National Environmental Research Institute
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Danish emission inventories for stationary combustion plants

Inventories until year 2001

Research Notes from NERI No. 192

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Data sheet

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Abstract: Emission inventories for stationary combustion plants are presented and the methodologies and assumptions used for the inventories are described. The pollutants considered are: SO_2, NO_x, NMVOC, CH_4, CO, CO_2, N_2O, particulate matter, heavy metals, dioxins and PAH. Since 1990 the fuel consumption in stationary combustion has increased by 12% - the fossil fuel consumption however only by 6%. Despite the increased fuel consumption the emission of several pollutants have decreased due to the improved flue gas cleaning technology, improved burner technology and the change of fuel type used. 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 greenhouse gas emission has decreased 1,5% since 1990. The emission of CH_4, however, has increased due to increased use of lean-burn gas engines in CHP plants. The emission of PAH increased as a result of the increased combustion of wood in residential boilers and stoves. Uncertainties for the emissions and trends have been estimated.

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, greenhouse gas
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Contents

Preface 5

Sammendrag 6

Summary 8

1 Introduction 10

2 International conventions and reduction targets 11

3 Total Danish emissions 12
3.1 Emission inventories reported in 2003 12

4 Methodology and references for emission inventories for stationary combustion 15
4.1 Emission source categories 15
4.2 Large point sources 17
4.3 Area sources 18
4.4 Activity rates, fuel consumption 18
4.5 Emission factors 19

5 Fuel consumption data 22

6 Greenhouse gas emission 24
6.1 CO_2 26
6.1.1 Reference approach 29
6.2 CH_4 30
6.3 N_2O 33

7 SO_2, NO_x, NMVOC and CO 35
7.1 SO_2 35
7.2 NO_x 37
7.3 NMVOC 39
7.4 CO 41

8 Particulate matter (PM) 44

9 Heavy metals 48

10 PAH and dioxin 53

11 Uncertainty 57
11.1 Methodology 57

11.1.1 Greenhouse gases 57
11.1.2 Other pollutants 58
11.2 Uncertainty estimates 59

12 Geographical distribution of the emissions 60

13 Future improvements 61

13.1 Improved emission factors for decentralised CHP plants 61
13.2 Disaggregation of fuel consumption in the industrial sector 62
13.3 Other improvements 62

14 Conclusion 64

References 66

Appendix 68

Preface

The Danish National Environmental Research Institute (NERI) works out the emission inventories and makes the annually reports to the Climate Convention and to the UNECE Convention on Long-Range Transboundary Air Pollution. This report is part of the documentation for the inventories covering emissions from stationary combustion plants. The results of the inventories are shown until 2001.

Sammendrag

Opgørelser over de samlede danske luftemissioner rapporteres årligt til Klimakonventionen (*UN Framework Convention on Climate Change, UNFCCC*) og til UNECE 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. De danske emissioner opgøres og rapporteres årligt af Danmarks Miljøundersøgelser (DMU). Emissionsopgørelserne omfatter følgende stoffer af relevans for stationær forbrænding: CO_2, CH_4, N_2O, SO_2, NO_x, NMVOC, CO, partikler, tungmetaller, dioxin og PAH. Foruden de årlige opgørelser over total emission rapporteres også sektoropdelt emission og usikkerhed på opgørelserne. Hvert femte år rapporteres endvidere geografisk fordeling af emissionerne, fremskrivning af emissionerne samt de aktivitetsdata – fx brændselsforbrug – der ligger til grund for opgørelserne.

Emissionsopgørelserne for forbrænding i ikke mobile kilder (stationær forbrænding) 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 en 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 (EMEP / Corinair Guidebook (EMEP / Corinair 2002) og IPCC Reference Manual (IPCC 1996)) udarbejdet til brug for denne type emissionsopgørelser. De fleste af de emissionsfaktorer, som stammer fra danske referencer, er hentet fra dansk miljølovgivning, danske rapporter eller er middelværdier baseret på anlægsspecifikke emissionsdata fra et betydeligt antal større værker. Anlægsspecifikke emissionsfaktorer oplyses af anlægsejere, bl.a. i grønne regnskaber.

I emissionsopgørelsen for 2001 er 63 stationære forbrændingsanlæg defineret som punktkilder. Punktkilderne omfatter: kraftværker, decentrale kraftvarmeværker, affaldsforbrændingsanlæg, industrielle forbrændingsanlæg samt raffinaderier. Brændselsforbruget for disse anlæg svarer til 57% af det samlede brændselsforbrug for alle stationære forbrændingsanlæg.

Det årlige danske brændselsforbrug varierer pga. varierende import / eksport af strøm. Siden 1990 er brændselsforbruget steget med 12%, mens forbruget af fossile brændsler er steget med 6%. 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 samlede danske emission: SO_2, CO_2, tungmetaller og PAH. Endvidere udgør emissionen over 10% for NO_x, CH_4, CO, NMVOC og partikler. Stationær forbrænding bidrager med mindre end 10% af den samlede danske N_2O emission.

Kraftværker og decentrale kraftvarmeværker er den betydeligste emissionskilde for SO_2, CO_2, NO_x, og tungmetaller. Gasmotorer installeret på decen-

trale kraftvarmeværker er den største CH_4 emissionskilde indenfor stationær forbrænding. Endvidere har gasmotorer en betydelig emission af NMVOC.

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

I rapporten vises tidsserier for emissioner fra stationær forbrænding.

Udviklingen i emissionen af drivhusgasser følger udviklingen i CO_2 emissionen ganske tæt. Både CO_2 emissionen og den samlede drivhusgasemission fra stationær forbrænding er faldet lidt fra 1990 til 2001 – CO_2 med 2,7% og drivhusgasemissionen med 1,5%. Emissionerne fluktuerer dog betydeligt pga. variationerne i import/eksport af strøm samt varierende opvarmningsbehov pga. variationer i udetemperaturen.

CH_4 emissionen fra stationær forbrænding er steget med en faktor 5 siden 1990. Denne stigning skyldes, at der i perioden er installeret et betydeligt antal gasmotorer på decentrale kraftvarmeværker.

SO_2 emissionen fra stationær forbrænding er faldet med 95% siden 1980 og 85% siden 1995. 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 51% siden 1985 og 35% siden 1995. 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. Variationen i NO_x emissionen følger variationen i import/eksport af strøm.

Forbrænding af træ i villakedler og brændeovne er fordoblet siden 1990 og dette har medført en stigning af CO emissionen. Stigningen i CO emission er dog ikke helt så stor, idet CO emissionen fra halmfyrede gårdanlæg samtidig er faldet betydeligt.

Emissionen af NMVOC fra stationær forbrænding er øget med 82% siden 1985 og 28% siden 1995. Stigningen skyldes primært idriftsættelsen af gasmotorer på decentrale kraftvarmeværker.

Tungmetalemissionerne er faldet betydeligt siden 1990. Emissionen af de enkelte tungmetaller er reduceret mellem 10% og 74%. Faldet skyldes den forbedrede røggasrensing på affaldsforbrændingsanlæg og på kraftværker.

PAH emissionen er steget siden 1990, hvilket hænger sammen med den øgede mængde træ, der forbrændes i brændeovne eller små villakedler.

Summary

Danish emission inventories are worked out annually and the inventories are reported to the *UNECE Framework Convention on Climate Change* (UNFCCC or Climate Convention) and to the UNECE *Convention on Long-Range Transboundary Air Pollution* (LRTAP Convention). Further the greenhouse gas emission inventory is reported to EU because EU – as well as the nations – is a party to the Climate Convention. The annual Danish emission inventories are reported by the Danish National Environmental Research Institute (NERI). The inventories include the pollutants: CO_2, CH_4, N_2O, SO_2, NO_x, NMVOC, CO, particulate matter, heavy metals, dioxin and PAH. In addition to annual total emissions the reporting includes sector specific emissions and uncertainty estimates. Every 5 year the reporting includes geographical distribution of the emissions, projection of emissions and the activity data – e.g. fuel consumption – on which the inventories are based.

The inventories are based on the Danish energy statistics and on a set of emission factors for different sectors, technologies and fuels. Plant specific emissions for large combustion sources are incorporated into the inventories. The report gives detailed background information about the methodology and references to the input data of the inventory - energy statistics and emission factors.

The emission factors are either based on national references or on the international guidebooks EMEP / Corinair Guidebook (EMEP / Corinair 2002) and IPCC Reference Manual (IPCC 1996). Most of the country specific emission factors refer to: Danish legislation, Danish research reports or calculations based on plant specific emissions from a considerable number of large point sources. The plant specific emission factors are provided by plant owners e.g. in annual environmental reports.

In the inventory for the year 2001 63 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 57% of the overall fuel consumption of stationary combustion.

The Danish fuel consumption rate fluctuates due to import / export of electricity. Since 1990 the fuel consumption has increased by 12% - the fossil fuel consumption however only by 6%. The use of coal has decreased whereas the use of natural gas and renewable fuels has increased.

Stationary combustion plants account for more than 50% of the total Danish emission for the following pollutants: SO_2, CO_2, heavy metals and PAH. Furthermore the emission from stationary combustion plants accounts for more than 10% of the total Danish emission for the following pollutants: NO_x, CH_4, CO, NMVOC and particulate matter. Stationary combustion plants account for less than 10% of the total Danish N_2O emission.

Public power plants are the most important stationary combustion emission source for SO_2, CO_2, NO_x and heavy metals.

Lean-burn gas engines installed in decentralised CHP plants are the largest emission source for CH_4. Further these plants are also a considerable emission source for NMVOC.

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

This report shows time series for stationary combustion plants for the different pollutants.

The greenhouse gas emission (GHG) development follows the CO_2 emission development very close by. Both the CO_2 and the total GHG emission decreased slightly from 1990 to 2001, CO_2 by 2,7% and GHG by 1,5%. 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 between years.

The CH_4 emission from stationary combustion has increased by a factor 5 since 1990. This is a result of the considerable number of lean-burn gas engines that was installed in CHP plants in Denmark during this period.

SO_2 emission from stationary combustion plants has decreased by 95% from 1980 and 85% from 1995. The large emission decrease is mainly a result of the reduced emission from electricity and district heat production that have been possible due to installation of desulphurization plants and due to the use of fuels with lower content of sulphur.

The NO_x emission from stationary combustion plants has decreased by 51% since 1985 and 35% since 1995. The reduced emission is mainly a result of the reduced emission from electricity and district heat production plants on which the use of low NO_x burners have increased and further de-NO_x flue gas cleaning units have been put into operation on several power plants. The fluctuations of the time series follow the fluctuations of fuel consumption in power plants, which occur due to electricity import/export.

The wood consumption in residential plants has doubled from 1990 to 2001 causing an increase in the CO emission. The increase in CO from residential plants is less than the increase of wood consumption because the CO emission from straw fired farmhouse boilers has decreased considerably.

The NMVOC emission from stationary combustion plants has increased by 82% from 1985 and 28% from 1995. The increased NMVOC emission is mainly a result of the increased use of lean-burn gas engines.

The heavy metal emissions decreased considerably since 1990 – between 10% and 74%. The decrease is caused by the improved flue gas cleaning systems installed in municipal waste incineration plants and in power plants.

The PAH emission has increased since 1990 due to the increased combustion of wood in residential plants.

1 Introduction

Danish emission inventories are worked out annually and the inventories are reported to the *UN Framework Convention on Climate Change* (UNFCCC or Climate Convention) and to the UNECE *Convention on Long-Range Transboundary Air Pollution* (LRTAP Convention). Further the greenhouse gas emission inventory is reported to EU because EU – as well as the nations – is a party to the Climate Convention. The Danish atmospheric emission inventories are worked out by the Danish National Environmental Research Institute (NERI).

This report provides a summary and documentation of the emission inventories for stationary combustion. Stationary combustion plants include power plants, district heating plants, non-industrial and industrial combustion plants, industrial process burners, petroleum refining plants, combustion in oil / gas extraction and in pipeline compressors. Emissions from flaring in oil / gas production and from flaring in refineries are not included.

This report presents detailed emission inventories and time series for emissions from stationary combustion plants. Further emissions from stationary combustion plants are compared with the total Danish emissions. The methodology and references for the emission inventories for stationary combustion plants are described. Furthermore uncertainty estimates are shown.

2 International conventions and reduction targets

Denmark is a party to two international conventions that are relevant concerning emissions from stationary combustion plants:

- The UNECE Convention on Long Range Transboundary Air Pollution (LRTAP Convention or the Geneva Convention)
- The UN Framework Convention on Climate Change under the Intergovernmental Panel on Climate Change (IPCC). The convention is also called UNFCCC or the Climate Convention.

The LRTAP Convention is a framework convention and has expanded to cover 8 protocols:

- *EMEP Protocol*, 1984 (Geneva).
- *Protocol on Reduction of Sulphur Emissions*, 1985 (Helsinki).
- *Protocol concerning the Control of Emissions of Nitrogen Oxides*, 1988 (Sofia).
- *Protocol concerning the Control of Emissions of Volatile Organic Compounds*, 1991 (Geneva).
- *Protocol on Further Reduction of Sulphur Emissions*, 1994 (Oslo).
- *Protocol on Heavy Metals*, 1988 (Aarhus).
- *Protocol on Persistent Organic Pollutants (POPs)*, 1998 (Aarhus).
- *Protocol to Abate Acidification, Eutrophication and Ground-level Ozone*, 1999 (Gothenburg).

The reduction targets / emission ceilings included in the protocols of the LRTAP Convention are stated in Table 1.

Table 1 Danish reduction targets / emission ceiling, LRTAP Convention

Pollutant	Reduction / emission ceiling	Reference	Comment
SO_2	55 Gg in 2010	Gothenburg protocol	The ceiling equals 217% of the 2001 emission
NO_x	127 Gg in 2010	Gothenburg protocol	The ceiling equals 63% of the 2001 emission
NMVOC	85 Gg in 2010	Gothenburg protocol	The ceiling equals 69% of the 2001 emission

The Climate Convention is a framework convention from 1992. The Kyoto protocol is a protocol to the Climate Convention.

The Kyoto protocol sets legally binding emission targets and timetables for 6 greenhouse gases: CO_2, CH_4, N_2O, HFC, PFC and SF_6. The greenhouse gas emission of each of the 6 pollutants is translated to CO_2 equivalents, that can be added up to produce the total greenhouse gas (GHG) emission in CO_2 equivalent. Denmark is obliged to reduce the average 2008-2010 GHG emission by 21% compared with the 1990 emission level.

EU is a party to the Climate Convention and thus the EU countries are obliged to submit emission data to the EU Monitoring Mechanism for CO_2 and other Greenhouse Gases.

3 Total Danish emissions

As mentioned above emission inventories are reported annually to the LRTAP Convention and to the Climate convention.

Links to the latest emission inventories can be found on the NERI home page: www.dmu.dk/1_viden/2_Miljoe-tilstand/3_luft/4_adaei/default_en.asp 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 some specific sources are not included in the inventory totals. These emissions are reported as memo items and thus estimated but not included in the totals.

- CO_2 emission from renewable fuels is not included in national totals, but reported as a memo item.
- Emissions from international bunkers and from international aviation are not included in national totals.

The data for total Danish emission presented in this report does not include memo items.

3.1 Emission inventories reported in 2003

An overview of the Danish emission inventories for 2001 including all sectors is shown in Table 2-Table 5. The detailed Danish emission inventories for 2001 reported in 2003 are shown in appendix 1 and appendix 2. Time series for the total Danish emissions are shown in appendix 11. A few improvements of the inventories have been carried out since the reporting in 2003 and thus time series shown in appendix 11 are not fully identical to the data that was reported to the conventions in 2003. Emission shares of each main sector are shown in appendix 12.

The emission inventories reported to the LRTAP Convention and to the Climate Convention are organised in 6 main source categories and a number of sub categories. The emission source *1A Energy, fuel combustion* covers combustion in stationary and mobile sources.

Table 2 Greenhouse gas emission for the year 2001 (Illerup et al. 2003a)

Pollutant	CO_2	CH_4	N_2O
Unit	Gg CO_2 equivalent		
1. Energy	52779	807	831
2. Industrial Processes	1464	0	0
3. Solvent and Other Product Use	112	0	0
4. Agriculture	0	3632	7918
5. Land-Use Change and Forestry	-3531	0	0
6. Waste	0	1168	0
Total Danish emission (gross)		**69410**	
Total Danish emission (net)		**65879**	

Table 3 Emissions 2001 reported to the LRTAP Convention (Illerup et al. 2003b)

Pollutant	NO_x Gg	CO Gg	NMVOC Gg	SO_2 Gg	TSP Mg	PM_{10} Mg	$PM_{2.5}$ Mg
1. Energy	202	587	84	25	29169	14017	12134
2. Industrial Processes	0	0	0	0	0	0	0
3. Solvent and Other Product Use	0	0	38	0	0	0	0
4. Agriculture	0	0	1	0	14191	6387	1419
5. Land-Use Change and Forestry	0	0	0	0	0	0	0
6. Waste	0	0	0	0	0	0	0
Total Danish emission	**202**	**587**	**124**	**25**	**43360**	**20403**	**13552**

Table 4 Emissions 2001 reported to the LRTAP Convention (Illerup et al. 2003b)

Pollutant	Pb Mg	Cd Mg	Hg Mg	As Mg	Cr Mg	Cu Mg	Ni Mg	Se Mg	Zn Mg
1. Energy	6,00	0,73	1,87	0,71	2,38	9,22	12,78	1,64	22,50
2. Industrial Processes	0,07	0,00	0,00	0,00	0,00	0,05	0,00	0,00	0,63
3. Solvent and Other Product Use	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
4. Agriculture	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
5. Land-Use Change and Forestry	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
6. Waste	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total Danish emission	**6,07**	**0,73**	**1,87**	**0,71**	**2,38**	**9,27**	**12,78**	**1,64**	**23,13**

Table 5 Emissions 2001 reported to the LRTAP Convention (Illerup et al. 2003b)

Pollutant	Benzo(a)-pyrene Mg	Benzo(b)fluo-ranthene Mg	Benzo(k)-fluoranthene Mg	Indeno(1,2,3-c,d)pyrene Mg	Dioxin g I-tec
1. Energy	2,751	3,698	1,237	2,055	35,356
2. Industrial Processes	0,000	0,000	0,000	0,000	0,879
3. Solvent and Other Product Use	0,000	0,000	0,000	0,000	13,250
4. Agriculture	0,000	0,000	0,000	0,000	0,000
5. Land-Use Change and Forestry	0,000	0,000	0,000	0,000	0,000
6. Waste	0,000	0,000	0,000	0,000	21,432
7. Other	0,000	0,000	0,000	0,000	10,250
Total Danish emission	2,751	3,698	1,237	2,055	81,167

The Danish greenhouse gas emission is almost the same in 2001 as in 1990. The inventory shows a decrease of 0,7%. The CO_2 emission increased 3% from 1990, the CH_4 emission decreased 1% and the N_2O emission decreased 19% from 1990.

The CO_2 emission accounts for 79% of the total Danish greenhouse gas emission (in ton CO_2 equivalents). The energy industry is the primary emission source for CO_2. Agriculture is the major emission source of CH_4 and N_2O.

The SO_2 emission has decreased considerably during the last 20 years. Thus the emission in 2001 is only 6% of the 1980 emission level and 14% of the 1990 emission level. The primary emission source for SO_2 is combustion in stationary plants in energy industries and in manufacturing industries and construction. The considerable decrease in emission level is caused mainly by the corresponding decrease in SO_2 emission from power plants.

The NO_x emission has decreased since 1985 and in 2001 the emission was 69% of the emission in 1985. The main emission sources are all combustion sources including transport. The decrease in NO_x emission is primarily a result of the decrease of NO_x emission in energy industries and transport.

The emission of NMVOC has decreased to 65% of the 1985 emission level. The emission sources causing this decrease are the transport sector, agriculture and the use of solvents and other products. The largest emission sources are transport and use of solvents and other products.

The emission of CO in 2001 has decreased to 59% of the emission in 1985 as a result of decreasing emissions from the transport sector and agriculture. The largest emission sources are transport and combustion in "Other sectors" which amongst others include residential plants and off road machinery.

Emissions of heavy metals decreased in general from 1990 to 2001. The decrease in Pb emission is very considerable and is caused primarily by the decrease in emission from the transport sector. The main emission sources for heavy metal are transport and stationary combustion.

Time series for particulate matter (PM) emission are not shown in appendix 11 because these emissions have only been estimated for the years 2000 and 2001. The emissions are almost the same in 2000 and 2001 for all sectors. The PM emission inventory includes inventories for total suspended particulate (TSP), the particle fraction consisting of particles smaller than 10µm (PM_{10}) and the particle fraction consisting of particles smaller than 2.5µm ($PM_{2.5}$). Up till now only emissions from stationary combustion, transport and agriculture have been estimated in the Danish inventory. Agriculture is the largest emission source for TSP, but for $PM_{2.5}$ the transport sector is the largest emission source.

The PAH emissions increased 40-75% since 1990. More than 85% of the PAH emission comes from "Other combustion sources", that includes residential plants.

NERI does not estimate the total dioxin emission reported to the LRTAP Convention. The dioxin inventories are estimated by the Danish Environmental Protection Agency and will not be further discussed in this report.

Further emission data for stationary combustion plants are shown in chapter 6-10.

4 Methodology and references for emission inventories for stationary combustion

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, prepared by the UNECE/EMEP Task Force on Emissions Inventories and Projections (EMEP/Corinair 2002). Emission data are stored in an Access database, from which data are transferred to the reporting format.

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

The emission inventory for dioxin is estimated by the Danish Environmental Protection Agency. The results of the dioxin emission inventory will be presented in this report, but the methodology for estimating the dioxin emission will not be described.

4.1 Emission source categories

In the Danish emission database all activity rates and emissions are defined in SNAP sector categories (Selected Nomenclature for Air Pollution). The data from the Danish database are aggregated to the sector codes used for both the Climate Convention and the LRTAP Convention. This sector classification defines 6 main source categories and a number of subcategories. The main source categories are shown in Table 6.

Table 7 shows detailed source categories for the energy sector. In appendix 3 a correspondence list between SNAP sector codes and the IPCC source categories for stationary combustion plants are shown.

Table 6 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 7 IPCC source categories for the energy sector

IPCC id	IPCC sector name	Stationary combustion or transport
1	**Energy**	**Stationary combustion + transport**
1A	**Fuel Combustion Activities**	**Stationary combustion + transport**
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
1A2a	Iron and Steel	Stationary combustion
1A2b	Non-Ferrous Metals	Stationary combustion
1A2c	Chemicals	Stationary combustion
1A2d	Pulp, Paper and Print	Stationary combustion
1A2e	Food Processing, Beverages and Tobacco	Stationary combustion
1A2f	Other (please specify)	Stationary combustion + transport
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)

Combustion in transport and stationary units is included in the source category *1A Fuel Combustion*. Stationary combustion plants are included in the emission source subcategories:

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

The emission sources *1A2* and *1A4* however also include emission from the some transport subsectors (appendix 3). The emission source *1A2* includes emission from some off road machinery in the industry. The emission source *1A4* includes off road machinery in agriculture, in forestry and in household / gardening. Further emissions from national fishing are included in subsector *1A4*.

The emission source categories used in the reportings will be referred to as IPCC source categories, but for stationary combustion plants the same emission source categories are used in the reporting to the Climate Convention and to the LRTAP Convention.

The Danish emission inventories are prepared from a complete emission database based on the SNAP categories. Aggregation to IPCC source categories is based on the correspondence list between SNAP and IPCC source categories from the EMEP / Corinair Guidebook (EMEP / Corinair 2002) enclosed in appendix 3.

4.2 Large point sources

Large emission sources like power plants, industrial plants and refineries are included as large point sources in the Danish emission database. Each point source might 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 for the plants.

In the inventory for the year 2001 63 stationary combustion plants are specified as large point sources in the Danish emission database. These point sources include:

- Power plants and decentralised CHP plants (combined heat and power plants)
- Municipal waste incineration plants
- A few large industrial plants
- Petroleum refining plants

The fuel consumption of stationary combustion plants registered as large point sources is 320 PJ (2001). This corresponds to 57% of the overall fuel consumption of stationary combustion.

A list of large point sources for 2001 and the fuel consumption rates is shown in appendix 8. It also shows which of the large point source emissions are based on plant specific emission data. The number of large point sources registered in the databases increased from 1990 to 2001. In the emission database for the years before 1990 no large point sources have been registered.

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 Authority due to Danish legislation
- Emission data reported by Elsam and E2, the two major electricity suppliers
- Emission data reported from industrial plants

Annual environmental reports from 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 might have been calculated from general emission factors. Only some of the pollutants included in the inventories for the Climate Convention and the LRTAP Con-

vention are reported in the annual environmental reports or in other plant specific reports. Emissions of the remaining pollutants are based on the emission factors applied for area sources for the fuel and source category.

Emissions of the greenhouse gases (CO_2, CH_4 and N_2O) from stationary combustion plants defined as large point sources are all based on the area source emission factors.

4.3 Area sources

Fuels not combusted in large point sources are included as sector specific area sources in the emission database. Plants like 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 about emission factors is given below.

4.4 Activity rates, fuel consumption

The fuel consumption rates are based on the official Danish energy statistics prepared by the Danish Energy Authority. The Danish Energy Authority aggregates fuel consumption rates to SNAP sector categories. Some fuel types in the official Danish energy statistics are added to obtain a less detailed fuel aggregation level, see appendix 10. The calorific values on which the energy statistics are based are also enclosed in appendix 10.

The Danish energy statistics do not yet specify fuel consumption rates in specific industries. Thus fuel consumption of the SNAP sector *03 Combustion in manufacturing industries* or the IPCC sector *1A2 Manufacturing industries and construction* can not be disaggregated to specific industries. In the Climate Convention reporting the emissions are included in *1A2f Other* because it is not technically possible to report any emission in the aggregated source category *1A2 Manufacturing industries and construction*.

Both traded and not traded fuels are included in the Danish energy statistics. Thus e.g. an estimation of the annual consumption of non-traded wood is included.

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

The Danish Energy Authority compile a database for the fuel consumption of district heating and power producing plants each year based on data reported by the plant owners. The fuel consumptions of large point sources specified in the Danish emission databases refer to this database.

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

Emissions from non-energy use of fuels have not been included in the Danish inventory yet, but it is however included in the reference approach of the Climate Convention reporting. The Danish energy statistics include three fuels used for non-energy purposes: Bitumen, white spirit and lube oil.

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

Fuel consumption data are presented in chapter 5.

4.5 Emission factors

For each fuel and SNAP (sector and e.g. type of plant) a set of general area source emission factors has been determined. The emission factors are either national referenced or based on the international guidebooks EMEP / Corinair Guidebook (EMEP / Corinair 2002) and IPCC Reference Manual (IPCC 1996).

A complete list of emission factors for area sources year 2001 is shown in Appendix 5. Time series of greenhouse gas emission factors 1990-2001 are also shown. The CO_2 emission factors are listed in Table 8. A selection of other emission factors for the year 2001 are shown in Table 9.

Table 8 CO_2 emission factors 2001

Fuel	**Emission factor**		**Unit**	**Reference type 1)**
	Biomass	Fossil fuel		
Coal		95	kg/GJ	cs
Petroleum coke		92	kg/GJ	cs
Wood	102		kg/GJ	c
Municipal waste	97,8	19,2	kg/GJ	cs
Agricultural waste (straw)	102		kg/GJ	cs
Residual oil		78	kg/GJ	c
Gas oil		74	kg/GJ	c
Kerosene		72	kg/GJ	c
Liquid bio fuel	102		kg/GJ	c
Orimulsion		80	kg/GJ	cs
Natural gas		57,25	kg/GJ	cs
LPG		52	kg/GJ	c
Refinery gas		57,1	kg/GJ	cs
Biogas	83,6		kg/GJ	cs

1) CS: country specific, C: CORINAIR

Table 9 Selection of the emission factors, 2001

fuel	IPCC source	SNAP	unit	unit	CH_4	N_2O	SO_2	NO_x	NMVOC	CO	TSP	PM_{10}	$PM_{2.5}$
AGRICUL. WASTES	1A1a	010102	g	GJ	32	4	100	153	50	50	8	6	4
AGRICUL. WASTES	1A1a	010103	g	GJ	32	4	100	156	50	50	8	6	4
AGRICUL. WASTES	1A1a	010202	g	GJ	32	4	100	153	50	325	21	15	12
AGRICUL. WASTES	1A1a	010203	g	GJ	32	4	100	156	50	325	21	15	12
AGRICUL. WASTES	1A4b	0202	g	GJ	200	4	100	153	600	4000	234	222	211
BIOGAS	1A1a	010103	g	GJ	4	2	11	31	4	36	1,5	1,5	1,5
BIOGAS	1A1a	010105	g	GJ	434	2	11	605	4	255	1,5	1,5	1,5
GAS OIL	1A1a	010103	g	GJ	1,5	2	23	52	1,5	15	5	5	5
GAS OIL	1A1a	010104	g	GJ	1,5	2	23	350	2	15	5	5	5
GAS OIL	1A1a	010105	g	GJ	1,5	2	23	700	100	100	5	5	5
GAS OIL	1A1a	010203	g	GJ	1,5	2	23	52	1,5	30	5	5	5
GAS OIL	1A2f	0301	g	GJ	1,5	2	23	52	1,5	30	5	5	5
KEROSENE	1A4b	0202	g	GJ	7	2	23	73	3	20	5	5	5
LPG	1A4b	0202	g	GJ	1	2	1	50	2	25	0,2	0,2	0,2
MUNICIP. WASTES	1A1a	010102	g	GJ	6	4	69	150	9	10	6	5	4
MUNICIP. WASTES	1A1a	010103	g	GJ	6	4	69	150	9	10	6	5	4
MUNICIP. WASTES	1A1a	010203	g	GJ	6	4	69	150	9	10	6	5	4
NATURAL GAS	1A1a	010101	g	GJ	6	1	0,3	88	2	15	0,1	0,1	0,1
NATURAL GAS	1A1a	010102	g	GJ	6	1	0,3	88	2	15	0,1	0,1	0,1
NATURAL GAS	1A1a	010103	g	GJ	15	1	0,3	30	2	15	0,1	0,1	0,1
NATURAL GAS	1A1a	010104	g	GJ	4	1	0,3	88	1	7	0,1	0,1	0,1
NATURAL GAS	1A1a	010105	g	GJ	573	1	0,3	193	163	169	0,1	0,1	0,1
NATURAL GAS	1A1a	010202	g	GJ	6	1	0,3	100	2	28	0,1	0,1	0,1
NATURAL GAS	1A1a	010203	g	GJ	15	1	0,3	30	2	28	0,1	0,1	0,1
NATURAL GAS	1A2f	0301	g	GJ	6	1	0,3	30	2	28	0,1	0,1	0,1
NATURAL GAS	1A4b	0202	g	GJ	6	1	0,3	30	4	20	0,1	0,1	0,1
NATURAL GAS	1A4b	020202	g	GJ	15	1	0,3	30	4	20	0,1	0,1	0,1
ORIMULSION	1A1a	010101	g	GJ	3	2	10	88	3	15	1,9	1,8	1,6
PETROLEUM COKE	1A4b	0202	g	GJ	15	3	573	50	1,5	1000	100	60	30
REFINERY GAS	1A1b	010303	g	GJ	2	2	0,3	30	4	15	5	5	5
REFINERY GAS	1A1b	010304	g	GJ	2	2	0,3	174	4	15	5	5	5
RESIDUAL OIL	1A1a	010101	g	GJ	3	2	315	240	3	15	3	3	2,5
RESIDUAL OIL	1A1a	010102	g	GJ	3	2	315	240	3	15	3	3	2,5
RESIDUAL OIL	1A1a	010103	g	GJ	3	2	315	142	3	15	3	3	2,5
RESIDUAL OIL	1A1a	010104	g	GJ	3	2	315	142	3	15	3	3	2,5
RESIDUAL OIL	1A1a	010202	g	GJ	3	2	315	240	3	30	3	3	2,5
RESIDUAL OIL	1A1a	010203	g	GJ	3	2	315	142	3	30	3	3	2,5
RESIDUAL OIL	1A2f	0301	g	GJ	3	2	344	130	3	30	14	10,5	7
STEAM COAL	1A1a	010101	g	GJ	1,5	3	39	139	1,5	10	3	2,6	2,1
STEAM COAL	1A1a	010102	g	GJ	1,5	3	39	139	1,5	10	3	2,6	2,1
STEAM COAL	1A1a	010103	g	GJ	15	3	464	95	1,5	10	3	2,6	2,1
STEAM COAL	1A1a	010202	g	GJ	15	3	464	95	15	10	6	6	5
STEAM COAL	1A1a	010203	g	GJ	15	3	464	95	15	10	6	6	5
WOOD AND SIMIL.	1A1a	010103	g	GJ	32	4	25	130	48	50	8	6	4
WOOD AND SIMIL.	1A1a	010203	g	GJ	32	4	25	130	48	240	19	13	10
WOOD AND SIMIL.	1A2f	0301	g	GJ	32	4	25	130	48	240	19	13	10
WOOD AND SIMIL.	1A4b	0202	g	GJ	200	4	25	130	600	9000	150	143	135
WOOD AND SIMIL.	1A4c	0203	g	GJ	200	4	25	130	600	240	143	143	135

Most country specific emission factors refers to:

- Danish legislation
- Danish research reports
- Calculations based on plant specific emissions from a considerable number of power plants
- Calculations based on plant specific emissions from a considerable number of municipal waste incineration plants

References for each area source emission factor are given in Appendix 5.

SO_2 and NO_x emissions from large point sources are often plant specific because they are based on emission measurements. Emissions of CO, NMVOC, PM and metals are also plant specific for some plants.

If emissions are not stated in annual environmental reports or other plant specific reports, the general area source emission factor is used. For power plants and municipal waste incineration plants emission factors used for large point sources and for area sources of the same sector are not always the same. The emission factors used only for large point sources are shown in appendix 5.

Some of the area source emission factors for power plants and municipal waste CHP plants take into account, that the large plants are included in the inventory as large point sources with plant specific emission data. Thus the area source emission factors are default values assuming that the remaining fuel consumption is combusted in smaller units with less effective flue gas cleaning. The area source emission factors are therefore not necessarily average values for these plant categories. To get a set of emission factors that expresses the average emission for power plants and municipal waste incineration CHP plants respectively implied emission factors have been calculated as total emission divided by total fuel consumption. These implied emission factors are shown in appendix 6.

The CO_2 emission from the plastic part of municipal waste incineration is included in the Danish Climate Convention emission inventory. The CO_2 emission from incineration of municipal waste is split in 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, that is reported as a memo item. The calculation of the two CO_2 emission factors is shown in appendix 7.

5 Fuel consumption data

In 2001 the total fuel consumption for stationary combustion plants was 561 PJ of which 490 PJ was fossil fuels. The fuel consumption rates are shown in Appendix 4.

Fuel consumption of the stationary combustion subsectors is shown in Figure 1 and Figure 2. The main part – 60% - of the fuels is combusted in the sector *Public electricity and heat production.* Other sectors with high fuel consumption are *Residential plants* and *Manufacturing industries and construction*.

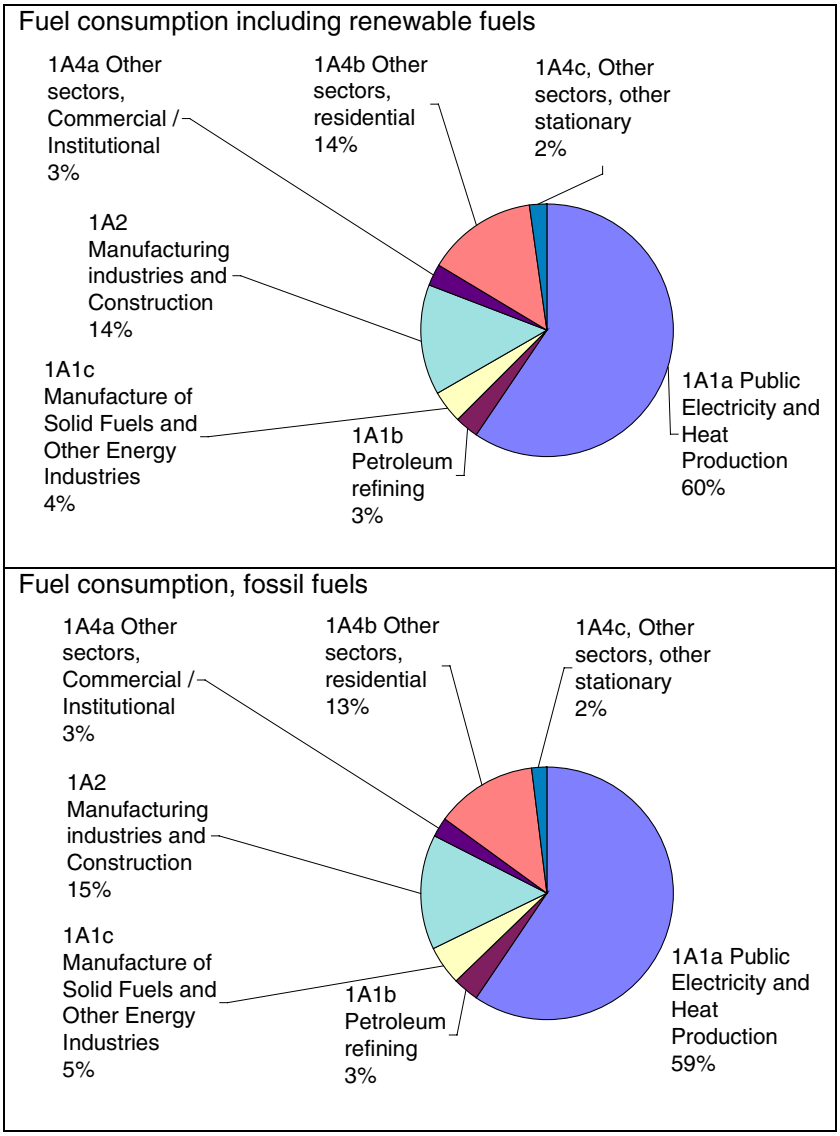

Figure 1 Fuel consumption rate of stationary combustion, 2001 (based on DEA 2002a)

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 CHP plants as well as in industry, district heating and households.

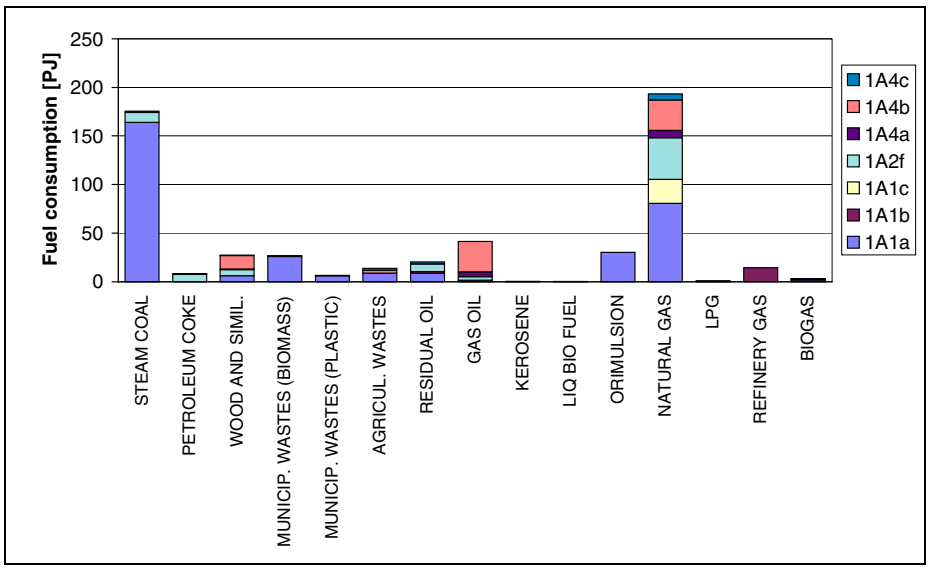

Figure 2 Fuel consumption of stationary combustion plants 2001 (based on DEA 2002a)

Fuel consumption time series for stationary combustion plants are shown in Figure 3. The total fuel consumption has increased by 12% from 1990 to 2001, while the fossil fuel consumption has only increased by 6%. The fuel consumption rate fluctuates considerably due to electricity import/export and due to outdoor temperature variations. The consumption of natural gas and renewable fuels has increased since 1990 whereas coal consumption has decreased.

