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Greenhouse Gas Emissions in the Netherlands: Summary Report 1990-1998 (IPCC Tables 1-7)

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National Inventory Report for submission in accordance with the UN Framework Convention on Climate Change (UNFCCC) and the European Union's Greenhouse Gas Monitoring Mechanism.

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Abstract

This report documents the 1999 Netherlands' annual submission of its greenhouse gas emission inventory in accordance with the European Union's Greenhouse Gas Monitoring Mechanism and the United Nation's Framework Convention on Climate Change (FCCC). Total CO_2 emissions increased in 1998 by about 12% compared to 1990 (10% when comparing temperature-corrected emissions). Comparison with a provisional calculation using the standards *IPCC CO_2 Reference Approach* showed that on average annual sectoral emissions are 1.3% higher than the reference calculation (range of 0.3-1.9%). In 1998 total CH_4 emissions have decreased by 18% compared to the 1990 level, whereas total N_2O emissions increased by about 9% compared to 1990. Of the new gases, for which 1995 is a reference year, emissions of PFCs increased by 4% in 1998, while emissions of HFCs and SF_6 (potential) remained at the same level. Total CO_2-eq. emissions of all greenhouse gases have increased in 1998 by 8% relative to 1990 (1995 for fluorinated gases) (6% when correcting for temperature).

Contents

Summary

This report documents the 1999 Netherlands' annual submission of its greenhouse gas emission inventory in accordance with the United Nation's Framework Convention on Climate Change (FCCC) and the European Union's Greenhouse Gas Monitoring Mechanism. The report comprises the Summary Report Tables 7A for 1990-1998 as defined in the *Revised 1996 IPCC Guidelines* and sectoral tables for 1990 and 1996-1998 (all data for 1998 are preliminary). The Summary Tables 7A for 1990-1995 are identical to the previous submission. Electronic data on emissions, activity data and implied emission factors in the so-called *Common Reporting Format* (CRF) as requested by the UNFCCC secretariat will be submitted separately to the extent that the data required for that format is readily available. The emission data for 1996 as reported in these tables differ slightly from the data reported in the previous report mainly due to revisions in energy consumption by the petrochemical industry and refineries, resulting in a decrease of 1.5 Mton CO_2 emissions in 1996, and revised estimates for energy consumption by off-road vehicles.

The uncertainty in the emission estimates per gas is based on expert judgement of uncertainty in emission factors and activity data for the relevant sources. These uncertainty estimates have been discussed by a larger group of Dutch emission experts at a national Workshop '*Monitoring of Greenhouse Gases in the Netherlands: uncertainty and priorities for improvement',* held on 1 September 1999, resulting in slightly modified estimates based on different assumptions of uncertainty in underlying data and simple, standard error propagation calculation of the overall uncertainty per greenhouse gas. Our current overall estimates of uncertainty are ±3% for CO_2, ±20% for CH_4, ±35% for N_2O; ±50% for HFCs and SF_6; ±100% for PFCs. For precursor gases the uncertainty are currently estimated at ±25% for CO, NO_x, and SO_2 and ±50% for NMVOC (SO_2 possibly ±10%).

Net total CO_2 emissions increased in 1998 by about 12% compared to 1990 (10% when comparing temperature-corrected emissions). The largest sectoral growth of almost 40% occurred in the electricity and heat production sector, contributing also most to the overall growth of national emissions. Emissions from transport increased in this period over 20%. In 1998, temperature-corrected CO_2 emissions were 3.7 Mton or 2% higher than total national uncorrected CO_2 emissions. The relative mild winter of 1998 may have caused the small decrease in uncorrected CO_2 emissions compared to 1997 and 1996. The results of a provisional calculation using the standard *IPCC CO_2 Reference Approach* showed that on average annual sectoral emissions are 1.3% higher than the reference calculation. Using different assumptions on carbon contents of crude oil resulted in a range of 0.3-1.9%.

In 1998 total methane emissions have decreased by 18% compared to the 1990 level. Sectors that contributed most to the decrease were the waste sector (over -20%) and agricultural sector. In 1998 total N_2O emissions increased by about 9% compared to 1990, mainly due to an increase in the agricultural sector of about 17% as a result of shifting manure spreading practices. Industrial process emissions increased in the same period by 7%.

Actual emissions of HFCs for 1994 onwards have been recalculated due to new information on the shares of various applications in the consumption of HFCs and PFCs and production data of aluminium resulting in a minor increase of the 1995 emissions of about 0.1 Mton CO_2-eq. Compared to the 1995 level, total actual emissions in 1998 of the three groups of fluorinated gases appeared to be almost constant. HFC emissions have increased in 1998 by 30% compared to 1990, largely because of an increase in HFC consumption as a substitute for CFC use, in particular of HFC-134a. On the other hand, PFC emissions from aluminium production decreased by about 12% in this period. In the period 1995-1998, the decrease in PFC and HFC-23 emissions (mainly due to reduced by-product emissions related to HCFC-22 production) was compensated by the increase in emissions of other HFCs.

In *Table 5.1* trends in national total (net) uncorrected emissions are summarised for 1990-1998. Emissions of CO_2 and N_2O increased from 1990 to 1998 by about 12% and 9%, respectively, while in the same period CH_4 emissions have decreased by 18%. Of the new gases, for which 1995 is a reference year, emissions of PFCs increased by 4% in 1998, while emissions of HFCs and SF_6 (potential) remained at the same level. Total CO_2-eq. emissions have increased in 1998 by 8% relative to 1990 (1995 for fluorinated gases) (6% when correcting for temperature).

Samenvatting

Dit rapport over de Nederlandse inventarisatie van broeikasgasemissies is geschreven om te voldoen aan de nationale rapportageverplichtingen in 2000 van het Klimaatverdrag van de Verenigde Naties (UN-FCCC) en van het Bewakingsmechanisme Broeikasgassen van de Europese Unie. Dit rapport bevat de zgn. *Summary Report Tables 7A* voor de periode 1990-1998 zoals gedefinieerd in de in 1996 *Herziene IPCC Richtlijnen* (de cijfers voor 1998 zijn voorlopig). De Tabellen 7A voor 1990-1995 zijn gelijk aan die van de vorige rapportage. Electronische data op file over emissies, activiteitendata en afgeleide emissiefactoren in het zgn. *Common Reporting Format* (CRF) dat door het Klimaat-secretariaat verzocht is zal separaat worden geleverd, voor zover de gevraagde data direct beschikbaar zijn. De emissiecijfers voor 1996 zoals hier gerapporteerd verschillen enigszins van de vorige rapportage, wat met name het gevolg is van een bijstelling in het energiegebruik door de petrochemische industrie en raffinaderijen, resulterend in een verlaging van de CO_2-emissies van 1.5 Mton in 1996 en een herziene schatting van het energiegebruik door zgn. overige mobiele werktuigen.

De onzekerheden in de emissieschattingen zijn gebaseerd op ‘expert judgement’ van de onzekerheid in emissiefactoren en activiteitendata. Deze inschattingen zijn onderwerp van discussie geweest in een groep Nederlandse emissie-experts op een nationale workshop 'Monitoring van broeikasgasemissies; onzekerheden en prioriteiten voor verbetering', die 1 september 1999 gehouden is. Dit heeft geleid tot kleine bijstelling van de geschatte onzekerheden gebaseerd op aannames over de onzekerheid in onderliggende data en een eenvoudige, standaardberekening voor foutenvoortplanting in de totale onzekerheid per broeikasgas. Thans worden de volgende onzekerheden per gas gebruikt: voor CO_2 ±3%, CH_4 ±20%, N_2O ±35%; HFK’s en SF_6: ±50%; PFK’s: ±100%. En voor de precursorgassen CO, NO_x, SO_2: ±25%; NMVOS: ±50% (SO_2 mogelijk ±10%).

De netto CO_2-emissies waren in 1998 12% hoger dan in 1990 (10% wanneer gecorrigeerd voor temperatuur). De grootste sectorale groei was in de elektriciteits- en warmteproduktiesector (bijna 40%), die ook het meest aan de totale emissiegroei bijdroeg. De transportemissies stegen in deze periode met ruim 20%. In 1998 zijn de temperatuurgecorrigeerde CO_2-emissies 3.7 Mton of 2% hoger dan de ongecorrigeerde emissies. De relatief milde winter van 1998 kan mogelijkerwijs de kleine afname in ongecorrigeerde CO_2-emissies ten opzichte van 1997 en 1996 verklaren. Resultaten van een voorlopige berekening volgens de standaard *IPCC-Referentiemethode voor CO_2* lieten een verschil zien van gemiddeld 1.3% met de som van de jaarlijkse sectorale emissies. Bij andere aannames voor het koolstofgehalte van ruwe olie varieerde dit tussen 0.3 en 1.9%.

In 1998 waren de methaanemissies 18% lager dan in 1990. De afvalsector (ruim -20%) en de landbouwsector droegen hieraan het meest bij. De N_2O-emissies zijn in 1998 ca. 9% gestegen ten opzichte van 1990, vooral als gevolg van een stijging van de landbouwemissies van ca. 17% als gevolg van de toepassing van een andere mestverwerkingstechniek (uitrijden/onderwerken van mest). De N_2O-emissies van industriële processen stegen in deze periode met 7%.

De actuele emissies van HFK's zijn voor de periode 1994-1998 herberekend op grond van nieuwe inzichten over de gebruikspercentages voor verschillende toepassingen van HFK's en PFK's en nieuwe data voor aluminiumproductie. Dit resulteerde in een geringe toename van de emissies in 1995 van ca. 0.1 Mton CO_2-eq. Vergeleken met 1995 zijn de totale emissies van de drie groepen F-gassen vrijwel constant gebleven. De HFK-emissies zijn in 1998 met 30% gestegen ten opzichte van 1990, vooral als gevolg van stijging van HFK-gebruik als alternatief voor CFK's, in het bijzonder van HFK-134a. Aan de andere kant verminderde de PFK-emissies van aluminiumproductie met 12% in dezelfde periode. In de periode 1995-1998 werden de verminderde PFK- en HFK-23-emissies (vooral door reductie van de bijproductemissies van de productie van HCFK-22) gecompenseerd door de stijging in de emissies van andere HFK's.

