-0.016	0.005	-1.638	0.015	1.638
Total	1489	3538				991973.465					531.291
Total uncertainties			Overall uncertainty in the year (%):				995.979		Trend uncertainty (%):		23.050

Appendix 11 Reference approach

TABLE 1.A(b) SECTORAL BACKGROUND DATA FOR ENERGY
CO_2 from Fuel Combustion Activities - Reference Approach (IPCC Worksheet 1-1)
(Sheet 1 of 1)

Inventory 2007
Submission 2009 v1.1
DENMARK

FUEL TYPES			Unit	Production	Imports	Exports	International bunkers	Stock change	Apparent consumption	Conversion factor (TJ/Unit)	NCV/ GCV (1)	Apparent consumption (TJ)	Carbon emission factor (t C/TJ)	Carbon content (Gg C)	Carbon stored (Gg C)	Net carbon emissions (Gg C)	Fraction of carbon oxidized	Actual CO_2 emissions (Gg CO_2)
Liquid Fossil	Primary Fuels	Crude Oil	TJ	652.563,17	87.380,82	404.314,81		1.742,10	333.887,08	1,00	NCV	333.887,08	20,00	6.677,74	NA	6.677,74	1,00	24.485,05
		Orimulsion	TJ	NA	NA	NA		NA	NA	1,00	NCV	NA	22,00	NA	NA	NA	1,00	NA
		Natural Gas Liquids	TJ	NA	NA	NA		NA	NA	1,00	NCV	NA	17,20	NA	NA	NA	1,00	NA
	Secondary Fuels	Gasoline	TJ		42.317,85	49.111,93	0,75	-919,09	-5.875,74	1,00	NCV	-5.875,74	18,90	-111,05	NA	-111,05	1,00	-407,19
		Jet Kerosene	TJ		32.113,13	22.171,05	36.789,23	-5.989,95	-20.857,20	1,00	NCV	-20.857,20	19,50	-406,72	NA	-406,72	1,00	-1.491,29
		Other Kerosene	TJ		NA	NA	NA	NA	NA	1,00	NCV	NA	19,60	NA	NA	NA	1,00	NA
		Shale Oil	TJ		NA	NA		NA	NA	1,00	NCV	NA	20,00	NA	NA	NA	1,00	NA
		Gas / Diesel Oil	TJ		90.761,89	49.745,65	10.946,73	-1.230,74	31.300,25	1,00	NCV	31.300,25	20,20	632,26	NA	632,26	1,00	2.318,30
		Residual Fuel Oil	TJ		60.603,22	68.480,37	35.243,14	-6.569,45	-36.550,85	1,00	NCV	-36.550,85	21,10	-771,22	NA	-771,22	1,00	-2.827,82
		Liquefied Petroleum Gas (LPG)	TJ		260,59	4.736,39		29,49	-4.505,29	1,00	NCV	-4.505,29	17,20	-77,49	NA	-77,49	1,00	-284,13
		Ethane	TJ		NA	NA		NA	NA	2,00	NCV	NA	16,80	NA	NA	NA	1,00	NA
		Naphtha	TJ		NA	1.891,16		-98,03	-1.793,13	1,00	NCV	-1.793,13	20,00	-35,86	NA	-35,86	1,00	-131,50
		Bitumen	TJ		10.526,07	223,04		371,69	9.931,33	1,00	NCV	9.931,33	22,00	218,49	221,15	-2,66	1,00	-9,75
		Lubricants	TJ		2.678,96	64,48	101,86	-3,27	2.515,89	1,00	NCV	2.515,89	20,00	50,32	25,74	24,58	1,00	90,11
		Petroleum Coke	TJ		10.886,03	409,14		684,02	9.792,88	1,00	NCV	9.792,88	27,50	269,30	NA	269,30	1,00	987,45
		Refinery Feedstocks	TJ		926,76	4.849,35		505,10	-4.427,69	1,00	NCV	-4.427,69	20,00	-88,55	NA	-88,55	1,00	-324,70
		Other Oil	TJ		NA	NA		NA	NA	1,00	NCV	NA	20,00	NA	NA	NA	1,00	NA
Other Liquid Fossil												608,39		12,17	9,13	3,04		11,15
White Spirit				NA	684,69	76,30	NA	NA	608,39	1,00	NCV	608,39	20,00	12,17	9,13	3,04	1,00	11,15
Liquid Fossil Totals												314.025,91		6.369,39	256,02	6.113,37		22.415,69
Solid Fossil	Primary Fuels	Anthracite (2)	TJ	NA	NA	NA		NA	NA	1,00	NCV	NA	26,80	NA	NA	NA	1,00	NA
		Coking Coal	TJ	NA	NA	NA		NA	NA	1,00	NCV	NA	25,80	NA	NA	NA	1,00	NA
		Other Bituminous Coal	TJ	NA	199.059,26	4.656,96	NA	661,15	193.741,14	1,00	NCV	193.741,14	25,80	4.998,52	NA	4.998,52	1,00	18.327,91
		Sub-bituminous Coal	TJ	NA	NA	NA	NA	NA	NA	1,00	NCV	NA	26,20	NA	NA	NA	1,00	NA
		Lignite	TJ	NA	NA	NA		NA	NA	1,00	NCV	NA	27,60	NA	NA	NA	1,00	NA
		Oil Shale	TJ	NA	NA	NA		NA	NA	1,00	NCV	NA	29,10	NA	NA	NA	1,00	NA
		Peat	TJ	NA	NA	NA		NA	NA	1,00	NCV	NA	28,90	NA	NA	NA	1,00	NA
	Secondary Fuels	BKB (3) and Patent Fuel	TJ		2,64	3,90		NA	-1,26	1,00	NCV	-1,26	25,80	-0,03	NA	-0,03	1,00	-0,12
		Coke Oven/Gas Coke	TJ		1.036,69	NA		-82,71	1.119,41	1,00	NCV	1.119,41	29,50	33,02	NA	33,02	1,00	121,08
Other Solid Fossil												9.041,04		196,52	NA	196,52		720,57
Plastic part of municipal waste				9.041,04	NA	NA	NA	NA	9.041,04	1,00	NCV	9.041,04	21,74	196,52	NA	196,52	1,00	720,57
Solid Fossil Totals												203.900,33		5.228,03	NA	5.228,03		19.169,45
Gaseous Fossil		Natural Gas (Dry)	TJ	346.146,14	NA	169.540,07		6.554,51	170.051,56	1,00	NCV	170.051,56	15,30	2.601,79	NA	2.601,79	1,00	9.539,89
Other Gaseous Fossil												NA		NA	NA	NA		NA
Gaseous Fossil Totals												170.051,56		2.601,79	NA	2.601,79		9.539,89
Total												687.977,80		14.199,21	256,02	13.943,19		51.125,03
Biomass total												112.777,60		3.344,26	NA	3.344,26		12.262,29
		Solid Biomass	TJ	90.097,99	18.765,61	NA		NA	108.863,60	1,00	NCV	108.863,60	29,90	3.255,02	NA	3.255,02	1,00	11.935,08
		Liquid Biomass	TJ	3.684,80	NA	3.684,80		NA	NA	1,00	NCV	NA	20,00	NA	NA	NA	1,00	NA
		Gas Biomass	TJ	3.914,00	NA	NA		NA	3.914,00	1,00	NCV	3.914,00	22,80	89,24	NA	89,24	1,00	327,21