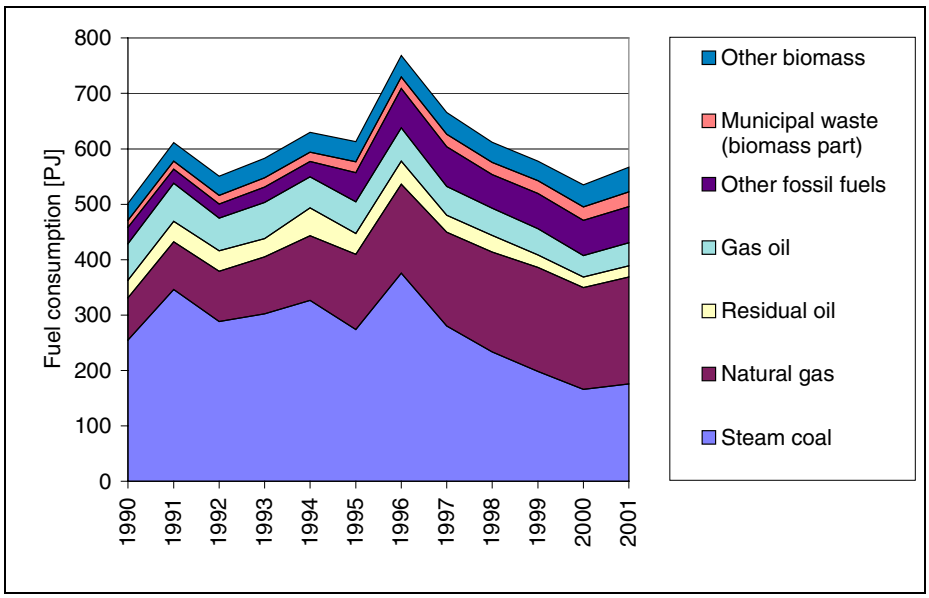

Figure 3 Fuel consumption time series, stationary combustion (based on DEA 2002a)

6 Greenhouse gas emission

The total Danish greenhouse gas (GHG) emission in the year 2001 was 69410 Gg CO_2 equivalent not including land-use change and forestry or 65879 Gg CO_2 equivalent including land-use change and forestry. The greenhouse gas pollutants HFCs, PFCs and SF_6 are not emitted from combustion plants and thus only the pollutants CO_2, CH_4 and N_2O are considered below.

The global warming potential of the non-CO_2 greenhouse gases is determined by IPCC. The global warming potentials of CH_4 and N_2O are:

- 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 shown in Table 10. The emission from stationary combustion accounts for 55% of the total Danish GHG emission.

The CO_2 emission from stationary combustion plants accounts for 68% of the total Danish CO_2 emission (gross). CH_4 accounts for 10% of the total Danish CH_4 emission and N_2O for only 4% of the total Danish N_2O emission.

Table 10 Greenhouse gas emission for the year 2001

	CO_2	CH_4	N_2O
	Gg CO_2 equivalent		
1A1 Fuel consumption, Energy industries	26375	384	280
1A2 Fuel consumption, Manufac-turing Industries and Construction[1)]	5029	35	46
1A4 Fuel consumption, Other sectors [1)]	5645	160	65
Total emission from stationary combustion plants	**37049**	**580**	**391**
Total Danish emission (gross)	54355	5606	8749
		%	
Emission share for stationary combustion	68	10	4

1) Only stationary combustion sources of the sector is included

CO_2 is the most important GHG pollutant and accounts for 97% of the GHG emission (CO_2 eq.). This is a much higher share than for the total Danish GHG emissions where CO_2 only accounts for 79% of the GHG emission (CO_2 eq.).

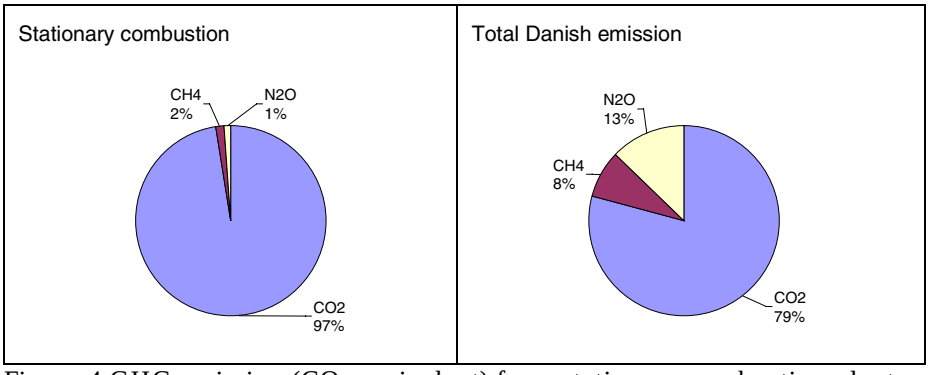

Figure 4 GHG emission (CO_2 equivalent) from stationary combustion plants and from all sources respectively. Importance of the pollutants

Figure 5 shows the time series of GHG emission (CO_2 eq.) from stationary combustion and it is seen that the GHG emission development follows the CO_2 emission development very close by. Both the CO_2 and the total GHG emission have decreased a little from 1990 to 2001, CO_2 by 2,7% and GHG by 1,5%. However fluctuations of the GHG emission level are large.

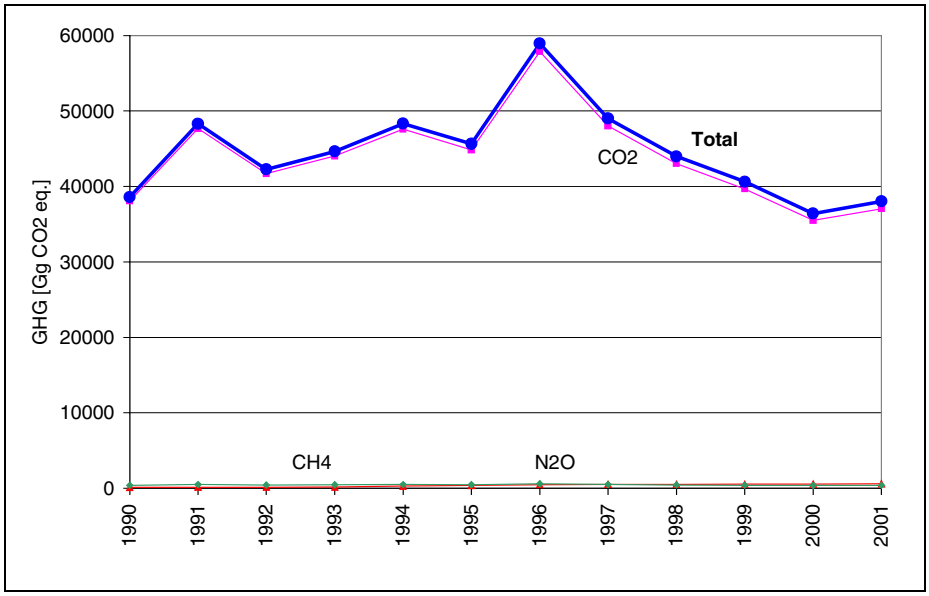

Figure 5 GHG emission time series for stationary combustion

The fluctuations in the time series are a result of electricity import/export and of outdoor temperature variations between years. These fluctuations are shown in Figure 6. In 1990 the Danish electricity import was large causing relatively low emissions, whereas the emissions are high in 1996 due to a large electricity export. In 2001 the electricity export was small.

To be able to follow the national energy consumption and for statistical and reporting purposes the Danish Energy Authority produces a correction of the actual emissions without random variations in electricity imports/exports and in ambient temperature. This emission trend is also shown in Figure 6. The corrections are further discussed in Illerup et al. (2003a) and the basis for the adjustment is shown in appendix 13. The corrected GHG emission for stationary combustion plants has decreased by 19% since 1990, the CO_2 emission by 20%.

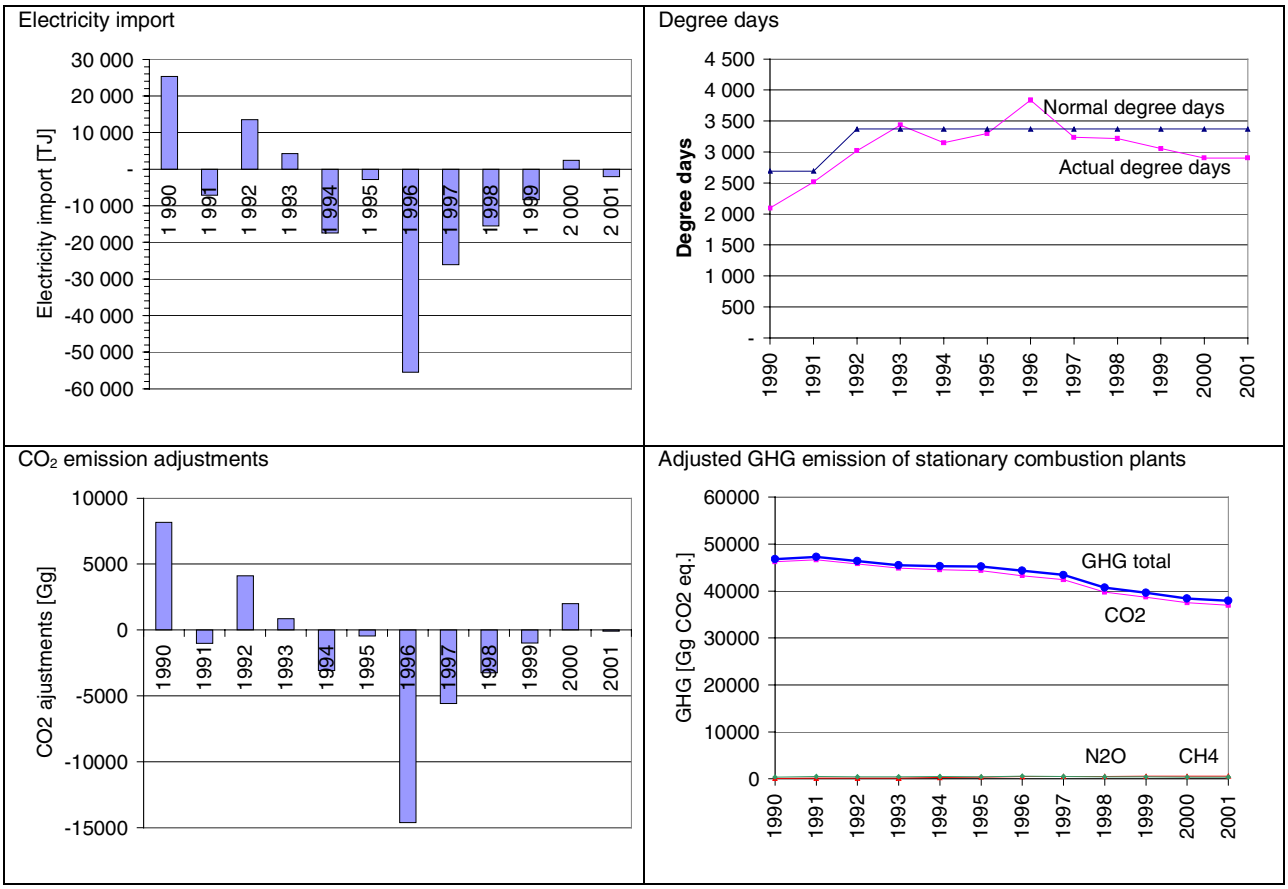

Figure 6 GHG emission time series for stationary combustion, adjusted for electricity import/export and temperature variations (DEA 2002b)

6.1 CO_2

The 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 68% of the total Danish CO_2 emission. Table 11 shows the CO_2 emission inventory for stationary combustion plants for 2001. Figure 7 shows that *Electricity and heat production* accounts for 64% of the CO_2 emission from stationary combustion. This share is somewhat higher than the fossil fuel consumption share of this sector, which is 59% (Figure 1). Other large CO_2 emission sources are industrial plants and residential plants. These are the sectors that also account for a considerable share of the fuel consumption.

Table 11 CO_2 emission from stationary combustion plants 2001

CO_2	2001	
1A1a Electricity and heat production	24022	Gg
1A1b Petroleum refining	943	Gg
1A1c Manufacture of solid fuels and other energy industries	1410	Gg
1A2a Industry-Iron and steel	0	Gg
1A2b Industry-Non-ferrous metals	0	Gg
1A2f Industry-Other [1)]	5029	Gg
1A4a Other stationary (including military)	821	Gg
1A4b i Other Sectors-Residential, Residential plants	4200	Gg
1A4c i Other Sectors-Agriculture/Forestry/Fishing, Stationary	625	Gg
Total	37049	Gg

1) Only emission from stationary combustion plants included

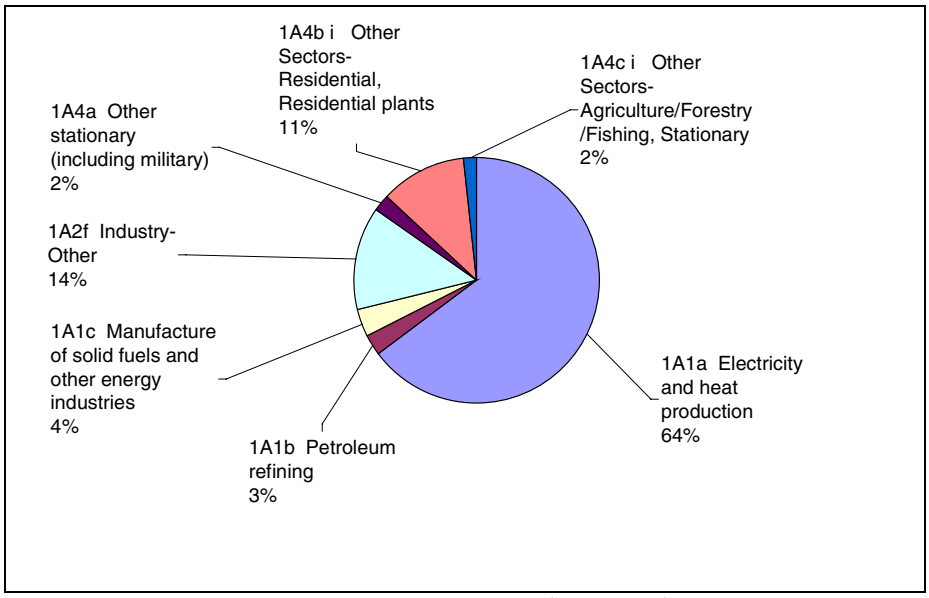

Figure 7 CO_2 emission sources, stationary combustion plants, 2001

The sector *Electricity and heat production* consists of the SNAP source sectors: *Public power* and *District heating*. The CO_2 emissions from each of these subsectors are shown in Table 12. The most important subsector is centralised power plants.

Table 12 CO_2 emission from subsectors to *1A1a Electricity and heat production*

SNAP source	SNAP name	2001	
0101	Public power	1	Gg
010101	Combustion plants ≥ 300MW (boilers)	19220	Gg
010102	Combustion plants ≥ 50MW and < 300 MW (boilers)	1085	Gg
010103	Combustion plants <50 MW (boilers)	219	Gg
010104	Gas turbines	1572	Gg
010105	Stationary engines	1629	Gg
0102	District heating plants		Gg
010201	Combustion plants ≥ 300MW (boilers)		Gg
010202	Combustion plants ≥ 50MW and < 300 MW (boilers)	85	Gg
010203	Combustion plants <50 MW (boilers)	219	Gg
010204	Gas turbines		Gg
010205	Stationary engines		Gg

In Figure 8 the fuel consumption share (fossil fuels) of stationary combustion is compared with the CO_2 emission disaggregated to fuel origin. Due to the higher CO_2 emission factor of coal than oil and gas the CO_2 emission share from coal combustion is higher than the fuel consumption share. Coal accounts for 36% of the fossil fuel consumption and for 45% of the CO_2 emission. Natural gas accounts for 40% of the fossil fuel consumption but only for 30% of the CO_2 emission.

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 2001 the CO_2 emission from biomass combustion was 7679 Gg.

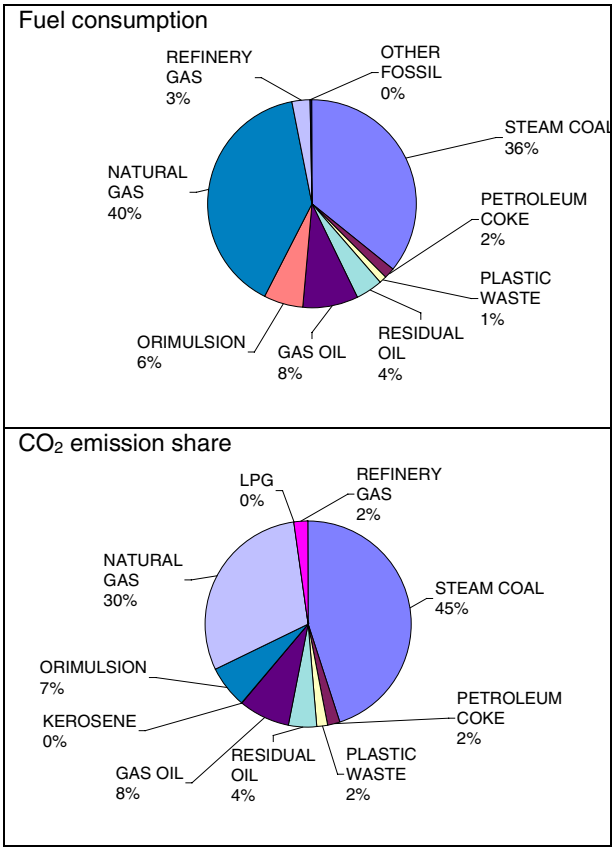

Figure 8 CO_2 emission, fuel origin

Time series for CO_2 emission are shown in Figure 9. Despite an increase in fuel consumption at 12% since 1990 CO_2 emission from stationary combustion has decreased by 2,7% because of the change of fuel type used. Figure 10 compares time series for fossil fuel consumption and CO_2 emission. As mentioned above the consumption of coal has decreased whereas the consumption of natural gas, that has a lower CO_2 emission factor, has increased. The total use of fossil fuels increased by 6% between 1990 and 2001.

The fluctuations of CO_2 emission follow the fluctuations of CO_2 emission from *Electricity and heat production* in Figure 9. The fluctuations are also seen in the coal consumption in Figure 10 and is a result of electricity import/export as discussed in chapter 6.

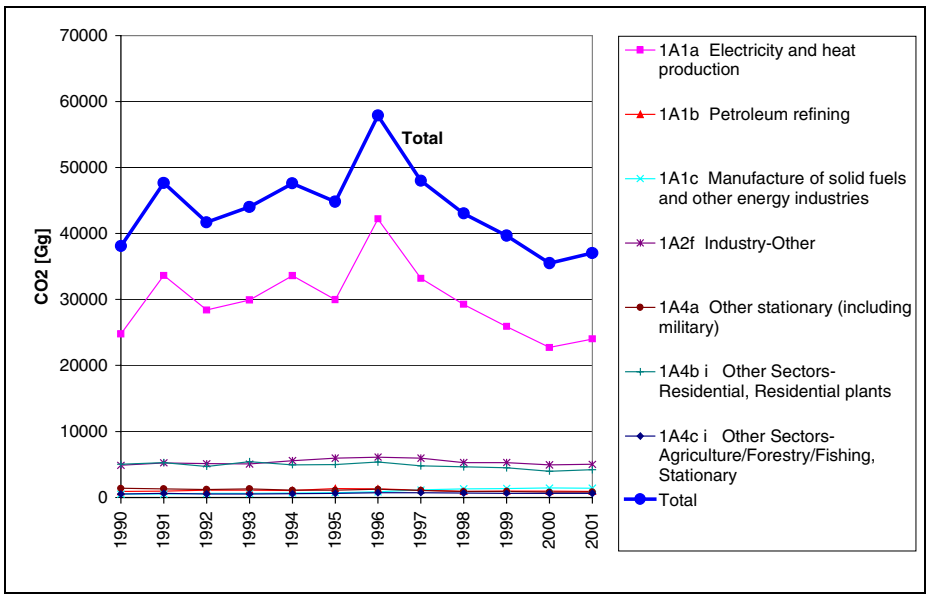

Figure 9 CO_2 emission time series for stationary combustion plants

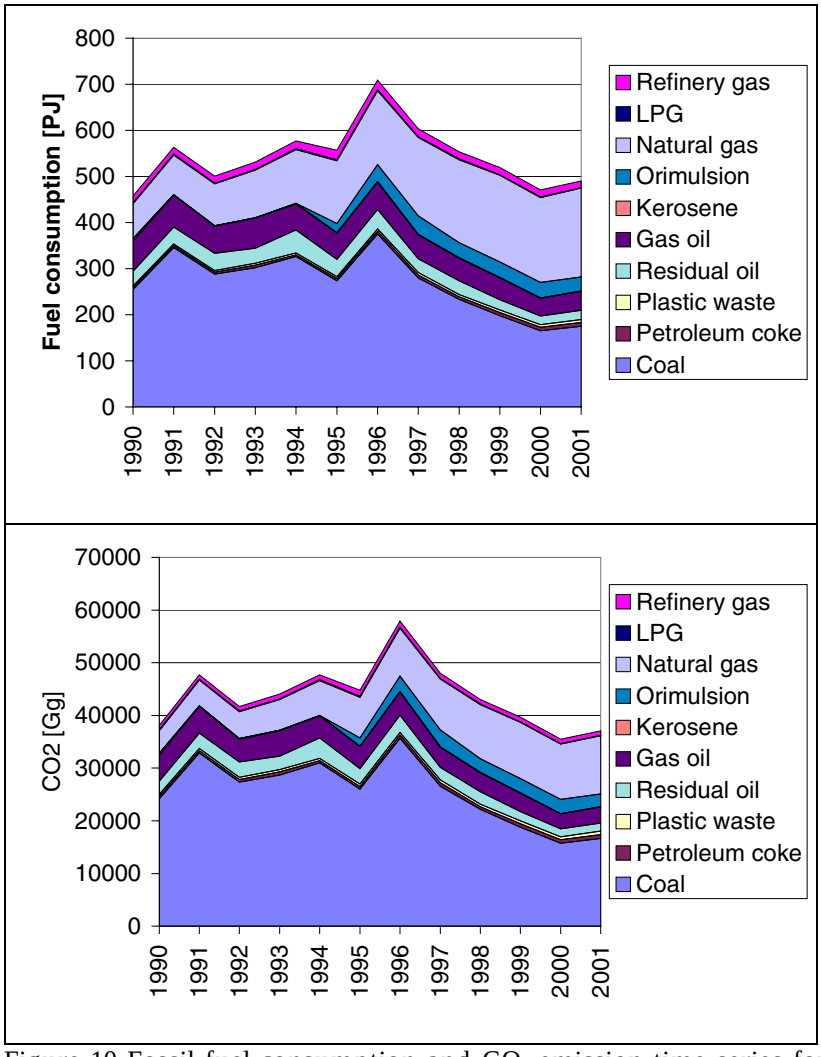

Figure 10 Fossil fuel consumption and CO_2 emission time series for stationary combustion

6.1.1 Reference approach

In addition to the sector specific CO_2 emission inventories (the national approach) the CO_2 emission is also estimated using the reference approach de-

scribed in the IPCC Reference Manual (IPCC 1996). 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 originates from the annual "basic data" table prepared by the Danish Energy Authority and published on their home page (DEA 2002b). 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 1996). The country specific emission factors are not used in the reference approach because it is used for verification.

As mentioned the Climate Convention reporting tables include a comparison of the national approach and the reference approach estimates for verification reasons. To make results comparable, the CO_2 emission from the plastic part of municipal waste incineration is added in the reference approach. Further consumption for non-energy purposes (10,63 PJ) is subtracted in the reference approach, because non-energy use of fuels is not included in the Danish national approach yet.

In 2001 fuel consumption rates of the two approaches differ 1,19% and the CO_2 emission differ 0,94%. In 1990-2001 the fuel consumption difference is within 1,91% and the CO_2 emission difference is within 1,69%. According to the IPCC Good Practice Guidance (IPCC 2000) the difference should be within 2%. The reference approach for 2001 and the comparison with the Danish national approach are shown in appendix 14. The appendix also includes a correspondence list for the fuel categories (Danish Energy Authority / IPCC reference approach).

6.2 CH_4

The CH_4 emission from stationary combustion plants accounts for 10% of the total Danish CH_4 emission. Table 13 shows the CH_4 emission inventory for stationary combustion plants in 2001. Figure 11 shows that *Electricity and heat production* accounts for 65% of the CH_4 emission from stationary combustion and this is close to the fuel consumption share.

Table 13 CH_4 emission from stationary combustion plants 2001

CH_4	2001	
1A1a Electricity and heat production	18123	Mg
1A1b Petroleum refining	1	Mg
1A1c Manufacture of solid fuels and other energy industries	166	Mg
1A2a Industry-Iron and steel	0	Mg
1A2b Industry-Non-ferrous metals	0	Mg
1A2f Industry-Other [1)]	1689	Mg
1A4a Other stationary (including military)	996	Mg
1A4b i Other Sectors-Residential, Residential plants	4464	Mg
1A4c i Other Sectors-Agriculture/Forestry/Fishing, Stationary	2160	Mg
Total	27598	Mg

1) Only emission from stationary combustion plants included

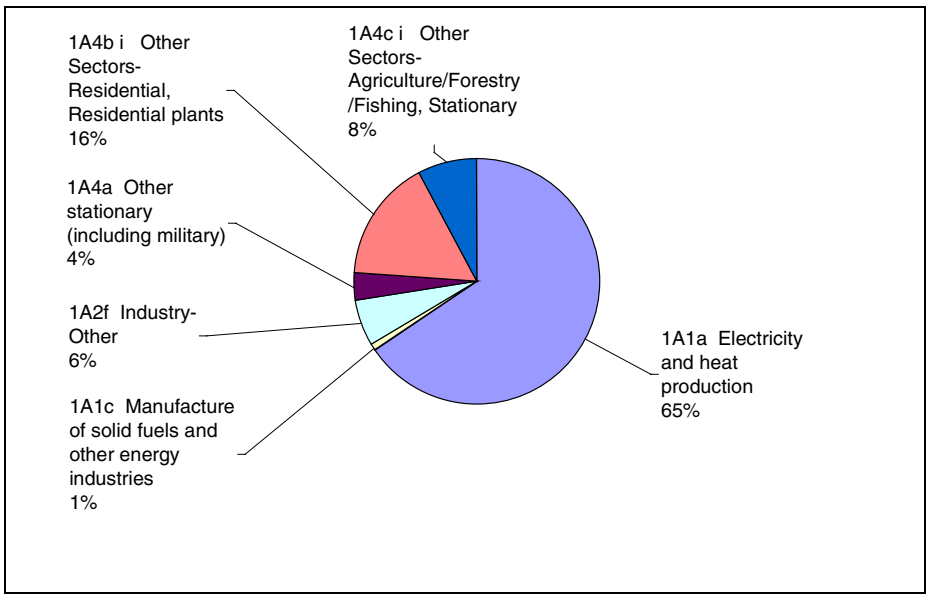

Figure 11 CH_4 emission sources, stationary combustion plants, 2001

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. Especially lean-burn gas engines have a high emission factor. A considerable number of lean-burn gas engines are in operation in Denmark and these plants accounts for 76% of the CH_4 emission from stationary combustion plants (Figure 12). The engines are installed in CHP plants and the fuel used is either natural gas or biogas.

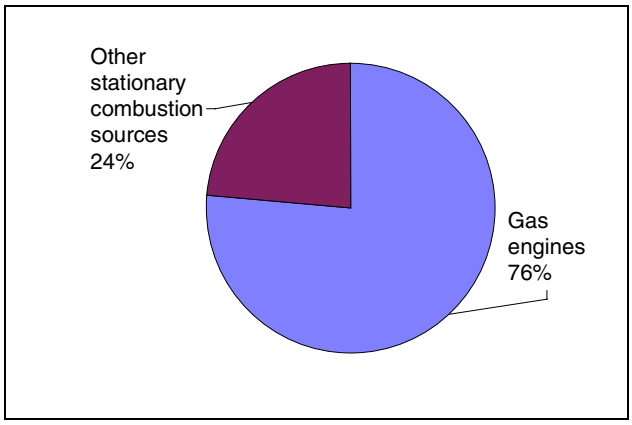

Figure 12 Gas engine CH_4 emission share, 2001

The CH_4 emission from stationary combustion increased by a factor 5 since 1990 (Figure 13). This is a result of the considerable number of lean-burn gas engines that was installed in CHP plants in Denmark in this period. Figure 14 shows time series for the fuel consumption rate in gas engines and the corresponding increase of CH_4 emission.

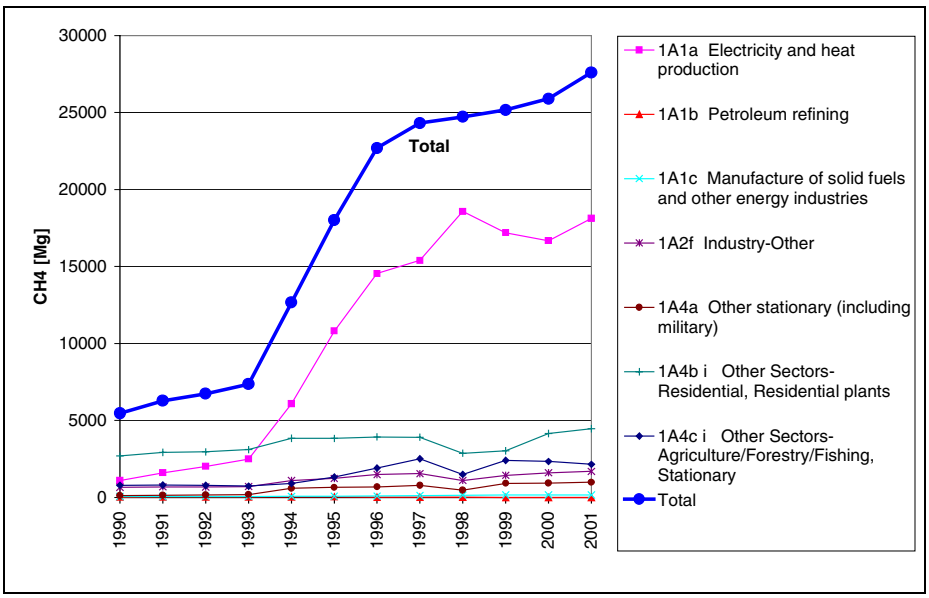

Figure 13 CH_4 emission time series for stationary combustion plants

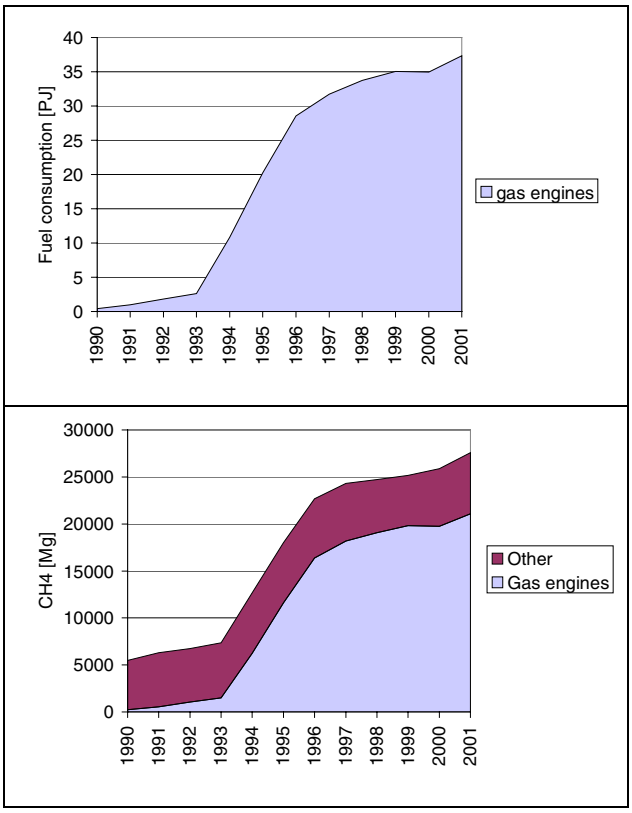

Figure 14 Fuel consumption and CH_4 emission from gas engines, time series

6.3 N_2O

The N_2O emission from stationary combustion plants accounts for 4% of the total Danish N_2O emission. Table 14 shows the N_2O emission inventory for stationary combustion plants in the year 2001. Figure 15 shows that *Electricity and heat production* accounts for 66% of the N_2O emission from stationary combustion. This is only a little higher than the fuel consumption share.

Table 14 N_2O emission from stationary combustion plants 2001

N_2O	2001	
1A1a Electricity and heat production	846	Mg
1A1b Petroleum refining	32	Mg
1A1c Manufacture of solid fuels and other energy industries	25	Mg
1A2a Industry-Iron and steel	0	Mg
1A2b Industry-Non-ferrous metals	0	Mg
1A2f Industry-Other [1)]	148	Mg
1A4a Other stationary (including military)	23	Mg
1A4b i Other Sectors-Residential, Residential plants	165	Mg
1A4c i Other Sectors-Agriculture/Forestry/Fishing, Stationary	23	Mg
Total	1261	Mg

1) Only emission from stationary combustion plants included

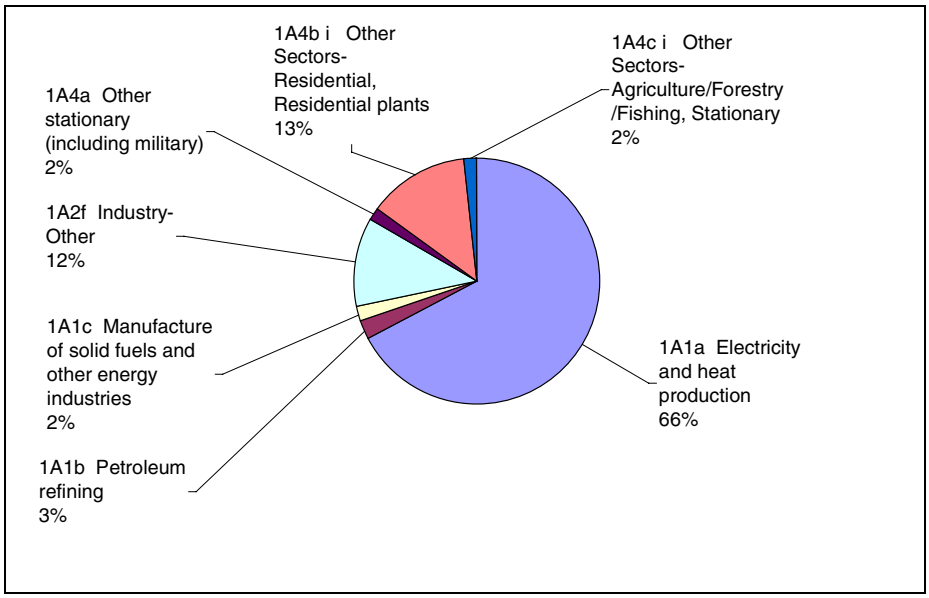

Figure 15 N_2O emission sources, stationary combustion plants, 2001

Figure 16 shows time series for N_2O emission. The N_2O emission from stationary combustion decreased 1,4% from 1990 to 2001, but again fluctuations of emission level are considerable.

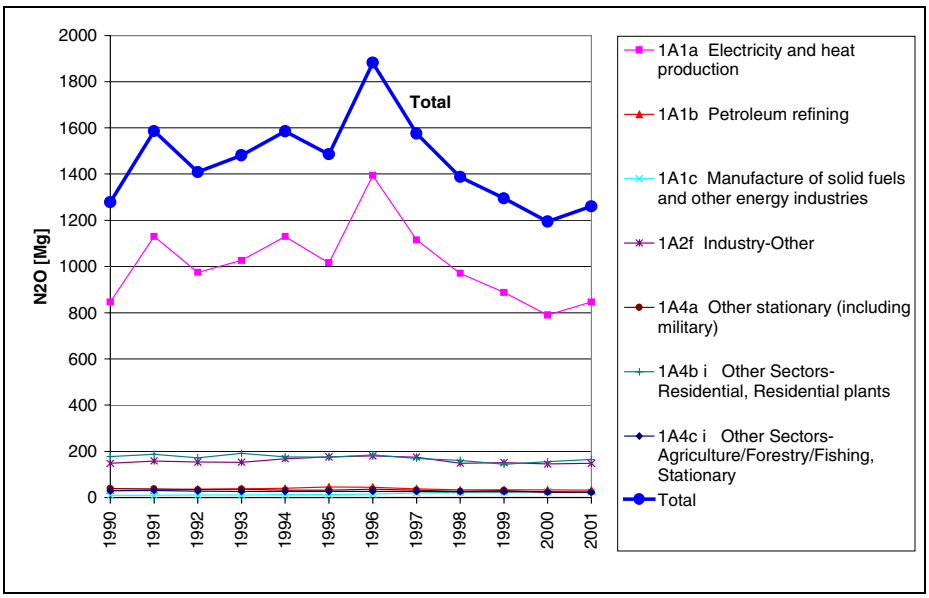

Figure 16 N_2O emission time series for stationary combustion plants

7 SO_2, NO_x, NMVOC and CO

The emissions of SO_2, NO_x, NMVOC and CO from Danish stationary combustion plants 2001 are shown in Table 15. The emission of these pollutants is reported to the LRTAP Convention, and the pollutants are also included in the reporting to the Climate Convention.

SO_2 from stationary combustion plants accounts for 85% of the total Danish emission. NO_x, CO and NMVOC account for 35%, 28% and 16% of the total Danish emissions respectively.

Table 15 The emission for the year 2001 reported to the LRTAP Convention in 2003

Pollutant	NO_x Gg	CO Gg	NMVOC Gg	SO_2 Gg
1A1 Fuel consumption, Energy industries	48,9	12,1	6,1	11,1
1A2 Fuel consumption, Manufacturing Industries and Construction (Stationary combustion)	14,5	6,1	0,8	7,1
1A4 Fuel consumption, Other sectors (Stationary combustion)	7,7	143,2	13,0	3,2
Total emission from stationary combustion plants	**71,1**	**161,4**	**19,9**	**21,4**
Total Danish emission (gross)	204	587	124	25,3
		%		
Emission share for stationary combustion	34,9	27,5	16,1	84,5

7.1 SO_2

Stationary combustion is the most important emission source for SO_2 accounting for 85% of the total Danish emission. Table 16 and Figure 17 show the SO_2 emission inventory for the stationary combustion subsectors. *Electricity and heat production* is the largest emission source (50%), but note that the SO_2 emission share is somewhat smaller than the fuel consumption share of the sector which, is 60%. This is possible due to the effective flue gas desulphurization plants installed in power plants combusting coal.

Figure 18 shows the SO_2 emission from *Electricity and heat production* on a disaggregated level. Power plants >300MW_{th} is the main emission source accounting for 71% of the emission. The fuel consumption and fuel origin of the SO_2 emission for power plants <25MW_e are shown in Figure 19. Coal combustion is the main source of SO_2 emission whereas the emission from natural gas is negligible.