In *Tabel 5.1* zijn de totale emissietrends 1990-1998 samengevat. In die periode zijn de emissies van CO_2 en N_2O met resp. 12% en 9% gestegen, terwijl de CH_4-emissies met 18% daalden. Van de zgn. F-gassen, waarvoor 1995 het referentiejaar is, stegen de PFK-emissies met 4% in 1998 ten opzichte van 1995, terwijl de emissies van HFK’s en SF_6 (potentieel) op hetzelfde niveau bleven. De totale CO_2-eq. emissies waren in 1998 8% hoger dan in 1990 (1995 voor de F-gassen) (6% bij temperatuurcorrectie).

Chemical compounds

CFCs	Chlorofluorocarbons
CF_4	Perfluoromethane (tetrafluoromethane)
C_2F_6	Perfluoroethane (hexafluoroethane)
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
CTC	Carbon tetrachloride (tetrachloromethane)
FICs	Fluoroiodocarbons
HCFCs	Hydrochlorofluorocarbons
HFCs	Hydrofluorocarbons
HNO_3	Nitric Acid
MCF	Methyl Chloroform (1,1,1-Trichloroethane)
NO_x	Nitrogen oxide (NO and NO_2), expressed as NO_2
N_2O	Nitrous oxide
NMVOC	Non-Methane Volatile Organic Compounds
PFCs	Perfluorocarbons
SO_2	Sulphur dioxide
SF_6	Sulphur hexafluoride
VOC	Volatile Organic Compounds (may include or exclude methane)

Units

MJ	Mega Joule (10^6 Joule)
GJ	Giga Joule (10^9 Joule)
TJ	Tera Joule (10^{12} Joule)
PJ	Peta Joule (10^{15} Joule)

Mg	Mega gramme (10^6 gramme)
Gg	Giga gramme (10^9 gramme)
Tg	Tera gramme (10^{12} gramme)
Pg	Peta gramme (10^{15} gramme)

ton	metric ton (= 1 000 kilogramme = 1 Mg)
kton	kiloton (= 1 000 metric ton = 1 Gg)
Mton	Megaton (= 1 000 000 metric ton = 1 Tg)

Conversion factors for emissions

From element basis to full molecular mass:

$C \rightarrow CO_2$:	x 44/12 = 3.67
$C \rightarrow CH_4$:	x 16/12 = 1.33
$C \rightarrow CO$:	x 28/12 = 2.33
$N \rightarrow N_2O$:	x 44/28 = 1.57
$N \rightarrow NO$:	x 30/14 = 2.14
$N \rightarrow NO_2$:	x 46/14 = 3.29
$N \rightarrow NH_3$:	x 17/14 = 1.21
$N \rightarrow HNO_3$:	x 63/14 = 4.50
$S \rightarrow SO_2$:	x 64/32 = 2.00

From full molecular mass to element basis:

$CO_2 \rightarrow C$:	x 12/44 = 0.27
$CH_4 \rightarrow C$:	x 12/16 = 0.75
$CO \rightarrow C$:	x 12/28 = 0.43
$N_2O \rightarrow N$:	x 28/44 = 0.64
$NO \rightarrow N$:	x 14/30 = 0.47
$NO_2 \rightarrow N$:	x 14/46 = 0.30
$NH_3 \rightarrow N$:	x 14/17 = 0.82
$HNO_3 \rightarrow N$:	x 14/63 = 0.22
$SO_2 \rightarrow S$:	x 32/64 = 0.50

1. Introduction

This report documents the 1999 Netherlands' annual submission of its greenhouse gas emission inventory in accordance with the European Union's Greenhouse Gas Monitoring Mechanism and the United Nation's Framework Convention on Climate Change (FCCC). The report comprises the Summary Report Tables 7A for 1990-1998 as defined in the *Revised 1996 IPCC Guidelines* (IPCC, 1997) and sectoral tables for 1990 and 1996-1998 (all data for 1998 are preliminary). Due to limitations of data processing at present it is not possible to provide sectoral tables for the years 1991-1995. The Summary Tables 7A for 1990-1995 are identical to the previous submission (Olivier *et al*., 1999). Electronic data on emissions, activity data and implied emission factors in the so-called *Common Reporting Format* (CRF) as requested by the UNFCCC secretariat will be submitted separately to the extent that the data required for that format is readily available.

The emission data for 1996 as reported in these tables differ slightly from the data reported in the previous report (Oliver *et al*., 1999) mainly due to:

- revisions in energy consumption by the petrochemical industry and refineries;
- revised estimates for energy consumption by off-road vehicles.

In addition, new insights/data resulted in updated methodology and revised emission estimates for some sources for the period 1990-1998. Also a few small corrections have been made in the allocation into IPCC source categories. These changes are discussed briefly in Chapter 2.

The uncertainty in the emission estimates per gas is based on expert judgement of uncertainty in emission factors and activity data for the relevant sources. These uncertainty estimates have been discussed by a larger group of Dutch emission experts at a national Workshop '*Monitoring of Greenhouse Gases in the Netherlands: uncertainty and priorities for improvement',* held on 1 September 1999, resulting in slightly modified estimates based on different assumptions of uncertainty in underlying data and simple, standard error propagation calculation of the overall uncertainty per greenhouse gas (Tier 1 in IPCC (2000)). For some sources, in particular for CO_2, the uncertainty estimate is based on a more detailed Tier 1 analysis of underlying activity data and emission factors. In the subsequent chapters the uncertainty estimate per main sector is briefly described. For more details we refer to the workshop proceedings (Van Amstel *et al*., 2000). Our current overall estimate of total uncertainty per greenhouse gas is:

CO_2	±3%	HFCs	±50%
CH_4	±20%	PFCs	±100%
N_2O	±35%	SF_6	±50%

The resulting uncertainty in national total CO_2-eq. emissions is about 5%. For precursor gases the uncertainty in national total emissions are estimated at (RIVM, 1999a):

CO	±25%
NO_x	±25%
NMVOC	±50%
SO_2	±25% (possibly ±10%)

Results of recent research indicate that the uncertainty in SO_2 emissions may be considerably lower, of the order of ±10%.

Chapters 3 to 5 briefly discuss the trends in emissions of greenhouse gas and precursor gases and their contribution to annual emissions are briefly discussed. IPCC Summary Report Tables 7A for 1990-1998 are provided in Appendix A, except for emissions of HFCs, PFCs and SF_6 which are

provided in Appendix B. Appendix C contains information similar to the IPCC Sectoral Tables 1-6 for 1990 and 1996-1998. Appendix D provides results of a provisional CO_2 Reference Approach calculation for CO2 for the period 1990-1998.

We note that in all tables the same number of decimal digits is used within a table (or per compound column). Therefore, the number of (decimal) digits shown does not correspond with the number significant digits of the figures presented. The uncertainty of the emissions is briefly discussed in the Chapters 3 to 5. Please also note that in the tables the figures may not exactly add up to the (sub)totals because of independent rounding.

2. Changes in methodology and definitions

In this chapter we outline the key differences compared with the previous submission reported by Olivier *et al.* (1999). As explained below, some emission recalculations apply to the whole period 1990-1998. However, because most changes are only of a minor nature and since these recalculations have not been performed for all years prior to 1996, all emission figures for the years 1990-1995 have been kept unchanged compared to the previous submission (except for a minor change in actual HFC emissions in 1994 and 1995, which has been incorporated in this report).

2.1. Differences due to revised source allocation

Emissions in the Netherlands are grouped by so-called target groups, on which environmental policy is focused. The definition of these groups is provided in Olivier *et al.* (1999) along with the updated correspondence table for emissions from target groups and IPCC source categories.

As a next step towards reporting at a more detailed source category level (the spreadsheet with the so-called Common Reporting Format, CRF) as requested by the Parties, all subcategories at the lowest aggregation level currently used for reporting for domestic purposes (so-called 'rapcodes') have received an additional attribute 'IPCC subsector'. In the course of this definition process, a few improvements of the current rapcode to 'IPCC sector' correspondence table have been made. This was done to achieve the best possible compliance with source category definitions in the *Revised 1996 IPCC Guidelines* within the constraints of lowest sub-source categories presently identified (rapcodes) in the Dutch Emission Registration system.

Compared with the previous submission the following allocations of subcategories have been changed for the allocation of the emissions in 1996-1998 only:

- 2 rapcodes from 1A1c (Other transformation) to 1B2 (Fugitive fuel emissions)
- 6 rapcodes from 1A2 (Industrial combustion) to 2G (Other industrial processes)
- 1 rapcode from 1A3 (Transport) to 2G (Other industrial processes)
- 3 rapcode from 1A4 (Small combustion) to 3D (Solvents and other product use)
- 1 rapcode from 1A5 (Other combustion) to 2G (Other industrial processes).

The changes from 1A1c to 1B2 have a very minor effect on the subsector totals presented in Tables 7A; all other modifications have a negligible effect in these tables. Because of the very minor impact on the Summary Tables 7A, the tables for 1990-1995 have not yet been updated in the respect.

Finally, we recall that due to data processing limitations the following sub-categories are used somewhat different from the IPCC source definitions:

- The transport sector [1A3] includes all *off-road transport* emissions as described in Spakman *et al*. (1997b).
- Under non-CO_2 *Domestic air traffic emissions* [1A3a] we report total LTO emissions as described in Spakman *et al*. (1997b), which relate to total national emissions from air traffic included in the Dutch national emissions inventory system.
- Under *Energy transformation* [1A1c] we include not only the emissions from refineries, but also from lubricants and waxes manufacturing and combustion emissions from the oil & gas production and distribution industry.