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)	314,03	300,97	22.415,69	302,68	22.287,55	-0,56	0,57
Solid Fuels (excluding international bunkers) [5]	203,90	194,86	19.169,45	195,27	18.425,76	-0,21	4,04
Gaseous Fuels	170,05	170,05	9.539,89	170,87	9.702,27	-0,48	-1,67
Other [5]	NA,NO	NO	NA,NO	IE,NA,NO	711,48		-100,00
Total [5]	*687,98*	*665,88*	*51.125,03*	*668,82*	*51.127,06*	*-0,44*	*0,00*

[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, plastic
Biomass	Solid Biomass	Waste combustion, other
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	-

Appendix 12 Emission inventory 2007 based on SNAP sectors

Table 104 Emission inventory 2007 based on SNAP sectors.

SNAP [2]	SO_2 Mg	NO_x Mg	NMVOC Mg	CH_4 Mg	CO Mg	CO_2 [1] Gg	N_2O 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	Flouran-the kg	Benzo-(b) kg	Benzo(k) kg	Benzo(a) kg	Benzo-(g,,) kg	Indeno kg
Total 01	9074	42482	2743	9183	9291	32062	483	1124	894	742	360	247	660	734	486	2330	3565	1242	15549	4	1	226	29	15	7	16	6
010100	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0
010101	6789	20634	322	376	2236	18834	178	627	504	416	130	11	180	102	181	935	155	1148	408	0	0	15	3	1	1	3	1
010102	724	4503	51	43	613	4180	45	77	60	49	143	116	319	400	121	539	2125	50	10030	3	1	3	1	0	0	0	0
010103	134	1318	19	56	308	1384	17	24	10	8	53	36	22	77	50	41	891	1	3193	1	0	3	0	0	0	0	0
010104	275	2553	64	61	772	2502	73	63	60	50	5	1	9	6	4	36	11	25	36	0	0	14	3	1	1	1	1
010105	33	3206	1734	8030	2264	1047	22	19	11	3	0	0	0	0	0	0	0	0	1	0	0	3	1	0	0	0	0
010201	1	2	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0
010202	64	103	34	24	187	114	4	15	11	9	1	5	2	5	5	36	4	2	84	0	0	6	1	1	0	0	0
010203	618	1158	440	323	2399	1371	49	175	123	97	16	66	100	133	121	215	360	4	1795	0	0	181	20	11	5	11	3
010204	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0
010205	3	126	34	189	75	30	0	1	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0
010304	2	723	3	3	27	248	10	22	22	22	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
010306	421	1031	0	0	198	722	25	99	91	87	12	11	27	11	4	528	19	10	2	-	0	1	0	0	0	0	0
010502	0	33	1	2	10	20	0	0	0	0	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
010504	8	7033	39	42	174	1597	62	3	2	1	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0
010505	2	54	2	34	27	8	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0
Total 02	4372	8481	23067	10493	147602	8800	269	26278	24887	23544	48	274	61	305	321	621	232	108	5394	0	20	30568	5187	2871	4957	8729	3523
020100	172	552	637	270	629	896	20	160	159	149	5	10	9	12	10	152	13	11	158	0	0	804	225	75	171	232	122
020103	2	12	1	1	5	16	0	1	0	0	0	0	0	1	2	0	1	0	18	0	0	1	0	0	0	0	0
020104	0	3	0	0	0	1	0	0	0	0	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0
020105	8	352	94	523	211	83	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
020200	2509	6467	20825	8010	138516	7043	225	25603	24252	22954	26	252	23	275	289	27	184	88	5167	0	18	29157	4787	2772	4623	8306	3139
020202	0	1	0	0	0	1	0	0	0	0	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0
020204	0	186	132	583	144	71	2	1	0	0	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0
020300	1661	536	1250	450	7863	588	18	510	474	439	16	11	27	17	20	421	34	9	51	0	1	604	174	24	162	191	263
020302	12	5	0	0	3	3	0	1	0	0	0	0	1	0	0	21	1	0	0	-	0	1	0	0	0	0	0
020303	0	4	0	0	0	2	0	0	0	0	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0
020304	7	364	128	655	230	96	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total 03	7157	11136	571	927	13574	5308	144	917	629	361	202	169	371	180	254	4951	812	538	1351	0	0	3968	104	16	30	8	8
030100	3865	2715	323	372	2049	2880	68	242	176	123	94	110	207	115	59	3876	173	75	615	0	0	73	8	9	1	3	3