The SO_2 emission from *Industry* is 33%, which is a remarkably large emission compared with the fuel consumption share. The main emission sources in the industry sector are combustion of coal and residual oil, but also emissions from cement industry and from industrial combustion of petroleum coke are considerable emission sources. In previous years SO_2 emission from the industry sector only accounted for a small part of the total emission, but as a result of the reduced emissions from power plants the share has now increased. To improve knowledge of the emission from industrial combustion of coal and residual oil knowledge of flue gas cleaning technology used in the industry sector should be examined in the future.

Time series for SO_2 emission from stationary combustion are shown in Figure 20. SO_2 emission from stationary combustion plants has decreased by 95% from 1980 and 85% from 1995. The large emission decrease is mainly a result of the reduced emission from *Electricity and heat production* that have been possible due to installation of desulphurization plants and due to the use of fuels with lower content of sulphur. Despite the considerable reduction of emission from electricity and heat production plants, they still account for 50% of the total emission from stationary combustion as mentioned above. The emission from other sectors also decreased considerably since 1980.

Table 16 SO_2 emission from stationary combustion plants 2001

SO_2	2001	
1A1a Electricity and heat production	10464	Mg
1A1b Petroleum refining	667	Mg
1A1c Manufacture of solid fuels and other energy industries	8	Mg
1A2a Industry-Iron and steel	0	Mg
1A2b Industry-Non-ferrous metals	0	Mg
1A2f Industry-Other	7115	Mg
1A4a Other stationary (including military)	251	Mg
1A4b i Other Sectors-Residential, Residential plants	1563	Mg
1A4c i Other Sectors-Agriculture/Forestry/Fishing, Stationary	1346	Mg
Total	21415	Mg

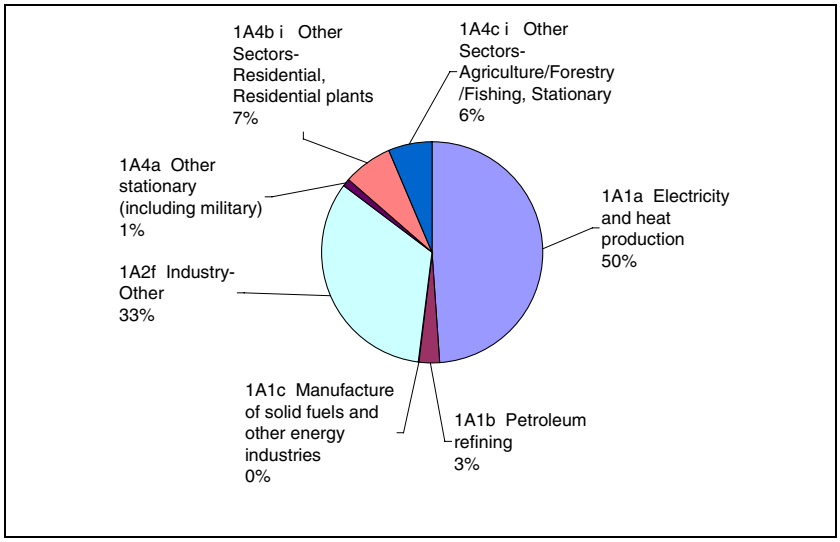

Figure 17 SO_2 emission contribution for stationary combustion

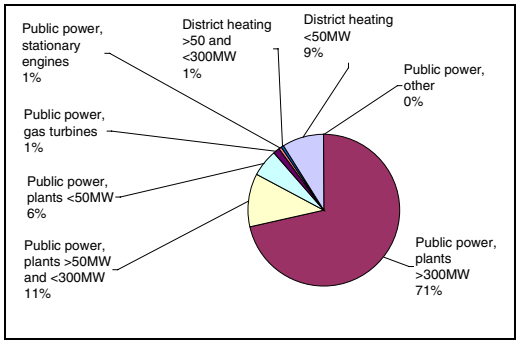

Figure 18 Disaggregated SO_2 emissions from *Energy and heat production*

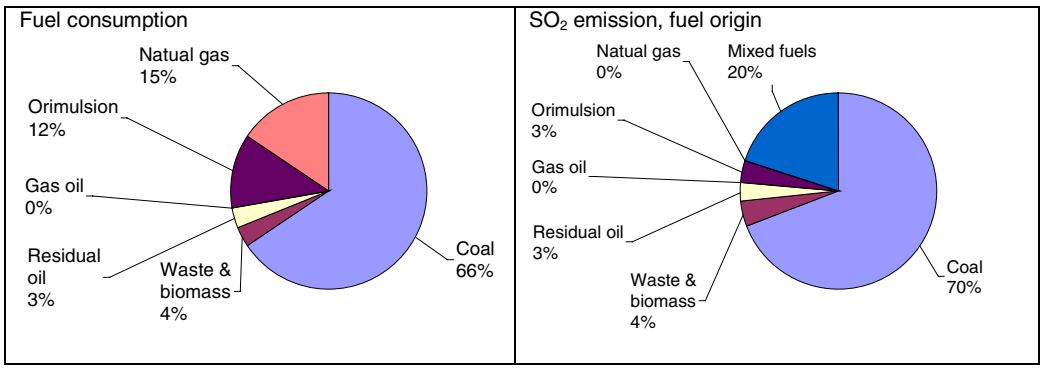

Figure 19 SO_2 emissions from power plants >25MW_e, fuel origin

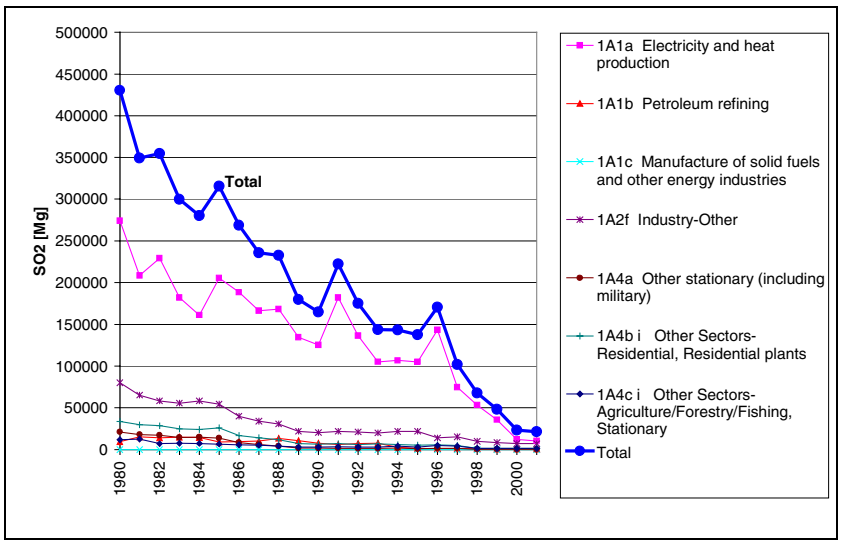

Figure 20 SO_2 emission time series for stationary combustion

7.2 NO_x

Stationary combustion accounts for 35% of the total Danish NO_x emission. Table 17 and Figure 21 show the NO_x emission inventory for stationary combustion subsectors. *Electricity and heat production* is the largest emission source accounting for 63% of the emission from stationary combustion plants. Power plants >50MW_{th} are the main emission source in this sector accounting for 68% of the emission.

Figure 22 shows fuel origin of the NO_x emission from power plants >25MW_e. The fuel origin is based on main fuel of each plant. Power plants combusting coal is the largest emission source accounting for a higher share than the fuel consumption share of coal in this plant category.

Industrial combustion plants are also an important emission source accounting for 20% of the emission. The main industrial emission source is cement production that accounts for 67% of the emission.

Residential plants accounts for 7% of the NO_x emission. The fuel origin of this emission is mainly wood, gas oil and natural gas accounting for 36%, 32% and 17% of the residential plant emission respectively.

Time series for NO_x emission from stationary combustion are shown in Figure 23. NO_x emission from stationary combustion plants has decreased by 51% from 1985 and 35% from 1995. 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 of the time series follow the fluctuations of *Electricity and heat production*, which is a result of fuel consumption fluctuations due to electricity import/export. The NO_x emission from industrial plants has increased but emissions from all other sectors have been reduced since 1985.

The increase of NO_x emission from the industry sector between 1995 and 1996 might be a result of insufficient data for NO_x emission from the cement industry in the years before 1996. Thus the indicated increase might not reflect the actual development of NO_x emission. Improvements of data are expected to be incorporated in the inventories reported in 2004.

Table 17 NO_x emission from stationary combustion plants 2001

	2001	
1A1a Electricity and heat production	44789	Mg
1A1b Petroleum refining	1620	Mg
1A1c Manufacture of solid fuels and other energy industries	2501	Mg
1A2a Industry-Iron and steel	0	Mg
1A2b Industry-Non-ferrous metals	0	Mg
1A2f Industry-Other	14517	Mg
1A4a Other stationary (including military)	1110	Mg
1A4b i Other Sectors-Residential, Residential plants	5153	Mg
1A4c i Other Sectors-Agriculture/Forestry/Fishing, Stationary	1398	Mg
Total	71088	Mg

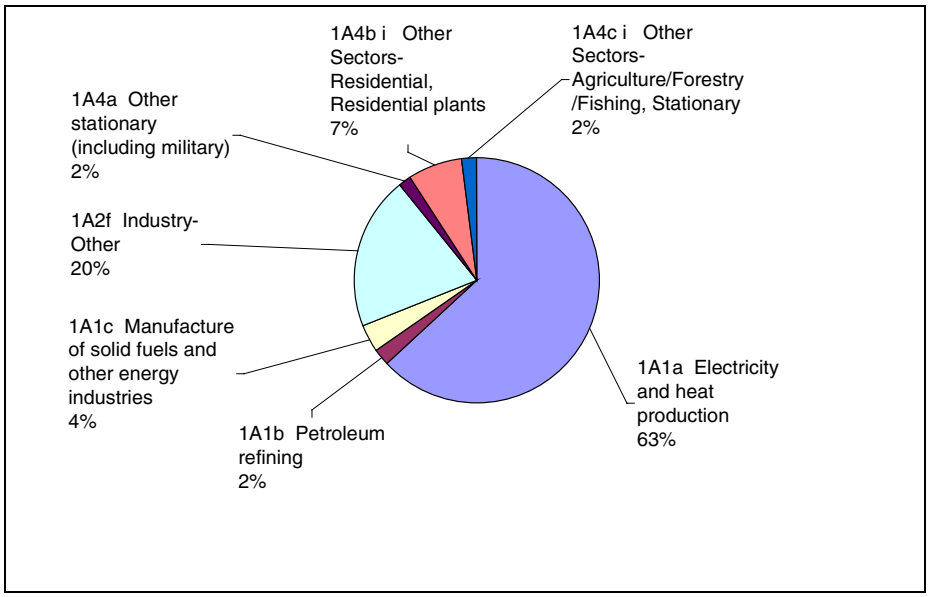

Figure 21 NO_x emission sources, stationary combustion plants, 2001

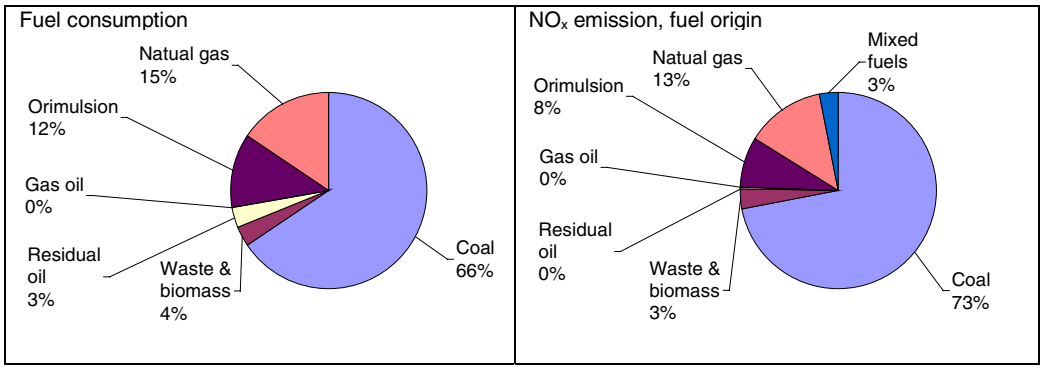

Figure 22 NO_x emissions from power plants >25MW_e, fuel origin

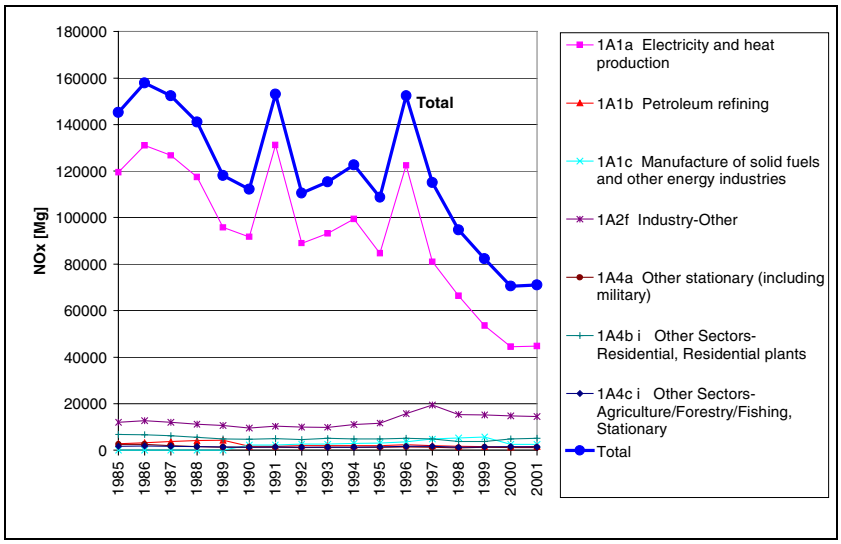

Figure 23 NO_x emission time series for stationary combustion

7.3 NMVOC

Stationary combustion plants account for 16% of the total Danish NMVOC emission. Table 18 and Figure 24 show the NMVOC emission inventory for the stationary combustion subsectors. Residential plants are the largest emission source accounting for 54% of the total emission from stationary combustion plants. The NMVOC emission from residential plants is mainly emitted from wood and straw combustion, see Figure 25.

Electricity and heat production is also a considerable emission source with 30% of the total emission from stationary combustion. Lean-burn gas engines have a relatively high NMVOC emission factor and the engines are the most important emission source (see Figure 25). The gas engines are either natural gas or biogas fuelled.

Time series for NMVOC emission from stationary combustion are shown in Figure 26. NMVOC emission from stationary combustion plants has increased by 82% from 1985 and 28% from 1995. The increased emission is mainly a result of the increased use of lean-burn gas engines in CHP plants as discussed in chapter 6.2.

The emission from residential plants is relatively constant, but the NMVOC emission from wood combustion almost doubled since 1990 due to increased wood consumption however this increase of emission corresponds to a de-

crease of emission from straw combustion in farmhouse boilers that have taken place at the same time.

The use of wood in residential boilers and stoves is relatively low in 1998-99 resulting in a dive of emission level for residential plants and total these years. The latest version of the energy statistics however moderates the fluctuation and thus the emission development from 1995 to 2001 is smoother than indicated in Figure 26. The sudden increase in emission from agriculture / forestry / fishing between 1989 and 1990 is a result of inconsistent emission factors for wood and straw combustion. The time series of emission factors will be improved in future inventories.

Table 18 NMVOC emission from stationary combustion plants 2001

	2001	
1A1a Electricity and heat production	6019	Mg
1A1b Petroleum refining	1	Mg
1A1c Manufacture of solid fuels and other energy industries	51	Mg
1A2a Industry-Iron and steel	0	Mg
1A2b Industry-Non-ferrous metals	0	Mg
1A2f Industry-Other	841	Mg
1A4a Other stationary (including military)	584	Mg
1A4b i Other Sectors-Residential, Residential plants	10655	Mg
1A4c i Other Sectors-Agriculture/Forestry/Fishing, Stationary	1781	Mg
Total	19932	Mg

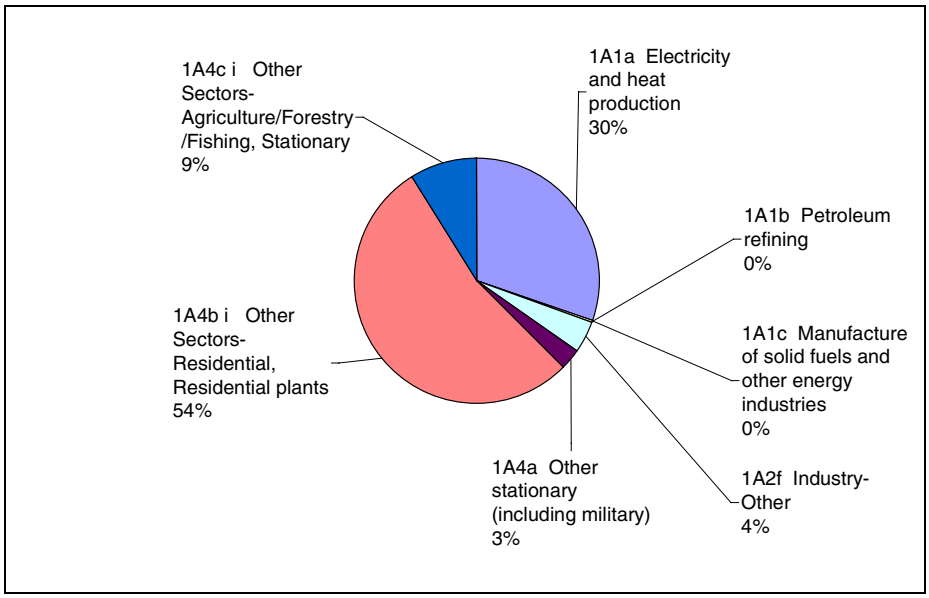

Figure 24 NMVOC emission sources, stationary combustion plants, 2001

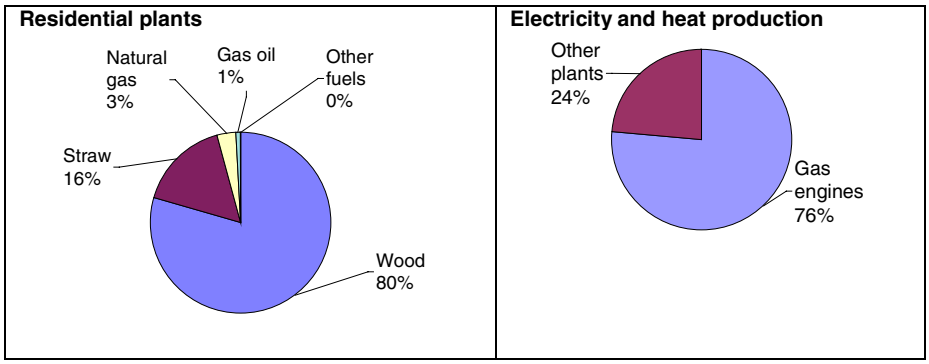

Figure 25 NMVOC emission from residential plants and from electricity and heat production, 2001

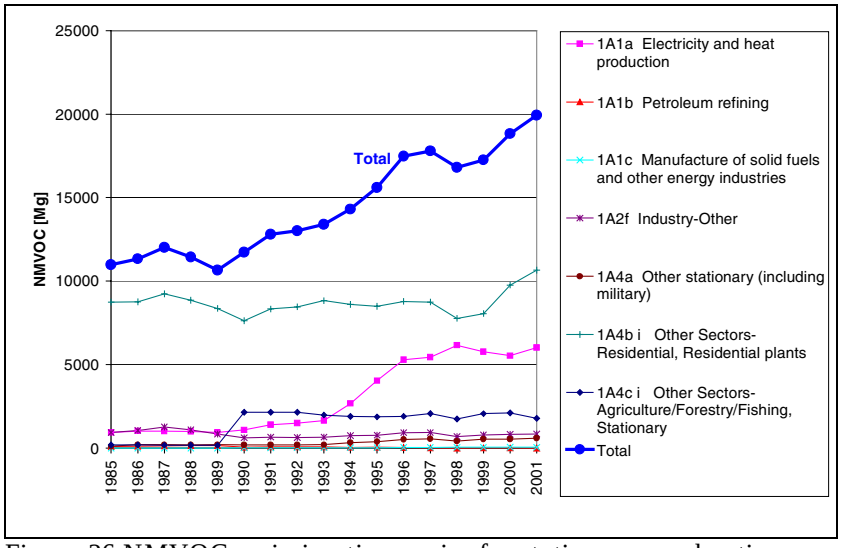

Figure 26 NMVOC emission time series for stationary combustion

7.4 CO

Stationary combustion accounts for 28% of the total Danish CO emission. Table 19 and Figure 27 show the CO emission inventory for stationary combustion subsectors. Residential plants are the largest emission source accounting for 87% of the emission.

Wood combustion accounts for 90% of the emission from residential plants, see Figure 28. This in spite of the fact that the fuel consumption share is only 17%. 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 is shown in Figure 29. The CO emission from stationary combustion plants has increased by 63% from 1985 and 19% from 1995. The time series for stationary combustion plants follow the time series for residential plants.

The wood consumption in residential plants has doubled from 1990 to 2001 causing an increase of the CO emission. The increase in CO from residential plants is less than the increase in wood consumption because CO emission from straw fired farmhouse boilers has decreased considerably. Both the an-

nual straw consumption and the CO emission factor for farmhouse boilers have decreased.

As mentioned in chapter 7.3 the energy statistics of wood consumption in residential plants have been revised and thus the dive of CO emission in 1998-99 is less pronounced than indicated in Figure 29.

Table 19 CO emission from stationary combustion plants 2001

	2001	
1A1a Electricity and heat production	11143	Mg
1A1b Petroleum refining	264	Mg
1A1c Manufacture of solid fuels and other energy industries	694	Mg
1A2a Industry-Iron and steel	0	Mg
1A2b Industry-Non-ferrous metals	0	Mg
1A2f Industry-Other	6140	Mg
1A4a Other stationary (including military)	824	Mg
1A4b i Other Sectors-Residential, Residential plants	141005	Mg
1A4c i Other Sectors-Agriculture/Forestry/Fishing, Stationary	1361	Mg
Total	161430	Mg

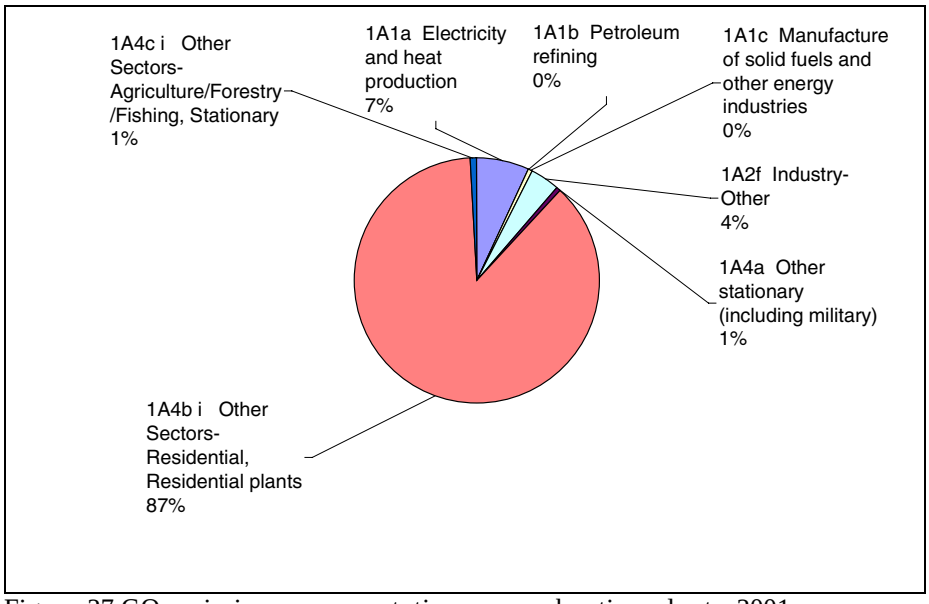

Figure 27 CO emission sources, stationary combustion plants, 2001

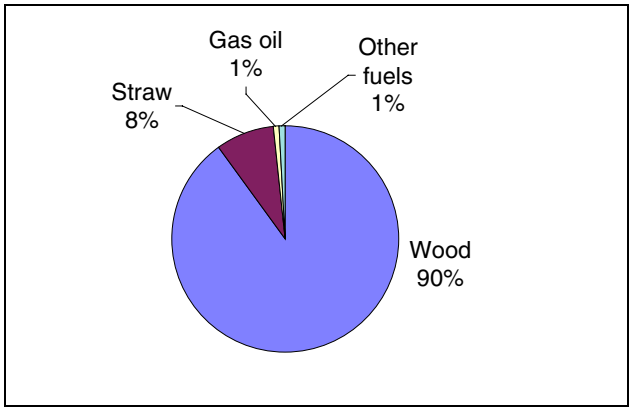

Figure 28 CO emission sources, residential plants, 2001

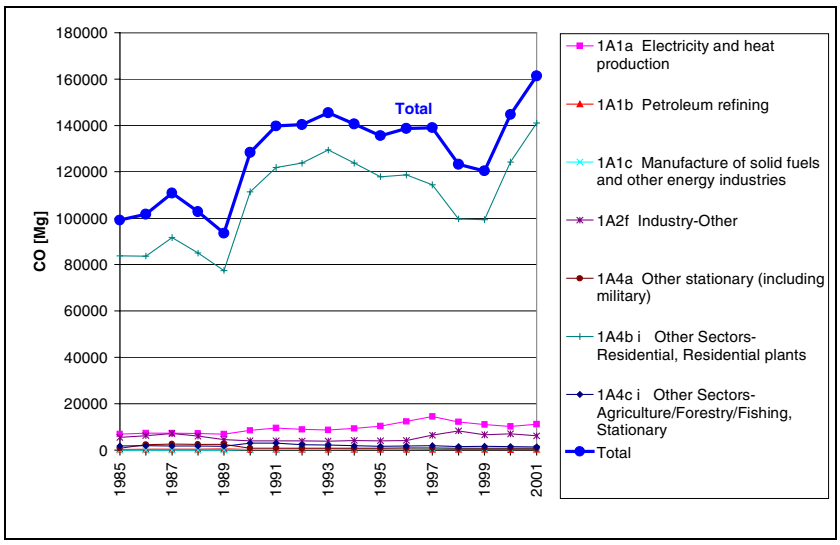

Figure 29 CO emission time series for stationary combustion

8 Particulate matter (PM)

The emission of TSP, PM_{10} and $PM_{2.5}$ from Danish stationary combustion plants 2001 is shown in Table 20. The PM emission is reported to the LRTAP Convention.

So far only PM emissions from stationary combustion, transport and agriculture have been included in the Danish inventory. TSP from stationary combustion accounts for 12% of the total Danish emission. The emission shares for PM_{10} and $PM_{2.5}$ are 23% and 31% respectively.

Table 20 Danish PM emissions 2001

Pollutant	TSP Mg	PM_{10} Mg	$PM_{2.5}$ Mg
1A1 Fuel consumption, Energy industries	1126	918	762
1A2 Fuel consumption, Manufacturing Industries and Construction (Stationary combustion)	933	636	444
1A4 Fuel consumption, Other sectors (Stationary combustion)	3240	3069	2888
Total emission from stationary combustion plants	**5300**	**4622**	**4094**
Total Danish emission (gross)	42873	20018	13173
		%	
Emission share for stationary combustion	12,4	23,1	31,1

Table 21 and Figure 30 show the PM emission inventory for the stationary combustion subsectors. Residential plants are the largest emission source accounting for 67% of the $PM_{2.5}$ emission from stationary combustion plants.

The primary sources of PM emission 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

Furthermore there are considerable emissions from:

- Residential boilers using gas oil
- Refineries

The PM emission from wood combusted in residential plants is the predominant source. Thus 40% of the $PM_{2.5}$ emission from stationary combustion is emitted from residential wood combustion. This corresponds to 13% of the overall Danish emission. A literature survey has shown that the uncertainty of the emission factors for residential combustion of wood in stoves and boilers is huge. In Figure 31 fuel consumption and $PM_{2.5}$ emission of residential plants is shown. Wood combustion accounts for almost 90% of the $PM_{2.5}$ emission from residential plants in spite of the limited wood consumption share.

Emission inventories for PM have only been reported for the years 2000-2001 and thus time series for PM emission are not shown. The emission level differ less than 2% between the years 2000 and 2001.

Table 21 PM emission from stationary combustion plants, 2001

	TSP	PM_{10}	$PM_{2.5}$	
1A1a Electricity and heat production	1113	906	752	Mg
1A1b Petroleum refining	11	9	8	Mg
1A1c Manufacture of solid fuels and other energy industries	3	3	3	Mg
1A2a Industry-Iron and steel	171	51	8	Mg
1A2b Industry-Non-ferrous metals	35	31	14	Mg
1A2f Industry-Other	727	553	421	Mg
1A4a Other stationary (including military)	142	139	131	Mg
1A4b i Other Sectors-Residential, Residential plants	2983	2839	2686	Mg
1A4c i Other Sectors-Agriculture/Forestry/Fishing, Stationary	115	91	72	Mg
Total	5300	4622	4094	Mg

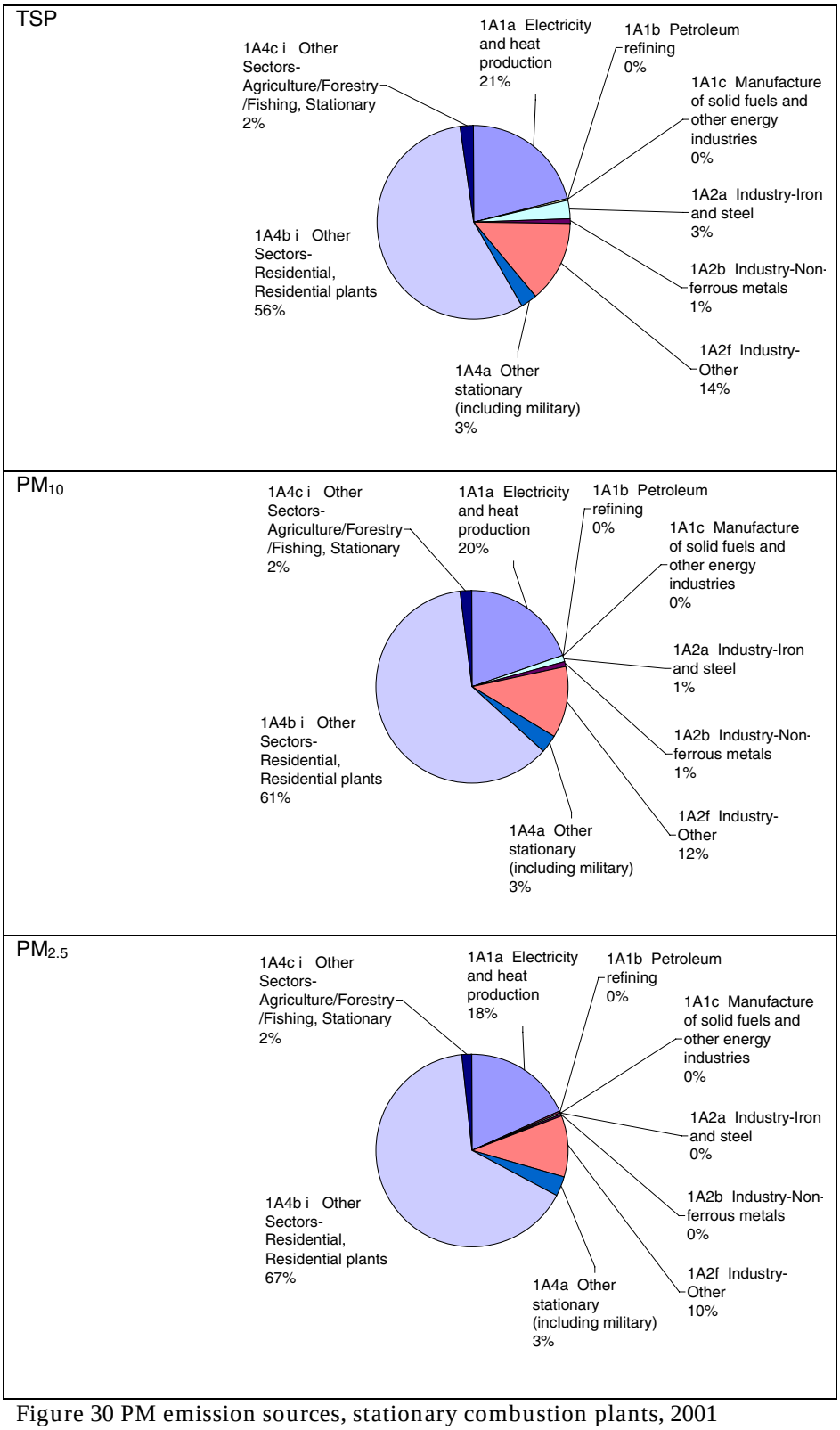

Figure 30 PM emission sources, stationary combustion plants, 2001

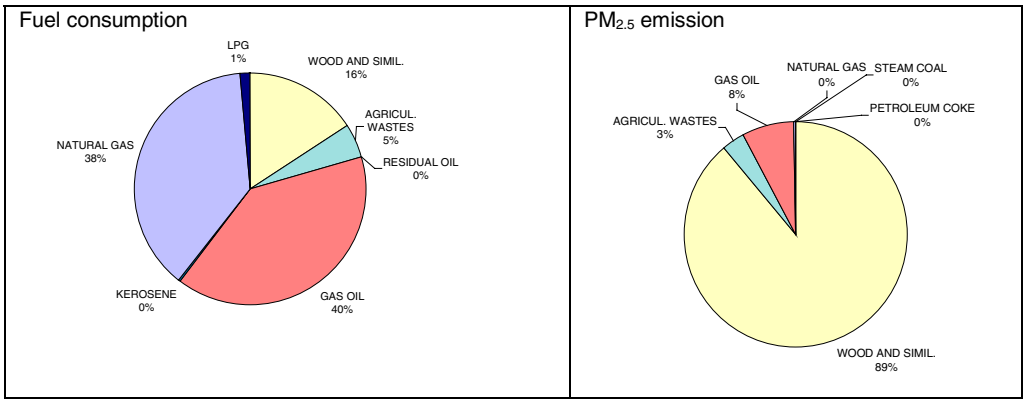

Figure 31 Fuel consumption and $PM_{2.5}$ emission from residential plants

9 Heavy metals

Emission inventories for 9 heavy metals are reported to the LRTAP Convention. Three of the metals are considered priority metals: Pb, Cd and Hg.

The emission inventories for heavy metals for the year 2001 are shown in Table 22. Stationary combustion plants are the most important emission sources for heavy metals. For Cu the emission share from stationary combustion plants is 19%, but for all other heavy metals the emission share is more than 70%, see Table 22.

Table 22 The emission of heavy metals in 2001, reported to the LRTAP Convention in 2003

Pollutant	Pb Mg	Cd Mg	Hg Mg	As Mg	Cr Mg	Cu Mg	Ni Mg	Se Mg	Zn Mg
1A1 Fuel consumption, Energy industries	2,40	0,35	1,50	0,38	1,28	1,23	4,56	0,59	13,51
1A2 Fuel consumption, Manufacturing Industries and Construction (Stationary combustion)	1,72	0,19	0,16	0,22	0,76	0,31	5,54	0,75	1,86
1A4 Fuel consumption, Other sectors (Stationary combustion)	0,35	0,15	0,20	0,08	0,11	0,19	1,25	0,19	2,56
Total emission from stationary combustion plants	**4,47**	**0,69**	**1,86**	**0,68**	**2,15**	**1,73**	**11,35**	**1,53**	**17,93**
Total Danish emission (gross)	6,06	0,72	1,87	0,71	2,38	9,26	12,8	1,63	23,1
					%				
Emission share for stationary combustion	73,8	95,5	99,5	95,8	90,3	18,7	88,8	93,7	77,5

Table 23 and Figure 32 show the heavy metal emission inventory for the stationary combustion subsectors. The sectors *Electricity and heat production* and *Industry* have the highest emission shares. *Electricity and heat production* accounts for 53%, 48% and 80% of the emission of the priority metals Pb, Cd and Hg respectively.

Table 24 shows the emission share for three important emission source categories: Power plants >25MW_e, municipal waste incineration plants and combustion of residual oil in industrial plants. In general municipal waste incineration accounts for the largest part of the heavy metal emission. However improved emission factors for power producing municipal waste incineration plants have been estimated in 2003 based on a considerable number of emission measurements (Nielsen & Illerup 2003). The emission factors applied so far turned out to be too high for most heavy metals and thus the emission from this plant category will decrease considerably in future inventories.

Glass works and gray iron foundries are large emission sources for Pb emission.

Table 23 Heavy metal emission from stationary combustion plants, 2001 [1)]

	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn	
1A1a Electricity and heat production	358	333	1220	1213	1485	3493	2356	569	13507	kg
1A1b Petroleum refining	24	23	56	22	7	1072	39	21	5	kg
1A1c Manufacture of solid fuels and other energy industries	0	0	0	0	0	0	0	0	0	kg
1A2a Industry-Iron and steel	26	12	94	0	0	111	617	429	429	kg
1A2b Industry-Non-ferrous metals	0	0	0	1	0	0	9	0	0	kg
1A2f Industry-Other	192	179	669	313	164	5432	1089	318	1429	kg
1A4a Other stationary (including military)	11	17	17	19	32	151	169	25	189	kg
1A4b i Other Sectors-Residential, Residential plants	38	105	33	137	153	40	134	148	2314	kg
1A4c i Other Sectors-Agriculture/Forestry/Fishing, Stationary	27	25	59	29	24	1067	53	21	61	kg
Total	675	694	2148	1734	1865	11368	4465	1530	17933	kg

1. Improved emission factors for decentralised CHP plants have been estimated in 2003. These improved emission factors will change the estimated total heavy metal emissions considerably

Table 24 Heavy metal emission share for three plant categories

Pollutant	Emission share of plant category, 2001		
	Municipal waste incineration, 2001 [2)]	Power plants >25MW$_{e}$, 2001 [1)]	Residual oil combusted in industrial boilers
As	27	20	16
Cd	37	9	15
Cr	42	19	12
Cu	53	21	6
Hg	61	27	2
Ni	13	13	42
Pb	44	8	4
Se	0	33	6
Zn	62	18	0

1) Includes some waste incineration plants
2) Improved emission factors for municipal waste incineration (CHP) will change the estimated emission considerably in future inventories

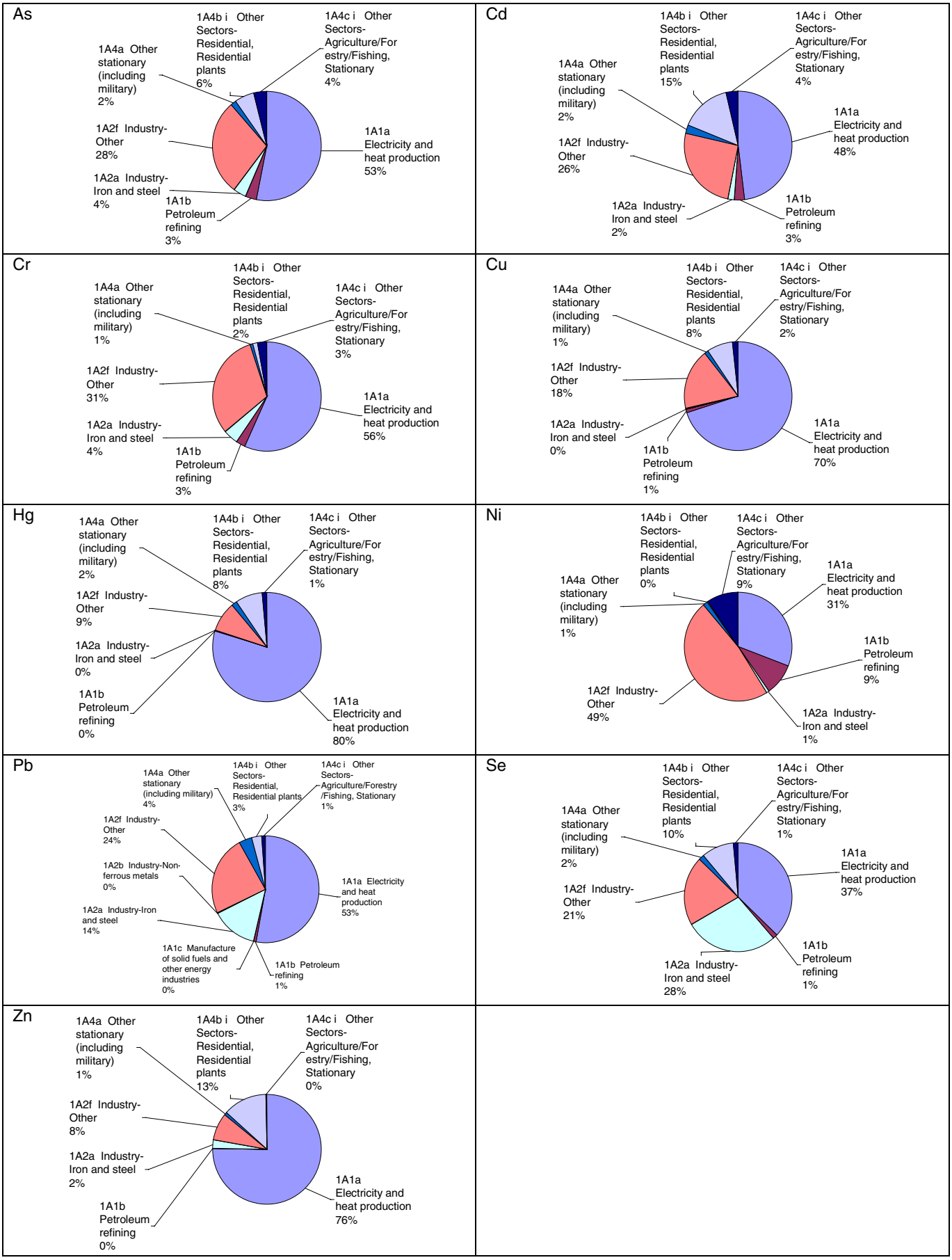

Figure 32 Heavy metal emission sources, stationary combustion plants, 2001

Time series for heavy metal emissions are shown in Figure 33. Time series are only shown for total emission from stationary combustion and for the two most important sectors: *Electricity and heat production* and *Industry-other*. The heavy metal emissions have decreased considerably since 1990. Table 25 shows the decrease of each heavy metal since 1990. The emissions have decreased despite of the increased incineration of municipal waste. This has been possible due to the increased use of gas cleaning devices at waste incineration plants and also at the large power plants, which is another important emission source.