2.2. Differences due to changes in methodology or data

Changes in activity data since the previous submission:

- Figures for energy consumption in 1996 have decreased due to an error correction in the amount of fuel consumption by the petrochemical industry and refineries; the total decrease is 12.4 PJ;
- Energy consumption for *inland shipping* is now based on information on shipping routes and velocities per type of ship; this resulted in a higher fuel consumption, in particular for freight transport;
- Energy consumption allocated to the transport sector increased by about 4 PJ due to revised estimates for energy consumption by off-road vehicles;
- Fuelwood and charcoal consumption is not part of the Energy Monitor of CBS (energy balances of the Netherlands). Recently a census was made of the number of open fireplaces and wood stoves and their use. This has lead to the revision of the degree of penetration and a decrease in the assumed use. As a result the biofuel consumption data have decreased about 40% in the period 1990-1998;

Changes in greenhouse gas emissions since the previous submission:

- The national total CO_2 emissions in 1996 have decreased by 1 500 Gg (1.5 Mtonne) mainly due to an error correction in the amount of fuel consumption by the petrochemical industry and refineries (see above); in addition higher fuel consumption by off-road vehicles (see above) resulted in some smaller changes of CO_2 and other emissions;
- The CH_4 emission calculation for gas production, in particular offshore gas production, has been revised for the period 1995-1998 because of an update of underlying data, effectively decreasing the emissions in 1996 by about 15 Gg.
- The emission factors for N_2O from LPG cars in road transport have been updated in view of the penetration of catalytic converters; this resulted in a decrease of 0.3 Gg N_2O in 1996;
- The actual emissions of HFCs and PFCs have been updated for the period 1996-1998 (HFC-134a emissions also for 1995). This was primarily based on new insights on the division per compound over the various types of applications, each with distinct emission factors. Also the preliminary figure for HFC-23 emissions in 1997 from the previous submission has been revised substantially as the newly installed abatement technology was not as effective as assumed, resulting in an increase of about 2 500 Gg (or 2.5 Mtonne) CO_2-eq. of HFC-23 emissions in 1997.
- The emissions from biofuel combustion have decreased by about 40% for the whole period 1990-1998 due to revised activity data (see explanation above).

Changes in ozone precursors and SO_2 since the previous submission:

- The emission factors for CO and NMVOC from heavy duty diesel vehicles in road transport have been updated for the period 1990-1998 in view of recent measurements of a sample of vehicle; this resulted in a decrease of 11 Gg CO and 10 Gg NMVOC in 1996;
- SO_2 emissions from petrol vehicles have decreased in response to a lower sulphur content of the fuel as reported by the oil companies; this resulted in an increase of over 1 Gg SO_2;

The figures comply with the *Environmental Balance 1999* (RIVM, 1999b,c) and with the *Annual emissions and waste report 1999* describing emissions and waste in 1995, 1997 and 1998 (VROM, 1999), except some minor differences between these reports due to different production dates and for the figure of 178 Gg CH_4 emissions in the column for 1995 emissions from the energy sector in the Environmental Balance 1999, where accidentally the value for 1996 has been used. We recall that all data in this report presented for 1998 are preliminary.

3. Trends in greenhouse gas emissions

In this chapter the trends in emissions are presented per IPCC category in tabular and graphic form. We recall that the data for 1998 are all preliminary data. The figures show both percentage change of emissions between 1998 and 1990 and the share of the sectors in 1990. When interpreting the relevance of large changes for national total emissions, these shares need to be taken into account as well.

3.1. Emissions and sources of CO_2

Trends in emissions per IPCC sector have been summarised in *Table 3.1*. In 1998 net total CO_2 emissions increased by about 12% compared to 1990 (10% when comparing temperature-corrected emissions). The largest sectoral growth of almost 40% occurred in the electricity and heat production sector, contributing also most to the overall growth of national emissions (*Figure 3.1*). Emissions from transport increased in this period by 22%. We note that due to some inconsistencies in the emission database, for the years 1996-1998, in the IPCC Tables 7A in Appendix A only *total* CO_2 emissions from industrial fuel consumption [1A2] is reported without distinction between combustion emissions and actual emissions from fuel use as chemical feedstock.

The uncertainty in emission estimates from fossil fuel combustion, which is related to uncertainty in activity data (energy statistics) and emission factors for CO_2 (basically, the carbon content of the fuels), is currently estimated to be about 3% (with order of magnitude-factor of 1.5) (Van Amstel *et al*., 2000). The uncertainty is not well known for other sources. However, due to the minor share from other sources, the uncertainty in the overall total is estimated to be about 3%. Figures for CO_2 sequestration in sinks (IPCC category 5) have just been kept constant in view of future changes to comply with Kyoto Protocol definition.

Table 3.1 CO_2 emissions and sinks per IPCC sector 1990-1998 (no T-corr.) (1000 Gg)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
TOTAL NET NATIONAL EMISSIONS	**161.4**	**166.9**	**165.2**	**167.5**	**168.4**	**177.2**	**184.7**	**183.2**	**181.4**
1. All Energy (combustion and fugitive)	**159.5**	**165.3**	**163.8**	**166.3**	**166.9**	**173.9**	**181.1**	**179.0**	**177.6**
A Fuel combustion total	159.0	164.9	163.4	165.9	166.8	173.0	180.0	178.0	176.8
1 a Electricity and heat production	42.2	41.6	43.3	43.2	44.8	43.7	45.1	56.1	58.5
1 c Other transformation	10.4	10.6	10.9	10.6	11.2	12.3	12.0	12.0	12.5
2 Industry	41.4	42.7	42.5	39.9	41.0	43.4	42.0	44.5	43.8
3 Transport	28.6	28.6	29.8	30.5	30.8	32.0	33.8	34.3	34.7
4 a Commercial / Institutional	8.7	10.3	9.4	10.6	10.1	9.4	10.9	8.9	9.2
4 b Residential	19.2	21.6	19.5	20.6	19.6	20.6	24.0	20.1	19.1
4 c Agriculture / Forestry / Fishing	7.4	8.5	8.5	8.8	8.8	8.9	10.3	7.7	7.8
5 Other	1.1	1.1	-0.4	1.7	0.6	2.5	2.0	6.3	3.6
B Fugitive fuel emissions	0.4	0.5	0.4	0.4	0.2	1.0	1.1	1.0	0.8
2 Crude oil and natural gas	0.4	0.5	0.4	0.4	0.2	1.0	1.1	1.0	0.8
2. Industrial processes	**1.9**	**1.5**	**1.3**	**1.2**	**1.4**	**1.6**	**1.8**	**1.7**	**1.5**
3. Solvent and other product use	**0.0**	**0.1**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**
5. Land use change and forestry	**(-1.50)**	**(-1.60)**	**(-1.60)**	**(-1.60)**	**(-1.70)**	**(-1.70)**	**(-1.70)**	**(-1.70)**	**(-1.70)**
6. Waste	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.6**	**1.9**	**2.5**	**2.3**

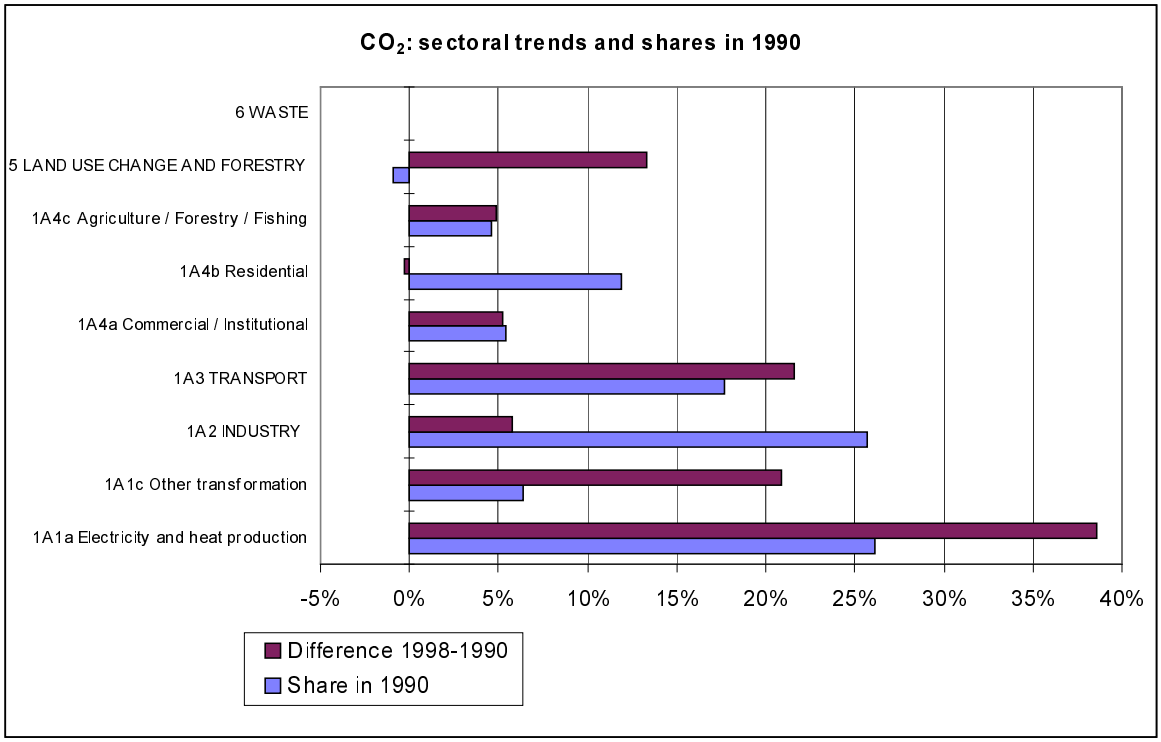

Figure 3.1. CO_2 emission shares and trends per IPCC sector 1990-1998 (no T-corr.)

CO_2 Reference calculation

We have performed a provisional calculation of the *IPCC Reference Approach* for CO_2 from energy use. However, due to a current lack of information on the carbon content of crude oil, natural gas liquids and other refinery inputs, which is required for this reference calculation, this could only be done with *estimated figures* for the carbon content of refinery inputs.

The results of this calculation are presented for 1990-1998 in some detail in Appendix D. Using one dataset for the missing data comparison of the sum of reported sectoral energy related CO_2 emissions with the provisional reference calculation showed that on average annual sectoral emissions are 1.3% higher. However, the latter include emissions associated with statistical difference in energy consumption, which the Netherlands presently assumes to represent unallocated sectoral fuel use.