030102	1126	506	80	69	357	446	13	104	39	18	24	26	50	30	16	916	45	18	163	0	0	28	3	3	0	1	1
030103	4	20	7	7	40	25	1	3	2	1	0	1	0	1	1	0	0	0	20	0	0	0	0	0	0	0	0
030104	1	438	6	7	27	250	10	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0
030105	2	108	50	240	73	33	1	1	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0
030303	-	-	-	-	-	-	-	148	44	7	22	10	82	-	-	96	534	371	371	-	-	-	-	-	-	-	-
030307	-	-	-	-	-	-	-	2	1	1	-	0	-	1	-	-	9	-	-	-	-	-	-	-	-	-	-
030308	-	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
030310	-	-	-	-	-	-	-	36	33	15	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
030311	1622	7080	92	210	1676	1497	48	177	159	71	59	21	29	29	177	59	29	21	147	0	0	3854	92	4	29	3	3
030312	-	-	-	-	-	-	-	27	13	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
030315	0	158	2	5	30	47	1	1	1	1	0	0	0	0	0	0	16	53	25	-	0	0	0	0	0	0	0
030316	-	-	-	-	-	-	-	52	47	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
030318	538	110	12	17	9322	131	3	124	112	86	3	0	2	3	1	4	5	0	9	-	0	12	1	1	0	1	1

[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 on http://ens.dk/sw16508.asp. It is an easy task to check for breaks in a series because the statistics is 100% time-series oriented.

The national energy statistics does not include Greenland and Faroe Islands.

For historical reasons, DEA receive monthly information from the Danish oil companies regarding Danish deliveries of oil products to Greenland and Faroe Islands. But the monthly (MOS) and annual (AOS) reporting of oil statistics to Eurostat and IEA exclude Greenland and Faroe Islands. For all other energy products the Danish figures are also excluding Greenland and Faroe Islands.

Reporting to the Danish Energy Agency

The Danish Energy Agency receives monthly statistics for the following fuel groups:

- Crude oil and oil products
  - Monthly data from 46 oil companies, the main purpose is monitoring oil stocks according to the oil preparedness system
- Natural gas
  - Fuel/flare from platforms in the North Sea
  - Natural gas balance from the regulator Energinet.dk (National monopoly)
- Coal and coke
  - Power plants (94 %)
  - Industry companies (4 %)
  - Coal and coke traders (2 %)
- Electricity
  - Monthly reporting by e-mail from the regulator Energinet.dk (National monopoly)

  The statistics covers:
  - Production by type of producer
  - Own use of electricity

    - Import and export by country
    - Domestic supply (consumption + distribution loss)
  - Town gas (quarterly) from two town gas producers

The large central power plants also report monthly consumption of biomass.

Annual data includes renewable energy including waste. The DEA conducts a biannual survey on wood pellets and wood fuel. Statistics Denmark conducts biannual surveys on the energy consumption in the service and industrial sectors. Statistics Denmark prepares annual surveys on forest (wood fuel) & straw.

Other annual data sources include:

- DEA
  - Survey on production of electricity and heat and fuels used
  - Survey on end use of oil
  - Survey on end use of natural gas
  - Survey on end use of coal and coke
- National Environmental Research Institute (NERI), Aarhus University
  - Energy consumption for domestic air transport
- Danish Energy Association (Association of Danish Energy companies)
  - Survey on electricity consumption
- Ministry of Taxation
  - Border trade
- Centre for Biomass Technology
  - Annual estimates of final consumption of straw and wood chips

Annual revisions

In general, DEA follows the same procedures as in the Danish national account. This means that normally only figures for the last two years are revised.