The 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 might have been overestimated for 1994.

Table 25 Decrease of heavy metal emission 1990-2001

Pollutant	Decrease since 1990
As	54%
Cd	36%
Cr	66%
Cu	54%
Hg	40%
Ni	50%
Pb	72%
Se	64%
Zn	10%

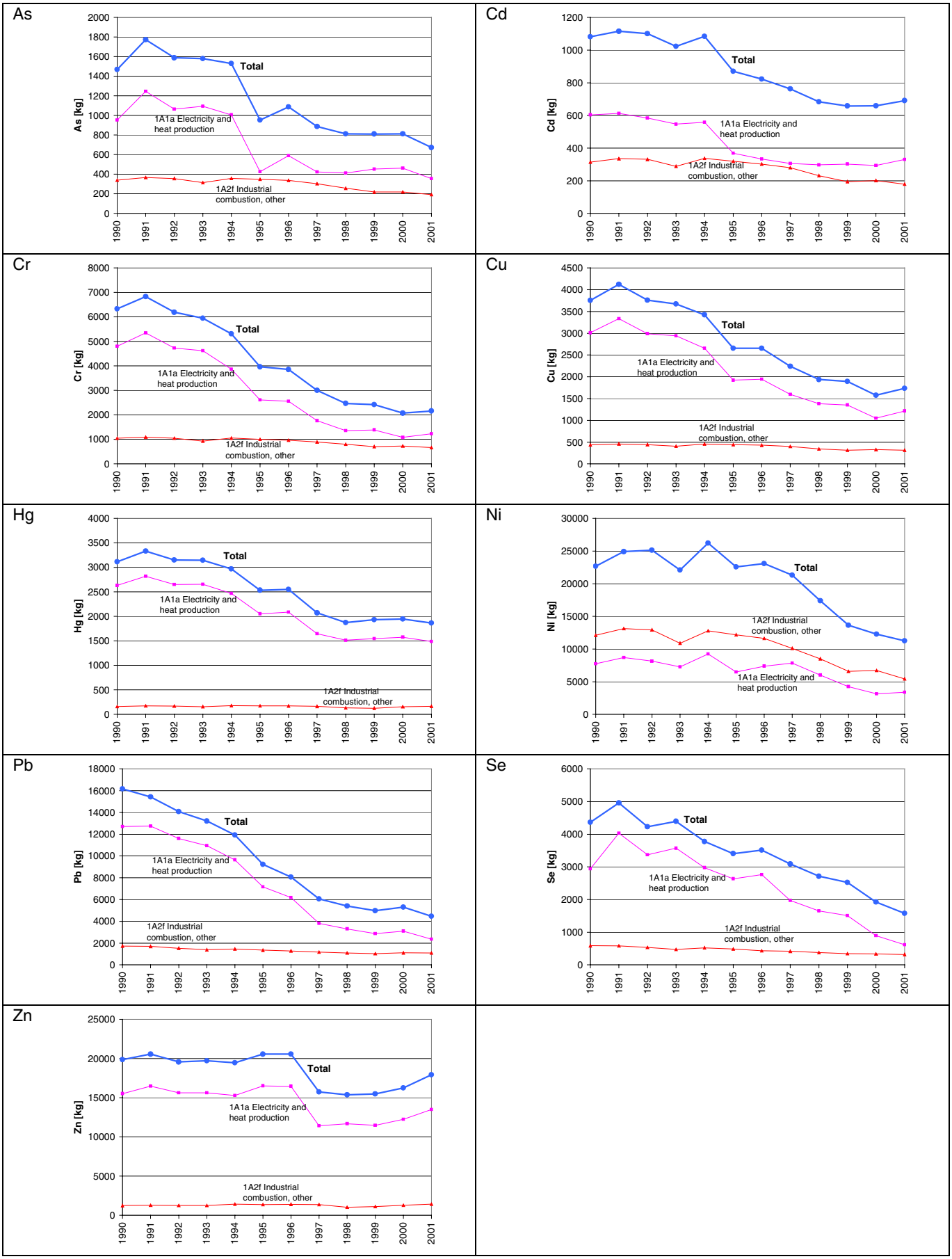

Figure 33 Heavy metal emission time series, stationary combustion plants

10 PAH and dioxin

Emission inventories for 4 PAHs and for dioxin are reported to the LRTAP Convention. The emission inventories for PAH and dioxin are shown in Table 26. Stationary combustion plants account for more than 90% of the PAH emissions and 36% of the dioxin emission.

As mentioned in chapter 4 dioxin emission inventories are estimated by COWI for the Danish Environmental Protection Agency (Hansen & Hansen 2003).

Table 26 The emission for the year 2001 reported to the LRTAP Convention in 2003

Pollutant	Benzo(a)-pyrene Mg	Benzo(b)fluo-ranthene Mg	Benzo(k)fluo-ranthene Mg	Indeno(1,2,3-c,d)pyrene Mg	Dioxin g I-tec
1A1 Fuel consumption, Energy industries	0,015	0,066	0,020	0,013	7,7
1A2 Fuel consumption, Manufacturing Industries and Construction (Stationary combustion)	0,026	0,093	0,018	0,009	0,3
1A4 Fuel consumption, Other sectors (Stationary combustion)	2,662	3,460	1,136	1,967	20,9
Total emission from stationary combustion plants	**2,70**	**3,62**	**1,17**	**1,99**	**28,9**
Total Danish emission (gross)	2,75	3,70	1,24	2,06	81,2
Emission share for stationary combustion	98,3	97,8	94,8	96,8	35,6

Table 27 and Figure 35 show the PAH emission inventory for the stationary combustion subsectors. Residential combustion is the largest emission source and combustion of wood is the predominant source, see Figure 34.

The increasing emission trend is a result of the increased combustion of wood in residential plants. The time series for wood combustion in residential plants is also shown in Figure 36.

Table 27 PAH emission from stationary combustion plants, 2001

	Benzo(a)-pyrene Mg	Benzo(b)-fluoranthene Mg	Benzo(k)-fluoranthene Mg	Indeno(1,2,3-c,d)pyrene Mg
1A1a Electricity and heat production	15	65	20	13
1A1b Petroleum refining	0	1	0	0
1A1c Manufacture of solid fuels and other energy industries	0	0	0	0
1A2a Industry-Iron and steel	0	0	0	0
1A2b Industry-Non-ferrous metals	0	0	0	0
1A2f Industry-Other	26	93	18	9
1A4a Other stationary (including military)	107	141	47	77
1A4b i Other Sectors-Residential, Residential plants	2423	3172	1058	1712
1A4c i Other Sectors-Agriculture/Forestry/Fishing, Stationary	132	147	31	179
Total	2704	3618	1174	1990

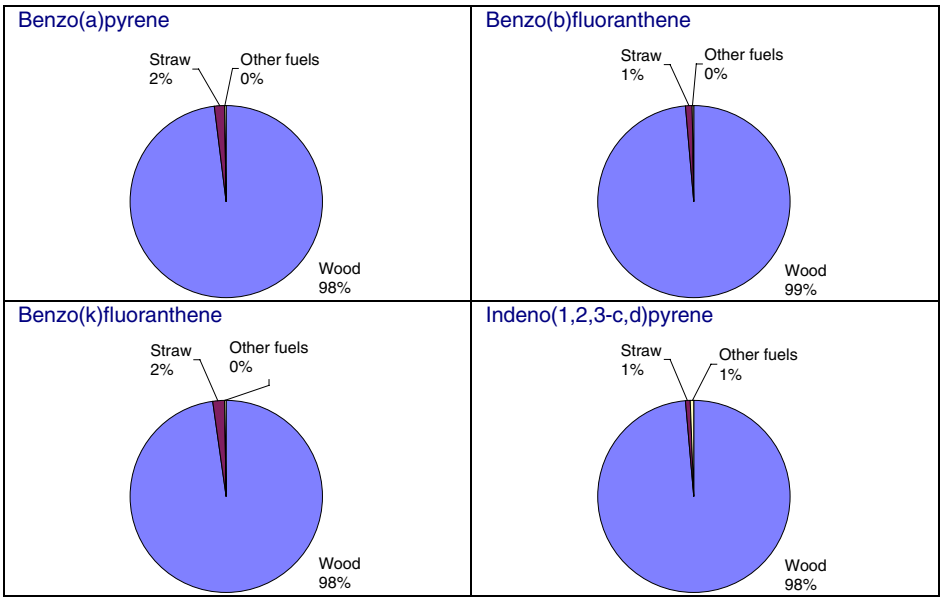

Figure 34 PAH emission from residential combustion plants (stationary), fuel origin

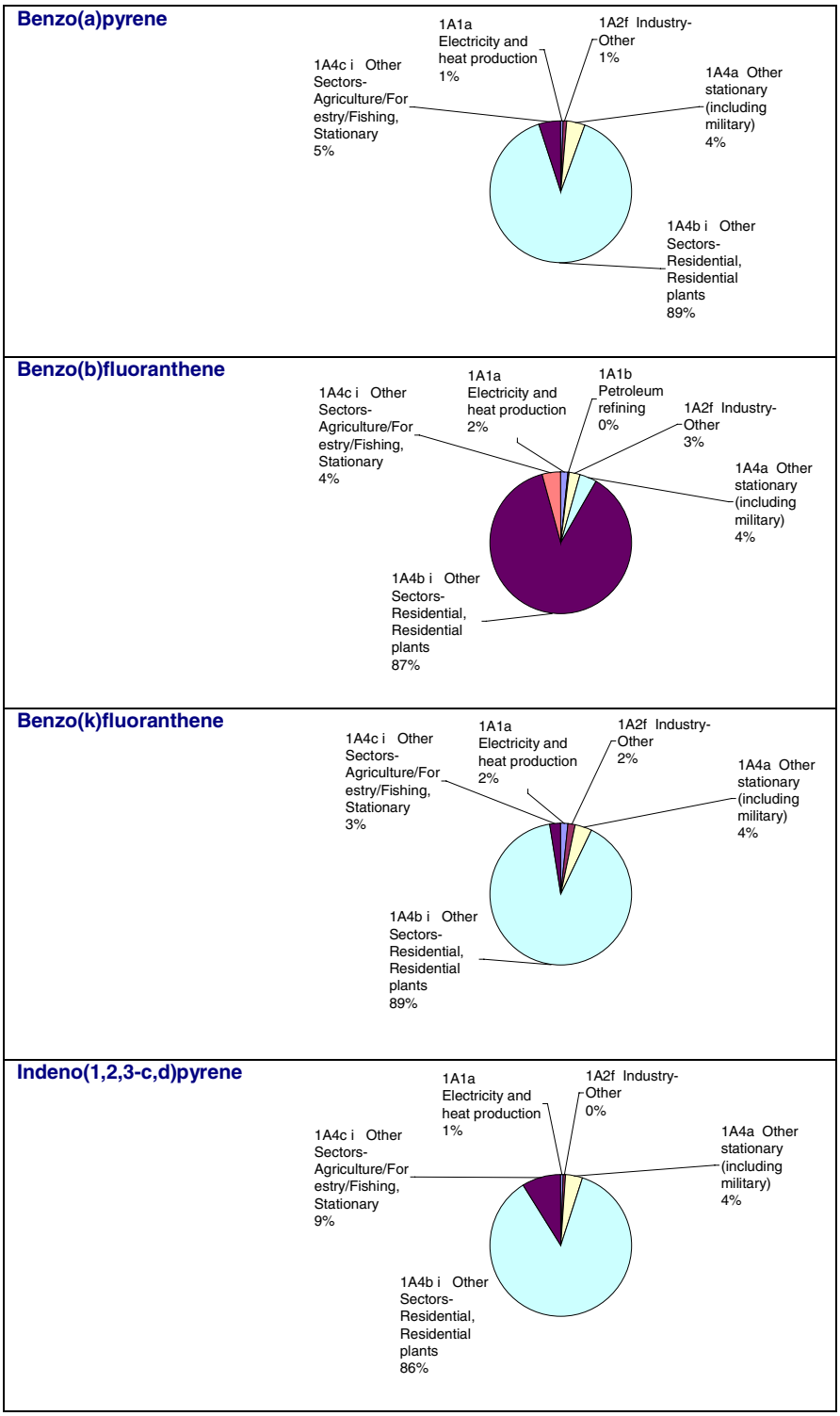

Figure 35 PAH emission sources, stationary combustion plants, 2001

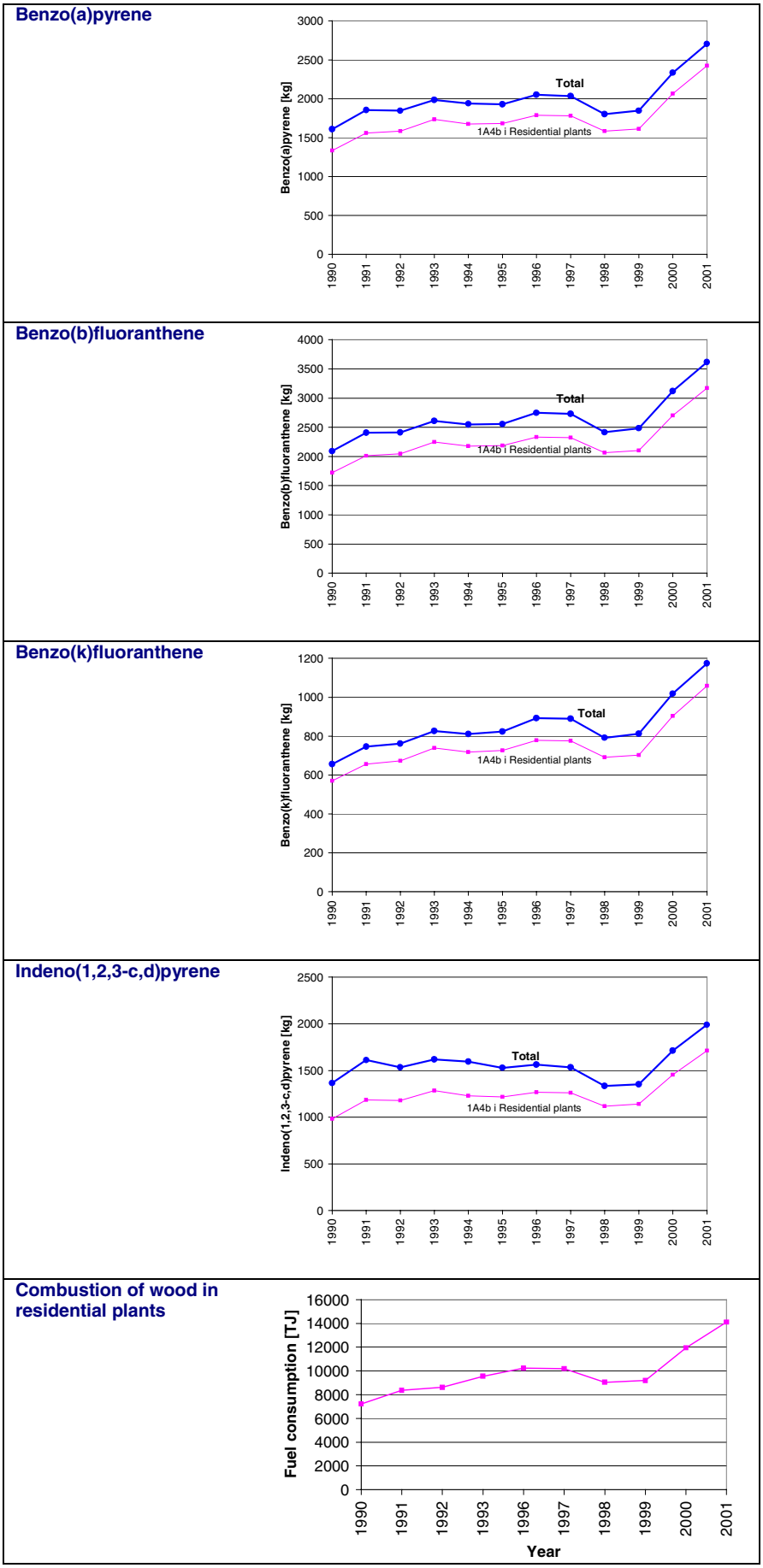

Figure 36 PAH emission time series, stationary combustion plants. Comparison with wood consumption in residential plants.

11 Uncertainty

According to the IPCC Good Practice Guidance (IPCC 2000) uncertainty estimates should be included in the annual National Inventory Report. Likewise uncertainty estimates for the LRTAP Convention inventories are included in the report for these inventories.

Uncertainty estimates include uncertainty of the total emission inventory as well as uncertainty of the trend. For example the CO_2 emission from stationary combustion plants was estimated with an uncertainty of 2,6% and the decrease of the CO_2 emission was estimated to be 3,3%[1] ± 1,8 %-age points since 1990.

11.1 Methodology

The IPCC Good Practice Guidance (IPCC 2000) describes two methodologies for uncertainty estimates: The tier 1 approach which is a simple approach used in the Danish uncertainty estimates and the tier 2 approach which is also called the Monte Carlo approach.

The IPCC methodologies for uncertainty estimates have been adopted for the LRTAP Convention reportings. The methodology is described in a new chapter in the EMEP / Corinair Guidebook (EMEP / Corinair 1996) called *Good Practice Guidance for CLRTAP Emission Inventories* (Pulles & Aardenne 2001).

The uncertainty estimates are based on uncertainties for emission factors and fuel consumption rates respectively. The input data needed for the uncertainty calculations are:

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

The emission source categories in the uncertainty estimates should be statistically independent.

11.1.1 Greenhouse gases

The Danish uncertainty estimates for GHGs is based on uncertainty estimates for the following emission source subcategories to 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

[1] The decrease differs from what is stated in chapter 6.1. The difference is small and it will be corrected in future uncertainty estimates.

The disaggregation of CH_4 emission from gas engines and other stationary combustion plants does not follow the recommendations in the IPCC Good Practice Guidance. The 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 known with a much smaller uncertainty than for other stationary combustion plants.

Most of the uncertainties for activity rates and emission factors used in the first Danish uncertainty estimates are default values from the IPCC Reference Manual. A few of the uncertainty estimates are however based on national estimates.

Table 28 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 [2)]
Stationary Combustion, Petroleum coke	CO_2	3 [1)]	5 [1)]
Stationary Combustion, Residual oil	CO_2	2 [1)]	2 [2)]
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 [2)]
Stationary Combustion, Natural gas	CO_2	3 [1)]	1 [2)]
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 Reference Manual (default value)
2) Kristensen (2003)
3) Jensen & Lindroth (2002)

11.1.2 Other pollutants

The uncertainty has also been estimated for SO_2, NO_x, NMVOC, CO and heavy metals. The uncertainty estimates for non-greenhouse gases are based on emission data and uncertainties for each of the main SNAP sectors as recommended in the LRTAP Good Practice Guidance (Pulles & Aardenne 2001).

All uncertainties for activity rates and for emission factors are based on default values from LRTAP Good Practice Guidance. The default uncertainties for emission factors are given in letter codes representing an uncertainty range. In the first Danish uncertainty estimate it was assumed that the uncertainties was in the lower end of the range for all sources and pollutants. The uncertainties for emission factors are shown in Table 29. The uncertainty for fuel consumption in stationary combustion plants was assumed to be 2%.

Table 29 Uncertainty rates for emission factors

SNAP sector	SO_2	NO_x	NMVOC	CO	Heavy metals
01	10	20	50	20	100
02	20	50	50	50	1000
03	10	20	50	20	100

11.2 Uncertainty estimates

The estimated uncertainties for stationary combustion emission inventories are shown in Table 30. Detailed calculation sheets are shown in appendix 9.

The uncertainty of GHG is estimated to be 11% and the uncertainty in trend of GHG is 1,8%. The main sources of uncertainty for GHG emission are N_2O emission (all plants) and CO_2 emission from coal combustion. Main sources of the trend uncertainty for GHG are CO_2 emission from combustion of natural gas and coal.

In general the calculated uncertainties in the first attempt estimation are assumed to be overestimated due to the fact that a considerable part of e.g. SO_2 and NO_x emissions in the Danish inventory are based on emission measurements.

Table 30 Danish uncertainty estimates, 2001

Pollutant	Uncertainty of emission inventory [%]	Trend 1990-2001 [%]	Uncertainty of emission trend [%]
CO_2	2,6	-3,3	±1,8
CH_4	39	+405	±389
N_2O	1000	-1,4	±3,1
GHG	11	2,1	±1,8
SO_2	7	-87,0	±0,6
NO_x	15	-36,7	±3,2
NMVOC	36	+70	±24
CO	44	+26	±3
As	130	-51	±11
Cd	220	-36	±58
Cr	85	-66	±8
Cu	130	-53	±14
Hg	138	-40	±7
Ni	127	-50	±14
Pb	103	-72	±11
Se	141	-62	±23
Zn	162	-9	±12

12 Geographical distribution of the emissions

Geographical distribution of the emissions has been reported to the LRTAP Convention for the years 1990, 1995 and 2000 (Illerup et al 2002). 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 and PAH. The assumptions and methodology will not be discussed here but gridded emission data for SO_2 from stationary combustion plants are shown. The gridded emission data are available on the EU eionet homepage that can be linked from the NERI home page www.dmu.dk.

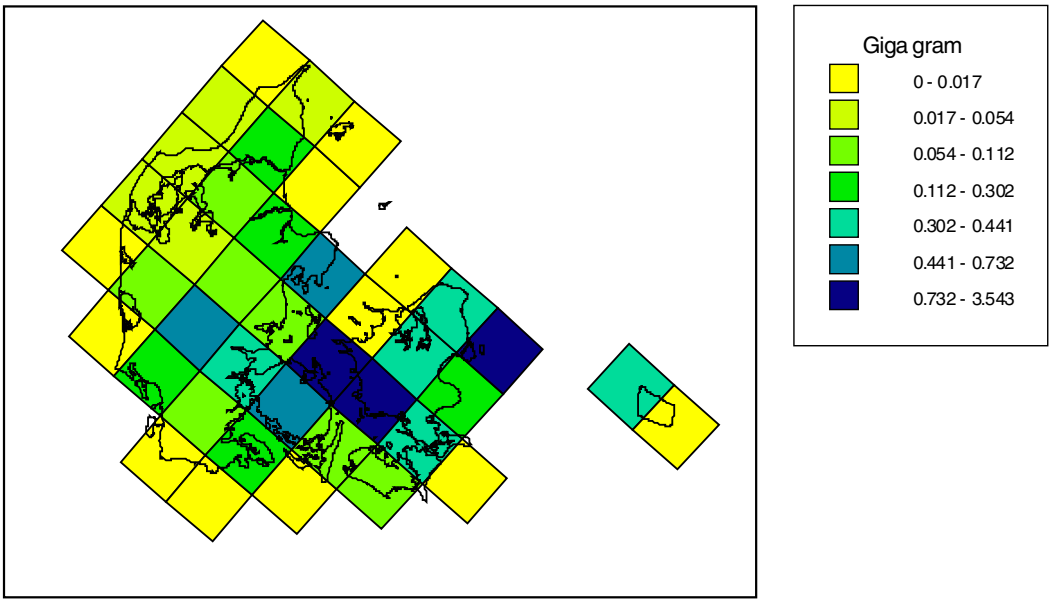

Figure 37 Gridded SO_2 emission from stationary combustion, 2000 (Hansen & Illerup 2002)

13 Future improvements

Some planned improvements of the emission inventories are discussed below.

13.1 Improved emission factors for decentralised CHP plants

A considerable part of the electricity production in Denmark is based on decentralised CHP plants and thus well documented emission factors for these plants are of importance. In a project carried out for the major electricity transmission company Eltra emission factors for CHP plants <25MW_e have been estimated. The work was reported in 2003 (Nielsen & Illerup 2003) and the results will be applied in future emission inventories. The following plant types were included in the work: municipal waste incineration plants, CHP plants combusting wood and straw, natural gas and biogas fuelled (reciprocating) engines and natural gas fuelled gas turbines. The 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 was comprehensive and detailed information about the number of emission measurements and the share of fuel consumption that they represent is included in the report. An extract of the emission factors is shown in Table 31.

Table 31 Emission factors for CHP plants <25MW_e, 2000

Emission	Unit	Natural gas engines	Biogas engines	Gas turbines	Municipal waste incineration plants	CHP combusting straw	CHP combusting wood
NO_x	g/GJ	168	540	124	124	131	69
UHC (C)	g/GJ	485	254	<2,3	<1,2	<0,93	<4,1
- CH_4	g/GJ	520	323	1,5	<0,6	<0,5	<2,1
- NMVOC	g/GJ	117	14	1,4	<1	<0,8	<3,4
CO	g/GJ	175	>273	6	<8	63	79
N_2O	g/GJ	1,3	0,5	2,2	<1,3	1,4	<0,8
TSP	g/GJ	0,76	2,63	0,10	<2,02	3,97	7,94
PM_{10}	mg/GJ	189	451	61	1126	133	1944
$PM_{2.5}$	mg/GJ	161	206	51	1084	102	1226
- Benzo[a]pyrene	mg/GJ	0,003	0,001	0,001	<0,0009	<0,022	<0,003
- Benzo[b]fluoranthene	mg/GJ	0,042	0,001	0,001	<0,002	0,157	0,002
- Benzo[k]fluoranthene	mg/GJ	0,024	<0,0004	<0,002	<0,0008	<0,091	<0,003
- Indeno[1,2,3-cd]pyrene	mg/GJ	0,006	<0,0011	<0,003	<0,0009	<0,023	<0,002
SO_2	g/GJ	x	19	x	<24	47	<1,8
As	mg/GJ	x	x	x	<6,8	<2,1	<2,4
Cd	mg/GJ	x	x	x	<4,8	<0,8	<1
Cr	mg/GJ	x	x	x	<2,5	<1,6	<2,4
Cu	mg/GJ	x	x	x	<10,1	<1,7	<2,7
Hg	mg/GJ	x	x	x	<7,4	<0,6	<0,8
Ni	mg/GJ	x	x	x	<4,8	<1,7	<2,4
Pb	mg/GJ	x	x	x	<123	<6,2	<3,7
Dioxin	µg/GJ	x	x	x	0,157	0,022	0,001

Emission factors for subgroups of each plant type have been prepared. Thus emission factors for different natural gas engine types, gas turbine manufactures and biogas engine manufactures have been estimated. Further, emission factors for municipal waste incineration plants equipped with different flue gas cleaning systems were worked out. The emission factors for subgroups can be used to estimate time series of the emission factors and to update emission factors annually.

So far heavy metal emission data for municipal waste incineration plants often refer to annual environmental reports. These data are however often based on emission measurements below a detection limit and thus the emissions might be overestimated. In future inventories it will be considered weather it would be better always to use the improved emission factors. In fact some of the data on which the improved heavy metal emission factors are based are also below a detection limit.

New Danish legislation is expected to result in a decrease in some emission factors for municipal waste incineration plants, gas engines and gas turbines in the next few years.

13.2 Disaggregation of fuel consumption in the industrial sector

So far the Danish energy statistics aggregated to SNAP sectors have not specified fuel consumption rates for specific industries or the split between boiler and process combustion. Thus the fuel consumption of *1A2 Manufacturing industries and construction* is included in sector *1A2f Manufacturing industries and construction, Other*. A disaggregation to industrial subsectors and in boiler combustion or process combustion is planned and expected to be implemented in the reportings in 2004 or 2005. The disaggregation will improve the inventory because the process combustion emission factors might differ from the general emission factors for the industry sector that is based on boiler emissions.

13.3 Other improvements

The CO_2 emission factor for the plastic part of municipal waste is based on data for crude oil. In future inventories heating value and emission factor for plastic will be applied.

As mentioned before time series for wood consumption in residential plants need to be revised according to the updated energy statistics. Time series for fuel consumption in 1990-1997 were last updated in 2001.

Time series for emission factors will be shown for all pollutants in future reports documenting the emission inventories.

Uncertainty estimates are mainly based on default uncertainties for activity rates and emission factors. More country specific uncertainty estimates will be incorporated in future inventories.

A formal QA / QC and validation plan for the emission inventory has not been developed yet. A number of validation checks could be incorporated in the

reportings in 2004 or 2005 and development of a formal QA/QC plan is also an aim for future inventories.

14 Conclusion

The annual Danish emission inventories are prepared and reported by NERI. The inventories are based on the Danish energy statistics and on a set of emission factors for different sectors, technologies and fuels. Plant specific emissions for large combustion sources are incorporated in the inventories.

Since 1990 the fuel consumption has increased by 12% - the fossil fuel consumption however only by 6%. The use of coal has decreased whereas the use of natural gas and renewable fuels have increased. The Danish fuel consumption fluctuates due to variation in import/export of electricity from year to year.

Stationary combustion plants account for more than 50% of the total Danish emission for the following pollutants: SO_2, CO_2, heavy metals and PAH. Further the emission from stationary combustion plants account for more than 10% of the total Danish emission for the following pollutants: NO_x, CH_4, CO, NMVOC and particulate matter. Stationary combustion plants account for less than 10% of the total Danish N_2O emission.

Public power plants are the most important stationary combustion emission source for SO_2, CO_2, NO_x and heavy metals.

Lean-burn gas engines installed in decentralised CHP plants are the largest stationary combustion emission source of CH_4. Further these plants are also a considerable emission source for NMVOC.

Residential plants is the most important stationary combustion source for CO, NMVOC, particulate matter and PAH. 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 decreased slightly from 1990 to 2001, CO_2 by 2,7% and GHG by 1,5%. However fluctuations of the GHG emission level are high. The fluctuations in the time series are a result of electricity import/export and of outdoor temperature variations between years.

The CH_4 emission from stationary combustion has increased by a factor 5 since 1990. This is a result of the considerable number of lean-burn gas engines that was installed in CHP plants in Denmark during this period.

SO_2 emission from stationary combustion plants has decreased by 95% from 1980 and 85% from 1995. The large emission decrease is mainly a result of the reduced emission from electricity and heat production due to installation of desulphurization plants and the use of fuels with lower content of sulphur.

The NO_x emission from stationary combustion plants has decreased by 51% since 1985 and 35% since 1995. The reduced emission is mainly a result of the reduced emission from electricity and heat production. The fluctuations of the emission time series follow the fluctuations of electricity import/export.

The wood consumption in residential plants has doubled from 1990 to 2001 causing an increased CO emission. The increase of CO emission from residen-

tial plants is less than the increase in wood consumption because the CO emission from straw fired farmhouse boilers has decreased considerably.

The NMVOC emission from stationary combustion plants has increased by 82% from 1985 and 28% from 1995. The increased NMVOC emission is mainly a result of the increased use of lean-burn gas engines. The emission from residential plants is relatively constant, but the emission from wood combustion increased considerably whereas the emission from straw combustion decreased.

The heavy metal emissions decreased considerably since 1990 – between 10% and 74% depending on the heavy metal in question. The emission inventories for heavy metals will be improved in future years as a result of improved emission factors for power producing waste incineration plants. The estimated emissions are expected to be lower than in the present inventory.

The PAH emission has increased since 1990 due to the increased consumption of wood in residential plants.

Some of the time series for subsectors revealed sudden changes in the time series that is a result of incomplete data series for some of the large plants Further an update of the fuel consumption rate for wood combustion in residential plants is desirable.

The uncertainty of the Danish greenhouse gas emission from stationary combustion is estimated at 11% and the trend uncertainty at 1,8%-points. The sources that contribute the most to the uncertainty are the N_2O emission (all plants) and the CO_2 emission from coal combustion.

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Appendix

Appendix 1: The Danish emission inventory for the year 2001 reported to the Climate Convention in 2003

Appendix 2: Emission inventory for the year 2001 reported to the LRTAP Convention in 2003

Appendix 3: IPCC / SNAP source correspondence list

Appendix 4: Fuel rate

Appendix 5: Emission factors

Appendix 6: Implied emission factors for power plants and municipal waste incineration plants

Appendix 7: CO_2 emission factor for municipal waste

Appendix 8: Large point sources

Appendix 9: Uncertainty estimates

Appendix 10: Lower Calorific Value (LCV) of fuels

Appendix 11: Time series for total Danish emissions

Appendix 12: Emission shares of the sectors, total Danish emissions

Appendix 13: Adjustment of CO_2 emission

Appendix 14: Reference approach

Appendix 15: Emission inventory 2001 based on SNAP sectors

Appendix 1 The Danish emission inventory for the year 2001 reported to the Climate Convention

Table 32 The Danish emission inventory for the year 2001 reported to the Climate Convention in 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs	PFCs	SF_6	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**50.823,53**	**5.606,48**	**8.749,33**	**647,32**	**22,13**	**30,43**	**65.879,20**
1. Energy	**52.778,58**	**806,77**	**830,85**				**54.416,20**
A. Fuel Combustion (Sectoral Approach)	52.145,26	659,81	827,42				53.632,49
1. Energy Industries	26.374,98	384,08	279,83				27.038,90
2. Manufacturing Industries and Construction	5.908,87	39,83	57,50				6.006,19
3. Transport	12.076,89	70,25	393,12				12.540,26
4. Other Sectors	7.687,64	165,53	95,40				7.948,58
5. Other	96,87	0,12	1,57				98,56
B. Fugitive Emissions from Fuels	633,32	146,96	3,43				783,71
1. Solid Fuels	0,00	68,86	0,00				68,86
2. Oil and Natural Gas	633,32	78,09	3,43				714,85
2. Industrial Processes	**1.464,20**	**0,00**	**0,00**	**647,32**	**22,13**	**30,43**	**2.164,07**
A. Mineral Products	1.464,20	0,00	0,00				1.464,20
B. Chemical Industry	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C. Metal Production	0,00	0,00	0,00		0,00	0,00	0,00
D. Other Production	0,00						0,00
E. Production of Halocarbons and SF_6				0,00	0,00	0,00	0,00
F. Consumption of Halocarbons and SF_6				647,32	22,13	30,43	699,87
G. Other	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3. Solvent and Other Product Use	**111,75**		**0,00**				**111,75**
4. Agriculture	**0,00**	**3.631,88**	**7.918,48**				**11.550,36**
A. Enteric Fermentation		2.747,40					2.747,40
B. Manure Management		884,48	441,51				1.326,00
C. Rice Cultivation		0,00					0,00
D. Agricultural Soils[2]		0,00	7.476,96				7.476,96
E. Prescribed Burning of Savannas		0,00	0,00				0,00
F. Field Burning of Agricultural Residues		0,00	0,00				0,00
G. Other		0,00	0,00				0,00
5. Land-Use Change and Forestry[1]	**-3.531,00**	**0,00**	**0,00**				**-3.531,00**
6. Waste	**0,00**	**1.167,82**	**0,00**				1.167,82
A. Solid Waste Disposal on Land	0,00	1.167,82					1.167,82
B. Wastewater Handling		0,00	0,00				0,00
C. Waste Incineration	0,00	0,00	0,00				0,00
D. Other	0,00	0,00	0,00				0,00
7. Other *(please specify)*	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
							0,00
Memo Items:							
International Bunkers	**5.982,79**	**2,50**	**95,86**				**6.081,15**
Aviation	2.377,95	0,79	25,32				2.404,06
Marine	3.604,83	1,72	70,54				3.677,09
Multilateral Operations	**0,00**	**0,00**	**0,00**				**0,00**
CO_2 Emissions from Biomass	**7.678,75**						**7.678,75**

[1] For CO_2 emissions from Land-Use Change and Forestry the net emissions are to be reported. Please note that for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).