We stress that these results are quite preliminary, since the reference calculation for the Netherlands is quite sensitive for the crude oil input figures due to the relatively high amounts of crude oil refined and oil products exported. A sensitivity analysis for four sets of carbon contents for crude oil showed that the annual average difference of sectoral and reference calculation may vary between 0.3% and 1.9%. For further details we refer to Appendix D.

Temperature correction for CO_2

For policy purposes, trends in CO_2 emissions are corrected for climate variation of domestic space heating. In *Table 3.2* key data used in this calculation are summarised; corrections are only applied to natural gas consumption since other fuels used for space heating are almost negligible. Positive figures indicate an addition of natural gas consumption and CO_2 emissions due to a relatively mild winter in that calendar year. From the table it can be observed that during the last years there has been a decreasing trend in the 30-year moving average used for the determination of the reference level of heating degree days. The temperature correction method as described in Spakman *et al.*

(1997b) has been evaluated; however, final conclusion have not yet been drawn (Van Amstel et al., 2000). The correction factor varies between -11% in 1996 to +20% in 1990. In 1998, CO_2 emissions were corrected by 3.7 Mton or 2% of total national emissions, while 1990 emissions have been corrected by 6.3 Mton or 3.9%.

Table 3.2 Temperature correction: energy and CO_2 emissions per IPCC sector 1990-1998

		1990	1991	1992	1993	1994	1995	1996	1997	1998
Heating degree days (HDD-t) [HDD]		2677	3163	2829	3076	2835	2917	3504	2929	2821
HDD: 30-year moving average (HDD-av)		3211	3198	3203	3177	3156	3140	3124	3135	3133
T correction factor (= HDD-av/HDD-t)		**1.199**	**1.011**	**1.132**	**1.033**	**1.113**	**1.076**	**0.892**	**1.070**	**1.111**
Space heating natural gas [PJ]										
1A1a	electricity and heat production	2.9	0.2	2.0	0.5	2.0	1.4	-2.2	1.2	0.2
1A2a-e	industry	13.8	0.9	8.0	2.1	7.1	5.0	-5.4	2.9	4.5
1A4a	commercial / institutional	22.5	1.4	16.1	4.3	14.3	9.6	-16.6	9.1	14.5
1A4b	households	51.8	3.2	36.1	9.1	29.8	20.0	-36.1	20.0	31.8
1A4c	agriculture / forestry / fishing	21.0	1.3	15.0	3.9	13.6	9.1	-15.8	8.8	14.0
TOTAL correction gas consumption [PJ]		**111.9**	**7.0**	**77.1**	**19.9**	**66.8**	**45.1**	**-76.1**	**41.9**	**65.0**
Emissions CO_2 [Gg]										
1A1a	electricity and heat production	160	10	110	30	110	80	-120	60	10
1A2a-e	industry	770	50	450	120	400	280	-300	160	250
1A4a	commercial / institutional	1260	80	900	240	800	540	-930	510	810
1A4b	households	2900	180	2020	510	1670	1120	-2020	1120	1780
1A4c	agriculture / forestry / fishing	1180	70	840	220	760	510	-880	490	780
TOTAL correction CO_2 emissions [Gg]		**6270**	**390**	**4320**	**1110**	**3740**	**2530**	**-4260**	**2350**	**3710**

International bunkers

In *Table 3.3* both energy consumption and CO_2 emissions from international bunkers are presented per detailed fuel type. In 1998 bunker emissions of CO_2 have increased by about 9 000 Gg or 23% compared to 1990. Both international shipping and aviation contributed about the same to this increase of 9 Mton CO_2.

Table 3.3 Bunkers: energy consumption and CO_2 emissions 1990-1998

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Energy consumption [PJ]									
Marine bunkers	466	476	478	495	474	479	488	518	522
- heavy fuel oil	*386*	*396*	*398*	*411*	*386*	*377*	*393*	*429*	*434*
- gasoil	*80*	*80*	*80*	*84*	*88*	*102*	*95*	*89*	*88*
Aviation Bunkers	61	68	81	89	92	105	113	123	130
- jetfuel (kerosine)	*61*	*68*	*81*	*89*	*92*	*105*	*113*	*123*	*130*
- aircraft gasoline	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
TOTAL Bunkers	**527**	**544**	**559**	**585**	**566**	**584**	**601**	**641**	**652**
Emissions [Gg CO_2]									
Marine bunkers	35 560	36 330	36 490	37 780	36 140	36 480	37 200	39 530	39 830
- heavy fuel oil	*29 720*	*30 490*	*30 650*	*31 650*	*29 720*	*29 030*	*30 260*	*33 030*	*33 410*
- gasoil	*5 840*	*5 840*	*5 840*	*6 130*	*6 420*	*7 450*	*6 940*	*6 500*	*6 420*
Aviation Bunkers	4 450	4 960	5 910	6 500	6 720	7 670	8 250	8 980	9 490
- jetfuel (kerosine)	*4 450*	*4 960*	*5 910*	*6 500*	*6 720*	*7 670*	*8 250*	*8 980*	*9 490*
- aircraft gasoline	-	-	-	-	-	-	-	-	-
TOTAL Bunkers	**40 010**	**41 290**	**42 400**	**44 280**	**42 860**	**44 150**	**45 450**	**48 510**	**49 320**

Source: CBS, 1990-1998 (NEH/Energy Monitor, table 1.1)

Emissions of CH_4

In 1998 total methane emissions have decreased by 18% compared to the 1990 level (*Table 3.4*). Sectors that contributed most to the decrease were the waste sector (over -20%) and agricultural sector (*Figure 3.2*). Less dumping in and high methane recovery rates from landfills and decreasing numbers of livestock were the major determining factors for this decrease but also fugitive fuel emissions contributed to the decrease in national total emissions of CH_4.

The uncertainty in emission estimates of CH_4 emissions from most sectors is estimated at about 25%, with an exception for the uncertainty in emissions from waste, estimated at about 30%. Thus, the uncertainty in the overall total will be roughly about 20% (with order of magnitude-factor of 1.5) (Van Amstel *et al*., 2000).

Table 3.4 CH_4 emissions per IPCC sector 1990-1998 (Gg)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
TOTAL NET NATIONAL EMISSIONS	**1292.3**	**1308.8**	**1256.2**	**1224.6**	**1203.0**	**1172.5**	**1164.5**	**1105.3**	**1065.4**
1. All Energy (combustion and fugitive)	**213.5**	**223.9**	**199.1**	**192.3**	**202.3**	**209.3**	**214.4**	**189.0**	**179.6**
A Fuel combustion total	34.8	35.8	36.0	34.3	33.7	35.3	36.9	30.1	30.0
1 Energy	3.0	3.3	3.8	3.4	3.7	4.9	5.7	3.1	3.6
2 Industry	4.0	3.5	4.9	3.2	2.6	2.8	1.5	1.6	1.9
3 Transport	7.8	6.9	6.8	6.4	6.3	6.3	5.7	5.3	4.9
4 a Commercial / Institutional	1.1	1.1	1.0	0.9	1.4	0.6	1.4	0.6	0.7
4 b Residential	16.5	18.3	16.8	17.7	17.0	17.9	19.9	17.2	16.4
4 c Agriculture / Forestry / Fishing	2.3	2.7	2.7	2.8	2.8	2.8	2.8	2.4	2.5
B Fugitive fuel emissions	178.8	188.1	163.1	158.0	168.5	174.0	177.5	158.9	149.6
2 Crude oil and natural gas	178.8	188.1	163.1	158.0	168.5	174.0	177.5	158.9	149.6
2. Industrial processes (ISIC)	**3.4**	**3.5**	**3.7**	**4.9**	**5.3**	**5.0**	**5.8**	**2.7**	**2.6**
3. Solvent and other product use	**2.0**	**2.0**	**2.0**	**2.0**	**2.3**	**2.0**	**2.0**	**2.0**	**1.9**
4. Agriculture	**505.0**	**517.0**	**505.0**	**497.0**	**483.0**	**475.7**	**464.8**	**446.3**	**435.1**
A Enteric fermentation	402.0	412.0	401.0	393.0	382.0	376.7	365.8	352.6	341.5
B Manure management	103.0	105.0	104.0	104.0	101.0	99.0	99.0	93.7	93.6
5. Land use change and forestry									
6. Waste	**568.4**	**562.4**	**546.4**	**528.4**	**510.2**	**480.5**	**477.6**	**465.3**	**446.2**
A Solid waste disposal on land	562.1	556.1	540.1	522.1	505.1	479.0	477.0	464.0	444.9
B Waste water handling	6.3	6.3	6.3	6.3	5.1	1.5	0.6	1.3	1.3

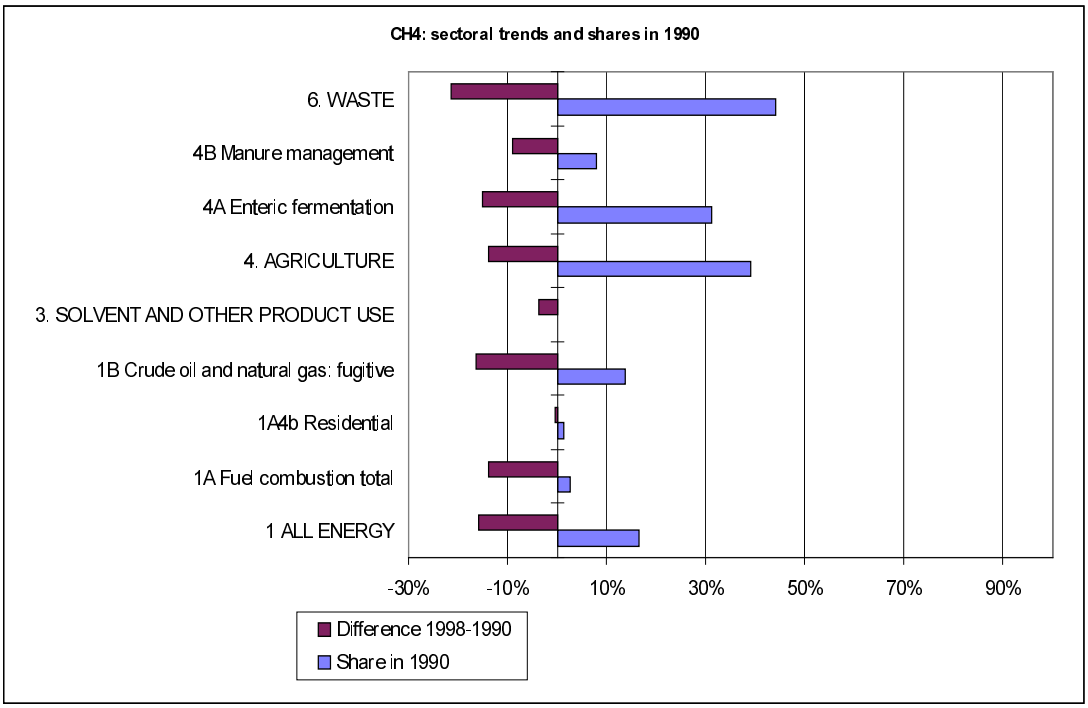

Figure 3.2. CH_4 emission shares and trends per IPCC sector 1990-1998

3.2. Emissions of N_2O

In 1998 total N_2O emissions increased by about 9% compared to 1990 (*Table 3.5*), mainly due to an increase in the agricultural sector of about 17% as a result of shifting manure spreading practices (*Figure 3.3.*). Industrial process emissions increased in the same period by 7%. In road transport, increasing emissions due to the further penetration of catalyst-equipped petrol cars were compensated by decreasing N_2O emissions calculated for diesel vehicles resulting in almost constant emissions in this sector.