Aggregating the energy statistics on SNAP level

As part of the data delivery agreement between the DEA and NERI, the DEA supplies a version of the official energy statistics aggregated on SNAP level to be used in the emission calculation. In cooperation between DEA and NERI a fuel correspondence table has been developed mapping the fuels used by the DEA in the official energy statistics with the fuel codes used in the Danish national emission database. Similarly the sectors used in the official energy statistics have been mapped to SNAP categories, used in the Danish emission database. The fuel correspondence table between fuel categories used by the DEA, NERI and IPCC is presented in annex 3A of the Danish NIR.

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, Level 2007.

IPCC Category Code	IPCC Category	Fuel	Green-house Gas	Latest Year Estimate Ex,t [in CO_2-equivalent units]	Absolute Value of Latest Year Estimate	Level Assess-ment Lx,t	Cumulative Total of Column H %	
1A1	Energy Industries	COAL	CO_2	17341	17341	0.498	50	Key Source, Level
1A1	Energy Industries	NATURAL GAS	CO_2	5194	5194	0.149	65	Key Source, Level
1A4	Other Sectors	NATURAL GAS	CO_2	2391	2391	0.069	72	Key Source, Level
1A2	Industry	NATURAL GAS	CO_2	2117	2117	0.061	78	Key Source, Level
1A4	Other Sectors	GAS OIL	CO_2	1506	1506	0.043	82	Key Source, Level
1A1	Energy Industries	RESIDUAL OIL	CO_2	919	919	0.026	85	Key Source, Level
1A1	Energy Industries	REFINERY GAS	CO_2	906	906	0.026	87	Key Source, Level
1A2	Industry	PETROLEUM COKE	CO_2	850	850	0.024	90	Key Source, Level
1A2	Industry	COAL	CO_2	768	768	0.022	92	Key Source, Level
1A1	Energy Industries	PLASTIC WASTE	CO_2	665	665	0.019	94	Key Source, Level
1A2	Industry	RESIDUAL OIL	CO_2	663	663	0.019	96	Key Source, Level
1A1, 1A2 and 1A4	Natural gas fuelled engines	GAS	CH_4	198	198	0.006	96	
1A4	Other Sectors	COAL	CO_2	196	196	0.006	97	
1A4	Other Sectors	BIOMASS	CH_4	177	177	0.005	97	
1A2	Industry	COKE OVEN COKE	CO_2	121	121	0.003	98	
1A4	Other Sectors	PETROLEUM COKE	CO_2	120	120	0.003	98	
1A1	Energy Industries	GAS OIL	CO_2	107	107	0.003	98	
1A4	Other Sectors	RESIDUAL OIL	CO_2	72	72	0.002	99	
1A4	Other Sectors	LPG	CO_2	58	58	0.002	99	
1A4	Other Sectors	BIOMASS	N_2O	53	53	0.002	99	
1A1	Energy Industries	GAS	N_2O	50	50	0.001	99	
1A1	Energy Industries	SOLID	N_2O	46	46	0.001	99	
1A2	Industry	PLASTIC WASTE	CO_2	45	45	0.001	99	
1A2	Industry	LPG	CO_2	32	32	0.001	99	
1A1	Energy Industries	BIOMASS	N_2O	20	20	0.001	99	
1A1	Energy Industries	LIQUID	N_2O	18	18	0.001	100	
1A1, 1A2 and 1A4	Biogas fuelled engines	BIOMASS	CH_4	17	17	0.000	100	
1A1	Energy Industries	OTHER 1	N_2O	17	17	0.000	100	
1A4	Other Sectors	LIQUID	N_2O	15	15	0.000	100	
1A2	Industry	LIQUID	N_2O	14	14	0.000	100	
1A4	Other Sectors	GAS	N_2O	13	13	0.000	100	
1A2	Industry	GAS	N_2O	13	13	0.000	100	
1A2	Industry	SOLID	N_2O	9	9	0.000	100	
1A4	Other Sectors	KEROSENE	CO_2	8	8	0.000	100	
1A2	Industry	BIOMASS	N_2O	7	7	0.000	100	
1A1	Energy Industries	BIOMASS	CH_4	7	7	0.000	100	
1A1	Energy Industries	SOLID	CH_4	6	6	0.000	100	
1A1	Energy Industries	GAS	CH_4	5	5	0.000	100	
1A4	Other Sectors	GAS	CH_4	5	5	0.000	100	
1A2	Industry	GAS	CH_4	4	4	0.000	100	
1A2	Industry	BIOMASS	CH_4	4	4	0.000	100	
1A2	Industry	LIQUID	CH_4	3	3	0.000	100	
1A2	Industry	SOLID	CH_4	3	3	0.000	100	
1A2	Industry	OTHER 1	N_2O	2	2	0.000	100	
1A4	Other Sectors	SOLID	N_2O	2	2	0.000	100	
1A4	Other Sectors	LIQUID	CH_4	1	1	0.000	100	
1A2	Industry	KEROSENE	CO_2	1	1	0.000	100	
1A2	Industry	GAS OIL	CO_2	1	1	0.000	100	
1A4	Other Sectors	PLASTIC WASTE	CO_2	1	1	0.000	100	
1A1	Energy Industries	LIQUID	CH_4	1	1	0.000	100	
1A1	Energy Industries	OTHER 1	CH_4	1	1	0.000	100	
1A4	Other Sectors	SOLID	CH_4	1	1	0.000	100	
1A2	Industry	OTHER 1	CH_4	0	0	0.000	100	
1A4	Other Sectors	COKE OVEN COKE	CO_2	0	0	0.000	100	
1A4	Other Sectors	OTHER 1	N_2O	0	0	0.000	100	
1A4	Other Sectors	OTHER 1	CH_4	0	0	0.000	100	

Table 107 GHG key source analysis, Level 1990.