[2] See footnote 4 to Summary 1.A of this common reporting format.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	Net CO_2 emissions / removals	CH_4	N_2O	Total emissions
Land-Use Change and Forestry	CO_2 equivalent (Gg)					
A. Changes in Forest and Other Woody Biomass Stocks	0,00	-3.531,00	-3.531,00			-3.531,00
B. Forest and Grassland Conversion	0,00		0,00	0,00	0,00	0,00
C. Abandonment of Managed Lands	0,00	0,00	0,00			0,00
D. CO_2 Emissions and Removals from Soil	0,00	0,00	0,00			0,00
E. Other	0,00	0,00	0,00	0,00	0,00	0,00
Total CO_2 Equivalent Emissions from Land-Use Change and Forestry	0,00	-3.531,00	-3.531,00	0,00	0,00	-3.531,00

Total CO_2 Equivalent Emissions without Land-Use Change and Forestry [a]	69.410,20
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry [a]	65.879,20

Appendix 2 Emission inventory for the year 2001 reported to the LRTAP Convention in 2003

Table 33 Emission inventory for the year 2001 reported to the LRTAP in 2003 (a)

	NO_x Gg NO_2	CO Gg	NMVOC Gg	SO_x Gg SO_2	TSP Mg	PM_{10} Mg	$PM_{2.5}$ Mg
1 A 1 a Public Electricity and Heat Production	44,79	11,14	6,02	10,46	1112,53	906,05	751,92
1 A 1 b Petroleum refining	1,62	0,26	0	0,67	11,37	9,1	7,96
1 A 1 c Manufacture of Solid Fuels and Other Energy Industries	2,5	0,69	0,05	0,01	2,51	2,51	2,51
1 A 2 Manufacturing Industries and Construction	27,38	18,45	4,88	7,34	1833,44	1605,41	1423
1 A 2 a Iron and Steel	0	0	0	0	171,4	51,42	7,71
1 A 2 b Non-ferrous Metals	0	0	0	0	34,68	31,23	14,31
1 A 2 c Chemicals	0	0	0	0	0	0	0
1 A 2 d Pulp, Paper and Print	0	0	0	0	0	0	0
1 A 2 e Food Processing, Beverages and Tobacco	0	0	0	0	0	0	0
1 A 2 f Other (Please specify in a covering note)	0	0	0	0	0	0	0
1 A 3 a ii Civil Aviation (Domestic, LTO)	0,27	0,78	0,13	0	1,68	1,68	1,68
1 A 3 a ii Civil Aviation (Domestic, Cruise)	0,51	0,12	0,02	0	1,91	1,91	1,91
1 A 3 b Road Transportation	0	0	0	0	0	0	0
1 A 3 b i R.T., Passenger cars	33,7502	267,408	21,7565	0,20249	693,631	693,6310	693,6310
1 A 3 b ii R.T., Light duty vehicles	9,97559	16,6004	1,94471	0,05957	1702,941	1702,941	1702,941
1 A 3 b iii R.T., Heavy duty vehicles	26,5308	6,72461	2,99073	0,09065	1331,855	1331,855	1331,855
1 A 3 b iv R.T., Mopeds & Motorcycles	0,09114	11,8034	2,56736	0,0018	45,54625	45,54625	45,54625
1 A 3 b v R.T., Gasoline evaporation	0	0	7,76663	0	0	0	0
1 A 3 b vi R.T., Automobile tyre and brake wear	0	0	0	0	5025,277	624,7190	323,0619
1 A 3 b vii R.T., Automobile road abrasion	0	0	0	0	9738,397	488,9743	0
1 A 3 c Railways	1,98	0,32	0,13	0,01	149,92	149,92	149,92
1 A 3 d ii National Navigation	6,92	10,92	6,04	1,38	419,95	399,58	380,22
1 A 3 e Other (Please specify in a covering note)	0	0	0	0	0	0	0
1 A 3 e i Pipeline compressors	0	0	0	0	0	0	0
1 A 3 e ii Other mobile sources and machinery	0	0	0	0	0	0	0
1 A 4 a Commercial / Institutional	1,11	0,82	0,58	0,25	142,11	138,86	130,68
1 A 4 b Residential	0	0	0	0	0	0	0
1 A 4 b i Residential plants	5,15	141,01	10,65	1,56	2983,33	2838,96	2686,01
1 A 4 b ii Household and gardening (mobile)	0,25	49,6	4,34	0	27,06	27,06	27,06
1 A 4 c Agriculture / Forestry / Fishing	0	0	0	0	0	0	0
1 A 4 c i Stationary	1,4	1,36	1,78	1,35	114,74	90,99	71,51
1 A 4 c ii Off-road Vehicles and Other Machinery	21,47	21,78	4,8	0,4	2169,34	2061,54	1959,12
1A 4 c iii National Fishing	11,92	1,61	0,53	0,83	375,94	357,16	339,32
1 A 5 a Other, Stationary (including Military)	0	0	0	0	0	0	0
1 A 5 b Other, Mobile (Including military)	0,61	0,3	0,07	0	39,27	39,27	39,27
1B1 Fugitive Emissions from Solid Fuels	0	0	0	0	0	0	0
1 B 1 a Coal Mining and Handling	0	23,51	0	0	1038,6	415,44	41,54
1 B 1 b Solid fuel transformation	0	0	0	0	0	0	0
1 B 1 c Other (Please specify in a covering note)	0	0	0	0	0	0	0
1 B 2 Oil and natural gas	0	0	0	0	0	0	0
1 B 2 a Oil	0	0	0	0	0	0	0
1 B 2 a i Exploration Production, Transport	0	0	0	0	0	0	0
1 B 2 a iv Refining / Storage	0	0	4,34	0,67	0	0	0
1 B 2 a v Distribution of oil products	0	0	1,07	0	0	0	0
1 B 2 a vi Other	0	0	0	0	0	0	0
1 B 2 b Natural gas	0	0	0,44	0	0	0	0
1 B 2 c Venting and flaring	3,35	2,17	0,95	0,05	1,08	1,08	1,08
2 A MINERAL PRODUCTS (b)	0	0	0	0	0	0	0
2 A 1 Cement Production	0	0	0	0	0	0	0
2 A 2 Lime Production	0	0	0	0	0	0	0
2 A 3 Limestone and Dolomite Use	0	0	0	0	0	0	0
2 A 4 Soda Ash Production and use	0	0	0	0	0	0	0
2 A 5 Asphalt Roofing	0	0	0	0	0	0	0
2 A 6 Road Paving with Asphalt	0	0	0	0	0	0	0
2 A 7 Other including Non Fuel Mining & Construction (Please specify in a covering note)	0	0	0	0	0	0	0
2 B CHEMICAL INDUSTRY	0	0	0	0	0	0	0
2 B 1 Ammonia Production	0	0	0	0	0	0	0
2 B 2 Nitric Acid Production	0,41	0	0	0	0	0	0
2 B 3 Adipic Acid Production	0	0	0	0	0	0	0
2 B 4 Carbide Production	0	0	0	0	0	0	0
2 B 5 Other (Please specify in a covering note)	0	0	0	0	0	0	0
2 C METAL PRODUCTION	0	0	0	0	0	0	0
2 D OTHER PRODUCTION (b)	0	0	0	0	0	0	0
2 D 1 Pulp and Paper	0	0	0	0	0	0	0
2 D 2 Food and Drink	0	0	0,45	0	0	0	0
2 G OTHER (Please specify in a covering note)	0	0	0	0	0	0	0

Table 33 (a) continued

	NO_x Gg NO_2	CO Gg	NMVOC Gg	SO_x Gg SO_2	TSP Mg	PM_{10} Mg	$PM_{2.5}$ Mg
3 A PAINT APPLICATION	0	0	23,22	0	0	0	0
3 B DEGREASING AND DRY CLEANING	0	0	0	0	0	0	0
3 C CHEMICAL PRODUCTS, MANUFACTURE AND PROC-ESSING	0	0	2,14	0	0	0	0
3 D OTHER including products containing HMs and POPs (Please specify in a covering note)	0	0	12,64	0	0	0	0
4 B MANURE MANAGEMENT (c)	0	0	0	0	0	0	0
4 B 1 Cattle	0	0	0	0	0	0	0
4 B 1 a Dairy	0	0	0	0	600,67	270,29	60,09
4 B 1 b Non-Dairy	0	0	0	0	1236,83	556,55	123,73
4 B 2 Buffalo	0	0	0	0	0	0	0
4 B 3 Sheep	0	0	0	0	0	0	0
4 B 4 Goats	0	0	0	0	0	0	0
4 B 5 Camels and Llamas	0	0	0	0	0	0	0
4 B 6 Horses	0	0	0	0	0	0	0
4 B 7 Mules and Asses	0	0	0	0	0	0	0
4 B 8 Swine	0	0	0	0	9830,57	4423,96	982,65
4 B 9 Poultry	0	0	0	0	2523,27	1135,84	252,12
4 B 13 Other	0	0	0	0	0	0	0
4 C RICE CULTIVATION	0	0	0	0	0	0	0
4 D AGRICULTURAL SOILS	0	0	0	0	0	0	0
4 D 1 Direct Soil Emission	0	0	1,21	0	0	0	0
4 F FIELD BURNING OF AGRICULTURAL WASTES	0	0	0	0	0	0	0
4 G OTHER (d)	0	0	0	0	0	0	0
5 B FOREST AND GRASSLAND CONVERSION	0	0	0	0	0	0	0
6 A SOLID WASTE DISPOSAL ON LAND	0	0	0	0	0	0	0
6 B WASTE-WATER HANDLING	0	0	0	0	0	0	0
6 C WASTE INCINERATION (e)	0	0	0	0	0	0	0
6 D OTHER WASTE (f)	0	0	0	0	0	0	0
7 OTHER	0	0	0	0	0	0	0
National Total	**202**	**587**	**124**	**25**	**43360**	**20403**	**13552**
Memo Items							
International Aviation (LTO)	1,07	0,62	0,11	0,01	3,91	3,91	3,91
International Aviation (Cruise)	8,53	1,12	0,25	0,07	34,47	34,47	34,47
International Navigation	98,72	8,4	2,64	54,37	6099,24	5794,28	5504,57
5 E Other	0	0	0	0	0	0	0
X (11 08 Volcanoes)	0	0	0	0	0	0	0

Table 33 (b)

	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	2,36	0,33	1,49	0,36	1,22	1,21	3,49	0,57	13,51
1 A 1 b Petroleum refining	0,04	0,02	0,01	0,02	0,06	0,02	1,07	0,02	0
1 A 1 c Manufacture of Solid Fuels and Other Energy Industries	0	0	0	0	0	0	0	0	0
1 A 2 Manufacturing Industries and Construction	1,09	0,18	0,16	0,19	0,68	0,7	5,45	0,32	1,66
1 A 2 a Iron and Steel	0,62	0,01	0	0,03	0,09	0	0,11	0,43	0,43
1 A 2 b Non-ferrous Metals	0,01	0	0	0	0	0	0	0	0
1 A 2 c Chemicals	0	0	0	0	0	0	0	0	0
1 A 2 d Pulp, Paper and Print	0	0	0	0	0	0	0	0	0
1 A 2 e Food Processing, Beverages and Tobacco	0	0	0	0	0	0	0	0	0
1 A 2 f Other (Please specify in a covering note)	0	0	0	0	0	0	0	0	0
1 A 3 a ii Civil Aviation (Domestic, LTO)	1,34	0	0	0	0	0,03	0	0	0,02
1 A 3 a ii Civil Aviation (Domestic, Cruise)	0	0	0	0	0	0,06	0	0	0,04
1 A 3 b Road Transportation	0	0	0	0	0	0	0	0	0
1 A 3 b i R.T., Passenger cars	0,054	0,020	0,000	0,000	0,101	3,442	0,142	0,020	2,025
1 A 3 b ii R.T., Light duty vehicles	0,002	0,006	0,000	0,000	0,030	1,013	0,042	0,006	0,596
1 A 3 b iii R.T., Heavy duty vehicles	0,000	0,009	0,000	0,000	0,045	1,541	0,063	0,009	0,906
1 A 3 b iv R.T., Mopeds & Motorcycles	0,001	0,000	0,000	0,000	0,001	0,031	0,001	0,000	0,018
1 A 3 b v R.T., Gasoline evaporation	0	0	0	0	0	0	0	0	0
1 A 3 b vi R.T., Automobile tyre and brake wear	0	0	0	0	0	0	0	0	0
1 A 3 b vii R.T., Automobile road abrasion	0	0	0	0	0	0	0	0	0
1 A 3 c Railways	0	0	0	0	0	0,11	0	0	0,07
1 A 3 d ii National Navigation	0,02	0	0	0,02	0,01	0,06	1,12	0,03	0,09
1 A 3 e Other (Please specify in a covering note)	0	0	0	0	0	0	0	0	0
1 A 3 e i Pipeline compressors	0	0	0	0	0	0	0	0	0
1 A 3 e ii Other mobile sources and machinery	0	0	0	0	0	0	0	0	0
1 A 4 a Commercial / Institutional	0,17	0,02	0,03	0,01	0,02	0,02	0,14	0,02	0,19
1 A 4 b Residential	0	0	0	0	0	0	0	0	0
1 A 4 b i Residential plants	0,13	0,11	0,15	0,04	0,03	0,14	0,04	0,15	2,31
1 A 4 b ii Household and gardening (mobile)	0	0	0	0	0	0,05	0	0	0,03
1 A 4 c Agriculture / Forestry / Fishing	0	0	0	0	0	0	0	0	0
1 A 4 c i Stationary	0,05	0,02	0,02	0,03	0,06	0,03	1,07	0,02	0,06
1 A 4 c ii Off-road Vehicles and Other Machinery	0	0	0	0	0,02	0,7	0,03	0	0,41
1A 4 c iii National Fishing	0,02	0	0,01	0,01	0,01	0,01	0,01	0,04	0,1
1 A 5 a Other, Stationary (including Military)	0	0	0	0	0	0	0	0	0
1 A 5 b Other, Mobile (Including military)	0,09	0	0	0	0	0,05	0	0	0,03
1B1 Fugitive Emissions from Solid Fuels	0	0	0	0	0	0	0	0	0
1 B 1 a Coal Mining and Handling	0	0	0	0	0	0	0	0	0
1 B 1 b Solid fuel transformation	0	0	0	0	0	0	0	0	0
1 B 1 c Other (Please specify in a covering note)	0	0	0	0	0	0	0	0	0
1 B 2 Oil and natural gas	0	0	0	0	0	0	0	0	0
1 B 2 a Oil	0	0	0	0	0	0	0	0	0
1 B 2 a i Exploration Production, Transport	0	0	0	0	0	0	0	0	0
1 B 2 a iv Refining / Storage	0	0	0	0	0	0	0	0	0
1 B 2 a v Distribution of oil products	0	0	0	0	0	0	0	0	0
1 B 2 a vi Other	0	0	0	0	0	0	0	0	0
1 B 2 b Natural gas	0	0	0	0	0	0	0	0	0
1 B 2 c Venting and flaring	0	0	0	0	0	0	0	0	0
2 A MINERAL PRODUCTS (b)	0	0	0	0	0	0	0	0	0
2 A 1 Cement Production	0	0	0	0	0	0	0	0	0
2 A 2 Lime Production	0	0	0	0	0	0	0	0	0
2 A 3 Limestone and Dolomite Use	0	0	0	0	0	0	0	0	0
2 A 4 Soda Ash Production and use	0	0	0	0	0	0	0	0	0
2 A 5 Asphalt Roofing	0	0	0	0	0	0	0	0	0
2 A 6 Road Paving with Asphalt	0	0	0	0	0	0	0	0	0
2 A 7 Other including Non Fuel Mining & Construction (Please specify in a covering note)	0	0	0	0	0	0	0	0	0
2 B CHEMICAL INDUSTRY	0	0	0	0	0	0	0	0	0
2 B 1 Ammonia Production	0	0	0	0	0	0	0	0	0
2 B 2 Nitric Acid Production	0	0	0	0	0	0	0	0	0
2 B 3 Adipic Acid Production	0	0	0	0	0	0	0	0	0
2 B 4 Carbide Production	0	0	0	0	0	0	0	0	0
2 B 5 Other (Please specify in a covering note)	0	0	0	0	0	0	0	0	0
2 C METAL PRODUCTION	0,07	0	0	0	0	0,05	0	0	0,63
2 D OTHER PRODUCTION (b)	0	0	0	0	0	0	0	0	0
2 D 1 Pulp and Paper	0	0	0	0	0	0	0	0	0
2 D 2 Food and Drink	0	0	0	0	0	0	0	0	0
2 G OTHER (Please specify in a covering note)	0	0	0	0	0	0	0	0	0
3 A PAINT APPLICATION	0	0	0	0	0	0	0	0	0
3 B DEGREASING AND DRY CLEANING	0	0	0	0	0	0	0	0	0
3 C CHEMICAL PRODUCTS, MANUFACTURE AND PROC-ESSING	0	0	0	0	0	0	0	0	0
3 D OTHER including products containing HMs and POPs (Please specify in a covering note)	0	0	0	0	0	0	0	0	0

Table 33 (b) continued

	Pb Mg	Cd Mg	Hg Mg	As Mg	Cr Mg	Cu Mg	Ni Mg	Se Mg	Zn Mg
4 B MANURE MANAGEMENT (c)	0	0	0	0	0	0	0	0	0
4 B 1 Cattle	0	0	0	0	0	0	0	0	0
4 B 1 a Dairy	0	0	0	0	0	0	0	0	0
4 B 1 b Non-Dairy	0	0	0	0	0	0	0	0	0
4 B 2 Buffalo	0	0	0	0	0	0	0	0	0
4 B 3 Sheep	0	0	0	0	0	0	0	0	0
4 B 4 Goats	0	0	0	0	0	0	0	0	0
4 B 5 Camels and Llamas	0	0	0	0	0	0	0	0	0
4 B 6 Horses	0	0	0	0	0	0	0	0	0
4 B 7 Mules and Asses	0	0	0	0	0	0	0	0	0
4 B 8 Swine	0	0	0	0	0	0	0	0	0
4 B 9 Poultry	0	0	0	0	0	0	0	0	0
4 B 13 Other	0	0	0	0	0	0	0	0	0
4 C RICE CULTIVATION	0	0	0	0	0	0	0	0	0
4 D AGRICULTURAL SOILS	0	0	0	0	0	0	0	0	0
4 D 1 Direct Soil Emission	0	0	0	0	0	0	0	0	0
4 F FIELD BURNING OF AGRICULTURAL WASTES	0	0	0	0	0	0	0	0	0
4 G OTHER (d)	0	0	0	0	0	0	0	0	0
5 B FOREST AND GRASSLAND CONVERSION	0	0	0	0	0	0	0	0	0
6 A SOLID WASTE DISPOSAL ON LAND	0	0	0	0	0	0	0	0	0
6 B WASTE-WATER HANDLING	0	0	0	0	0	0	0	0	0
6 C WASTE INCINERATION (e)	0	0	0	0	0	0	0	0	0
6 D OTHER WASTE (f)	0	0	0	0	0	0	0	0	0
7 OTHER	0	0	0	0	0	0	0	0	0
National Total	**6,1**	**0,7**	**1,9**	**0,7**	**2,4**	**9,3**	**12,8**	**1,6**	**23,1**
Memo Items									
International Aviation (LTO)	0,11	0	0	0	0	0,13	0,01	0	0,08
International Aviation (Cruise)	0	0,01	0	0	0,03	1,15	0,05	0,01	0,68
International Navigation	0,18	0,02	0,04	0,34	0,15	0,34	19,05	0,35	0,82
5 E Other	0	0	0	0	0	0	0	0	0
X (11 08 Volcanoes)	0	0	0	0	0	0	0	0	0

Table 33 (c)

	Dioxin g I-tec	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	7,700000	0,015242	0,064960	0,019615	0,013082
1 A 1 b Petroleum refining	0,000000	0,000183	0,000794	0,000156	0,000296
1 A 1 c Manufacture of Solid fuels and Other Energy Indus-	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 2 Manufacturing Industries and Construction	0,000000	0,028510	0,097676	0,022959	0,011586
1 A 2 a Iron and Steel	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 2 b Non-ferrous Metals	0,324000	0,000000	0,000000	0,000000	0,000000
1 A 2 c Chemicals	0,002400	0,000000	0,000000	0,000000	0,000000
1 A 2 d Pulp, Paper and Print	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 2 e Food Processing, Beverages & Tobacco	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 2 f Other (Please specify in a covering note)	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 3 a ii Civil Aviation (Domestic, LTO)	0,000000	0,000011	0,000021	0,000007	0,000024
1 A 3 a ii Civil Aviation (Domestic, Cruise)	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 3 b Road Transportation	1,500000	0,000000	0,000000	0,000000	0,000000
1 A 3 b i R.T., Passenger cars	0,000000	0,019414	0,024251	0,015602	0,024624
1 A 3 b ii R.T., Light duty vehicles	0,000000	0,015822	0,018137	0,014743	0,014745
1 A 3 b iii R.T., Heavy duty vehicles	0,000000	0,002136	0,012923	0,014437	0,003324
1 A 3 b iv R.T., Mopeds & Motorcycles	0,000000	0,000207	0,000379	0,000129	0,000444
1 A 3 b v R.T., Gasoline evaporation	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 3 b vi R.T., Automobile tyre and brake wear	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 3 b vii R.T., Automobile road abrasion	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 3 c Railways	0,750000	0,000170	0,001027	0,001147	0,000265
1 A 3 d ii National Navigation	0,750000	0,000670	0,002780	0,001266	0,004096
1 A 3 e Other (Please specify in a covering note)	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 3 e i Pipeline compressors	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 3 e ii Other mobile sources and machinery	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 4 a Commercial / Institutional	0,000000	0,107223	0,140759	0,046829	0,076575
1 A 4 b Residential	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 4 b i Residential plants	20,900000	2,423026	3,171624	1,058324	1,711547
1 A 4 b ii Household and gardening (mobile)	3,430000	0,000133	0,000243	0,000083	0,000285
1 A 4 c Agriculture / Forestry / Fishing	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 4 c i Stationary	0,000000	0,132117	0,147225	0,030506	0,179056
1 A 4 c ii Off-road Vehicles and Other Machinery	0,000000	0,004401	0,008776	0,008450	0,004621
1A 4 c iii National Fishing	0,000000	0,001337	0,005702	0,002673	0,010513
1 A 5 a Other, Stationary (including Military)	0,000000	0,000000	0,000000	0,000000	0,000000
1 A 5 b Other, Mobile (Including military)	0,000000	0,000227	0,000453	0,000439	0,000236
1B1 Fugitive Emissions from Solid Fuels	0,000000	0,000000	0,000000	0,000000	0,000000
1 B 1 a Coal Mining and Handling	0,000000	0,000000	0,000000	0,000000	0,000000
1 B 1 b Solid fuel transformation	0,000000	0,000000	0,000000	0,000000	0,000000
1 B 1 c Other (Please specify in a covering note)	0,000000	0,000000	0,000000	0,000000	0,000000
1 B 2 Oil and natural gas	0,000000	0,000000	0,000000	0,000000	0,000000
1 B 2 a Oil	0,000000	0,000000	0,000000	0,000000	0,000000
1 B 2 a i Exploration Production, Transport	0,000000	0,000000	0,000000	0,000000	0,000000
1 B 2 a iv Refining / Storage	0,000000	0,000000	0,000000	0,000000	0,000000
1 B 2 a v Distribution of oil products	0,000000	0,000000	0,000000	0,000000	0,000000
1 B 2 a vi Other	0,000000	0,000000	0,000000	0,000000	0,000000
1 B 2 b Natural gas	0,000000	0,000000	0,000000	0,000000	0,000000
1 B 2 c Venting and flaring	0,000000	0,000000	0,000000	0,000000	0,000000
2 A MINERAL PRODUCTS (a)	0,000000	0,000000	0,000000	0,000000	0,000000
2 A 1 Cement Production	0,640000	0,000000	0,000000	0,000000	0,000000
2 A 2 Lime Production	0,000000	0,000000	0,000000	0,000000	0,000000
2 A 3 Limestone and Dolomite Use	0,000000	0,000000	0,000000	0,000000	0,000000
2 A 4 Soda Ash Production and use	0,000000	0,000000	0,000000	0,000000	0,000000
2 A 5 Asphalt Roofing	0,000000	0,000000	0,000000	0,000000	0,000000
2 A 6 Road Paving with Asphalt	0,041000	0,000000	0,000000	0,000000	0,000000
2 A 7 Other including Non Fuel Mining & Construction	0,198000	0,000000	0,000000	0,000000	0,000000
2 B CHEMICAL INDUSTRY	0,000000	0,000000	0,000000	0,000000	0,000000
2 B 1 Ammonia Production	0,000000	0,000000	0,000000	0,000000	0,000000
2 B 2 Nitric Acid Production	0,000000	0,000000	0,000000	0,000000	0,000000
2 B 3 Adipic Acid Production	0,000000	0,000000	0,000000	0,000000	0,000000
2 B 4 Carbide Production	0,000000	0,000000	0,000000	0,000000	0,000000
2 B 5 Other (Please specify in a covering note)	0,000000	0,000000	0,000000	0,000000	0,000000
2 C METAL PRODUCTION	0,000000	0,000000	0,000000	0,000000	0,000000
2 D OTHER PRODUCTION (a)	0,000000	0,000000	0,000000	0,000000	0,000000
2 D 1 Pulp and Paper	0,000000	0,000000	0,000000	0,000000	0,000000
2 D 2 Food and Drink	0,000000	0,000000	0,000000	0,000000	0,000000
2 G OTHER (Please specify in a covering note)	0,000000	0,000000	0,000000	0,000000	0,000000
3 A PAINT APPLICATION	0,000000	0,000000	0,000000	0,000000	0,000000
3 B DEGREASING AND DRY CLEANING	0,000000	0,000000	0,000000	0,000000	0,000000
3 C CHEMICAL PRODUCTS, MANUFACTURE AND	0,000000	0,000000	0,000000	0,000000	0,000000
3 D OTHER including products containing HMs and POPs	13,250000	0,000000	0,000000	0,000000	0,000000

Table 33 (c) continued

	Dioxin g I-tec	Benzo(a)pyrene Mg	Benzo(b)fluoranthene Mg	Benzo(k)fluoranthene Mg	Indeno(1,3,3-c,d)pyrene Mg
4 B MANURE MANAGEMENT (b)	0,000000	0,000000	0,000000	0,000000	0,000000
4 B 1 Cattle	0,000000	0,000000	0,000000	0,000000	0,000000
4 B 1 a Dairy	0,000000	0,000000	0,000000	0,000000	0,000000
4 B 1 b Non-Dairy	0,000000	0,000000	0,000000	0,000000	0,000000
4 B 2 Buffalo	0,000000	0,000000	0,000000	0,000000	0,000000
4 B 3 Sheep	0,000000	0,000000	0,000000	0,000000	0,000000
4 B 4 Goats	0,000000	0,000000	0,000000	0,000000	0,000000
4 B 5 Camels and Llamas	0,000000	0,000000	0,000000	0,000000	0,000000
4 B 6 Horses	0,000000	0,000000	0,000000	0,000000	0,000000
4 B 7 Mules and Asses	0,000000	0,000000	0,000000	0,000000	0,000000
4 B 8 Swine	0,000000	0,000000	0,000000	0,000000	0,000000
4 B 9 Poultry	0,000000	0,000000	0,000000	0,000000	0,000000
4 B 13 Other	0,000000	0,000000	0,000000	0,000000	0,000000
4 C RICE CULTIVATION	0,000000	0,000000	0,000000	0,000000	0,000000
4 D AGRICULTURAL SOILS	0,000000	0,000000	0,000000	0,000000	0,000000
4 D 1 Direct Soil Emission	0,000000	0,000000	0,000000	0,000000	0,000000
4 F FIELD BURNING OF AGRICULTURAL WASTES	0,000000	0,000000	0,000000	0,000000	0,000000
4 G OTHER (c)	0,000000	0,000000	0,000000	0,000000	0,000000
5 B FOREST AND GRASSLAND CONVERSION	0,000000	0,000000	0,000000	0,000000	0,000000
6 A SOLID WASTE DISPOSAL ON LAND	5,130000	0,000000	0,000000	0,000000	0,000000
6 B WASTEWATER HANDLING	0,001800	0,000000	0,000000	0,000000	0,000000
6 C WASTE INCINERATION (d)	16,300000	0,000000	0,000000	0,000000	0,000000
6 D OTHER WASTE (e)	0,000000	0,000000	0,000000	0,000000	0,000000
7 OTHER	10,250000	0,000000	0,000000	0,000000	0,000000
National Total	**81,17000**	**2,750830**	**3,697730**	**1,237367**	**2,055318**
Memo Items:					
International Aviation (LTO)	0,000000	0,000001	0,000002	0,000001	0,000002
International Aviation (Cruise)	0,000000	0,000000	0,000000	0,000000	0,000000
International Marine (b)	0,000000	0,000000	0,000000	0,000000	0,000000
5 E Other	0,000000	0,000000	0,000000	0,000000	0,000000
X (11 08 Volcanoes)	0,000000	0,000000	0,000000	0,000000	0,000000

Appendix 3 IPCC/SNAP source correspondence list

Table 34 Correspondence list for IPCC source categories 1A1, 1A2 and 1A4 and SNAP

SNAP_id	SNAP_name	IPCC source
01	Combustion in energy and transformation industries	
0101	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
0102	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
0103	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
0104	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
0105	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	
0201	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
0202	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	Other equipments (stoves, fireplaces, cooking,...)	1A4b
0203	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	
0301	Comb. in boilers, gas turbines and stationary	1A2f
030101	Combustion plants >= 300 MW (boilers)	1A2f
030102	Combustion plants >= 50 and < 300 MW (boilers)	1A2f
030103	Combustion plants < 50 MW (boilers)	1A2f
030104	Gas turbines	1A2f
030105	Stationary engines	1A2f
030106	Other stationary equipments (n)	1A2f
0302	Process furnaces without contact	
030203	Blast furnace cowpers	1A2a
030204	Plaster furnaces	1A2f

030205	Other furnaces	1A2f
0303	Processes with contact	
030301	Sinter and pelletizing plants	1A2a
030302	Reheating furnaces steel and iron	1A2a
030303	Gray iron foundries	1A2a
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

Appendix 4 Fuel rate

Table 35 Fuel consumption rate of stationary combustion plants [GJ]

fuel	fuel_gr_abbr	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
102	STEAM COAL	254836509,9	345917400	288115156	302081600	326290605	273898682,5	375387102,1	280010525	233354509	197985454	165920864	175451125
110	PETROLEUM COKE	4459477	4403484	4562922	5928437	4057802	4598673	6130172,2	6271959	5546731	7032313	7040382,8	8062464
111	WOOD AND SIMIL.	16500600	18260900	19300300	20390100	21623600	21244800	22806525,3	23224986	20455971	20904487	24078950	27217801
114	MUNICIP. WASTES	16384900	17727900	18829500	20469900	21468400	24152480	26146927,5	27925960	27322664,6	28522787	30265049,7	33037670
115	INDUSTR. WASTES							33813,3					
116	WOOD WASTES										607044		
117	AGRICUL. WASTES	13225200	14050200	14624200	14103200	12757200	13074201,5	13475808	13358144	13363125,5	14370434	13053790	13698057
118	SEWAGE SLUDGE											40162	0
203	RESIDUAL OIL	32115737,2	37019700	37331700	32497878	49806729,2	37527060,4	41791442,5	30158107	30173567,3	22563263	18860842,75	20093058,05
204	GAS OIL	65654597,56	68771200	58909344,19	65374961,84	56515233,28	57052400	59940747,1	52181204,9	49026338,89	47449456,4	38645775,52	41395271
206	KEROSENE	5086000	943300	783700	771300	649600	580700	539700	436600	414294	255606	169963	286786
215	BLACK LIQUOR												191475
225	OTHER LIQ. FUEL						19968824,3	36885721,33	40611318	32580001	34190630	34148181	30243687
301	NATURAL GAS	76099386,63	86421571	90523946,5	103173352,3	117014079	135645219,7	160599206,5	169726176	180201987,7	187958726,5	183757320,8	193449630,7
303	LPG	2278323	2083369	1793833	1873657	1966707	2104244	2282775	1738849	1737976	734746	1108008	852741
308	REFINERY GAS	14169000	14537000	14865000	15405000	16390999,1	21005286,4	20271223,92	17091995	15224935	15724000	15219727	14233595
309	BIOGAS	751600	910100	898900	1076800	1409100	2055800	2244826	2714861	2662881	2640444	2980430	3046907
Grand Total		**501561331,3**	**611046124**	**550538501,7**	**583146186,1**	**629950054,6**	**612908371,8**	**768535990,8**	**665450684,9**	**612064982**	**580939390,9**	**535289446,6**	**561260267,8**

Appendix 5 Emission factors

Table 36 Emission factors 2001 (a)

fuel	IPCC source	SNAP	unit1	unit2	CH_4	Reference	N_2O	Reference	SO_2	Reference	NO_x	Reference	NMVOC	Reference	CO	Reference
AGRICUL. WASTES	1A1a	010102	g	GJ	32	C 1	4	C 1	100	CS 5 19	153	SC 28	50	C 1	50	CS 3
AGRICUL. WASTES	1A1a	010103	g	GJ	32	C 1	4	C 1	100	CS 5 19	156	CS 4	50	C 1	50	CS 3
AGRICUL. WASTES	1A1a	010202	g	GJ	32	C 1	4	C 1	100	CS 5 19	153	CS 28	50	C 1	325	CS 4 5
AGRICUL. WASTES	1A1a	010203	g	GJ	32	C 1	4	C 1	100	CS 5 19	156	CS 4	50	C 1	325	CS 4 5
AGRICUL. WASTES	1A2f	030102	g	GJ	32	C 1	4	C 1	100	CS 5 19	153	CS 28	50	C 1	325	CS 4 5
AGRICUL. WASTES	1A2f	030105	g	GJ	32	C 1	4	C 1	100	CS 5 19	153	CS 28	50	C 1	325	CS 4 5
AGRICUL. WASTES	1A4a	0201	g	GJ	200	C 1	4	C 1	100	CS 5 19	153	CS 28	600	C 1	325	CS 4 5
AGRICUL. WASTES	1A4b	0202	g	GJ	200	C 1	4	C 1	100	CS 5 19	153	CS 28	600	C 1	4000	CS 1 6 7
AGRICUL. WASTES	1A4c	0203	g	GJ	200	C 1	4	C 1	100	CS 5 19	153	CS 28	600	C 1	325	CS 4 5
AGRICUL. WASTES	1A4c	020302	g	GJ	200	C 1	4	C 1	100	CS 5 19	153	CS 28	600	C 1	325	CS 4 5
BIOGAS	1A1a	010102	g	GJ	4	C 1	2	C 1	11	CS 26	31	CS 4	4	C 1	36	CS 8
BIOGAS	1A1a	010103	g	GJ	4	C 1	2	C 1	11	CS 26	31	CS 4	4	C 1	36	CS 8
BIOGAS	1A1a	010105	g	GJ	434	CS 2	2	C 1	11	CS 26	605	CS 2	4	C 1	255	CS 2
BIOGAS	1A1a	010203	g	GJ	4	C 1	2	C 1	11	CS 26	31	CS 4	4	C 1	36	CS 8
BIOGAS	1A1c	010405	g	GJ	434	CS 2	2	C 1	11	CS 26	605	CS 2	4	C 1	255	CS 2
BIOGAS	1A1c	010505	g	GJ	434	CS 2	2	C 1	11	CS 26	605	CS 2	4	C 1	255	CS 2
BIOGAS	1A2f	0301	g	GJ	4	C 1	2	C 1	11	CS 26	31	CS 4	4	C 1	36	CS 8
BIOGAS	1A2f	030102	g	GJ	4	C 1	2	C 1	11	CS 26	66	CS 4	4	C 1	36	CS 8
BIOGAS	1A2f	030105	g	GJ	434	CS 2	2	C 1	11	CS 26	605	CS 2	4	C 1	255	CS 2
BIOGAS	1A4a	0201	g	GJ	4	C 1	2	C 1	11	CS 26	31	CS 4	4	C 1	36	CS 8
BIOGAS	1A4a	020103	g	GJ	4	C 1	2	C 1	11	CS 26	31	CS 4	4	C 1	36	CS 8
BIOGAS	1A4a	020105	g	GJ	434	CS 2	2	C 1	11	CS 26	605	CS 2	4	C 1	255	CS 2
BIOGAS	1A4c	0203	g	GJ	4	C 1	2	C 1	11	CS 26	31	CS 4	4	C 1	36	CS 8
BIOGAS	1A4c	020304	g	GJ	434	CS 2	2	C 1	11	CS 26	605	CS 2	4	C 1	255	CS 2
LIQUID BIOMASS FUEL	1A1a	010203	g	GJ	32	CS 15	4	C 4	100	CS 15	153	CS 15	50	CS 15	325	CS 15
LIQUID BIOMASS FUEL	1A4c	020304	g	GJ	200	CS 15	4	C 4	100	CS 15	153	CS 15	600	CS 15	325	CS 15
GAS OIL	1A1a	0101	g	GJ	1,5	C 1	2	C 1	23	CS 27	65	CS 28	1,5	C 1	15	CS 3
GAS OIL	1A1a	010101	g	GJ	1,5	C 1	2	C 1	23	CS 27	65	CS 28	1,5	C 1	15	CS 3
GAS OIL	1A1a	010102	g	GJ	1,5	C 1	2	C 1	23	CS 27	65	CS 28	1,5	C 1	15	CS 3
GAS OIL	1A1a	010103	g	GJ	1,5	C 1	2	C 1	23	CS 27	52	CS 4	1,5	C 1	15	CS 3
GAS OIL	1A1a	010104	g	GJ	1,5	C 1	2	C 1	23	CS 27	350	C 1	2	C 1	15	CS 3
GAS OIL	1A1a	010105	g	GJ	1,5	C 1	2	C 1	23	CS 27	700	- -	100	C 1	100	C 1
GAS OIL	1A1a	010202	g	GJ	1,5	C 1	2	C 1	23	CS 27	65	CS 28	1,5	C 1	30	C 1
GAS OIL	1A1a	010203	g	GJ	1,5	C 1	2	C 1	23	CS 27	52	CS 4	1,5	C 1	30	C 1
GAS OIL	1A1a	010205	g	GJ	1,5	C 1	2	C 1	23	CS 27	700	- -	100	C 1	100	C 1
GAS OIL	1A2f	0301	g	GJ	1,5	C 1	2	C 1	23	CS 27	52	CS 4	1,5	C 1	30	C 1
GAS OIL	1A2f	030102	g	GJ	1,5	C 1	2	C 1	23	CS 27	52	CS 4	1,5	C 1	30	C 1
GAS OIL	1A2f	030103	g	GJ	1,5	C 1	2	C 1	23	CS 27	52	CS 4	1,5	C 1	30	C 1
GAS OIL	1A2f	030104	g	GJ	1,5	C 1	2	C 1	23	CS 27	350	C 1	2	C 1	15	CS 3
GAS OIL	1A2f	030105	g	GJ	1,5	C 1	2	C 1	23	CS 27	700	- -	100	C 1	100	C 1
GAS OIL	1A2f	030106	g	GJ	1,5	C 1	2	C 1	23	CS 27	52	CS 4	1,5	C 1	30	C 1
GAS OIL	1A4a	0201	g	GJ	1,5	C 1	2	C 1	23	CS 27	52	CS 4	3	C 1	30	C 1
GAS OIL	1A4a	020103	g	GJ	1,5	C 1	2	C 1	23	CS 27	52	CS 4	3	C 1	30	C 1
GAS OIL	1A4a	020105	g	GJ	1,5	C 1	2	C 1	23	CS 27	700	- -	100	C 1	100	C 1
GAS OIL	1A4b	0202	g	GJ	1,5	C 1	2	C 1	23	CS 27	52	CS 4	3	C 1	43	C 1
GAS OIL	1A4c	020304	g	GJ	1,5	C 1	2	C 1	23	CS 27	700	- -	100	C 1	100	C 1
KEROSENE	1A2f	0301	g	GJ	7	C 1	2	C 1	23	CS 27	73	C 1	3	C 1	20	C 1
KEROSENE	1A4a	0201	g	GJ	7	C 1	2	C 1	23	CS 30	73	C 1	3	C 1	20	C 1
KEROSENE	1A4b	0202	g	GJ	7	C 1	2	C 1	23	CS 30	73	C 1	3	C 1	20	C 1
KEROSENE	1A4c	0203	g	GJ	7	C 1	2	C 1	23	CS 30	73	C 1	3	C 1	20	C 1
LPG	1A1a	010203	g	GJ	1	C 1	1	C 1	1	- -	50	C 1	2	C 1	25	C 1
LPG	1A2f	0301	g	GJ	1	C 1	2	C 1	1	- -	50	C 1	2	C 1	25	C 1
LPG	1A4a	0201	g	GJ	1	C 1	2	C 1	1	- -	50	C 1	2	C 1	25	C 1