The uncertainty in emission estimates for N_2O emissions is related to uncertainty in activity data and in emission factors for N_2O. Compared to sources of CO_2 and CH_4, the uncertainty in emission factors for identified sources is often fairly large: in the order of 50 to 100%. Also, some sources are not well-known or may not have been identified yet. The uncertainty in the overall total of sources included in the inventory is estimated to be roughly about 35% (with order of magnitude-factor of 1.5) (Van Amstel *et al.*, 2000).

Table 3.5 N_2O emissions per IPCC sector 1990-1998 (Gg)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
TOTAL NET NATIONAL EMISSIONS	**65.8**	**66.9**	**69.2**	**68.8**	**70.7**	**72.2**	**71.8**	**73.3**	**71.6**
1. All Energy (combustion and fugitive)	**7.3**	**6.9**	**7.9**	**7.9**	**7.9**	**8.1**	**7.7**	**7.5**	**7.1**
A Fuel combustion total	7.3	6.9	7.9	7.9	7.5	8.1	7.7	7.5	7.1
1 Energy transformation	0.5	0.5	0.5	0.5	0.1	0.5	0.4	0.4	0.4
2 Industry	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
3 Transport	6.6	6.2	7.2	7.2	7.2	7.4	7.1	6.9	6.5
4 Small combustion	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
5 Other	-	-	-	-	-	-	-	-	-
B Fugitive fuel emissions	-	-	-	-	0.4	0.0	0.0	0.0	-
2. Industrial processes	**31.5**	**32.3**	**30.4**	**30.0**	**31.6**	**31.6**	**31.7**	**35.0**	**33.8**
3. Solvent and other product use	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.4**	**0.4**
4. Agriculture	**22.2**	**22.9**	**26.2**	**26.2**	**26.4**	**27.6**	**27.5**	**25.9**	**25.9**
5. Land use change and forestry	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
6. Waste	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.6**	**0.6**	**0.6**	**0.6**
7. Other (specified)	**3.8**	**3.8**	**3.8**	**3.8**	**3.8**	**3.8**	**3.8**	**3.8**	**3.8**

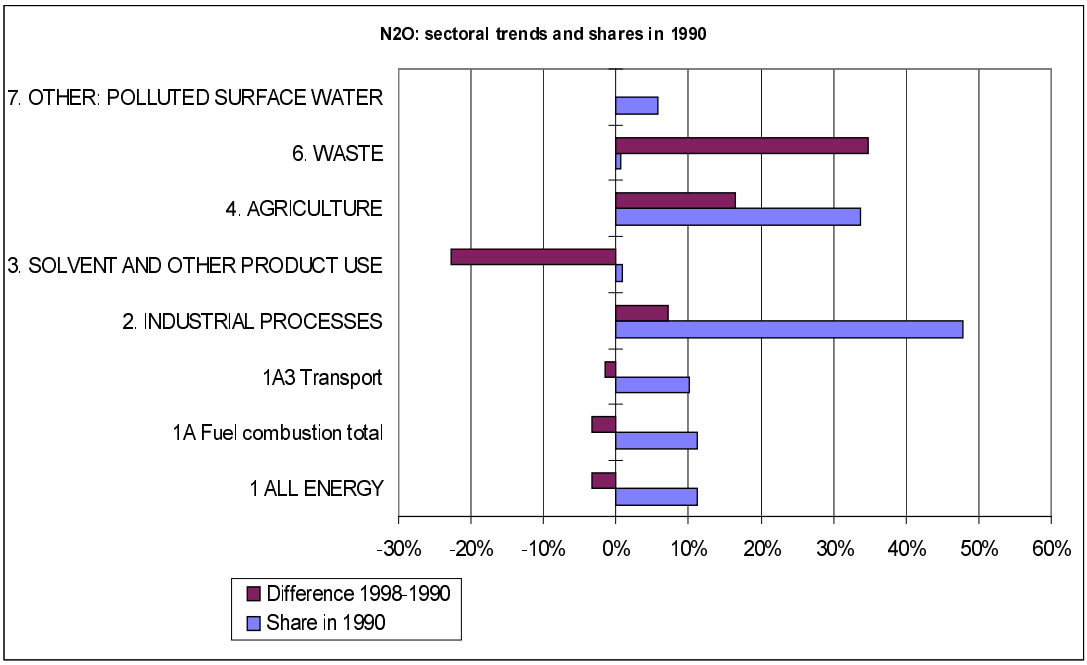

Figure 3.3. N_2O emission shares and trends per IPCC sector 1990-1998

3.3. Emissions of fluorinated halocarbons

Actual emissions of HFCs for 1994 onwards have been recalculated due to new information on the shares of various applications in the consumption of HFCs and PFCs and production data of aluminium. As a result total CO_2-eq. emissions in 1995 from the 'new' gases increased slightly by about 100 Gg CO_2-eq.

Trends in potential emissions (or so-called *apparent consumption*) from 1990 onwards are presented in *Table 3.6*, whereas actual emissions (for SF_6 still potential) are shown in *Table 3.7*. It shows that HFC emissions have increased in 1998 by 30% compared to 1990, largely because of an increase in HFC consumption as a substitute for CFC use, in particular of HFC-134a. On the other hand, PFC emissions from aluminium production decreased by about 12% in this period. However, compared to the 1995 level, total emissions of these three groups of fluorinated gases appeared to be almost constant (*Figure 3.4*). It clearly shows that in the period 1995-1998 the decrease in PFC and HFC-23 emissions (mainly due to reduced by-product emissions related to HCFC-22 production) was compensated by the increase in emissions of other HFCs.

The uncertainty in actual emission estimates of HFC, PFC and SF_6 is related to the uncertainty in activity data, emission factors, and other factors such as duration of storage and leakage rates. Activity data are often precise; the largest uncertainties are found in the other data. For PFCs, which predominantly stem from aluminium production, the emission factors are very uncertain, presently of the order of 100% (i.e. uncertainty factor of 2). The uncertainty in the overall total of sources included in the inventory is estimated to be in the order of 50% for HFCs and SF_6, and roughly 100% for PFCs (each with order of magnitude-factor of 1.5) (Van Amstel *et al*., 2000).

Table 3.6 Potential emissions per compound of HFCs, PFCs and SF_6 1990-1998 (Gg CO_2-eq.)

Compound	IPCC	GWP	1990	1991	1992	1993	1994	1995	1996	1997	1998
HFC-134a	2F	1300	0	0	0	0	356	590	1 187	1 398	1 521
HFC-143a	2F	3800	0	0	0	0	0	129	315	350	391
HFC-125	2F	2800	0	0	0	0	0	140	286	274	266
HFC-23	2E	11700	0	0	0	0	0	0	0	0	0
HFC (unspecified)	2E	3000 (estimate)	0	0	0	0	0	69	168	138	120
HFC-TOTAL			**0**	**0**	**0**	**0**	**356**	**928**	**1 956**	**2 160**	**2 298**
CF_4 (PFC-14)	2C	6500	0	0	0	0	0	0	0	0	0
C_2F_6 (PFC-116)	2C	9200	0	0	0	0	0	0	0	0	0
PFC use	2F	7200	0	0	0	0	0	166	94	94	94
PFC-TOTAL			**0**	**0**	**0**	**0**	**0**	**166**	**94**	**94**	**94**
SF_6 use	2F	23900	**1 386**	**1 386**	**1 410**	**1 434**	**1 458**	**1 458**	**1 458**	**1 458**	**1 458**
TOTAL HFC/PFC/SF_6			**1 386**	**1 386**	**1 410**	**1 434**	**1 814**	**2 552**	**3 507**	**3 711**	**3 850**

Table 3.7 Actual emissions per compound of HFCs, PFCs and potential SF_6 1990-1998 (Gg CO_2-eq.)

Compound	IPCC	GWP	1990	1991	1992	1993	1994	1995	1996	1997	1998
HFC-134a	2F	1300	12	12	23	7	94	333	607	877	989
HFC-143a	2F	3800	10	10	10	10	24	35	69	107	133
HFC-125	2F	2800	20	20	20	20	55	68	100	131	139
HFC-23	2E	11700	5 101	4 820	4 540	5 066	6 271	6 271	6 709	6 709	5 370
HFC-152a	2E	140	1	1	1	4	3	3	6	4	3
Other HFCs	2F	3000 (est)	0	0	0	0	0	12	36	48	51
HFC-TOTAL			**5 144**	**4 863**	**4 594**	**5 107**	**6 447**	**6 723**	**7 527**	**7 876**	**6 686**
CF_4 (PFC-14)	2C	6500	2 012	1 981	1 771	1 778	1 794	1 685	1 786	1 817	1 817
C_2F_6 (PFC-116)	2C	9200	285	280	251	252	254	239	253	257	257
PFC use	2F	7200	158	158	166	166	166	166	94	94	94
PFC-TOTAL			**2 456**	**2 420**	**2 187**	**2 196**	**2 214**	**2 089**	**2 133**	**2 168**	**2 168**
SF_6 use	2F	23900	**1 386**	**1 386**	**1 410**	**1 434**	**1 458**	**1 458**	**1 458**	**1 458**	**1 458**
TOTAL HFC/PFC/SF_6			**8 986**	**8 669**	**8 191**	**8 737**	**10 118**	**10 270**	**11 118**	**11 502**	**10 312**

Notes:
* Mainly by-product from HCFC-22 production.
** From aluminium production.
*** SF_6 figures are potential emissions.