IPCC Category Code	IPCC Category	Fuel	Green-house Gas	1990 Estimate Ex,t [in CO_2-equivalent units]	Absolute Value of 1990 Estimate	Level Assess-ment Lx,t	Cumula-tive Total of Column H, %	
1A1	Energy Industries	COAL	CO_2	22462	22462	0.590	59	Key Source, Level 1990
1A4	Other Sectors	GAS OIL	CO_2	4341	4341	0.114	70	Key Source, Level 1990
1A1	Energy Industries	NATURAL GAS	CO_2	1540	1540	0.040	74	Key Source, Level 1990
1A4	Other Sectors	NATURAL GAS	CO_2	1486	1486	0.039	78	Key Source, Level 1990
1A2	Industry	RESIDUAL OIL	CO_2	1427	1427	0.037	82	Key Source, Level 1990
1A2	Industry	COAL	CO_2	1318	1318	0.035	86	Key Source, Level 1990
1A2	Industry	NATURAL GAS	CO_2	1294	1294	0.034	89	Key Source, Level 1990
1A1	Energy Industries	RESIDUAL OIL	CO_2	882	882	0.023	91	Key Source, Level 1990
1A1	Energy Industries	REFINERY GAS	CO_2	795	795	0.021	93	Key Source, Level 1990
1A4	Other Sectors	KEROSENE	CO_2	361	361	0.009	94	Key Source, Level 1990
1A1	Energy Industries	PLASTIC WASTE	CO_2	328	328	0.009	95	Key Source, Level 1990
1A4	Other Sectors	COAL	CO_2	298	298	0.008	96	
1A2	Industry	PETROLEUM COKE	CO_2	258	258	0.007	97	
1A4	Other Sectors	RESIDUAL OIL	CO_2	196	196	0.005	97	
1A1	Energy Industries	GAS OIL	CO_2	166	166	0.004	98	
1A4	Other Sectors	PETROLEUM COKE	CO_2	153	153	0.004	98	
1A2	Industry	COKE OVEN COKE	CO_2	126	126	0.003	98	
1A2	Industry	LPG	CO_2	102	102	0.003	99	
1A4	Other Sectors	BIOMASS	CH_4	74	74	0.002	99	
1A4	Other Sectors	LPG	CO_2	66	66	0.002	99	
1A1	Energy Industries	SOLID	N_2O	63	63	0.002	99	
1A4	Other Sectors	LIQUID	N_2O	43	43	0.001	99	
1A2	Industry	GAS OIL	CO_2	40	40	0.001	99	
1A4	Other Sectors	BIOMASS	N_2O	22	22	0.001	99	
1A4	Other Sectors	PLASTIC WASTE	CO_2	21	21	0.001	99	
1A1	Energy Industries	OTHER 1	N_2O	17	17	0.000	100	
1A1	Energy Industries	LIQUID	N_2O	17	17	0.000	100	
1A2	Industry	LIQUID	N_2O	15	15	0.000	100	
1A2	Industry	SOLID	N_2O	14	14	0.000	100	
1A1	Energy Industries	GAS	N_2O	13	13	0.000	100	
1A4	Other Sectors	COKE OVEN COKE	CO_2	12	12	0.000	100	
1A2	Industry	REFINERY GAS	CO_2	11	11	0.000	100	
1A4	Other Sectors	BROWN COAL BRI.	CO_2	11	11	0.000	100	
1A1	Energy Industries	SOLID	CH_4	9	9	0.000	100	
1A1	Energy Industries	BIOMASS	N_2O	9	9	0.000	100	
1A4	Other Sectors	GAS	N_2O	8	8	0.000	100	
1A2	Industry	GAS	N_2O	7	7	0.000	100	
1A2	Industry	BIOMASS	N_2O	7	7	0.000	100	
1A2	Industry	KEROSENE	CO_2	5	5	0.000	100	
1A2	Industry	SOLID	CH_4	5	5	0.000	100	
1A1, 1A2 and 1A4	Natural gas fuelled engines	GAS	CH_4	5	5	0.000	100	
1A1	Energy Industries	BIOMASS	CH_4	5	5	0.000	100	
1A2	Industry	BIOMASS	CH_4	4	4	0.000	100	
1A4	Other Sectors	LIQUID	CH_4	3	3	0.000	100	
1A4	Other Sectors	GAS	CH_4	3	3	0.000	100	
1A4	Other Sectors	SOLID	N_2O	3	3	0.000	100	
1A2	Industry	GAS	CH_4	3	3	0.000	100	
1A1	Energy Industries	GAS	CH_4	2	2	0.000	100	
1A2	Industry	LIQUID	CH_4	2	2	0.000	100	
1A1, 1A2 and 1A4	Biogas fuelled engines	BIOMASS	CH_4	2	2	0.000	100	
1A1	Energy Industries	OTHER 1	CH_4	2	2	0.000	100	
1A1	Energy Industries	LIQUID	CH_4	1	1	0.000	100	
1A4	Other Sectors	OTHER 1	N_2O	1	1	0.000	100	
1A4	Other Sectors	SOLID	CH_4	1	1	0.000	100	
1A2	Industry	PLASTIC WASTE	CO_2	1	1	0.000	100	
1A1	Energy Industries	LPG	CO_2	1	1	0.000	100	
1A2	Industry	BROWN COAL BRI.	CO_2	0	0	0.000	100	
1A4	Other Sectors	OTHER 1	CH_4	0	0	0.000	100	
1A2	Industry	OTHER 1	N_2O	0	0	0.000	100	
1A2	Industry	OTHER 1	CH_4	0	0	0.000	100	