LPG	1A4b	0202	g	GJ	1	C	1	2	C	1	1	-	-	50	C	1	2	C	1	25	C	1
MUNICIP. WASTES	1A1a	010102	g	GJ	6	C	1	4	C	1	69	CS	9	150	CS	9	9	C	1	10	CS	9
MUNICIP. WASTES	1A1a	010103	g	GJ	6	C	1	4	C	1	69	CS	9	150	CS	9	9	C	1	10	CS	9
MUNICIP. WASTES	1A1a	010104	g	GJ	6	C	1	4	C	1	69	CS	9	150	CS	9	9	C	1	10	CS	9
MUNICIP. WASTES	1A1a	010105	g	GJ	6	C	1	4	C	1	69	CS	9	150	CS	9	9	C	1	10	CS	9
MUNICIP. WASTES	1A1a	010203	g	GJ	6	C	1	4	C	1	69	CS	9	150	CS	9	9	C	1	10	CS	9
MUNICIP. WASTES	1A4a	0201	g	GJ	6	C	1	4	C	1	69	CS	9	150	CS	9	9	C	1	10	CS	9
MUNICIP. WASTES	1A4a	020103	g	GJ	6	C	1	4	C	1	69	CS	9	150	CS	9	9	C	1	10	CS	9
NATURAL GAS	1A1a	0101	g	GJ	6	CS	14	1	C	1	0,3	CS	17	100	CS	18	2	CS	14	15	CS	3
NATURAL GAS	1A1a	010101	g	GJ	6	CS	14	1	C	1	0,3	CS	17	88	CS	9	2	CS	14	15	CS	3
NATURAL GAS	1A1a	010102	g	GJ	6	CS	14	1	C	1	0,3	CS	17	88	CS	9	2	CS	14	15	CS	3
NATURAL GAS	1A1a	010103	g	GJ	15	CS	11	1	C	1	0,3	CS	17	30	CS	4	2	CS	14	15	CS	3
NATURAL GAS	1A1a	010104	g	GJ	4	CS	2	1	C	1	0,3	CS	17	88	CS	9	1	CS	2	7	CS	10
NATURAL GAS	1A1a	010105	g	GJ	573	CS	2	1	C	1	0,3	CS	17	193	CS	2	163	CS	2	169	CS	2
NATURAL GAS	1A1a	010202	g	GJ	6	CS	14	1	C	1	0,3	CS	17	100	CS	18	2	CS	14	28	CS	4
NATURAL GAS	1A1a	010203	g	GJ	15	CS	11	1	C	1	0,3	CS	17	30	CS	4	2	CS	14	28	CS	4
NATURAL GAS	1A1b	010304	g	GJ	4	CS	2	1	C	1	0,3	CS	17	174	CS	2	1	CS	2	7	CS	10
NATURAL GAS	1A1c	010405	g	GJ	573	CS	2	1	C	1	0,3	CS	17	193	CS	2	163	CS	2	169	CS	2
NATURAL GAS	1A1c	010502	g	GJ	6	CS	14	1	C	1	0,3	CS	17	100	CS	18	2	CS	14	28	CS	4
NATURAL GAS	1A1c	010504	g	GJ	4	CS	2	1	C	1	0,3	CS	17	174	CS	2	1	CS	2	7	CS	10
NATURAL GAS	1A1c	010505	g	GJ	573	CS	2	1	C	1	0,3	CS	17	193	CS	2	163	CS	2	169	CS	2
NATURAL GAS	1A2f	0301	g	GJ	6	CS	14	1	C	1	0,3	CS	17	30	CS	4	2	CS	14	28	CS	4
NATURAL GAS	1A2f	030103	g	GJ	15	CS	11	1	C	1	0,3	CS	17	30	CS	4	2	CS	14	28	CS	4
NATURAL GAS	1A2f	030104	g	GJ	4	CS	2	1	C	1	0,3	CS	17	174	CS	2	1	CS	2	7	CS	10
NATURAL GAS	1A2f	030105	g	GJ	573	CS	2	1	C	1	0,3	CS	17	193	CS	2	163	CS	2	169	CS	2
NATURAL GAS	1A2f	030106	g	GJ	15	CS	11	1	C	1	0,3	CS	17	30	CS	4	2	CS	14	28	CS	4
NATURAL GAS	1A4a	0201	g	GJ	6	CS	14	1	C	1	0,3	CS	17	30	CS	4	2	CS	14	28	CS	4
NATURAL GAS	1A4a	020103	g	GJ	15	CS	11	1	C	1	0,3	CS	17	30	CS	4	2	CS	14	28	CS	4
NATURAL GAS	1A4a	020104	g	GJ	4	CS	2	1	C	1	0,3	CS	17	174	CS	2	1	CS	2	7	CS	10
NATURAL GAS	1A4a	020105	g	GJ	573	CS	2	1	C	1	0,3	CS	17	193	CS	2	163	CS	2	169	CS	2
NATURAL GAS	1A4b	0202	g	GJ	6	CS	14	1	C	1	0,3	CS	17	30	CS	4	4	CS	11	20	CS	11
NATURAL GAS	1A4b	020202	g	GJ	15	CS	11	1	C	1	0,3	CS	17	30	CS	4	4	CS	11	20	CS	11
NATURAL GAS	1A4b	020204	g	GJ	573	CS	2	1	C	1	0,3	CS	17	193	CS	2	163	CS	2	169	CS	2
NATURAL GAS	1A4c	0203	g	GJ	6	CS	14	1	C	1	0,3	CS	17	30	CS	4	2	CS	14	28	CS	4
NATURAL GAS	1A4c	020303	g	GJ	4	CS	2	1	C	1	0,3	CS	17	174	CS	2	1	CS	2	7	CS	10
NATURAL GAS	1A4c	020304	g	GJ	573	CS	2	1	C	1	0,3	CS	17	193	CS	2	163	CS	2	169	CS	2
ORIMULSION (Orimulsion)	1A1a	010101	g	GJ	3	CS	16	2	C	16	10	CS	16	88	CS	9	3	CS	16	15	CS	16
PETROLEUM COKE	1A2f	0301	g	GJ	15	C	1	3	C	1	573	CS	24	50	C	1	1,5	C	1	61	CS	4
PETROLEUM COKE	1A4a	0201	g	GJ	15	C	1	3	C	1	573	CS	24	50	C	1	1,5	C	1	1000	C	1
PETROLEUM COKE	1A4b	0202	g	GJ	15	C	1	3	C	1	573	CS	24	50	C	1	1,5	C	1	1000	C	1
PETROLEUM COKE	1A4c	0203	g	GJ	15	C	1	3	C	1	573	CS	24	50	C	1	1,5	C	1	1000	C	1
REFINERY GAS	1A1b	010303	g	GJ	2	C	1	2	C	1	0,3	CS	23	30	CS	23	4	C	1	15	C	1
REFINERY GAS	1A1b	010304	g	GJ	2	C	1	2	C	1	0,3	CS	23	174	CS	23	4	C	1	15	C	1
RESIDUAL OIL	1A1a	0101	g	GJ	3	C	1	2	C	1	315	CS	20	240	CS	18	3	C	1	15	CS	3
RESIDUAL OIL	1A1a	010101	g	GJ	3	C	1	2	C	1	315	CS	20	240	CS	18	3	C	1	15	CS	3
RESIDUAL OIL	1A1a	010102	g	GJ	3	C	1	2	C	1	315	CS	20	240	CS	18	3	C	1	15	CS	3
RESIDUAL OIL	1A1a	010103	g	GJ	3	C	1	2	C	1	315	CS	20	142	CS	4	3	C	1	15	CS	3
RESIDUAL OIL	1A1a	010104	g	GJ	3	C	1	2	C	1	315	CS	20	142	CS	4	3	C	1	15	C	1
RESIDUAL OIL	1A1a	010202	g	GJ	3	C	1	2	C	1	315	CS	20	240	CS	18	3	C	1	30	C	1
RESIDUAL OIL	1A1a	010203	g	GJ	3	C	1	2	C	1	315	CS	20	142	CS	4	3	C	1	30	C	1
RESIDUAL OIL	1A1b	010303	g	GJ	3	C	1	2	C	1	315	CS	20	142	CS	4	3	C	1	30	C	1
RESIDUAL OIL	1A2f	0301	g	GJ	3	C	1	2	C	1	344	CS	25	130	CS	28	3	C	1	30	C	1
RESIDUAL OIL	1A2f	030102	g	GJ	3	C	1	2	C	1	344	CS	25	130	CS	28	3	C	1	30	C	1
RESIDUAL OIL	1A2f	030103	g	GJ	3	C	1	2	C	1	344	CS	25	142	CS	4	3	C	1	30	C	1
RESIDUAL OIL	1A2f	030104	g	GJ	3	C	1	2	C	1	344	CS	25	142	CS	4	3	C	1	15	C	1
RESIDUAL OIL	1A2f	030105	g	GJ	3	C	1	2	C	1	344	CS	25	142	CS	4	3	C	1	100	C	1
RESIDUAL OIL	1A4a	0201	g	GJ	3	C	1	2	C	1	344	CS	25	130	CS	28	3	C	1	30	C	1
RESIDUAL OIL	1A4a	020105	g	GJ	3	C	1	2	C	1	344	CS	25	142	CS	4	3	C	1	100	C	1
RESIDUAL OIL	1A4b	0202	g	GJ	3	C	1	2	C	1	344	CS	25	130	CS	28	3	C	1	30	C	1
RESIDUAL OIL	1A4c	0203	g	GJ	3	C	1	2	C	1	344	CS	25	130	CS	28	3	C	1	30	C	1
RESIDUAL OIL	1A4c	020302	g	GJ	3	C	1	2	C	1	344	CS	25	130	CS	28	3	C	1	30	C	1
RESIDUAL OIL	1A4c	020304	g	GJ	3	C	1	2	C	1	344	CS	25	142	CS	4	3	C	1	100	C	1

STEAM COAL	1A1a	010101	g	GJ	1,5	C	1	3	C	1	39	CS	21	139	CS	21	1,5	C	1	10	CS	3
STEAM COAL	1A1a	010102	g	GJ	1,5	C	1	3	C	1	39	CS	21	139	CS	21	1,5	C	1	10	CS	3
STEAM COAL	1A1a	010103	g	GJ	15	C	1	3	C	1	464	CS	20	95	CS	4	1,5	C	1	10	CS	3
STEAM COAL	1A1a	010202	g	GJ	15	C	1	3	C	1	464	CS	20	95	CS	4	15	C	1	10	CS	3
STEAM COAL	1A1a	010203	g	GJ	15	C	1	3	C	1	464	CS	20	95	CS	4	15	C	1	10	CS	3
STEAM COAL	1A2f	0301	g	GJ	15	C	1	3	C	1	464	CS	20	95	CS	4	15	C	1	10	C	1
STEAM COAL	1A4b	0202	g	GJ	15	C	1	3	C	1	464	CS	20	95	CS	4	15	C	1	10	C	1
STEAM COAL	1A4c	0203	g	GJ	15	C	1	3	C	1	464	CS	20	95	CS	4	15	C	1	10	C	1
WOOD AND SIMIL.	1A1a	010102	g	GJ	32	C	1	4	C	1	25	CS	22	130	CS	22	48	C	1	50	CS	3
WOOD AND SIMIL.	1A1a	010103	g	GJ	32	C	1	4	C	1	25	CS	22	130	CS	22	48	C	1	50	CS	3
WOOD AND SIMIL.	1A1a	010105	g	GJ	32	C	1	4	C	1	25	CS	22	130	CS	22	48	C	1	50	CS	3
WOOD AND SIMIL.	1A1a	010202	g	GJ	32	C	1	4	C	1	25	CS	22	130	CS	22	48	C	1	240	CS	4
WOOD AND SIMIL.	1A1a	010203	g	GJ	32	C	1	4	C	1	25	CS	22	130	CS	22	48	C	1	240	CS	4
WOOD AND SIMIL.	1A1a	010205	g	GJ	32	C	1	4	C	1	25	CS	22	130	CS	22	48	C	1	240	CS	4
WOOD AND SIMIL.	1A2f	0301	g	GJ	32	C	1	4	C	1	25	CS	22	130	CS	22	48	C	1	240	CS	4
WOOD AND SIMIL.	1A2f	030102	g	GJ	32	C	1	4	C	1	25	CS	22	130	CS	22	48	C	1	240	CS	4
WOOD AND SIMIL.	1A2f	030103	g	GJ	32	C	1	4	C	1	25	CS	22	130	CS	22	48	C	1	240	CS	4
WOOD AND SIMIL.	1A4a	0201	g	GJ	200	C	1	4	C	1	25	CS	22	130	CS	22	600	C	1	240	CS	4
WOOD AND SIMIL.	1A4a	020105	g	GJ	200	C	1	4	C	1	25	CS	22	130	CS	22	600	C	1	240	CS	4
WOOD AND SIMIL.	1A4b	0202	g	GJ	200	C	1	4	C	1	25	CS	22	130	CS	22	600	C	1	9000	CS	12 13
WOOD AND SIMIL.	1A4c	0203	g	GJ	200	C	1	4	C	1	25	CS	22	130	CS	22	600	C	1	240	CS	4

1. Emission Inventory Guidebook 3rd edition, prepared by the UNECE/EMEP Task Force on Emissions Inventories and Projections
2. Emissionsforhold for gasdrevne kraftvarmeanlæg <25MWe, Arbejdsrapport fra Miljøstyrelsen nr 17 1997 (In Danish)
3. Elsam, Bo Sander, mail 17-05-2002
4. Luftvejledningen, Begrænsning af luftforurening fra virksomheder, Vejledning fra Miljøstyrelsen Nr. 2 2001 (Danish legislation)
5. Halm til energiformål, Teknik – Miljø – Økonomi, 2. udgave, 1998, Videncenter for halm og flisfyring (In Danish)
6. Emissioner fra halm- og flisfyr, dk-Teknik 1990 (In Danish)
7. Danish Technological Institute, personal communication
8. dk-Teknik, personal communication
9. Calculation based on annual environmental reports of Danish plants year 2000
10. Technical note from Danish Gas Technology Centre, Eltra PSO 2002 (In Danish, not published)
11. Energi- og miljøoversigt, Danish Gas Technology Centre 2000 (In Danish)
12. Miljøprojekt 149/1990 Emissionsundersøgelse for pejse og brændeovne, Miljøstyrelsen (In Danish)
13. Miljøprojekt 249/1994 Emissioner af dioxiner fra pejse og brændeovne, Miljøstyrelsen (In Danish)
14. Naturgas – Energi og miljø, Danish Gas Technology Centre, 2000 (In Danish)
15. Same emission factors as agricultural waste (straw) is assumed
16. Same emission factors as residual oil assumed
17. Calculation based on S content of natural gas 6mg(S)/m_n^3 gas. S content from the Danish natural gas transmission company DONG
18. Indberetning af SO_2 og NO_x emissioner, Eltra og Elkraft System (Reportingof SO_2 and NO_x emissions from power plants >25MW_e due to Danish legislation)
19. Fyring med biomassebaserede restprodukter, Miljøprojekt nr. 358 1997, Miljøstyrelsen
20. Indberetning af SO_2 og NO_x emissioner, Eltra og Elkraft System, antaget ingen røggasrensning for arealkilder (Reportingof SO_2 and NO_x emissions from power plants >25MW_e due to Danish legislation)
21. Average of large point sources 2000
22. Træ til energiformål, Teknik – Miljø – Økonomi, 2. udgave, 1999, Videncenter for halm og flisfyring (In Danish)
23. Same emission factor as for natural gas assumed
24. Bekendtgørelseom begrænsning af svovlindholdet i visse flydende og faste brændstoffer, Bekendtgørelse 698 af 22/09/1998 (Danish legislation)
25. Assumed 0,7% S. Product data from Shell and Statoil
26. S content stated by plant owners (~200 ppm H2S)
27. Assumed 0,05% S. Bilag 750, Kom 97/0105 and product sheets from Q8, Shell and Statoil
28. Bekendtgørelse om begrænsning af emissioner af svovldioxid, kvælstofoxider og støv fra store fyringsanlæg, Bekendtgørelse 689 af 15/10/1990 (Danish legislation)
29. –
30. Product sheet from Shell

Table 37 Emission factors 2001 (b)

fuel	IPCC source	SNAP	unit1	unit2	As	Reference	Cd	Reference	Cr	Reference	Cu	Reference	Hg	Reference	Ni	Reference	Pb	Reference	Se	Reference	Zn	Reference
AGRICUL. WASTES	all	all	mg	GJ			0,62	CS 1	0,62	CS 1	1,06	CS 1	6,8	CS 1	0,53	CS 1	3,22	CS 1			8,39	CS 1
LIQUID BIOMASS FUEL	all	all	mg	GJ			0,62	CS 1	0,62	CS 1	1,06	CS 1	6,8	CS 1	0,53	CS 1	3,22	CS 1			8,39	CS 1
GAS OIL	all	all	mg	GJ	1,17	CS 1	0,23	CS 1	0,94	CS 1	1,17	CS 1	1,17	CS 1	0,64	CS 1	2,34	CS 1	4,68	CS 1	11,7	CS 1
MUNICIP. WASTES	all	all	mg	GJ	3,53	CS 1	9,21	CS 1	32,97	CS 1	31,8	CS 1	58,7	CS 1	55,4	CS 1	137,5	CS 1			359,5	CS 1
																	7					
ORIMULSION	all	all	mg	GJ	14,07	CS 1	13,5	CS 1	33,33	CS 1	12,96	CS 1	4,3	CS 1	642	CS 1	23,46	CS 1	12,3	CS 1	2,72	CS 1
PETROLEUM COKE	all	all	mg	GJ	3,2	CS 1	0,1	CS 1	2,3	CS 1	3,1	CS 1	1,7	CS 1	4,4	CS 1	6	CS 1	0,5	CS 1	10,5	CS 1
RESIDUAL OIL	all	all	mg	GJ	14,07	CS 1	13,5	CS 1	33,33	CS 1	12,96	CS 1	4,3	CS 1	642	CS 1	23,46	CS 1	12,3	CS 1	2,72	CS 1
STEAM COAL	all	all	mg	GJ	3,2	CS 1	0,1	CS 1	2,3	CS 1	3,1	CS 1	1,7	CS 1	4,4	CS 1	6	CS 1	0,5	CS 1	10,5	CS 1
WOOD AND SIMIL.	all	all	mg	GJ			6,8	CS 1			6,8	CS 1	6,8	CS 1			3,4	CS 1			136	CS 1

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

Table 38 Emission factors 2001 (c)

fuel	IPCC source	SNAP	unit1	unit2	Benzo(a) pyrene	Reference	Benzo(b) flouran-thene	Reference	Benzo(k) flouran-thene	Reference	Indeno-(1,2,3-c,d)-pyrene	Reference
AGRICUL. WASTES	1A1a	010102	microgr	GJ	1,6	CS 1	1,4	CS 1	1	CS 1	1,6	CS 1
AGRICUL. WASTES	1A1a	010103	microgr	GJ	1529	CS 2	3452	CS 2	1400	CS 2	1029	CS 2
AGRICUL. WASTES	1A1a	010202	microgr	GJ	1529	CS 2	3452	CS 2	1400	CS 2	1029	CS 2
AGRICUL. WASTES	1A1a	010203	microgr	GJ	1529	CS 2	3452	CS 2	1400	CS 2	1029	CS 2
AGRICUL. WASTES	1A2f	all	microgr	GJ	1529	CS 2	3452	CS 2	1400	CS 2	1029	CS 2
AGRICUL. WASTES	1A4	all	microgr	GJ	12956	CS 2	12828	CS 2	6912	CS 2	4222	CS 2
LIQUID BIOMASS FUEL	all	all	microgr	GJ	1529	CS 3	3452	CS 3	1400	CS 3	1029	CS 3
GAS OIL	1A1a	all	microgr	GJ	109,6	CS 4	475,41	CS 4	93,21	CS 4	177,28	CS 4
GAS OIL	1A2f	all	microgr	GJ	80	CS 4	42	CS 4	66	CS 4	160	CS 4
GAS OIL	1A4	all	microgr	GJ	80	CS 4	42	CS 4	66	CS 4	160	CS 4
MUNICIP. WASTES	1A1a	all	microgr	GJ	67	CS 5	571	CS 5				
NATURAL GAS	1A2f	030103	microgr	GJ	1,5	CS 6	3,1	CS 6	2	CS 6	22,3	CS 6
NATURAL GAS	1A4b	020202	microgr	GJ	0,133	CS 6	0,663	CS 6	0,265	CS 6	2,653	CS 6
ORIMULSION	1A1a	010101	microgr	GJ	109,6	CS 7	475,41	CS 7	93,21	CS 7	177,28	CS 7
PETROLEUM COKE	all	all	microgr	GJ	3184	CS 5	9554	CS 5				
RESIDUAL OIL	1A1	all	microgr	GJ	109,6	CS 4	475,41	CS 4	93,21	CS 4	177,28	CS 4
RESIDUAL OIL	1A2f	all	microgr	GJ	80	CS 4	42	CS 4	66	CS 4	160	CS 4
RESIDUAL OIL	1A4	all	microgr	GJ	80	CS 4	42	CS 4	66	CS 4	160	CS 4
STEAM COAL	1A1a	all	microgr	GJ	0,14	CS 4	0,29	CS 4	0,29	CS 4	0,28	CS 4
STEAM COAL	1A2f	0301	microgr	GJ	23	CS 4	929	CS 4	929	CS 4	698	CS 4
STEAM COAL	1A4	all	microgr	GJ	59524	CS 4	63492	CS 4	1984	CS 4	119048	CS 4
WOOD AND SIMIL.	1A1 and 1A2	all	microgr	GJ	6,46	CS 4	1292,52	CS 4	1292,52	CS 4	11,56	CS 4
WOOD AND SIMIL.	1A4	all	microgr	GJ	168707	CS 4	221769	CS 4	73469	CS 4	119728	CS 4

1. Elsam, Bo Sander e-mail 11-10-2001
2. Emissioner fra halm- og flisfyr, Arb. rap fra MST nr 5 1996, bilagsrapport
3. Same emission factors as for agricultural waste (straw) is assumed
4. TNO-report TNO-MEP-R95/247
5. Utslipp til luft av noen miljøgifter i Norge
6. Stated by Danish Gas Technology Centre
7. Same emission factors as for residual oil is assumed

Table 39 Emission factors 2001 (d)

fuel	IPCC source	SNAP	unit1	unit2	TSP	Reference	PM_{10}	Reference	$PM_{2.5}$	Reference
AGRICUL. WASTES	1A1a	010102	g	GJ	8	CS 3	6	CS 2	4	CS 2
AGRICUL. WASTES	1A1a	010103	g	GJ	8	CS 3	6	CS 2	4	CS 2
AGRICUL. WASTES	1A1a	010202	g	GJ	21	CS 1	15	CS 2	12	CS 2
AGRICUL. WASTES	1A1a	010203	g	GJ	21	CS 1	15	CS 2	12	CS 2
AGRICUL. WASTES	1A2f	030102	g	GJ	21	CS 1	15	CS 2	12	CS 2
AGRICUL. WASTES	1A2f	030105	g	GJ	21	CS 1	15	CS 2	12	CS 2
AGRICUL. WASTES	1A4a	0201	g	GJ	21	CS 1	15	CS 2	12	CS 2
AGRICUL. WASTES	1A4b	0202	g	GJ	234	CS 4	222	CS 5	211	CS 5
AGRICUL. WASTES	1A4c	0203	g	GJ	21	CS 1	15	CS 2	12	CS 2
AGRICUL. WASTES	1A4c	020302	g	GJ	21	CS 1	15	CS 2	12	CS 2
BIOGAS	all	all	g	GJ	1,5	CS 6	1,5	CS 7	1,5	CS 7
LIQUID BIO FUEL	all	all	g	GJ	19	CS 8	19	CS 8	19	CS 8
GAS OIL	all	all	g	GJ	5	C 9	5	C 9	5	C 9
KEROSENE	all	all	g	GJ	5	C 9	5	C 9	5	C 9
LPG	all	all	g	GJ	0,2	C 9	0,2	C 9	0,2	C 9
MUNICIP. WASTES	1A1a	all	g	GJ	6	CS 10	5	CS 11	4	CS 11
MUNICIP. WASTES	1A4a	all	g	GJ	100	C 9	95	C 9	90	C 9
NATURAL GAS	all	all	g	GJ	0,1	C 9	0,1	C 9	0,1	C 9
ORIMULSION	1A1a	010101	g	GJ	1,9	CS 12	1,8	CS 12	1,6	CS 12
PETROLEUM COKE	1A2f	0301	g	GJ	10	C 9	7	C 9	3	C 9
PETROLEUM COKE	1A4	all	g	GJ	100	C 9	60	C 9	30	C 9
REFINERY GAS	all	all	g	GJ	5	C 9	5	C 9	5	C 9
RESIDUAL OIL	1A1a	all	g	GJ	3	C 9	3	C 9	2,5	C 9
RESIDUAL OIL	1A1b	010303	g	GJ	50	C 9	40	C 9	35	C 9
RESIDUAL OIL	1A2f	all	g	GJ	14	CS 6	10,5	CS 13	7	CS 13
RESIDUAL OIL	1A4a	0201	g	GJ	14	CS 6	10,5	CS 13	7	CS 13
RESIDUAL OIL	1A4a	020105	g	GJ	60	C 9	50	C 9	40	C 9
RESIDUAL OIL	1A4b	0202	g	GJ	14	CS 6	10,5	CS 13	7	CS 13
RESIDUAL OIL	1A4c	0203	g	GJ	14	CS 6	10,5	CS 13	7	CS 13
RESIDUAL OIL	1A4c	020302	g	GJ	14	CS 6	10,5	CS 13	7	CS 13
RESIDUAL OIL	1A4c	020304	g	GJ	60	C 9	50	C 9	40	C 9
STEAM COAL	1A1a	010101	g	GJ	3	CS 12	2,6	CS 12	2,1	CS 12
STEAM COAL	1A1a	010102	g	GJ	3	CS 12	2,6	CS 12	2,1	CS 12
STEAM COAL	1A1a	010103	g	GJ	3	CS 12	2,6	CS 12	2,1	CS 12
STEAM COAL	1A1a	010202	g	GJ	6	C 9	6	C 9	5	C 9
STEAM COAL	1A1a	010203	g	GJ	6	C 9	6	C 9	5	C 9
STEAM COAL	1A2f	0301	g	GJ	17	CS 6	12	CS 14	7	CS 14
STEAM COAL	1A4b	0202	g	GJ	17	CS 6	12	CS 14	7	CS 14
STEAM COAL	1A4c	0203	g	GJ	17	CS 6	12	CS 14	7	CS 14
WOOD AND SIMIL.	1A1a	010102	g	GJ	8	CS 3 12	6	CS 3 12	4	CS 3 12
WOOD AND SIMIL.	1A1a	010103	g	GJ	8	CS 3 12	6	CS 3 12	4	CS 3 12
WOOD AND SIMIL.	1A1a	010105	g	GJ	8	CS 3 12	6	CS 3 12	4	CS 3 12
WOOD AND SIMIL.	1A1a	010202	g	GJ	19	CS 1	13	CS 2	10	CS 2
WOOD AND SIMIL.	1A1a	010203	g	GJ	19	CS 1	13	CS 2	10	CS 2
WOOD AND SIMIL.	1A1a	010205	g	GJ	19	CS 1	13	CS 2	10	CS 2
WOOD AND SIMIL.	1A2f	all	g	GJ	19	CS 1	13	CS 2	10	CS 2
WOOD AND SIMIL.	1A4a	0201	g	GJ	143	CS 1	143	C 9	135	C 9
WOOD AND SIMIL.	1A4a	020105	g	GJ	143	CS 1	143	C 9	135	C 9
WOOD AND SIMIL.	1A4b	0202	g	GJ	150	C 9	143	C 9	135	C 9
WOOD AND SIMIL.	1A4c	0203	g	GJ	143	CS 1	143	C 9	135	C 9

1. Danish legislation, Luftvejledningen. Vejledning fra Miljøstyrelsen nr 2 2001
2. Particulate size distribution for wood combustion in power plants stated by TNO
3. Eltra PSO 3141, Temporary report
4. The Danish Technological Institute, rough estimate
5. Particulate size distribution for wood combustion in residential plants stated by TNO
6. Danish legislation. Bekendtgørelse om begrænsning af emissioner af svovldioxid, kvælstofoxider og støv fra store fyringsanlæg. Bekendtgørelse nr 689 af 15/10/1990
7. All TSP emission is assumed to be <2,5µm
8. Same emission factor as for agricultural waste (straw) is assumed
9. TNO CEPMEIP database
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
12. 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 stated by TNO
14. Particulate size distribution for coal combustion stated by TNO

Table 40 Emission factors of NMVOC [g / GJ] Time series of area sources

fuel_gr_abbr	SNAP_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
STEAM COAL	0101	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5
STEAM COAL	Other	15	15	15	15	15	15	15	15	15	15	15	15
PETROLEUM COKE	all	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5
WOOD AND SIMIL.	01 and 03	48	48	48	48	48	48	48	48	48	48	48	48
WOOD AND SIMIL.	0201, 0202 and 0203	600	600	600	600	600	600	600	600	600	600	600	600
MUNICIP. WASTES	all	9	9	9	9	9	9	9	9	9	9	9	9
AGRICUL. WASTES	01 and 03	50	50	50	50	50	50	50	50	50	50	50	50
AGRICUL. WASTES	02	600	600	600	600	600	600	600	600	600	600	600	600
RESIDUAL OIL	all	3	3	3	3	3	3	3	3	3	3	3	3
GAS OIL	010105, 010205, 020105, 020304, 030105									100	100	100	100
GAS OIL	010104, 030104									2	2	2	2
GAS OIL	01 and 03 Other	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5
GAS OIL	02 other	3	3	3	3	3	3	3	3	3	3	3	3
KEROSENE	all	3	3	3	3	3	3	3	3	3	3	3	3
LIQUID BIOMASS FUEL	010203												50
LIQUID BIOMASS FUEL	020304												600
ORIMULSION (Orimulsion)	0101						3	3	3	3	3	3	3
NATURAL GAS	Engines: 010105, 010405, 010505, 020105, 020204, 020304, 030105	163	163	163	163	163	163	163	163	163	163	163	163
NATURAL GAS	Gas turbines: 010104, 010304, 010504, 020104, 020303, 030104	1	1	1	1	1	1	1	1	1	1	1	1
NATURAL GAS	0202 (-02)	4	4	4	4	4	4	4	4	4	4	4	4
NATURAL GAS	Other	2	2	2	2	2	2	2	2	2	2	2	2
LPG	all	2	2	2	2	2	2	2	2	2	2	2	2
REFINERY GAS	all	4	4	4	4	4	4	4	4	4	4	4	4
BIOGAS	all	4	4	4	4	4	4	4	4	4	4	4	4

Table 41 Emission factors of CO [g / GJ] Time series of area sources

fuel_gr_abbr	SNAP_id	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
STEAM COAL	all	10	10	10	10	10	10	10	10	10	10	10	10
PETROLEUM COKE	010102				61								
PETROLEUM COKE	02	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
PETROLEUM COKE	03	61	61	61	61	61	61	61	61	61	61	61	61
WOOD AND SIMIL.	0101			50	50	50	50	50	50	50	50	50	50
WOOD AND SIMIL.	0102 and 0201	400	373	347	320	293	267	240	240	240	240	240	240
WOOD AND SIMIL.	0202	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000
WOOD AND SIMIL.	0203 and 0301	400	373	347	320	293	267	240	240	240	240	240	240
MUNICIP. WASTES	all	100	85	70	55	40	25	10	10	10	10	10	10
AGRICUL. WASTES	0101	50	50	50	50	50	50	50	50	50	50	50	50
AGRICUL. WASTES	0102 and 0201	600	554	508	463	417	371	325	325	325	325	325	325
AGRICUL. WASTES	0202	8500	8500	8500	8500	8500	7500	6500	5500	4500	4000	4000	4000
AGRICUL. WASTES	0203 and 0301	600	554	508	463	417	371	325	325	325	325	325	325
RESIDUAL OIL	0101	15	15	15	15	15	15	15	15	15	15	15	15
RESIDUAL OIL	0102, 0103, 02	30	30	30	30	30	30	30	30	30	30	30	30
RESIDUAL OIL	0301 (-02 and -03)	30	30	30	30	30	30	30	30	30	30	30	30
RESIDUAL OIL	030104										15	15	15
RESIDUAL OIL	030105												100
GAS OIL	0101 (not –05)	15	15	15	15	15	15	15	15	15	15	15	15
GAS OIL	010105									100	100	100	100
GAS OIL	0102 (not –05) and 0103 and 0104	30	30	30	30	30	30	30	30	30	30	30	30
GAS OIL	010205											100	100
GAS OIL	0201 (-03)	30	30	30	30	30	30	30	30	30	30	30	30
GAS OIL	020105											100	100
GAS OIL	0202 (-02)	43	43	43	43	43	43	43	43	43	43	43	43
GAS OIL	0203 (-02)	30	30	30	30	30	30	30	30				
GAS OIL	020304											100	100
GAS OIL	0301 (-02-, 03)	30	30	30	30	30	30	30	30	30	30	30	30
GAS OIL	030104											15	15
GAS OIL	030105											100	100
GAS OIL	030106	30	30	30	30	30	30	30	30	30	30	30	30
KEROSENE	all	20	20	20	20	20	20	20	20	20	20	20	20
LIQUID BIOMASS FUEL	all												325
ORIMULSION (Orimulsion)	0101						15	15	15	15	15	15	15
NATURAL GAS	0101 (-01, -02, -03)	15	15	15	15	15	15	15	15	15	15	15	15
NATURAL GAS	010104, 010304, 010504, 020104, 020303, 030104	7	7	7	7	7	7	7	7	7	7	7	7
NATURAL GAS	010105, 010405, 010505, 020105, 020204, 020304, 030105	212	212	212	212	212	212	203	195	186	178	169	169
NATURAL GAS	0202 (-02)	20	20	20	20	20	20	20	20	20	20	20	20
NATURAL GAS	Other	28	28	28	28	28	28	28	28	28	28	28	28
LPG	all	25	25	25	25	25	25	25	25	25	25	25	25
REFINERY GAS	all	15	15	15	15	15	15	15	15	15	15	15	15
BIOGAS	010105, 010405, 010505, 020105, 020304, 030105									255	255	255	255
BIOGAS	Other	36	36	36	36	36	36	36	36	36	36	36	36

Table 42 Emission factors 2001 for large point sources. Only emission factors that differs from the area source emission factors are included

Fuel	SNAP	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Coal	010101,	3,3	-	8,02	4,41	2,2	6,81	-	13	-
Residual oil	010101, 010102, 010104	1,48	4,43	1,33	1,48	0,15	191	1,48	0,59	11,7

Appendix 6 Implied emission factors for power plants and municipal waste CHP plants

Table 43 Implied emission factors for municipal waste incineration plants 2001

Pollutant	Implied Emission factor	Unit
SO_2	36	g/GJ
NO_x	145	g/GJ
TSP	3,9	g/GJ
PM_{10}	3,5	g/GJ
$PM_{2.5}$	2,9	g/GJ
As	6	mg/GJ
Cd	8	mg/GJ
Cr	30	mg/GJ
Cu	30	mg/GJ
Hg	38	mg/GJ
Ni	50	mg/GJ
Pb	61	mg/GJ
Zn	356	mg/GJ

Table 44 Implied emission factors for power plants >25MW_e, 2001

Pollutant	Implied Emission factor	Unit
SO_2	33	g/GJ
NO_x	125	g/GJ
TSP	3	g/GJ
PM_{10}	3	g/GJ
$PM_{2.5}$	2	g/GJ
As	0,6	mg/GJ
Cd	0,3	mg/GJ
Cr	1,7	mg/GJ
Cu	1,5	mg/GJ
Hg	2,0	mg/GJ
Ni	5,9	mg/GJ
Pb	1,5	mg/GJ
Se	2,1	mg/GJ
Zn	13,4	mg/GJ

Appendix 7 CO_2 emission factor for municipal waste

11 April 2000
Jytte Boll Illerup
The National Environmental Research Institute
Denmark

CO_2 emission from plastic in municipal waste

In the Danish air emission inventory the emission of CO_2 from plastic in municipal waste is included in the total CO_2 emission.

The Danish Environmental Agency has estimated the content of plastic in municipality waste (C_{plast}) to be 6.4 w / w%. The energy content in plastic (E_{plast}) from one ton waste can be calculated to be:

(1) $E_{plast}(t) = C_{plast} \times H_{plast}(t)$

where $H_{plast}(t)$ is the lower heating value of plastic. It is assumed that H_{plast} equals the lower heating value of crude oil.

The emission of CO_2 from the plastic part of the waste per GJ plastic ($EMF_{,p,p}$) is

(2) $EMF_{p,p} = (C_{C,plast} \times M_{CO2}) / M_C$

where M_{CO2} is the mole weight for CO2 and M_C is the mole weight for carbon.

The emission of CO_2 from the plastic part of the waste per GJ waste ($EMF_{p,w}$) is

(3) $EMF_{p,w}(t) = EMF_{p,p} \times E_{plast} / H_{waste}(t)$

where H_{waste} is the lower heating value of waste.

Equations (1)-(3) gives:

(4) $EMF_{p,w}(t) = C_{C,plast} \times C_{plast} \times M_{CO2/MC} \times H_{plast} / H_{waste}$

Constants:
C_{plast} = 6,4 w / w% (Ref. The Danish Environmental Agency)
$C_{c,plast}$ = 20 kg carbon / GJ in plastic (Ref. IPCC Guidelines)
M_{CO2} = 44 kg / kmol
M_C = 12 kg / kmol

The values of $EMF_{p,w}$ for 1990 to 1998 used in the Danish air emission inventory are given in table A
.

Table A CO_2-emissionfactor for plastic in municipal waste.