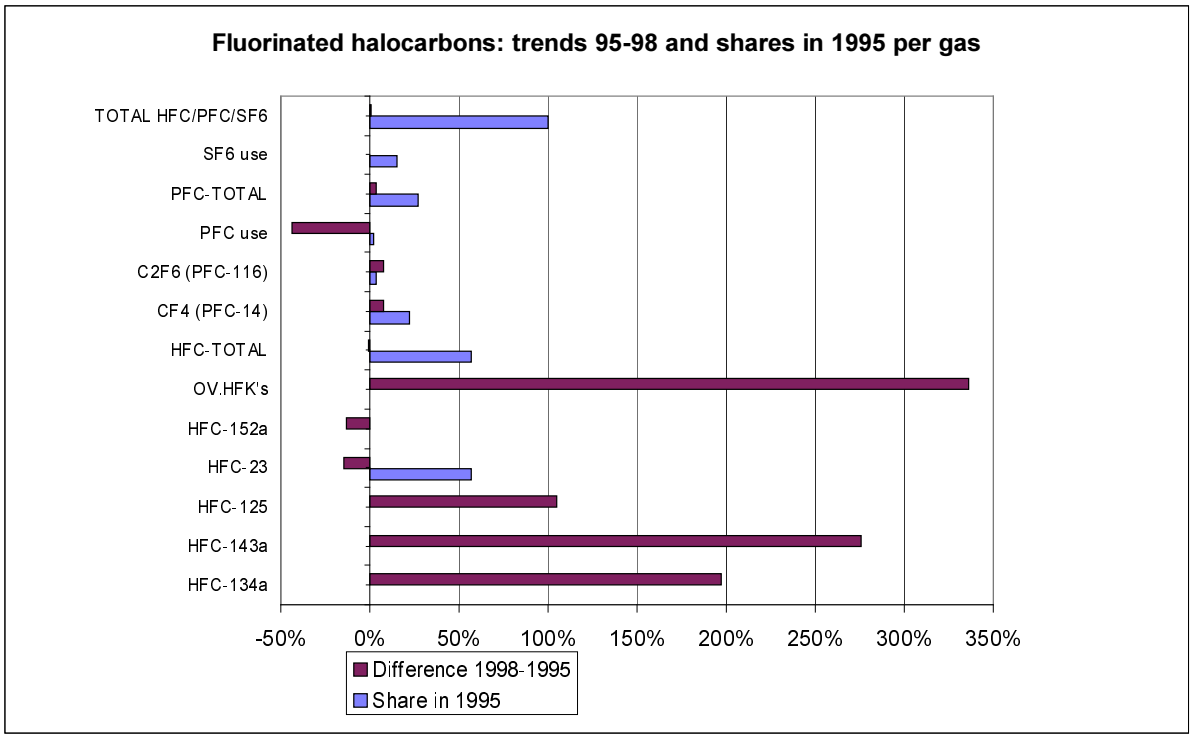

Figure 3.4. Shares and trends in actual emissions of fluorinated halocarbons 1995-1998 (SF_6 potential emissions) (CO_2-eq.)

4. Trends in precursor gases

Trends in sectoral emissions of NO_x, CO, NMVOC and SO_2 are presented in *Tables 4.1 to 4.4*, respectively, whereas the trends and shares per sector are also graphically shown in *Figures 4.2 to 4.5*. In *Figure 4.1* the trends in total emissions are summarised. It clearly shows that the emissions are in 1998 reduced by about 40% compared to 1990, except for NO_x, for which the 1997 emissions are about 20% lower than the 1990 level. We recall that in contrast with the direct greenhouse gases, emissions of precursors from road transport have not been corrected for domestic fuel sales according to the national energy statistics but are directly related to statistics on vehicle-km.

Except for NMVOC, most of the emissions stem from fuel combustion, of which the uncertainty in the emission factor for NO_x, CO and NMVOC is often estimated to be in the order of 25%. For emission factors for SO_2 from fuel combustion (basically the sulphur content of the fuels) the uncertainty is estimated at about 25% (possibly 10%). Since the uncertainty in the activity data is small compared to the accuracy of the emission factors, the uncertainty in the overall total of sources included in the inventory is estimated to be of the order of 25% for CO, NO_x and SO_2 and about 50% for NMVOC (uncertainty factor of 1.5). However, results of recent research indicate that the uncertainty in SO_2 emissions may be considerably lower, of the order of ±10%.

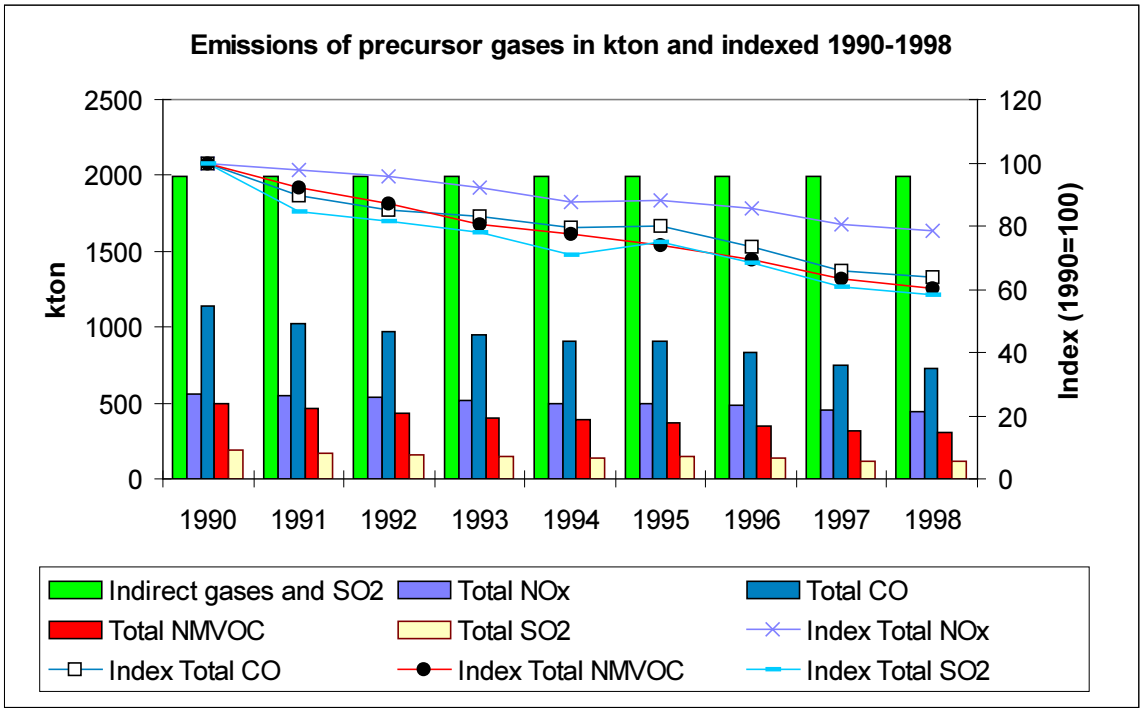

Figure 4.1. Trends in total emissions of NO_x, CO, NMVOC and SO_2 1990-1998

Table 4.1 CO emissions per IPCC sector 1990-1998 (Gg)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
TOTAL NET NATIONAL EMISSIONS	**1139.2**	**1022.4**	**966.3**	**948.5**	**905.1**	**909.1**	**836.0**	**749.3**	**724.0**
1. All Energy (combustion and fugitive)	**981.8**	**891.3**	**861.6**	**846.0**	**799.9**	**811.6**	**661.7**	**600.3**	**569.6**
A Fuel combustion total	975.6	883.1	855.9	840.0	792.2	802.1	661.7	592.7	562.3
1 Energy transformation	16.6	18.8	16.4	15.3	17.1	17.3	45.5	21.5	23.6
2 Industry	114.2	108.3	114.8	139.1	114.3	120.5	31.3	33.4	39.4
3 Transport	748.9	658.4	626.4	582.3	559.9	563.7	511.0	475.3	437.8
4 Small combustion	95.9	97.5	98.3	103.3	101.0	100.6	65.8	62.5	61.5
5 Other	-	-	-	-	-	-	-	-	-
B Fugitive fuel emissions	6.2	8.2	5.7	6.0	7.6	9.5	8.2	7.6	7.3
2. Industrial processes	**153.6**	**127.4**	**101.1**	**99.1**	**101.7**	**94.8**	**171.6**	**146.3**	**151.9**
3. Solvent and other product use	**2.4**	**2.4**	**2.2**	**2.0**	**2.1**	**2.1**	**1.9**	**2.0**	**2.0**
4. Agriculture	-	-	-	-	-	-	-	-	-
5. Land use change and forestry	-	-	-	-	-	-	-	-	-
6. Waste	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**0.5**	**0.7**	**0.7**	**0.4**