Table 108 GHG key source analysis, Trend.

IPCC Category Code	IPCC Category	Fuel	Green-house Gas	Base Year Estimate, Ex,0	Latest Year Estimate Ex,t	Trend As-sessment Tx,t	Contribu-tion to Trend %	Cumulative Total of Column H %	
1A1	Energy Industries	NATURAL GAS	CO_2	1540	5194	0.0995	25	25	Key Source, Trend
1A1	Energy Industries	COAL	CO_2	22462	17341	0.0839	21	46	Key Source, Trend
1A4	Other Sectors	GAS OIL	CO_2	4341	1506	0.0647	16	63	Key Source, Trend
1A4	Other Sectors	NATURAL GAS	CO_2	1486	2391	0.0271	7	70	Key Source, Trend
1A2	Industry	NATURAL GAS	CO_2	1294	2117	0.0245	6	76	Key Source, Trend
1A2	Industry	RESIDUAL OIL	CO_2	1427	663	0.0169	4	80	Key Source, Trend
1A2	Industry	PETROLEUM COKE	CO_2	258	850	0.0161	4	84	Key Source, Trend
1A2	Industry	COAL	CO_2	1318	768	0.0115	3	87	Key Source, Trend
1A1	Energy Industries	PLASTIC WASTE	CO_2	328	665	0.0096	2	90	Key Source, Trend
1A4	Other Sectors	KEROSENE	CO_2	361	8	0.0085	2	92	Key Source, Trend
1A1, 1A2 and 1A4	Natural gas fuelled engines	GAS	CH_4	5	198	0.0051	1	93	Key Source, Trend
1A1	Energy Industries	REFINERY GAS	CO_2	795	906	0.0047	1	94	Key Source, Trend
1A1	Energy Industries	RESIDUAL OIL	CO_2	882	919	0.0030	1	95	Key Source, Trend
1A4	Other Sectors	BIOMASS	CH_4	74	177	0.0029	1	96	
1A4	Other Sectors	RESIDUAL OIL	CO_2	196	72	0.0028	1	97	
1A4	Other Sectors	COAL	CO_2	298	196	0.0020	1	97	
1A2	Industry	LPG	CO_2	102	32	0.0016	0	97	
1A1	Energy Industries	GAS OIL	CO_2	166	107	0.0012	0	98	
1A2	Industry	PLASTIC WASTE	CO_2	1	45	0.0012	0	98	
1A1	Energy Industries	GAS	N_2O	13	50	0.0010	0	98	
1A2	Industry	GAS OIL	CO_2	40	1	0.0009	0	99	
1A4	Other Sectors	BIOMASS	N_2O	22	53	0.0009	0	99	
1A4	Other Sectors	LIQUID	N_2O	43	15	0.0006	0	99	
1A4	Other Sectors	PETROLEUM COKE	CO_2	153	120	0.0005	0	99	
1A4	Other Sectors	PLASTIC WASTE	CO_2	21	1	0.0005	0	99	
1A1, 1A2 and 1A4	Biogas fuelled engines	BIOMASS	CH_4	2	17	0.0004	0	99	
1A1	Energy Industries	SOLID	N_2O	63	46	0.0003	0	99	
1A1	Energy Industries	BIOMASS	N_2O	9	20	0.0003	0	99	
1A4	Other Sectors	COKE OVEN COKE	CO_2	12	0	0.0003	0	100	
1A2	Industry	REFINERY GAS	CO_2	11	0	0.0003	0	100	
1A4	Other Sectors	BROWN COAL BRI.	CO_2	11	0	0.0003	0	100	
1A2	Industry	GAS	N_2O	7	13	0.0002	0	100	
1A4	Other Sectors	GAS	N_2O	8	13	0.0002	0	100	
1A2	Industry	COKE OVEN COKE	CO_2	126	121	0.0001	0	100	
1A2	Industry	SOLID	N_2O	14	9	0.0001	0	100	
1A2	Industry	KEROSENE	CO_2	5	1	0.0001	0	100	
1A1	Energy Industries	GAS	CH_4	2	5	0.0001	0	100	
1A1	Energy Industries	LIQUID	N_2O	17	18	0.0001	0	100	
1A1	Energy Industries	BIOMASS	CH_4	5	7	0.0001	0	100	
1A1	Energy Industries	SOLID	CH_4	9	6	0.0001	0	100	
1A2	Industry	OTHER 1	N_2O	0	2	0.0001	0	100	
1A4	Other Sectors	GAS	CH_4	3	5	0.0001	0	100	
1A4	Other Sectors	LPG	CO_2	66	58	0.0000	0	100	
1A4	Other Sectors	LIQUID	CH_4	3	1	0.0000	0	100	
1A2	Industry	GAS	CH_4	3	4	0.0000	0	100	
1A2	Industry	LIQUID	CH_4	2	3	0.0000	0	100	
1A2	Industry	SOLID	CH_4	5	3	0.0000	0	100	
1A4	Other Sectors	OTHER 1	N_2O	1	0	0.0000	0	100	
1A4	Other Sectors	SOLID	N_2O	3	2	0.0000	0	100	
1A1	Energy Industries	OTHER 1	N_2O	17	17	0.0000	0	100	
1A1	Energy Industries	OTHER 1	CH_4	2	1	0.0000	0	100	
1A1	Energy Industries	LPG	CO_2	1	0	0.0000	0	100	
1A1	Energy Industries	LIQUID	CH_4	1	1	0.0000	0	100	
1A2	Industry	BROWN COAL BRI.	CO_2	0	0	0.0000	0	100	
1A4	Other Sectors	SOLID	CH_4	1	1	0.0000	0	100	
1A2	Industry	BIOMASS	N_2O	7	7	0.0000	0	100	
1A2	Industry	OTHER 1	CH_4	0	0	0.0000	0	100	
1A4	Other Sectors	OTHER 1	CH_4	0	0	0.0000	0	100	
1A2	Industry	BIOMASS	CH_4	4	4	0.0000	0	100	
1A2	Industry	LIQUID	N_2O	15	14	0.0000	0	100	