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
H_{plast} [1)]	42,7	42,7	42,7	42,7	42,7	42,7	42,7	42,7	43	43	43	43
H_{waste} [1)] (GJ/ton)	8,2	8,2	9	9,4	9,4	10	10,5	10,5	10,4	10,5	10,5	10,5
EMFp,w (kg/GJ in waste)	24,44	24,44	22,27	21,32	21,32	20,04	19,09	19,09	19,41	19,22	19,22	19,22

1) Ref.: The Danish Energy Agency

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Municipal waste (GJ)	15,006	16,255	17,325	18,963	19,979	24,088	25,394	27,632	27,323	29,13	30,27	33,04
CO_2 emission from plastic (kton)	367	397	386	404	426	483	485	527	530	560	582	635

Appendix 8 Large point sources

Table 45 Large point sources, fuel consumption in 2001 (1A1, 1A2 and 1A4)

lps_id	lps_name	part_id	SNAP_id	fuel	fuel cons. [GJ]	IPCC source
001	Amagervaerket	01	010101	STEAM COAL	2785006	1A1a
001	Amagervaerket	01	010101	RESIDUAL OIL	124657	1A1a
001	Amagervaerket	02	010101	STEAM COAL	2765850	1A1a
001	Amagervaerket	02	010101	RESIDUAL OIL	148840	1A1a
001	Amagervaerket	03	010101	STEAM COAL	14334732	1A1a
001	Amagervaerket	03	010101	RESIDUAL OIL	126698	1A1a
002	Svanemoellevaerket	05	010101	NATURAL GAS	1882525	1A1a
002	Svanemoellevaerket	07	010104	NATURAL GAS	4344799	1A1a
003	H.C.Oerstedsvaerket	03	010101	RESIDUAL OIL	1177110	1A1a
003	H.C.Oerstedsvaerket	03	010101	NATURAL GAS	1688830	1A1a
003	H.C.Oerstedsvaerket	07	010101	RESIDUAL OIL	1931452	1A1a
003	H.C.Oerstedsvaerket	07	010101	NATURAL GAS	2327121	1A1a
004	Kyndbyvaerket	22	010101	RESIDUAL OIL	103088	1A1a
004	Kyndbyvaerket	26	010101	RESIDUAL OIL	187734	1A1a
004	Kyndbyvaerket	28	010101	RESIDUAL OIL	89515	1A1a
004	Kyndbyvaerket	41	010105	GAS OIL	1009	1A1a
004	Kyndbyvaerket	51	010104	GAS OIL	6186	1A1a
004	Kyndbyvaerket	52	010104	GAS OIL	7801	1A1a
005	Masnedoevaerket	12	010102	WOOD AND SIMIL.	95934	1A1a
005	Masnedoevaerket	12	010102	AGRICUL. WASTES	484060	1A1a
005	Masnedoevaerket	12	010102	GAS OIL	1108	1A1a
005	Masnedoevaerket	31	010104	GAS OIL	5584	1A1a
007	Stigsnaesvaerket	01	010101	STEAM COAL	330455	1A1a
007	Stigsnaesvaerket	01	010101	RESIDUAL OIL	67899	1A1a
007	Stigsnaesvaerket	02	010101	STEAM COAL	5558569	1A1a
007	Stigsnaesvaerket	02	010101	RESIDUAL OIL	250782	1A1a
008	Asnaesvaerket	01	010101	RESIDUAL OIL	144268	1A1a
008	Asnaesvaerket	03	010101	STEAM COAL	2173576	1A1a
008	Asnaesvaerket	03	010101	RESIDUAL OIL	66746	1A1a
008	Asnaesvaerket	04	010101	STEAM COAL	7479179	1A1a
008	Asnaesvaerket	04	010101	RESIDUAL OIL	82560	1A1a
008	Asnaesvaerket	05	010101	RESIDUAL OIL	266167	1A1a
008	Asnaesvaerket	05	010101	ORIMULSION	30243677	1A1a
009	Statoil Raffinaderi	01	010306	RESIDUAL OIL	765537	1A1b
009	Statoil Raffinaderi	01	010306	REFINERY GAS	6909888	1A1b
010	Avedoerevaerket	01	010101	STEAM COAL	17199365	1A1a
010	Avedoerevaerket	01	010101	RESIDUAL OIL	63657	1A1a
010	Avedoerevaerket	01	010101	GAS OIL	40018	1A1a
010	Avedoerevaerket	02	010104	AGRICUL. WASTES	101730	1A1a
010	Avedoerevaerket	02	010104	RESIDUAL OIL	1715776	1A1a
010	Avedoerevaerket	02	010104	NATURAL GAS	1279897	1A1a
011	Fynsvaerket	03	010101	STEAM COAL	1684670	1A1a
011	Fynsvaerket	03	010101	WOOD AND SIMIL.	920	1A1a
011	Fynsvaerket	03	010101	MUNICIP. WASTES	185500	1A1a
011	Fynsvaerket	03	010101	AGRICUL. WASTES	10070	1A1a
011	Fynsvaerket	03	010101	RESIDUAL OIL	98330	1A1a
011	Fynsvaerket	03	010101	NATURAL GAS	7666490	1A1a
011	Fynsvaerket	07	010101	STEAM COAL	10731460	1A1a
011	Fynsvaerket	07	010101	RESIDUAL OIL	88460	1A1a
011	Fynsvaerket	08	010101	MUNICIP. WASTES	2623520	1A1a
011	Fynsvaerket	08	010101	GAS OIL	42420	1A1a
012	Studstrupvaerket	03	010101	STEAM COAL	15240450	1A1a
012	Studstrupvaerket	03	010101	RESIDUAL OIL	132130	1A1a
012	Studstrupvaerket	04	010101	STEAM COAL	11462760	1A1a
012	Studstrupvaerket	04	010101	AGRICUL. WASTES	28160	1A1a
012	Studstrupvaerket	04	010101	RESIDUAL OIL	136920	1A1a
014	Vendsysselvaerket	03	010101	STEAM COAL	19831710	1A1a
014	Vendsysselvaerket	03	010101	RESIDUAL OIL	206640	1A1a
014	Vendsysselvaerket	03	010101	GAS OIL	15280	1A1a
017	Shell Raffinaderi	01	010306	RESIDUAL OIL	677392	1A1b
017	Shell Raffinaderi	01	010306	REFINERY GAS	4866618	1A1b
017	Shell Raffinaderi	05	010304	REFINERY GAS	2457089	1A1b
018	Skaerbaekvaerket	01	010101	RESIDUAL OIL	85000	1A1a
018	Skaerbaekvaerket	03	010101	GAS OIL	25000	1A1a
018	Skaerbaekvaerket	03	010101	NATURAL GAS	6950000	1A1a
019	Enstedvaerket	03	010101	STEAM COAL	27937970	1A1a
019	Enstedvaerket	03	010101	RESIDUAL OIL	153050	1A1a
019	Enstedvaerket	04	010101	AGRICUL. WASTES	1549480	1A1a
019	Enstedvaerket	04	010101	RESIDUAL OIL	15520	1A1a
020	Esbjergvaerket	03	010101	STEAM COAL	19474710	1A1a
020	Esbjergvaerket	03	010101	RESIDUAL OIL	74420	1A1a
022	Oestkraft	05	010102	RESIDUAL OIL	17990	1A1a
022	Oestkraft	06	010102	STEAM COAL	723407	1A1a
022	Oestkraft	06	010102	WOOD AND SIMIL.	31020	1A1a
022	Oestkraft	06	010102	RESIDUAL OIL	29102	1A1a
023	Danisco Ingredients	01	030102	STEAM COAL	552101	1A2f
023	Danisco Ingredients	01	030102	NATURAL GAS	10500	1A2f
024	Dansk Naturgas Behandlingsanlaeg	01	010502	NATURAL GAS	352650,31	1A1c
025	Horsens Kraftvarmevaerk	01	010102	MUNICIP. WASTES	875920	1A1a
025	Horsens Kraftvarmevaerk	02	010104	NATURAL GAS	878260	1A1a
026	Herningvaerket	01	010102	RESIDUAL OIL	21650	1A1a
026	Herningvaerket	01	010102	NATURAL GAS	3806740	1A1a
027	Vestforbraendingen	01	010102	MUNICIP. WASTES	2086623	1A1a
027	Vestforbraendingen	01	010102	GAS OIL	17862	1A1a
027	Vestforbraendingen	02	010102	MUNICIP. WASTES	3007981	1A1a
028	Amagerforbraendingen	01	010102	MUNICIP. WASTES	3019970	1A1a

029	Randersvaerket	01	010102	STEAM COAL	3229268	1A1a
029	Randersvaerket	01	010102	BIOGAS	23338	1A1a
029	Randersvaerket	02	010102	GAS OIL	46594	1A1a
030	Grenaavaerket	01	010102	STEAM COAL	1017827	1A1a
030	Grenaavaerket	01	010102	WOOD AND SIMIL.	217337	1A1a
030	Grenaavaerket	01	010102	MUNICIP. WASTES	130991	1A1a
030	Grenaavaerket	01	010102	AGRICUL. WASTES	853970	1A1a
030	Grenaavaerket	01	010102	RESIDUAL OIL	77083	1A1a
030	Grenaavaerket	01	010102	GAS OIL	7470	1A1a
031	Hilleroedvaerket	01	010104	NATURAL GAS	3190810	1A1a
032	Helsingoervaerket	01	010104	NATURAL GAS	2066843	1A1a
033	Staalvalsevaerket	01	030102	NATURAL GAS	1803744	1A2f
034	Stora Dalum	01	030102	NATURAL GAS	1054807,5	1A2f
035	Assens Sukkerfabrik	01	030102	STEAM COAL	445279,5	1A2f
035	Assens Sukkerfabrik	01	030102	RESIDUAL OIL	306379,05	1A2f
035	Assens Sukkerfabrik	01	030102	BIOGAS	17020	1A2f
036	Kolding Kraftvarmevaerk	01	010103	MUNICIP. WASTES	762059	1A1a
036	Kolding Kraftvarmevaerk	02	010103	MUNICIP. WASTES	285185	1A1a
037	Maabjergvaerket	02	010102	WOOD AND SIMIL.	432000	1A1a
037	Maabjergvaerket	02	010102	MUNICIP. WASTES	1720000	1A1a
037	Maabjergvaerket	02	010102	AGRICUL. WASTES	408000	1A1a
037	Maabjergvaerket	02	010102	NATURAL GAS	218000	1A1a
038	Soenderborg Kraftvarmevaerk	01	010102	MUNICIP. WASTES	461825	1A1a
038	Soenderborg Kraftvarmevaerk	02	010104	NATURAL GAS	910366	1A1a
039	Kara Affaldsforbraendingsanlaeg	01	010102	MUNICIP. WASTES	1962022	1A1a
039	Kara Affaldsforbraendingsanlaeg	01	010102	NATURAL GAS	16851	1A1a
040	Viborg Kraftvarmevaerk	01	010104	NATURAL GAS	2398896,9	1A1a
042	Nordforbraendingen	01	010102	MUNICIP. WASTES	1018068	1A1a
045	Aalborg Portland	01	030311	STEAM COAL	4718457,5	1A2f
045	Aalborg Portland	01	030311	PETROLEUM COKE	7656733	1A2f
045	Aalborg Portland	01	030311	MUNICIP. WASTES	795492	1A2f
045	Aalborg Portland	01	030311	RESIDUAL OIL	784	1A2f
046	Aarhus Nord	01	010102	MUNICIP. WASTES	1211385	1A1a
046	Aarhus Nord	02	010102	MUNICIP. WASTES	648292	1A1a
047	Reno Nord	01	010103	MUNICIP. WASTES	1487290	1A1a
048	Silkeborg Kraftvarmevaerk	01	010104	NATURAL GAS	3571656	1A1a
049	Rensningsanlægget Lynetten	01	020103	MUNICIP. WASTES	12669	1A4a
049	Rensningsanlægget Lynetten	01	020103	GAS OIL	44010	1A4a
049	Rensningsanlægget Lynetten	01	020103	BIOGAS	84512	1A4a
050	I/S Fasan	01	010203	MUNICIP. WASTES	754394	1A1a
051	AVV Forbrændingsanlæg	01	010103	MUNICIP. WASTES	632966	1A1a
052	I/S REFA Kraftvarmeværk	01	010103	MUNICIP. WASTES	1040783	1A1a
053	Svendborg Kraftvarmeværk	01	010102	MUNICIP. WASTES	470264	1A1a
053	Svendborg Kraftvarmeværk	01	010102	NATURAL GAS	6727	1A1a
054	Kommunekemi	02	010102	MUNICIP. WASTES	651702	1A1a
054	Kommunekemi	02	010102	RESIDUAL OIL	40171	1A1a
054	Kommunekemi	02	010102	GAS OIL	7604	1A1a
054	Kommunekemi	03	010102	MUNICIP. WASTES	637250	1A1a
054	Kommunekemi	03	010102	RESIDUAL OIL	49654	1A1a
054	Kommunekemi	03	010102	GAS OIL	9110	1A1a
054	Kommunekemi	04	010104	NATURAL GAS	1000	1A1a
055	I/S Fælles Forbrænding	01	010203	MUNICIP. WASTES	235484	1A1a
056	Vestfyns Forbrænding	01	010203	MUNICIP. WASTES	242970	1A1a
058	I/S Reno Syd	01	010103	MUNICIP. WASTES	614638	1A1a
059	I/S Kraftvarmeværk Thisted	01	010103	MUNICIP. WASTES	562958	1A1a
059	I/S Kraftvarmeværk Thisted	01	010103	AGRICUL. WASTES	943	1A1a
060	Knudmoseværket	01	010103	MUNICIP. WASTES	341618	1A1a
060	Knudmoseværket	01	010103	NATURAL GAS	27263	1A1a
061	Kavo I/S Energien	01	010103	MUNICIP. WASTES	699867	1A1a
062	VEGA	01	010203	MUNICIP. WASTES	574350	1A1a
063	Hadsund Bys Fjernvarmeværk	01	010203	WOOD AND SIMIL.	30286	1A1a
063	Hadsund Bys Fjernvarmeværk	01	010203	MUNICIP. WASTES	198468	1A1a
064	Aars Fjernvarmeforsyning	01	010103	WOOD AND SIMIL.	6410	1A1a
064	Aars Fjernvarmeforsyning	01	010103	MUNICIP. WASTES	520526	1A1a
065	Haderslev Kraftvarmeværk	01	010103	MUNICIP. WASTES	615093	1A1a
065	Haderslev Kraftvarmeværk	01	010103	NATURAL GAS	53	1A1a
066	Frederiskhavn Affaldskraftvar-meværk	01	010103	MUNICIP. WASTES	370380	1A1a
066	Frederiskhavn Affaldskraftvar-meværk	01	010103	GAS OIL	1260	1A1a
067	Vejen Kraftvarmeværk	01	010103	MUNICIP. WASTES	409800	1A1a
068	Bofa I/S	01	010203	MUNICIP. WASTES	189372	1A1a
068	Bofa I/S	01	010203	RESIDUAL OIL	561	1A1a
069	DTU	01	010104	NATURAL GAS	1325022	1A1a
070	Næstved Kraftvarmeværk	01	010104	NATURAL GAS	446555	1A1a
071	Maricogen	01	030104	NATURAL GAS	2249317	1A2f
072	Hjørring KVV	01	010104	NATURAL GAS	1473666	1A1a

Table 46 Large point sources, plant specific emissions (IPCC 1A1, 1A2 and 1A4) [2)]

lps_id	lps_name	part id	SNAP id	ipcc id	SO_2 Mg	NO_x Mg	NMVOC Mg	CO Mg	TSP Mg	PM_{10} Mg 1)	$PM_{2.5}$ Mg1)	As kg	Cd kg	Cr kg	Cu kg	Hg kg	Ni kg	Pb kg	Se kg	Zn kg
001	Amagervaerket	01	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
		02	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
		03	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
002	Svanemoellevaerket	05	010101	1A1a		x														
		07	010104	1A1a		x														
003	H.C.Oerstedsvaerket	03	010101	1A1a	x	x						x	x	x	x	x	x	x	x	x
		05	010101	1A1a	x	x														
		07	010101	1A1a	x	x						x	x	x	x	x	x	x	x	x
004	Kyndbyvaerket	21	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
		22	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
		26	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
		28	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
		41	010105	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
		51	010104	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
		52	010104	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
005	Masnedoevaerket	12	010102	1A1a	x	x														
		31	010104	1A1a	x	x														
007	Stigsnaesvaerket	01	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
		02	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
008	Asnaesvaerket	02	010101	1A1a	x	x														
		03	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
		04	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
		05	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
009	Statoil Raffinaderi	01	010306	1A1b	x															
010	Avedoerevaerket	01	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
		02	010104	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	x
011	Fynsvaerket	03	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	
		07	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	
		08	010101	1A1a	x	x		x	x	x	x							x		
012	Studstrupvaerket	03	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	
		04	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	
014	Vendsysselvaerket	03	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	
017	Shell Raffinaderi	01	010306	1A1b	x	x														
		05	010304	1A1b		x														
018	Skaerbaekvaerket	01	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	
		03	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	
019	Enstedvaerket	03	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	
		04	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	
020	Esbjergvaerket	03	010101	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	
022	Oestkraft	06	010102	1A1a	x	x														
024	Dansk Naturgas Behandlingsanlaeg	01	010502	1A1c		x														
025	Horsens Kraftvarmevaerk	01	010102	1A1a	x	x		x	x	x	x							x		
		02	010104	1A1a		x														
026	Herningvaerket	01	010102	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	
027	Vestforbraendingen	01	010102	1A1a	x	x		x	x	x	x					x				
		02	010102	1A1a	x	x		x	x	x	x					x				
028	Amagerforbraendingen	01	010102	1A1a	x	x		x	x	x	x		x			x		x		
029	Randersvaerket	01	010102	1A1a	x	x			x	x	x									
030	Grenaavaerket	01	010102	1A1a	x	x			x	x	x	x	x	x	x	x	x	x	x	
031	Hilleroedvaerket	01	010104	1A1a		x														
032	Helsingoervaerket	01	010104	1A1a		x														
034	Stora Dalum	01	030102	1A2f		x														
035	Assens Sukkerfabrik	01	030102	1A2f	x				x	x	x									
036	Kolding Kraftvarmevaerk	01	010103	1A1a	x			x	x	x	x	x	x	x	x	x	x	x		
		02	010103	1A1a	x			x	x	x	x	x	x	x	x	x	x	x		
037	Maabjergvaerket	02	010102	1A1a	x	x	x	x	x	x	x							x		
038	Soenderborg Kraftvarmevaerk	01	010102	1A1a	x	x		x	x	x	x	x	x	x	x	x	x	x		
		02	010104	1A1a		x														
039	Kara Affaldsforbraendingsanlaeg	01	010102	1A1a	x			x	x	x	x							x		
040	Viborg Kraftvarmevaerk	01	010104	1A1a		x														
042	Nordforbraendingen	01	010102	1A1a	x			x	x	x	x							x		
045	Aalborg Portland	01	030311	1A2f	x	x		x	x	x	x									
046	Aarhus Nord	01	010102	1A1a	x				x	x	x							x		
		02	010102	1A1a	x				x	x	x							x		
047	Reno Nord	01	010103	1A1a	x			x	x	x	x	x	x	x	x	x	x	x		
048	Silkeborg Kraftvarmevaerk	01	010104	1A1a		x														
049	Rensningsanlægget Lynetten	01	020103	1A4a	x				x	x	x	x	x	x	x	x	x	x		
050	I/S Fasan	01	010203	1A1a	x	x		x	x	x	x	x					x	x		
051	AVV Forbrændingsanlæg	01	010103	1A1a					x	x	x							x		
052	I/S REFA Kraftvarmeværk	01	010103	1A1a					x	x	x							x		
053	Svendborg Kraftvarmeværk	01	010102	1A1a	x	x		x	x	x	x							x		
054	Kommunekemi	02	010102	1A1a	x			x	x	x	x					x				
		03	010102	1A1a	x			x	x	x	x					x				
055	I/S Fælles Forbrænding	01	010203	1A1a	x			x					x			x	x	x		
056	Vestfyns Forbrænding	01	010203	1A1a	x	x		x	x	x	x							x		
058	I/S Reno Syd	01	010103	1A1a	x		x	x	x	x	x							x		
059	I/S Kraftvarmeværk Thisted	01	010103	1A1a	x			x	x	x	x							x		
060	Knudmoseværket	01	010103	1A1a	x			x	x	x	x									
061	Kavo I/S Energien	01	010103	1A1a	x		x	x	x	x	x	x	x	x	x	x	x	x		x
062	VEGA	01	010203	1A1a	x			x	x	x	x							x		

lps_id	lps_name	part id	SNAP id	ipcc id	SO_2 Mg	NO_x Mg	NMVOC Mg	CO Mg	TSP Mg	PM_{10} Mg 1)	$PM_{2.5}$ Mg1)	As kg	Cd kg	Cr kg	Cu kg	Hg kg	Ni kg	Pb kg	Se kg	Zn kg
063	Hadsund Bys Fjernvar-meværk	01	010203	1A1a	x			x	x	x	x							x		
064	Aars Fjernvarmeforsyning	01	010103	1A1a	x			x	x	x	x							x		
065	Haderslev Kraftvar-meværk	01	010103	1A1a	x	x		x	x	x	x							x		
066	Frederiskhavn Af-faldskraftvarmeværk	01	010103	1A1a	x	x		x	x	x	x							x		
067	Vejen Kraftvarmeværk	01	010103	1A1a	x	x		x	x	x	x							x		
068	Bofa I/S	01	010203	1A1a	x			x	x	x	x							x		
069	DTU	01	010104	1A1a		x														
070	Næstved Kraftvarmeværk	01	010104	1A1a		x														
071	Maricogen	01	030104	1A2f		x														
072	Hjørring KVV	01	010104	1A1a		x														
	TOTAL				**11675**	**44890**	**12**	**3398**	**1257**	**1033**	**861**	**232**	**51**	**241**	**246**	**318**	**1212**	**1774**	**545**	**111**

1) Based on particle size distribution

2) CO_2, CH_4 and N_2O are not based on plant specific emission factors for any large point source

Appendix 9 Uncertainty estimates

Table 47 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 i trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Gg CO_2 eq	Gg CO_2 eq	%	%	%	%	%	%	%	%	%
Stationary Combustion, Coal	CO_2	24209	16668	1	5	5,099	2,273	-0,183	0,436	-0,916	0,617	1,104
Stationary Combustion, Petroleum coke	CO_2	455	742	3	5	5,831	0,116	0,008	0,019	0,039	0,082	0,091
Stationary Combustion, Residual oil	CO_2	2505	1567	2	2	2,828	0,119	-0,023	0,041	-0,046	0,116	0,125
Stationary Combustion, Gas oil	CO_2	4858	3063	4	5	6,403	0,525	-0,044	0,080	-0,222	0,454	0,505
Stationary Combustion, Kerosene	CO_2	366	21	4	5	6,403	0,004	-0,009	0,001	-0,044	0,003	0,044
Stationary Combustion, Orimulsion	CO_2	0	2419	1	2	2,236	0,145	0,063	0,063	0,127	0,090	0,155
Stationary Combustion, Natural gas	CO_2	4330	11075	3	1	3,162	0,937	0,179	0,290	0,179	1,230	1,243
Stationary Combustion, LPG	CO_2	148	55	4	5	6,403	0,009	-0,002	0,001	-0,012	0,008	0,014
Stationary Combustion, Refinery gas	CO_2	806	813	3	5	5,831	0,127	0,001	0,021	0,003	0,090	0,090
Stationary combustion plants, gas engines	CH_4	5	443	2,2	40	40,060	0,475	0,011	0,012	0,459	0,036	0,460
Stationary combustion plants, other	CH_4	110	137	2,2	100	100,024	0,365	0,001	0,004	0,076	0,011	0,077
Stationary combustion plants	N_2O	396	391	2,2	1000	1000,002	10,451	0,000	0,010	0,071	0,032	0,078
Total		38189	37394				115,965					3,302

Total uncertainties	**Overall uncertainty i the year (%):**	**10,769**	**Trend uncertainty (%):**	**1,817**

Table 48 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 i trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Gg CO_2	Gg CO_2	%	%	%	%	%	%	%	%	%
Stationary Combustion, Coal	CO_2	24209	16668	1	5	5,099	2,333	-0,178	0,442	-0,888	0,626	1,086
Stationary Combustion, Petroleum coke	CO_2	455	742	3	5	5,831	0,119	0,008	0,020	0,040	0,084	0,093
Stationary Combustion, Residual oil	CO_2	2505	1567	2	2	2,828	0,122	-0,023	0,042	-0,045	0,118	0,126
Stationary Combustion, Gas oil	CO_2	4858	3063	4	5	6,403	0,539	-0,043	0,081	-0,216	0,460	0,508
Stationary Combustion, Kerosene	CO_2	366	21	4	5	6,403	0,004	-0,009	0,001	-0,044	0,003	0,044
Stationary Combustion, Orimulsion	CO_2	0	2419	1	2	2,236	0,149	0,064	0,064	0,128	0,091	0,157
Stationary Combustion, Natural gas	CO_2	4330	11075	3	1	3,162	0,962	0,183	0,294	0,183	1,247	1,260
Stationary Combustion, LPG	CO_2	148	55	4	5	6,403	0,010	-0,002	0,001	-0,012	0,008	0,014
Stationary Combustion, Refinery gas	CO_2	806	813	3	5	5,831	0,130	0,001	0,022	0,004	0,092	0,092
Total	CO_2	37678	36423				6,727					3,087

Total uncertainties	**Overall uncertainty i the year (%):**	**2,594**	**Trend uncertainty (%):**	**1,757**

Table 49 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 i trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg CH_4	Mg CH_4	%	%	%	%	%	%	%	%	%
Stationary combustion plants, gas engines	CH_4	237	21096	2,2	40	40,060	30,622	3,640	3,860	145,586	12,010	146,081
Stationary combustion plants, other	CH_4	5228	6502	2,2	100	100,024	23,566	-3,607	1,190	-360,673	3,702	360,692
Total	CH_4	5465	27598				1493,06					151439
Total uncertainties			**Overall uncertainty i the year (%):**				**38,640**			**Trend uncertainty (%):**		**389,151**

Table 50 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 i trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Gg N_2O	Gg N_2O	%	%	%	%	%	%	%	%	%
Stationary combustion plants	N_2O	1,279	1,261	2,200	1000,000	1000,002	1000,002	0,000	0,986	0,000	3,068	3,068
Total	N_2O	1,279	1,261				1000005					9,411
Total uncertainties			**Overall uncertainty i the year (%):**				**1000,002**		**Trend uncertainty (%):**			**3,068**

Table 51 Uncertainty estimation, SO_2

SNAP	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in	Type A sensitivity	Type B sensitivity	Uncertainty i trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg SO_2	Mg SO_2	%	%	%	%	%	%	%	%	%
01	SO_2	133114	11139	2	10	10,198	5,675	-0,035	0,079	-0,353	0,222	0,417
02	SO_2	11197	3160	2	20	20,100	2,644	0,009	0,019	0,180	0,053	0,187
03	SO_2	20430	7115	2	10	10,198	3,181	0,027	0,044	0,265	0,125	0,293
Total	SO_2	164741	21415				49,320					0,295

Total uncertainties	Overall uncertainty i the year (%):	6,958	Trend uncertainty (%):	0,555

Table 52 Uncertainty estimation, NO_x

SNAP	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty i trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg NO_x	Mg NO_x	%	%	%	%	%	%	%	%	%
01	NO_x	95479	48909	2	20	20,100	13,757	-0,102	0,4331	-2,035	1,225	2,376
02	NO_x	7237	7662	2	50	50,040	5,247	0,025	0,0663	1,251	0,188	1,265
03	NO_x	9508	14517	2	20	20,100	4,235	0,078	0,1333	1,551	0,377	1,596
Total	NO_x	112224	71088				234,733					9,790

Total uncertainties	Overall uncertainty i the year (%):	15,400	Trend uncertainty (%):	3,168

Table 53 Uncertainty estimation, NMVOC

SNAP	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty i trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data							
		Mg NMVOC	Mg NMVOC	%	%	%	%	%	%	%	%	%
01	NMVOC	1164	6070	2	50	50,040	14,884	0,346	0,5657	17,282	1,600	17,356
02	NMVOC	9958	13020	2	50	50,040	32,949	-0,299	1,2522	-14,960	3,542	15,373
03	NMVOC	619	841	2	50	50,040	2,207	-0,044	0,0839	-2,219	0,237	2,232
Total	NMVOC	11741	19932				1312,053					542,556

Total uncertainties	Overall uncertainty i the year (%):	36,128	Trend uncertainty (%):	24,196

Table 54 Uncertainty estimation, CO

SNAP	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty 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	9008	12100	2	20	20,100	1,321	-0,056	0,149	-1,124	0,421	1,200
02	CO	115324	143190	2	50	50,040	44,863	0,050	2,033	2,476	5,750	6,260
03	CO	3995	6140	2	20	20,100	0,759	0,006	0,086	0,126	0,242	0,273
Total	CO	128326	161430				2014,965					40,703

Total uncertainties	Overall uncertainty i the year (%):	44,418	Trend uncertainty (%):	3,259

Table 55 Uncertainty estimation, Pb

SNAP	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty 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	12699	2402	2	100	100,020	53,721	-0,069	0,149	-6,900	0,421	6,913
02	Pb	939	356	2	1000	1000,002	79,514	0,006	0,022	5,900	0,062	5,901
03	Pb	2482	1714	2	100	100,020	38,346	0,064	0,106	6,355	0,301	6,362
Total	Pb	16120	4472				10678,82					123,084

Total uncertainties	Overall uncertainty i the year (%):	103,34	Trend uncertainty (%):	11,094

Table 56 Uncertainty estimation, Hg

SNAP	Gas	Base year emission	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty 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	2609	1492	2	100	100,020	80,050	-0,027	0,483	-2,657	1,367	2,988
02	Hg	317	208	2	1000	1000,002	111,754	0,005	0,067	5,448	0,191	5,452
03	Hg	162	164	2	100	100,020	8,792	0,021	0,053	2,133	0,150	2,138
Total	Hg	3088	1865				18974,33					43,224

Total uncertainties	Overall uncertainty i the year (%):	137,75	Trend uncertainty (%):	6,574

Appendix 10 Lower Calorific Value (LCV) of fuels

Table 57 Time series for calorific values of fuels (Danish Energy Authority, DEA 2002b)

	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Calorific Value													
Crude Oil, North Sea	GJ/ton	42,7	42,7	42,7	42,7	42,7	42,7	42,7	43,0	43,0	43,0	43,0	43,0
Refinery Feedstocks	GJ/ton	41,6	41,6	41,6	41,6	41,6	41,6	41,6	42,7	42,7	42,7	42,7	42,7
Refinery Gas	GJ/ton	52,0	52,0	52,0	52,0	52,0	52,0	52,0	52,0	52,0	52,0	52,0	52,0
LPG	GJ/ton	46,0	46,0	46,0	46,0	46,0	46,0	46,0	46,0	46,0	46,0	46,0	46,0
Naphtha (LVN)	GJ/ton	44,5	44,5	44,5	44,5	44,5	44,5	44,5	44,5	44,5	44,5	44,5	44,5
Motor Gasoline	GJ/ton	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8
Aviation Gasoline	GJ/ton	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8
JP4	GJ/ton	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,8
Other Kerosene	GJ/ton	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5
JP1	GJ/ton	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5
Gas/Diesel Oil	GJ/ton	42,7	42,7	42,7	42,7	42,7	42,7	42,7	42,7	42,7	42,7	42,7	42,7
Fuel Oil	GJ/ton	40,4	40,4	40,4	40,4	40,4	40,4	40,7	40,7	40,7	40,7	40,7	40,7
Orimulsion	GJ/ton	27,6	27,6	27,6	27,6	27,6	28,1	28,0	27,7	27,8	27,6	27,6	27,6
Petroleum Coke	GJ/ton	31,4	31,4	31,4	31,4	31,4	31,4	31,4	31,4	31,4	31,4	31,4	31,4
Waste Oil	GJ/ton	41,9	41,9	41,9	41,9	41,9	41,9	41,9	41,9	41,9	41,9	41,9	41,9
White Spirit	GJ/ton	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5	43,5
Bitumen	GJ/ton	39,8	39,8	39,8	39,8	39,8	39,8	39,8	39,8	39,8	39,8	39,8	39,8
Lubricants	GJ/ton	41,9	41,9	41,9	41,9	41,9	41,9	41,9	41,9	41,9	41,9	41,9	41,9
Natural Gas	GJ/1000 Nm3	39,0	39,0	39,0	39,3	39,3	39,3	39,3	39,6	39,9	40,0	40,2	40,0
Town Gas	GJ/1000 m3		16,7	16,8	16,9	17,1	17,3	17,0	17,1	17,0	17,0	17,0	16,9
Electricity Plant Coal	GJ/ton	25,3	25,4	25,8	25,2	24,5	24,5	24,7	25,0	25,0	25,0	24,8	24,9
Other Hard Coal	GJ/ton	26,1	26,5	26,5	26,5	26,5	26,5	26,5	26,5	26,5	26,5	26,5	26,5
Gas Plant Coal	GJ/ton												
Coke	GJ/ton	31,8	29,3	29,3	29,3	29,3	29,3	29,3	29,3	29,3	29,3	29,3	29,3
Brown Coal Briquettes	GJ/ton	18,3	18,3	18,3	18,3	18,3	18,3	18,3	18,3	18,3	18,3	18,3	18,3
Straw	GJ/ton	14,5	14,5	14,5	14,5	14,5	14,5	14,5	14,5	14,5	14,5	14,5	14,5
Wood Chips	GJ/cubic m	2,8	2,8	2,8	2,8	2,8	2,8	2,8	2,8	2,8	2,8	2,8	2,8
Firewood, Hardwood	GJ/m3	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4
Firewood, Conifer	GJ/m3	7,6	7,6	7,6	7,6	7,6	7,6	7,6	7,6	7,6	7,6	7,6	7,6
Wood Pellets	GJ/ton	17,5	17,5	17,5	17,5	17,5	17,5	17,5	17,5	17,5	17,5	17,5	17,5
Wood Waste	GJ/ton	14,7	14,7	14,7	14,7	14,7	14,7	14,7	14,7	14,7	14,7	14,7	14,7
Wood Waste	GJ/cubic m	3,2	3,2	3,2	3,2	3,2	3,2	3,2	3,2	3,2	3,2	3,2	3,2
Biogas	GJ/1000 m3								23,0	23,0	23,0	23,0	23,0
Waste Combustion	GJ/ton	8,2	8,2	9,0	9,4	9,4	10,0	10,5	10,5	10,5	10,5	10,5	10,5
Fish Oil	GJ/ton	37,2	37,2	37,2	37,2	37,2	37,2	37,2	37,2	37,2	37,2	37,2	37,2

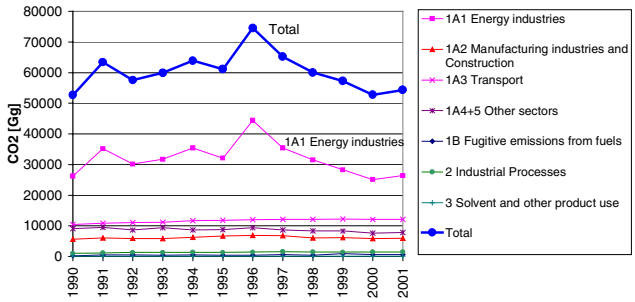
Table 58 Fuel category correspondance list, Danish Energy Authority, NERI and Climate convention reportings (CRF)

Danish Energy Authority	NERI Emission database	CRF fuel category
Other Hard Coal	Coal	Solid
Coke	Coal	Solid
Electricity Plant Coal	Coal	Solid
Brown Coal Briquettes	Coal	Solid
Orimulsion	Orimulsion (Other liq. fuel)	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	Agricul. wastes (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	Municip. wastes	Biomass 1)
Biogas	Biogas	Biomass
Biogas, other	Biogas	Biomass
Biogas, landfill	Biogas	Biomass
Biogas, sewage sludge	Biogas	Biomass

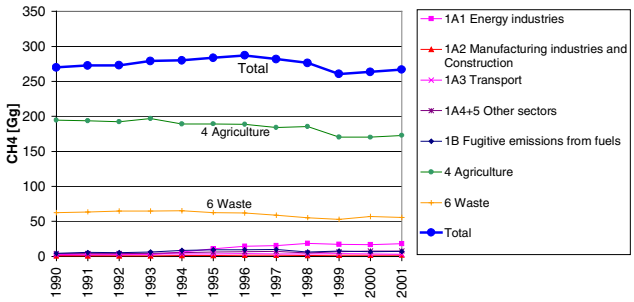
1) CO_2 from plastic part included in Other fuels