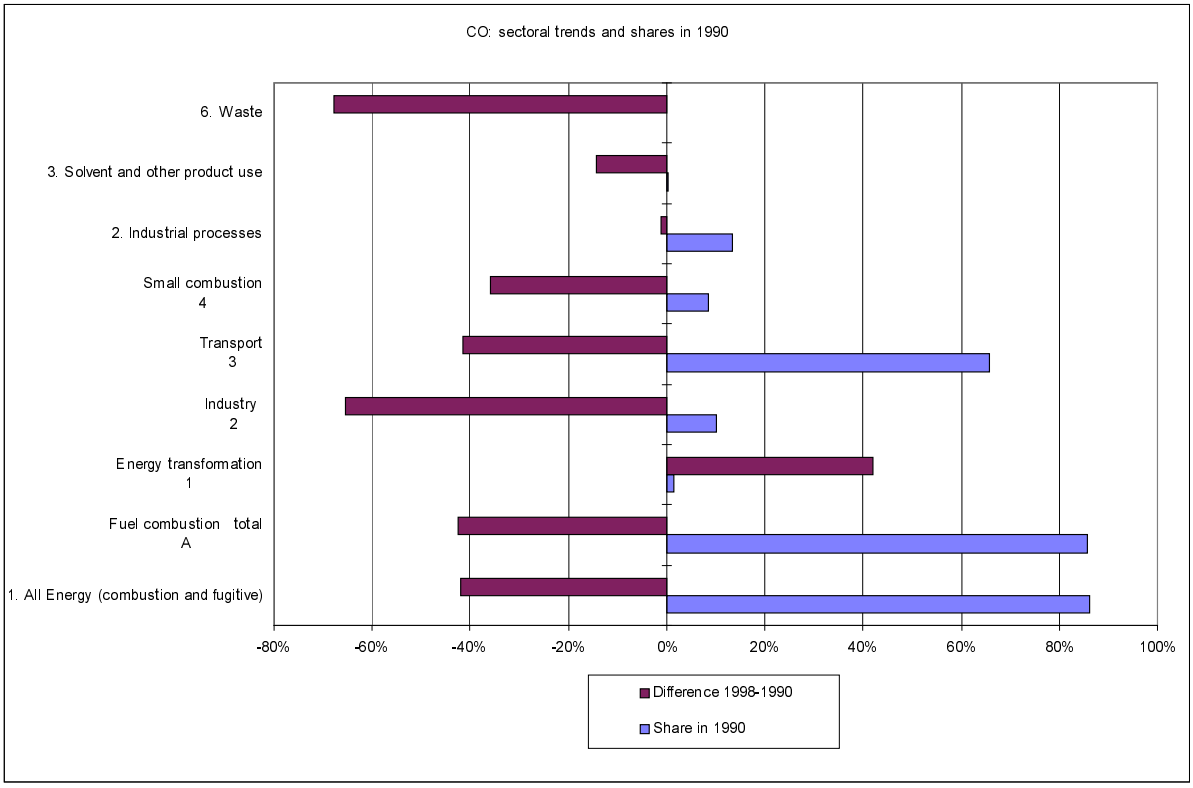

Figure 4.2. Shares and trends in CO emissions per IPCC sector 1990-1998

Table 4.2 NO_x emissions per IPCC sector 1990-1998 (Gg)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
TOTAL NET NATIONAL EMISSIONS	**563.2**	**551.5**	**539.0**	**518.8**	**493.3**	**497.4**	**480.9**	**453.1**	**441.2**
1. All Energy (combustion and fugitive)	**549.2**	**537.9**	**525.9**	**505.0**	**482.4**	**485.4**	**461.2**	**435.8**	**424.1**
A Fuel combustion total	548.1	536.7	524.6	504.0	481.9	484.7	460.6	435.0	423.7
1 Energy transformation	102.8	95.6	95.9	91.7	81.4	75.7	70.7	62.3	59.9
2 Industry	65.7	60.4	61.4	54.6	54.4	52.4	44.3	42.6	43.6
3 Transport	336.9	336.2	325.5	311.8	304.4	314.9	300.0	292.7	283.2
4 Small combustion	42.7	44.5	41.8	45.8	41.7	41.7	45.7	37.4	37.0
5 Other	-	-	-	-	-	-	-	-	-
B Fugitive fuel emissions	1.1	1.2	1.3	1.0	0.5	0.7	0.6	0.9	0.4
2. Industrial processes	**13.5**	**13.1**	**12.7**	**13.4**	**10.4**	**9.2**	**17.9**	**15.3**	**15.1**
3. Solvent and other product use	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
4. Agriculture	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
5. Land use change and forestry	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
6. Waste	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**2.7**	**1.8**	**1.9**	**1.9**

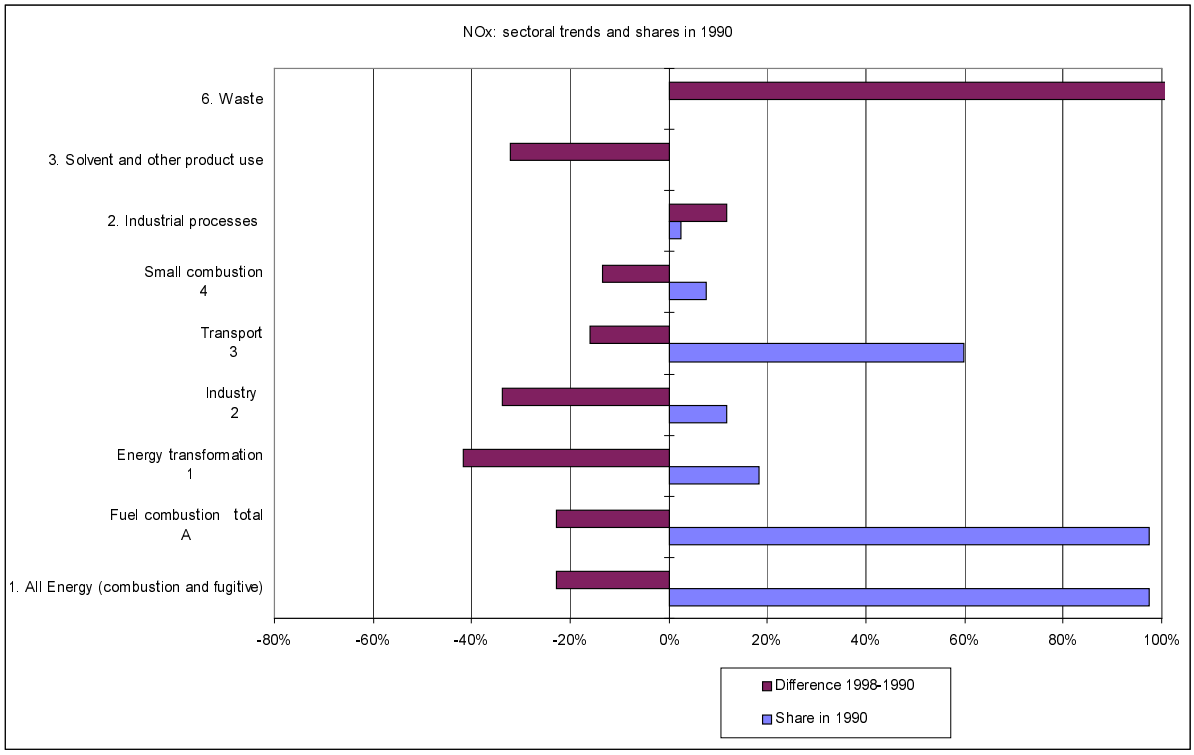

Figure 4.3. Shares and trends in NO_x emissions per IPCC sector 1990-1998

Table 4.3 NMVOC emissions per IPCC sector 1990-1998 (Gg)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
TOTAL NET NATIONAL EMISSIONS	**499.8**	**460.4**	**436.1**	**403.1**	**387.6**	**369.7**	**347.8**	**316.5**	**301.5**
1. All Energy (combustion and fugitive)	**267.6**	**247.5**	**237.5**	**223.0**	**216.8**	**216.7**	**200.2**	**181.6**	**172.5**
A Fuel combustion total	220.1	200.1	194.1	181.1	174.5	173.8	158.3	145.7	138.9
1 Energy transformation	3.8	4.1	4.3	3.6	4.0	5.0	7.0	2.8	3.2
2 Industry	4.7	4.3	5.8	2.9	2.6	2.8	1.3	2.3	2.5
3 Transport	200.5	180.3	172.4	162.0	156.5	154.2	135.0	126.9	119.8
4 Small combustion	11.0	11.4	11.6	12.6	11.5	11.9	15.1	13.6	13.3
5 Other	-	-	-	-	-	-	-	-	-
B Fugitive fuel emissions	47.6	47.4	43.4	41.9	42.3	42.8	41.9	35.9	33.7
2. Industrial processes	**130.4**	**120.9**	**115.4**	**100.0**	**88.2**	**79.5**	**73.5**	**68.9**	**63.8**
3. Solvent and other product use	**101.4**	**91.7**	**82.8**	**79.8**	**82.3**	**71.7**	**72.3**	**64.2**	**63.8**
4. Agriculture	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**-**	**-**	**-**
5. Land use change and forestry	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
6. Waste	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**1.7**	**1.8**	**1.7**	**1.4**