Table 109 Key source analysis, Level 2007, SO_2.

NFR	NFR_name	Level Assessment Lx,t	Cumulative Total, %	001
1A1a	Public electricity and heat production	0.419	42	KS
1A2	Industry	0.347	77	KS
1A4b	Residential	0.122	89	KS
1A4c	Agriculture / Forestry / Fisheries	0.082	97	
1A1b	Petroleum refining	0.021	99	
1A4a	Commercial / Institutional	0.009	100	
1A1c	Other energy industries	0.001	100	

Table 110 Key source analysis, Level 2007, NO_x.

NFR	NFR_name	Level Assessment Lx,t	Cumulative Total, %	002
1A1a	Public electricity and heat production	0.541	54	KS
1A2	Industry	0.179	72	KS
1A1c	Other energy industries	0.115	84	KS
1A4b	Residential	0.107	94	
1A1b	Petroleum refining	0.028	97	
1A4a	Commercial / Institutional	0.015	99	
1A4c	Agriculture / Forestry / Fisheries	0.015	100	

Table 111 Key source analysis, Level 2007, NMVOC.

NFR	NFR_name	Level Assessment Lx,t	Cumulative Total, %	003
1A4b	Residential	0.794	79	KS
1A1a	Public electricity and heat production	0.102	90	KS
1A4c	Agriculture / Forestry / Fisheries	0.052	95	
1A4a	Commercial / Institutional	0.028	98	
1A2	Industry	0.022	100	
1A1c	Other energy industries	0.002	100	
1A1b	Petroleum refining	0.000	100	

Table 112 Key source analysis, Level 2007, CO.

NFR	NFR_name	Level Assessment Lx,t	Cumulative Total, %	005
1A4b	Residential	0.813	81	KS
1A2	Industry	0.080	89	
1A1a	Public electricity and heat production	0.052	94	
1A4c	Agriculture / Forestry / Fisheries	0.047	99	
1A4a	Commercial / Institutional	0.005	100	
1A1b	Petroleum refining	0.001	100	
1A1c	Other energy industries	0.001	100	

Table 113 Key source analysis, Level 2007, TSP.

NFR	NFR_name	Level Assessment Lx,t	Cumulative Total, %	009
1A4b	Residential	0,904	90	KS
1A1a	Public electricity and heat production	0,035	94	
1A2	Industry	0,032	97	
1A4c	Agriculture / Forestry / Fisheries	0,018	99	
1A4a	Commercial / Institutional	0,006	100	
1A1b	Petroleum refining	0,004	100	
1A1c	Other energy industries	0,000	100	

Table 114 Key source analysis, Level 2007, PM_{10}.

NFR	NFR_name	Level Assessment Lx,t	Cumulative Total, %	011
1A4b	Residential	0.918	92	KS
1A1a	Public electricity and heat production	0.030	95	
1A2	Industry	0.024	97	
1A4c	Agriculture / Forestry / Fisheries	0.018	99	
1A4a	Commercial / Institutional	0.006	100	
1A1b	Petroleum refining	0.004	100	
1A1c	Other energy industries	0.000	100	

Table 115 Key source analysis, Level 2007, $PM_{2.5}$.