Appendix 11 Time series for total Danish emissions

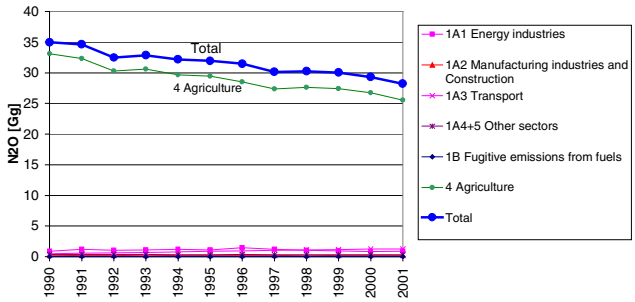
CO_2



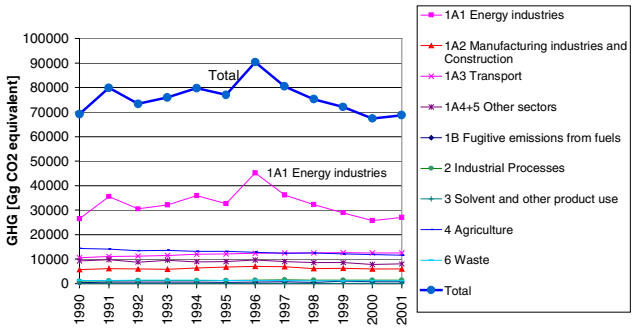
CH_4



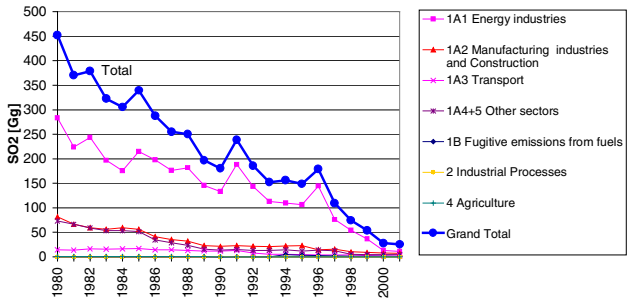
N_2O



GHG total

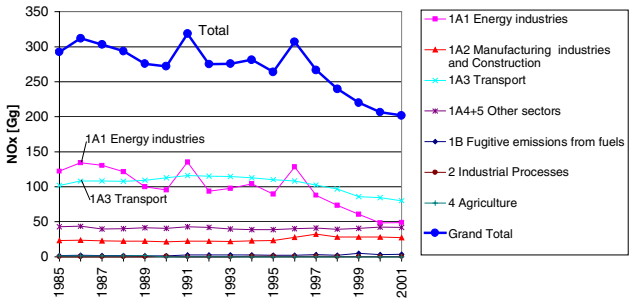


SO_2



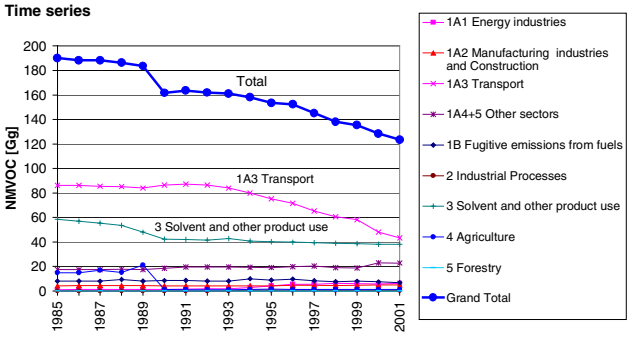
NO_x

Time series



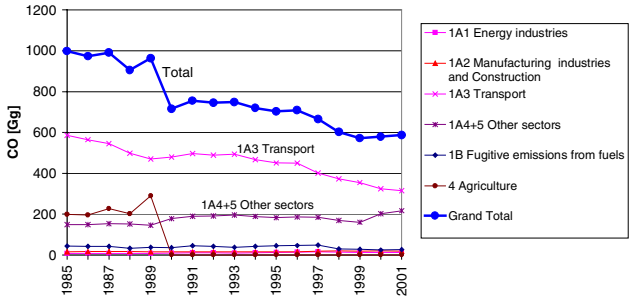
NMVOC

Time series

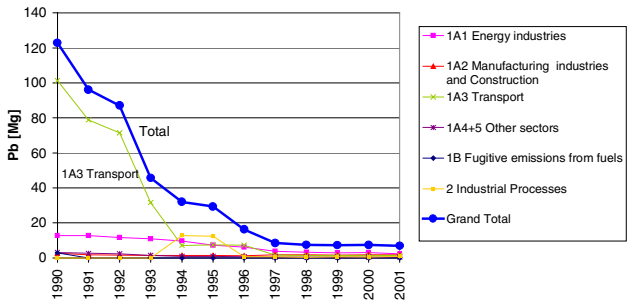


CO

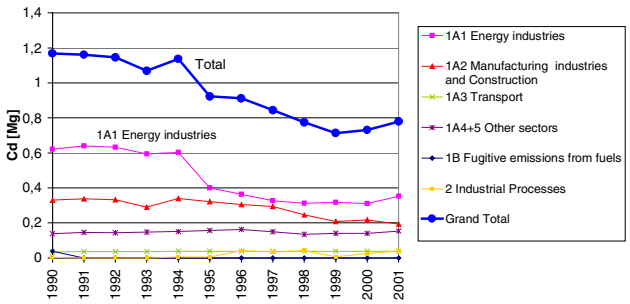
Time series



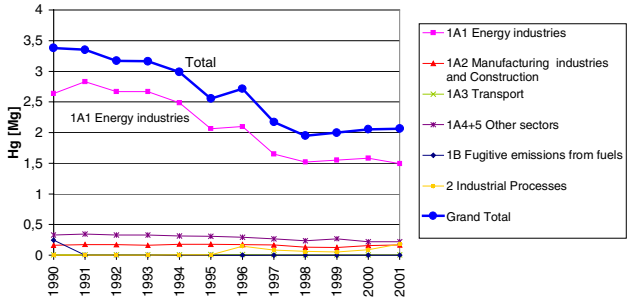
Pb



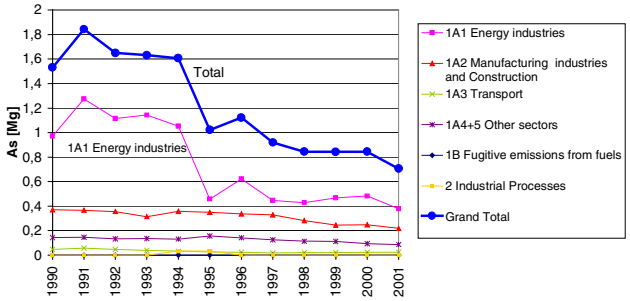
Cd



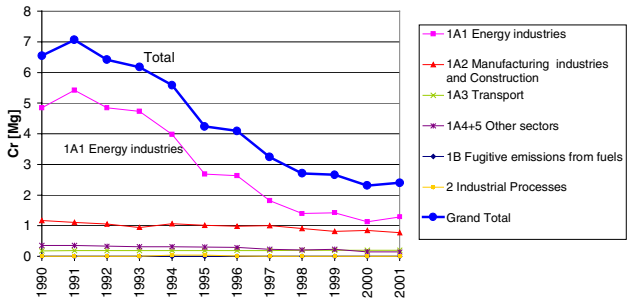
Hg



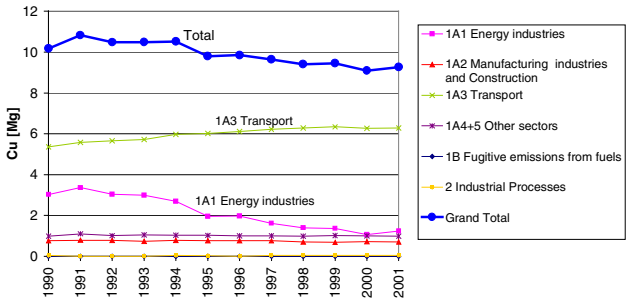
As



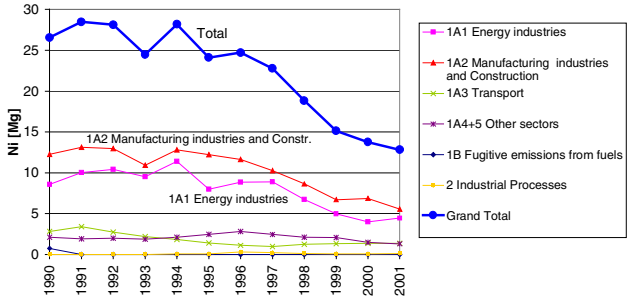
Cr



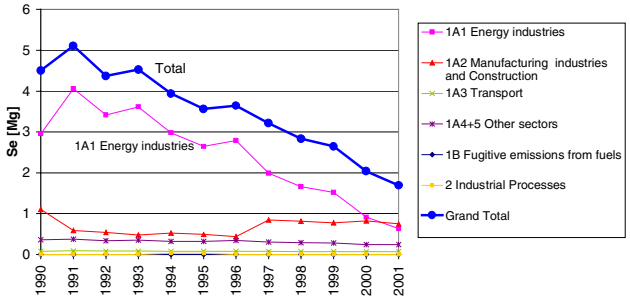
Cu



Ni



Se



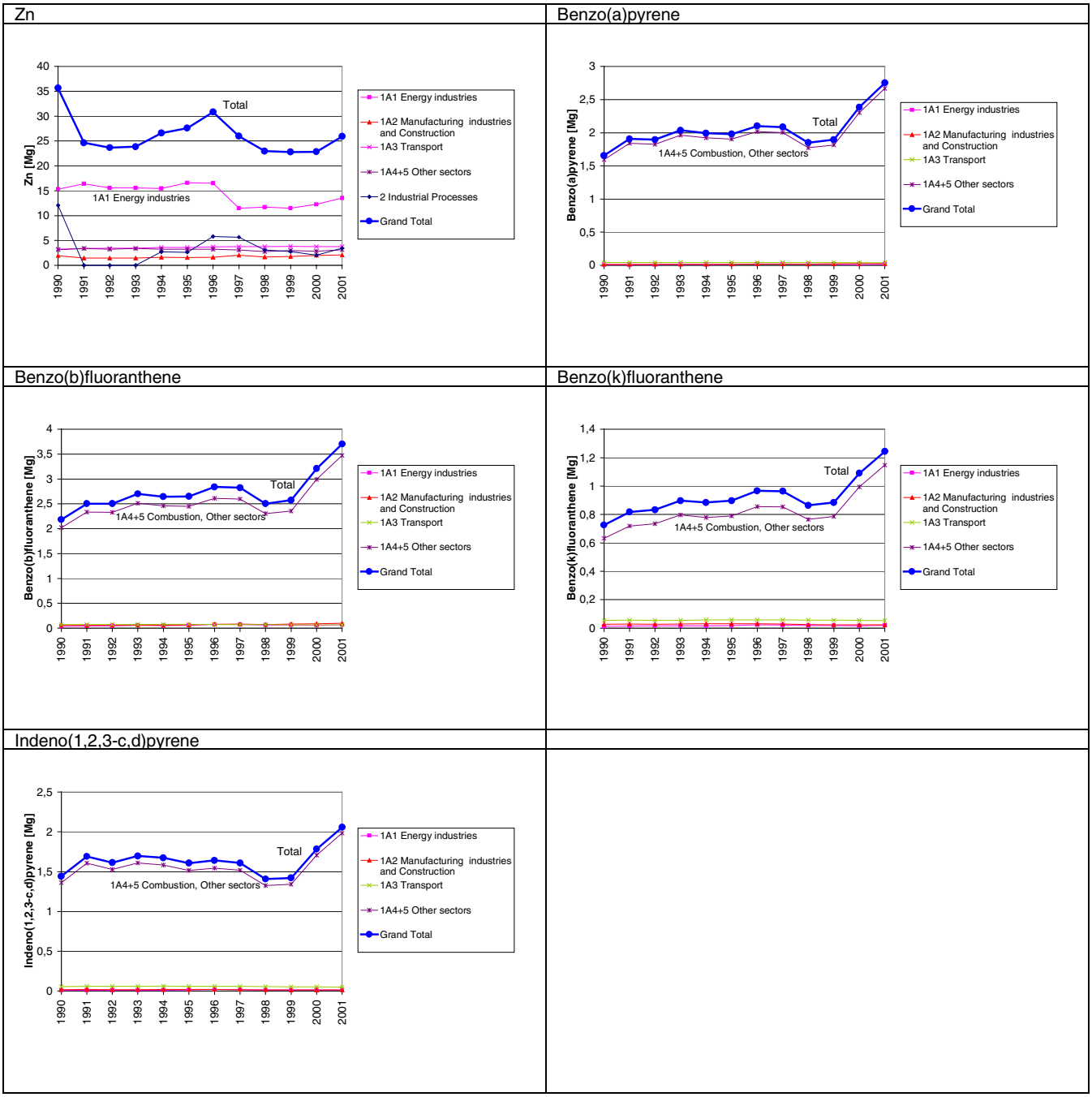
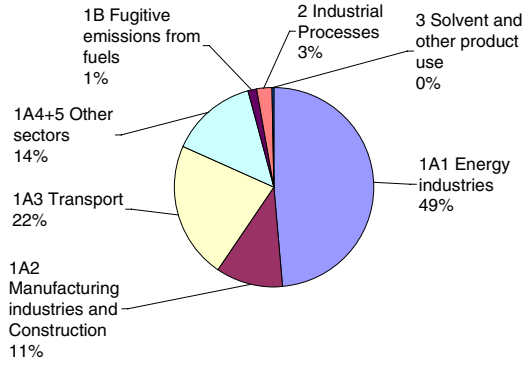


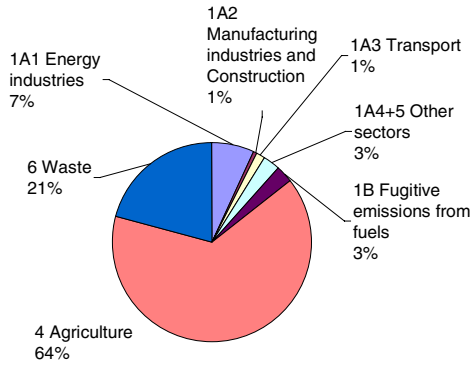
Figure 39 Time series for total Danish emissions

Appendix 12 Emission shares of the sectors, total Danish emissions

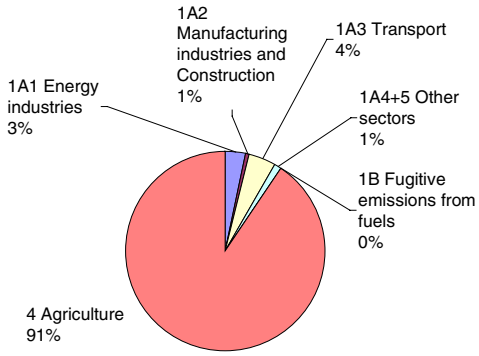
CO_2



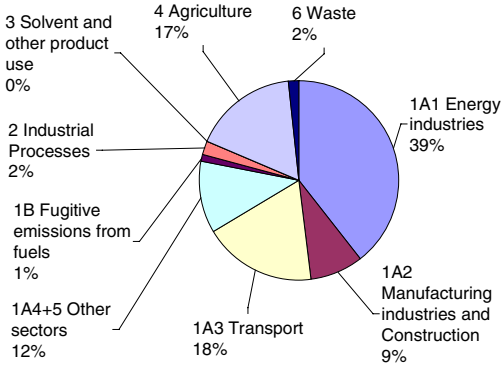
CH_4



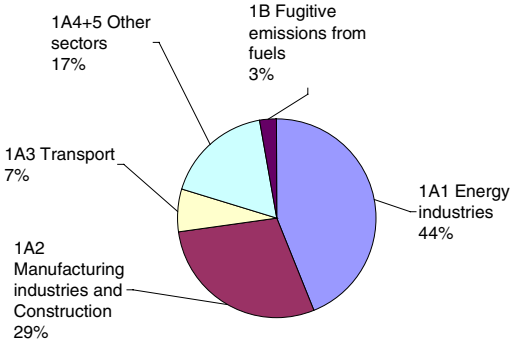
N_2O



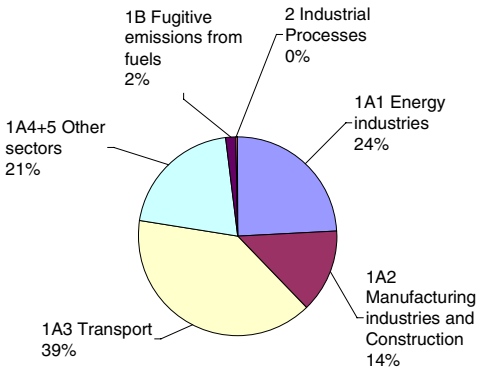
GHG



SO_2



NO_x



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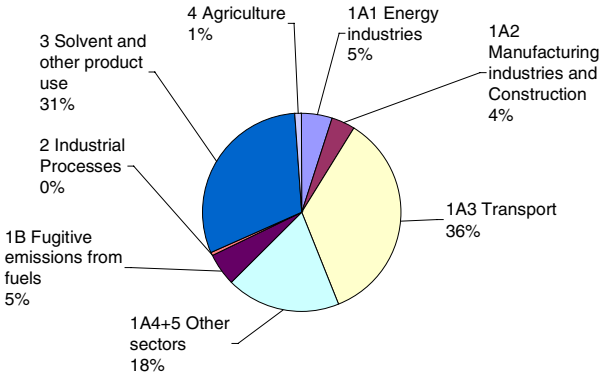
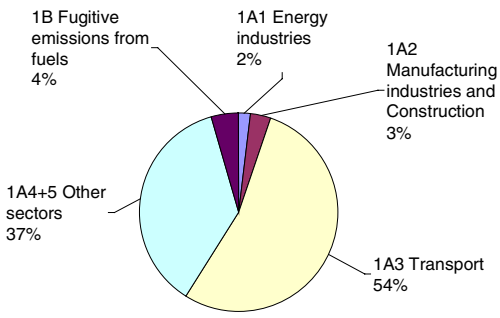


CO



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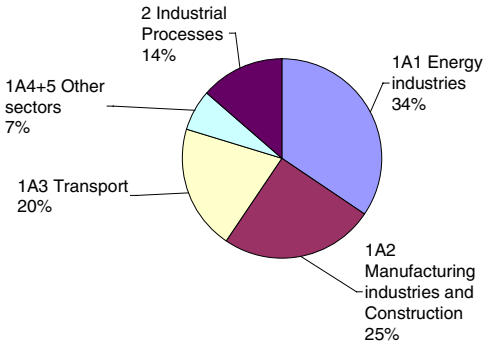

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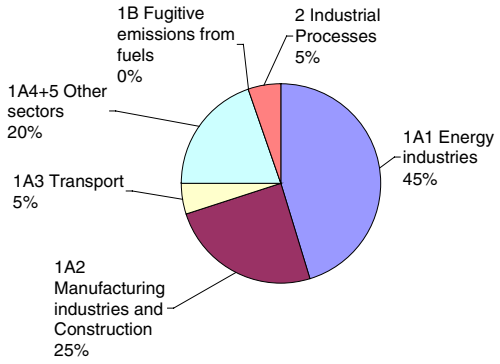

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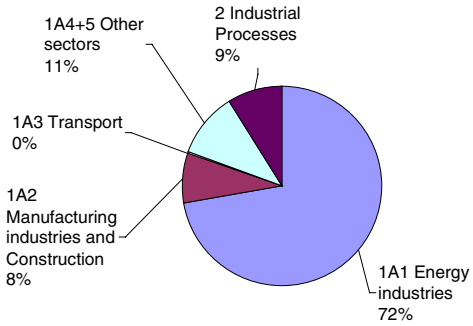

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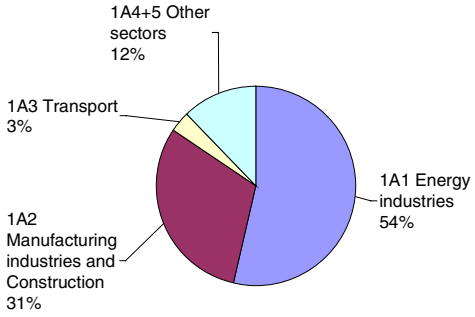
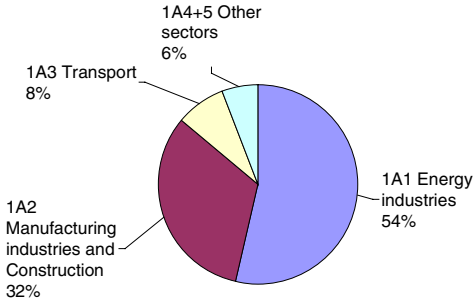
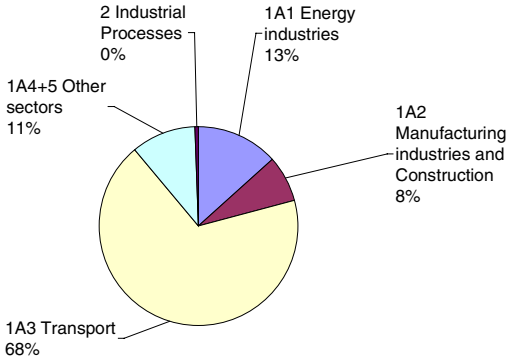


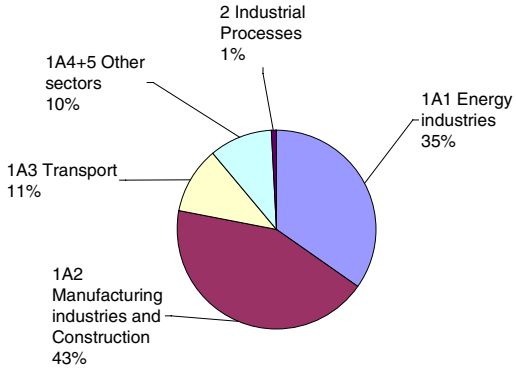
Cr



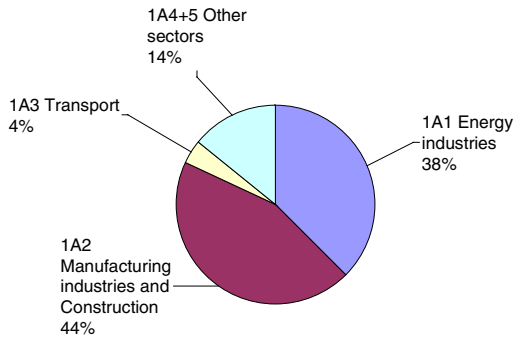
Cu



Ni



Se



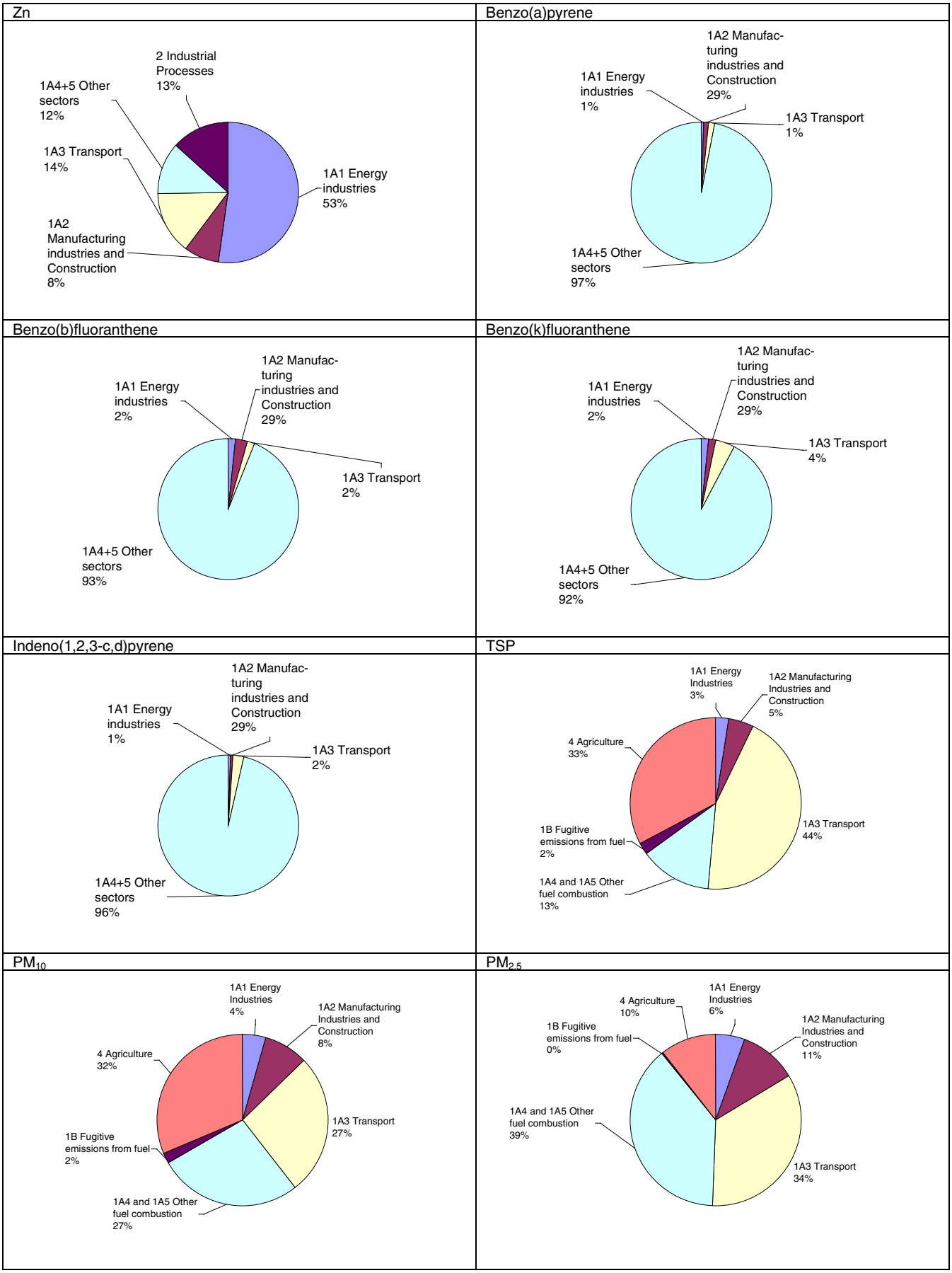


Figure 40 Emission share for different sources, 2001

Appendix 13 Adjustment of CO_2 emission

Table 59 Basis of adjustment calculation of CO_2 emission (ref. Danish Energy Authority)

Degree Days		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Actual Degree Days	Degree days	2 093	2 515	3 022	3 434	3 148	3 297	3 837	3 236	3 217	3 056	2 902	2 902
Normal Degree Days	Degree days	2 691	2 691	3 370	3 370	3 370	3 370	3 370	3 370	3 370	3 370	3 370	3 370
Net Electricity Import Adjustment													
Total	TJ	67 692	-16 115	31 311	11 215	-42 798	-7 058	-141 037	-63 910	-38 981	-20 131	7 300	7 300
Fuel Oil	TJ	3 421	1 322	579	- 903	-15 448	891	-4 555	-1 354	365	298	-	-
Orimulsion	TJ	-	-	-	-	-	287	-11 160	-3 566	392	-	2 294	2 295
Natural Gas	TJ	1 916	114	680	330	-	-	- 48	-	-	-	-	-
Electricity Plant Coal	TJ	62 356	-17 551	30 052	11 788	-27 350	-8 236	-125 274	-58 990	-39 738	-20 429	5 006	5 006

Appendix 14 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)

Denmark
2001
2003, Apr 15

FUEL TYPES			Unit	Production	Imports	Exports	International bunkers	Stock change	Apparent consumption	Conversion factor [1] (TJ/Unit)	[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	726.825,00	130.796,00	########		-61,00	344.522,00	1,00	NCV	344.522,00	20,00	6.890,44		6.890,44	1,00	25.264,95
		Orimulsion	TJ	0,00	33.435,00	0,00		3.213,00	30.222,00	1,00	NCV	30.222,00	22,00	664,88		664,88	1,00	2.437,91
		Natural Gas Liquids	TJ	0,00	0,00	0,00		0,00	0,00	1,00	NCV	0,00	17,20	0,00		0,00	1,00	0,00
	Secondary Fuels	Gasoline	TJ		45.239,00	56.758,00	7,00	588,00	-12.114,00	1,00	NCV	-12.114,00	18,90	-228,95		-228,95	1,00	-839,50
		Jet Kerosene	TJ		34.781,00	17.571,00	33.614,00	4.880,00	-21.284,00	1,00	NCV	-21.284,00	19,50	-415,04		-415,04	1,00	-1.521,81
		Other Kerosene	TJ		0,00	0,00	0,00	0,00	0,00	1,00	NCV	0,00	19,60	0,00		0,00	1,00	0,00
		Shale Oil	TJ		0,00	0,00		0,00	0,00	1,00	NCV	0,00	20,00	0,00		0,00	1,00	0,00
		Gas / Diesel Oil	TJ		78.349,00	37.936,00	21.389,00	708,00	18.316,00	1,00	NCV	18.316,00	20,20	369,98	0,00	369,98	1,00	1.356,61
		Residual Fuel Oil	TJ		29.906,00	46.022,00	25.924,00	208,00	-42.248,00	1,00	NCV	-42.248,00	21,10	-891,43		-891,43	1,00	-3.268,59
		LPG	TJ		326,00	4.674,00		91,00	-4.439,00	1,00	NCV	-4.439,00	17,20	-76,35	0,00	-76,35	1,00	-279,95
		Ethane	TJ		0,00	0,00		0,00	0,00	1,00	NCV	0,00	16,80	0,00	0,00	0,00	1,00	0,00
		Naphtha	TJ		938,00	336,00		-151,00	753,00	1,00	NCV	753,00	20,00	15,06	13,21	1,85	1,00	6,78
		Bitumen	TJ		6.872,00	291,00		-184,00	6.765,00	1,00	NCV	6.765,00	22,00	148,83	168,77	-19,94	1,00	-73,11
		Lubricants	TJ		2.584,00	426,00	163,00	-39,00	2.034,00	1,00	NCV	2.034,00	20,00	40,68	20,74	19,94	1,00	73,11
		Petroleum Coke	TJ		9.375,00	878,00		167,00	8.330,00	1,00	NCV	8.330,00	27,50	229,08		229,08	1,00	839,94
		Refinery Feedstocks	TJ		7.553,00	793,00		213,00	6.547,00	1,00	NCV	6.547,00	20,00	130,94		130,94	1,00	480,11
		Other Oil	TJ		0,00	0,00		0,00	0,00	1,00	NCV	0,00	20,00	0,00		0,00	1,00	0,00
Liquid Fossil Totals												337.404,00		6.878,12	202,72	6.675,40		24.476,45
Solid Fossil	Primary Fuels	Anthracite [2]	TJ	0,00	0,00	0,00		0,00	0,00	1,00	NCV	0,00	26,80	0,00		0,00	1,00	0,00
		Coking Coal	TJ	0,00	0,00	0,00		0,00	0,00	1,00	NCV	0,00	25,80	0,00	0,00	0,00	1,00	0,00
		Other Bit. Coal	TJ	0,00	173.270,00	4.094,00	0,00	-5.675,00	174.851,00	1,00	NCV	174.851,00	25,80	4.511,16		4.511,16	1,00	16.540,90
		Sub-bit. Coal	TJ	0,00	0,00	0,00	0,00	0,00	0,00	1,00	NCV	0,00	26,20	0,00		0,00	1,00	0,00
		Lignite	TJ	0,00	14,00	10,00		-2,00	6,00	1,00	NCV	6,00	27,60	0,17		0,17	1,00	0,61
		Oil Shale	TJ	0,00	0,00	0,00		0,00	0,00	1,00	NCV	0,00	29,10	0,00		0,00	1,00	0,00
		Peat	TJ	0,00	0,00	0,00		0,00	0,00	1,00	NCV	0,00	28,90	0,00		0,00	1,00	0,00
	Secondary Fuels	BKB & Patent Fuel	TJ		0,00	0,00		0,00	0,00	1,00	NCV	0,00	25,80	0,00		0,00	1,00	0,00
		Coke Oven/Gas Coke	TJ		894,00	28,00		-241,00	1.107,00	1,00	NCV	1.107,00	29,50	32,66		32,66	1,00	119,74
Solid Fuel Totals												175.964,00		4.543,98	0,00	4.543,98		16.661,25
Gaseous Fossil		Natural Gas (Dry)	TJ	317.756,00	0,00	########		-3.733,00	193.608,00	1,00	NCV	193.608,00	15,30	2.962,20	0,00	2.962,20	1,00	10.861,41
Total												**706.976,00**		**14.384,30**	**202,72**	**14.181,58**		**51.999,11**
Biomass total												75.996,00		2.248,76	0,00	2.248,76		8.245,44
		Solid Biomass	TJ	71.037,00	1.721,00	0,00		0,00	72.758,00	1,00	NCV	72.758,00	29,90	2.175,46		2.175,46	1,00	7.976,70
		Liquid Biomass	TJ	191,00	0,00	0,00		0,00	191,00	1,00	NCV	191,00	20,00	3,82		3,82	1,00	14,01
		Gas Biomass	TJ	3.047,00	0,00	0,00		0,00	3.047,00	1,00	NCV	3.047,00	22,80	69,47		69,47	1,00	254,73

[1] To convert quantities expressed in natural units to energy units, use net calorific values (NCV). If gross calorific values (GCV) are used in this table, please indicate this by replacing "NCV" with "GCV" in this column.
[2] If Anthracite is not separately available, include with Other Bituminous Coal.

TABLE 1.A(c) COMPARISON OF CO_2 EMISSIONS FROM FUEL COMBUSTION
(Sheet 1 of 1)

Denmark
2001
2003, Apr 15

FUEL TYPES	Reference approach		National approach [1]		Difference [2]	
	Energy consumption (PJ)	CO_2 emissions (Gg)	Energy consumption (PJ)	CO_2 emissions (Gg)	Energy consumption (%)	CO_2 emissions (%)
Liquid Fuels (excluding international bunkers)	337,40	24.476,45	318,74	23.728,97	5,86	3,15
Solid Fuels (excluding international bunkers)	175,96	16.661,25	175,45	16.667,86	0,29	-0,04
Gaseous Fuels	193,61	10.861,41	193,45	11.074,99	0,08	-1,93
Other [3]	-10,63	634,32	0,54	673,44	-2.083,06	-5,81
Total [3]	**696,35**	**52.633,44**	**688,18**	**52.145,26**	**1,19**	**0,94**

[1] "National approach" is used to indicate the approach (if different from the Reference approach) followed by the Party to estimate its CO_2 emissions from fuel combustion reported in the national GHG inventory.
[2] Difference of the Reference approach over the National approach (i.e. difference = 100% x ((RA-NA)/NA), where NA = National approach and RA = Reference approach).
[3] Emissions from biomass are not included.

Note: In addition to estimating CO_2 emissions from fuel combustion by sector, Parties should also estimate these emissions using the IPCC Reference approach, as found in the IPCC Guidelines, Worksheet 1-1(Volume 2. Workbook). The Reference approach is to assist in verifying the sectoral data. Parties should also complete the above tables to compare the alternative estimates, and if the emission estimates lie more than 2 percent apart, should explain the source of this difference in the documentation box provided.

Documentation Box:

Non-energy use of fuels is not included in the Danish National Approach. Fuel consumption for non-energy (10,63 Pj) is subtracted in Reference Approach to make results comparable. Inclusion of these fuels in future inventories will be considered.
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. (Other fuels of sources 1A1, 1A2 and 1A4)

Appendix 15 Emission inventory 2001 based on SNAP sectors

Emission inventory 2001 based on SNAP sectors

SNAP 2)	SO2 [Mg]	NOX [Mg]	NMVOC [Mg]	CH4 [Mg]	CO [Mg]	CO2 1) [Gg]	N2O [Mg]	TSP [Mg]	PM10 [Mg]	$PM_{2.5}$ [Mg]	As [kg]	Cd [kg]	Cr [kg]	Cu [kg]	Hg [kg]	Ni [kg]	Pb [kg]	Se [kg]	Zn [kg]	Flouran-the [kg]	Benzo(b) [kg]	Benzo(k) [kg]	Benzo(a) [kg]	Benzo (g,,) [kg]	Indeno [kg]
Total:	**79789**	**312277**	**140990**	**621358**	**597428**	**64373**	**28489**	**34356**	**21348**	**14998**	**1050**	**813**	**2568**	**10887**	**2102**	**32019**	**7227**	**2006**	**27487**	**17816**	**3716**	**1251**	**2750**	**3758**	**2078**
Total for stationary combustion:	**21415**	**71088**	**19932**	**27598**	**161430**	**44728**	**1261**	**5300**	**4622**	**4094**	**675**	**694**	**2146**	**1734**	**1865**	**11357**	**4472**	**1530**	**17933**	**16854**	**3618**	**1174**	**2704**	**3629**	**1990**
Total 01	11139,37	48909,15	6070,34	18289,74	12099,92	31212,81	902,68	1126,4	917,65	762,38	381,74	355,41	1275,54	1234,93	1492,41	4565,78	2401,66	589,53	13511,9	773,37	65,75	19,77	15,43	30,96	13,38
0101	0,28	1,58	0,03	0,08	0,25	1,05	0,02	0,03	0,03	0,03	0,01	0,01	0,02	0,01	0,01	0,35	0,02	0,03	0,06	0,01	0	0	0	0	0
010101	7430,5	27769,61	492,48	537,52	2547,05	19649,16	587,38	758,76	630,14	529,7	124,85	36,38	317,55	271,61	333,24	1143,6	270,56	498,59	2238,11	106,34	18,89	3,43	4,19	9,61	6,47
010102	1204,16	4317,74	273,01	235,05	575,28	3136,16	103,19	97,03	80,77	64,9	79,41	154,95	589,82	585,14	541,26	1126,75	869,36	53,05	6665,14	260,06	11,91	1,56	1,25	0,16	0,08
010103	732,06	1628,56	181	134,35	204,74	1274,4	43,79	64,83	53,42	42,04	99,85	70,02	181,87	211,39	381,53	375,97	936,64	1,77	2828,54	194,97	11,87	3,13	3,49	6,73	2
010104	133,98	2728,18	35,47	108,63	207,21	1582,56	29,02	2,65	2,65	2,63	1,66	1,13	2,97	2,02	0,36	276,2	2,8	1,07	0,75	3,11	0,86	0,17	0,2	0,43	0,32
010105	81,46	6561,08	4604,11	16796,83	5172,5	1842,13	34,71	10,61	9,73	8,86	2,76	7,4	25,03	24,57	44,93	41,98	104,52	0,37	281,24	11,13	0,55	0,09	0,06	0,02	0,01
0102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010202	63,15	150,81	18,96	14,36	127,1	119,94	3,51	11,23	9,14	8,05	2,19	3,12	3,74	3,9	3,7	56,35	5,14	4,94	44,7	6,15	1,09	0,54	0,25	0,57	0,27
010203	818,69	1631,33	413,54	295,78	2308,51	1252,03	44,57	167,38	120,16	95,72	47,48	59,85	98,86	114,63	180,18	472,21	173,43	9,18	1448,82	188,72	19,79	10,7	5,81	13,04	3,93
010204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010303	71,64	32,3	0,68	0,68	6,82	17,74	0,45	11,37	9,1	7,96	3,2	3,07	7,58	2,95	0,98	146,02	5,34	2,8	0,62	0,39	0,11	0,02	0,02	0,05	0,04
010304	0,74	396	0	0	36,86	140,3	4,91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010305	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010306	595	1191,42	0	0	219,94	784,99	26,44	0	0	0	20,3	19,48	48,09	18,7	6,2	926,36	33,85	17,75	3,92	2,48	0,69	0,13	0,16	0,34	0,26
0104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010401	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010402	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010403	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

010407	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010501	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010502	7,31	2440,39	48,77	146,3	682,73	1395,94	24,38	2,44	2,44	2,44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010503	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010504	0,07	40,54	0,23	0,93	1,63	13,34	0,23	0,02	0,02	0,02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010505	0,32	19,61	2,05	19,24	9,31	3,07	0,07	0,04	0,04	0,04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010506	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total 02	3160,41	7661,97	13020,31	7619,52	143189,9	7772,05	210,4	3240,18	3068,81	2888,2	76,29	147,51	107,18	184,98	208,39	1247,11	355,55	193,76	2563,65	12648,4	3459,61	1135,66	2662,37	3588,69	1967,18
0201	217,87	589,93	410,49	176	512,24	860,35	20,53	131,42	129,65	122,94	8,85	9,2	15,06	16,19	17,51	140,09	33,94	24,68	183,61	517,8	140,73	46,82	107,2	145,68	76,56
020101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
020102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
020103	27,32	8,82	0,72	1,49	6,37	15,65	0,37	9,81	8,34	6,87	2	8	0	3	14	0	135	0,21	5,07	0,32	0,01	0	0	0,01	0,01
020104	0,01	5,39	0,03	0,12	0,22	1,77	0,03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
020105	5,85	506,11	172,98	818,21	305,08	101,98	2,05	0,87	0,87	0,87	0	0	0	0	0	0	0	0	0,02	0,08	0,02	0,01	0,02	0,02	0,01
020106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0202	1562,78	4871,26	10418,2	3631,96	140758,5	5847,3	163,34	2983,17	2838,81	2685,86	38,24	105,34	33,03	137,15	153,13	40,33	133,51	147,94	2314,24	11563,88	3171,62	1058,32	2423,03	3281,75	1711,55
020201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
020202	0,02	2,07	0,28	1,04	1,38	3,95	0,07	0,01	0,01	0,01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
020203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
020204	0,44	279,9	236,39	831	245,09	83,03	1,45	0,15	0,15	0,15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
020205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0203	1341,06	766,56	1310,43	472,34	846,65	680,41	19,38	113,84	90,17	70,76	27,1	24,87	58,87	28,55	23,67	1062,42	52,91	20,85	60,61	565,64	147,15	30,46	132,04	161,13	179,03
020301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
020302	1,29	1,16	3,49	1,17	1,95	0,75	0,03	0,15	0,11	0,08	0,03	0,03	0,07	0,03	0,05	1,33	0,07	0,03	0,05	0,63	0,07	0,04	0,08	0,1	0,02
020303	0,02	10,35	0,06	0,24	0,42	3,41	0,06	0,01	0,01	0,01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
020304	3,76	620,4	467,24	1685,95	511,97	173,44	3,09	0,75	0,7	0,66	0,07	0,06	0,16	0,06	0,03	2,94	0,12	0,07	0,05	0,05	0	0	0	0	0
020305	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total 03	7115,39	14517,24	841,43	1688,71	6139,92	5743,25	147,58	933,37	635,56	443,51	217,38	190,83	762,81	313,77	163,92	5543,63	1714,34	746,46	1857,87	3432,33	92,71	18,16	26,02	9,73	9
0301	4908,32	3106,04	365,96	427,06	2314,37	3554,88	85,08	284,28	209,61	147,75	123,68	131,21	262,33	144,25	73,26	4808,66	225,28	110,33	695,5	164,16	11,4	10,44	1,41	5,58	4,92
030101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030102	509,49	480,46	89,6	78,5	440,45	432,12	12,25	78,01	59,34	47,97	7,51	13,83	12,51	16,66	12,62	201,09	17,98	4,29	203,29	19,27	2,76	2,77	0,06	0,82	0,76
030103	41,52	71,96	21,08	15,75	108,85	57,45	2,01	9,41	6,52	4,92	1,26	4,12	2,98	4,07	3,3	57,42	3,56	1,1	58,53	1,6	0,56	0,56	0,01	0,04	0,02
030104	1,84	750,09	6,14	24,56	42,97	351,45	6,14	0,61	0,61	0,61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030105	0,78	331,68	267,79	951,18	283,65	96,04	1,69	0,2	0,2	0,2	0	0	0	0	0	0,01	0	0	0,01	0,01	0	0	0	0	0

030106	0,25	3,01	0,18	1,26	2,62	5,49	0,1	0,06	0,06	0,06	0,01	0	0,01	0,01	0,01	0,01	0,02	0,05	0,12	0,03	0	0	0	0	0
0302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030303	0	0	0	0	0	0	0	171,4	51,42	7,71	25,71	12	94,27	0	0	111,41	617,04	428,5	428,5	0	0	0	0	0	0
030304	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030305	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030306	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030307	0	0	0	0	0	0	0	1,5	1,43	0,75	0	0,08	0	1,1	0	0	8,75	0	0	0	0	0	0	0	0
030308	0	0	0	0	0	0	0	0,63	0,5	0,38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030309	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030310	0	0	0	0	0	0	0	32,55	29,3	13,18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030311	1592	9774	89,42	190,4	2947	1245,81	40,31	311	248,8	205,26	42,42	8,57	54,72	63,67	67,74	99,02	183,71	6,2	415,92	3247,26	77,99	4,38	24,54	3,29	3,29
030312	0	0	0	0	0	0	0	28,95	14,47	2,89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030313	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030314	0	0	0	0	0	0	0	10,57	9,51	8,45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030315	61,18	0	1,26	0	0	0	0	4,2	3,78	3,36	16,8	21	336	84	7	266	658	196	56	0	0	0	0	0	0
030316	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030317	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030318	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030319	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030321	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030322	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030323	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030324	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030325	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030326	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1) Including CO_2 emission from biomass

2) SNAP sector codes are shown in appendix 3

National Environmental Research Institute

The National Environmental Research Institute, NERI, is a research institute of the Ministry of the Environment. In Danish, NERI is called *Danmarks Miljøundersøgelser (DMU)*.
NERI's tasks are primarily to conduct research, collect data, and give advice on problems related to the environment and nature.

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