NFR	NFR_name	Level Assessment Lx,t	Cumulative Total, %	012
1A4b	Residential	0.931	93	KS
1A1a	Public electricity and heat production	0.026	96	
1A4c	Agriculture / Forestry / Fisheries	0.018	97	
1A2	Industry	0.015	99	
1A4a	Commercial / Institutional	0.006	100	
1A1b	Petroleum refining	0.004	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	2007 SO_2	2007 NO_x	2007 NMVOC	2007 CO
1A1a	Public electricity and heat production	126187	90746	1002	7952	8641	33608	2698	8854
1A1b	Petroleum refining	3411	1616	60	249	423	1754	3	225
1A1c	Other energy industries	3	2376	13	61	10	7120	42	211
1A2	Industry	16708	13167	627	15877	7157	11136	571	13574
1A4a	Commercial / Institutional	1884	1399	193	892	183	919	732	846
1A4b	Residential	6415	4939	8566	85074	2509	6653	20957	138661
1A4c	Agriculture / Forestry / Fisheries	3192	1180	2142	29863	1680	909	1379	8096
		157800	115423	12603	139967	20604	62100	26382	170467

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	0.050	0.132	0.048	0.006	49.5	50.0	7.6	1.2
1A1b	Petroleum refining	0.000	0.008	0.010	0.001	0.1	2.9	1.5	0.1
1A1c	Other energy industries	0.000	0.051	0.001	0.001	0.1	19.2	0.2	0.2
1A2	Industry	0.032	0.035	0.059	0.041	31.4	13.3	9.3	8.2
1A4a	Commercial / Institutional	0.000	0.001	0.026	0.002	0.4	0.5	4.1	0.3
1A4b	Residential	0.011	0.035	0.240	0.250	10.6	13.1	38.1	49.8
1A4c	Agriculture / Forestry / Fisheries	0.008	0.002	0.246	0.202	8.0	0.9	39.1	40.2
		0.100	0.264	0.630	0.503	100	100	100	100

: Key source

Appendix 15 Fuel consumption time-series 1980-2007

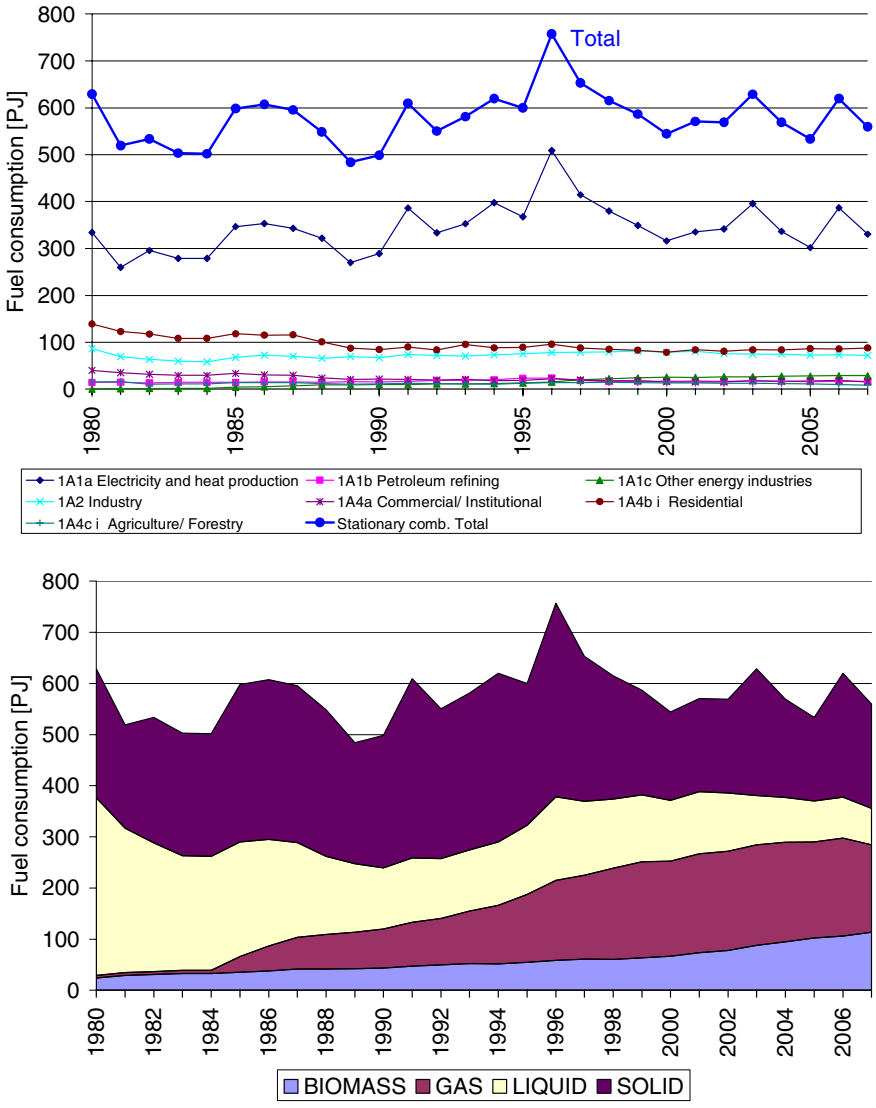

Figure 60 Fuel consumption time-series, stationary combustion (based on DEA (2008a)).

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DANISH EMISSION INVENTORIES FOR STATIONARY COMBUSTION PLANTS

Inventories until year 2007

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, particulate matter, heavy metals, dioxins, HCB and PAH. The CO_2 emission in 2007 was 10% 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 2007 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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