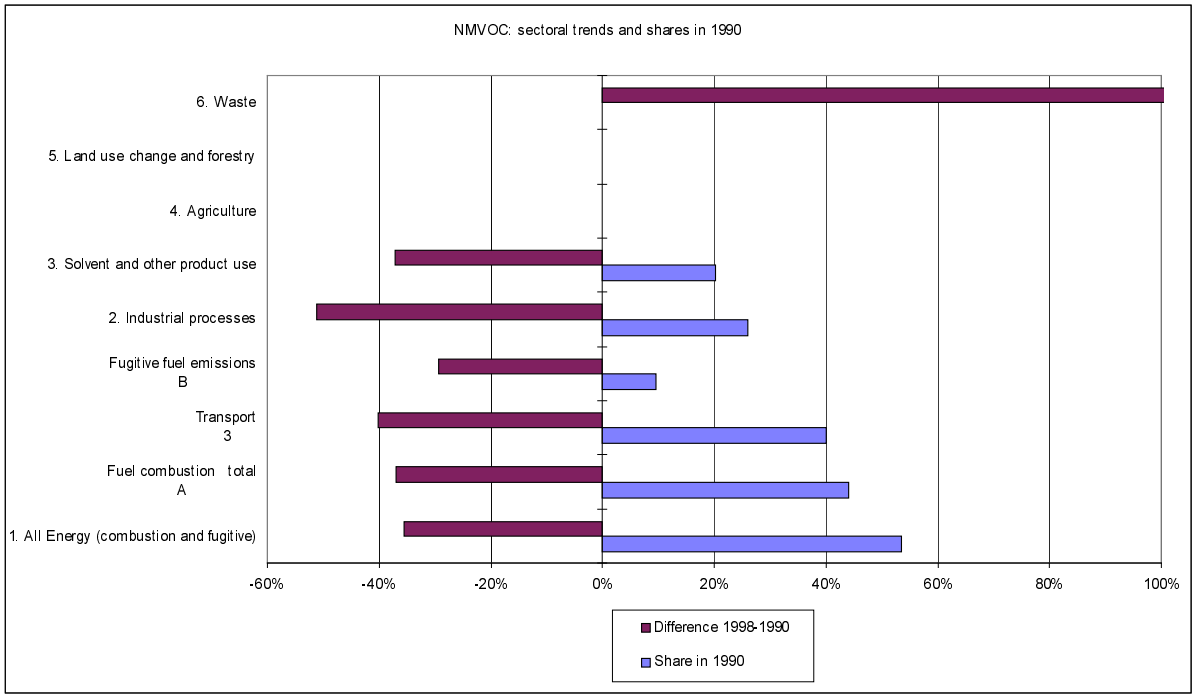

Figure 4.4. Shares and trends in NMVOC emissions per IPCC sector 1990-1998

Table 4.4 SO_2 emissions per IPCC sector 1990-1998 (Gg)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
TOTAL NET NATIONAL EMISSIONS	**193.2**	**163.5**	**157.4**	**150.5**	**136.6**	**145.0**	**132.1**	**117.7**	**112.7**
1. All Energy (combustion and fugitive)	**166.9**	**140.9**	**138.3**	**133.6**	**120.2**	**129.1**	**113.2**	**100.4**	**97.3**
A Fuel combustion total	159.1	131.2	126.8	122.2	109.5	118.7	102.7	90.3	87.8
1 Energy transformation	108.6	88.6	81.1	77.4	66.2	67.8	63.7	54.8	51.7
2 Industry	26.2	17.5	20.0	17.6	16.2	15.7	10.8	11.5	11.6
3 Transport	20.0	21.0	21.4	21.3	21.7	31.0	26.7	22.6	23.2
4 Small combustion	4.3	4.1	4.2	5.8	5.4	4.2	1.4	1.4	1.3
5 Other	-	-	-	-	-	-	-	-	-
B Fugitive fuel emissions	7.8	9.7	11.6	11.5	10.6	10.3	10.5	10.1	9.5
2. Industrial processes	**26.0**	**22.4**	**18.8**	**16.7**	**16.2**	**14.8**	**17.9**	**16.3**	**14.5**
3. Solvent and other product use	**0.3**	**0.2**	**0.1**	**0.1**	**0.2**	**0.0**	**0.2**	**0.2**	**0.0**
4. Agriculture	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.2**	**-**	**-**	**-**
5. Land use change and forestry	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
6. Waste	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**0.9**	**0.9**	**0.8**	**0.8**

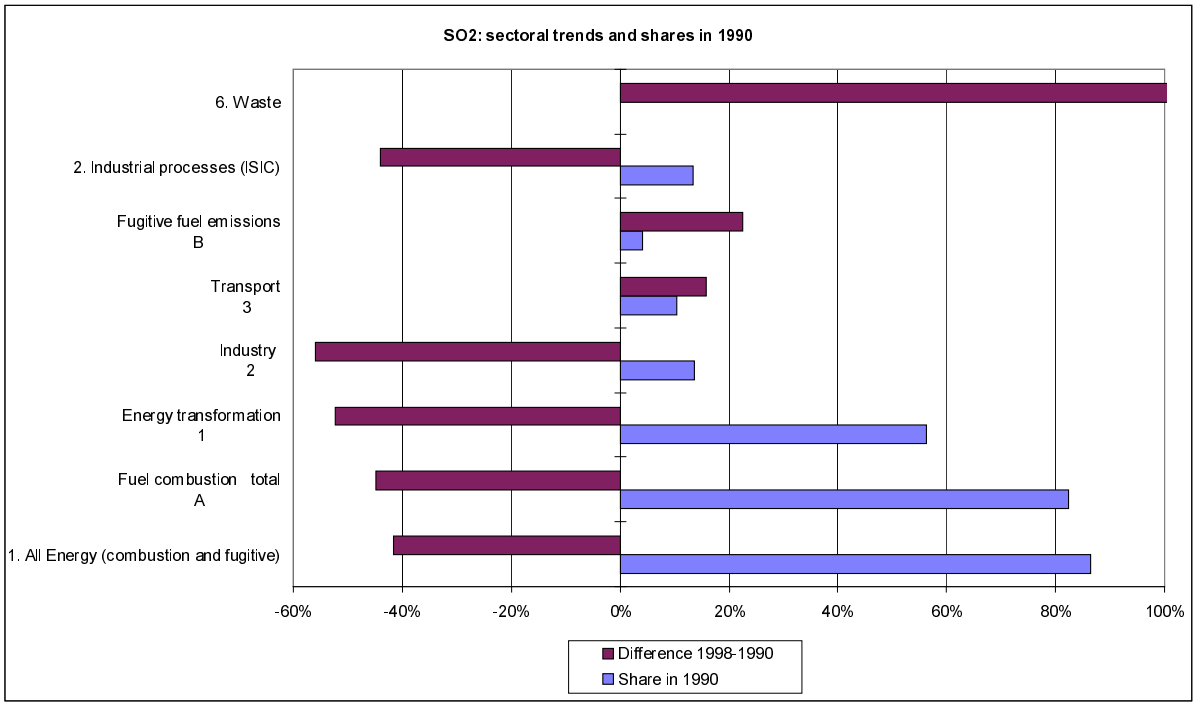

Figure 4.5. Shares and trends in SO_2 emissions per IPCC sector 1990-1998

5. Trends in total greenhouse gas emissions

The trend in total CO_2-eq. emissions of greenhouse gases and comparison of the contribution of the various gases has been calculated using the IPCC *Global Warming Potentials* (GWP) for a time horizon of 100 years. For the ozone precursor gases CO, NO_x and NMVOC no total GWP exist (only the GWP due to direct effect on radiative forcing, but not the indirect effect of enhancing concentrations of tropospheric ozone which is also a greenhouse gas). Also for SO_2 no GWP is available.

In *Table 5.1* trends in national total (net) emissions are summarised for 1990-1998. The trends are also visualised in *Figures 5.1 and 5.2*, showing the relative contribution of each gas to annual total emissions. Emissions of CO_2 and N_2O are increasing from 1990 to 1998 by about 12% and 9%, respectively, while in the same period CH_4 emissions have decrease by 18%. In 1996 CO_2 emissions peaked due to a very cold winter, whereas the relative mild winter of 1998 may have caused the small decrease compared to 1997 and 1998 (see *Table 3.2* and residential CO_2 emissions in *Table 3.1*). Of the new gases, for which 1995 is a reference year, emissions of PFCs increased by 4% in 1998, while emissions of HFCs and SF_6 (potential) remained at the same level. Overall CO_2-eq. emissions of the six gases together have increased in 1998 by 8% relative to 1990 (1995 for fluorinated gases).

In *Table 5.2* the same emissions are presented but now with CO_2 emissions corrected for temperature in order to try to exclude the climatic influence that partially masks the trends in emissions. With temperature correction CO_2-eq. emissions in 1998 have increased 2 per cent points less than without this correction. The influence of the weather on annual emissions, e.g. as suggested by the bump in 1996 in *Figure 5.2*, can indeed be traced back by annual variation in residential, commercial and agricultural emissions as presented in *Figure 5.3*. Both the cold winter in 1996 and mild winter in 1990 cause the emissions from the 'small combustion sector' to clearly deviate from the trend.

Table 5.1 Total greenhouse gas emissions in CO_2-eq. and indexed (no T-corr.) 1990-1998

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Emissions (Tg CO_2-eq)									
CO_2	161.4	166.9	165.2	167.5	168.4	177.2	184.7	183.2	181.4
CH_4	27.1	27.5	26.4	25.7	25.3	24.6	24.5	23.2	22.4
N_2O	20.4	20.7	21.5	21.3	21.9	22.4	22.3	22.7	22.2
HFCs	5.1	4.9	4.6	5.1	6.5	6.7	7.5	7.9	6.7
PFCs	2.5	2.4	2.2	2.2	2.2	2.1	2.1	2.2	2.2
SF_6 (potential)	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5
Total [group of six]	**217.9**	**223.8**	**221.2**	**223.3**	**225.8**	**234.4**	**242.6**	**240.7**	**236.2**
Index (1990=100)									
Index CO_2	100	103.4	102.4	103.8	104.3	109.8	114.5	113.5	112.4
Index CH_4	100	101.3	97.2	94.8	93.1	90.7	90.1	85.5	82.4
Index N_2O	100	101.7	105.2	104.6	107.4	109.7	109.1	111.3	108.7
Total [group of three]	**100**	**103.0**	**102.0**	**102.7**	**103.2**	**107.3**	**110.8**	**109.7**	**108.1**
Index HFCs	100	94.5	89.3	99.3	127.3	129.4	146.3	153.1	130.0
Index PFCs	100	98.5	89.1	89.4	90.1	85.1	86.8	88.3	88.3
Index SF_6 (potential)	100	100.0	101.7	103.4	105.2	105.2	105.2	105.2	105.2
Index [group of six]	**100**	**102.7**	**101.5**	**102.5**	**103.6**	**107.6**	**111.3**	**110.4**	**108.4**
Index (1995 = 100)									
Index HFCs	77.3	73.0	69.0	76.7	98.4	100	112.0	117.2	99.5
Index PFCs	117.5	115.8	104.7	105.1	105.9	100	102.1	103.8	103.8
Index SF_6 (potential)	95.1	95.1	96.7	98.4	100.0	100	100.0	100.0	100.0
Index [group of new gases]	**88.0**	**84.9**	**80.3**	**85.6**	**100.1**	**100**	**108.3**	**112.0**	**100.4**
Index ('90; new gases '95)									
Index [group of six composite]	**99.4**	**102.1**	**101.0**	**101.9**	**103.0**	**107.0**	**110.7**	**109.8**	**107.8**

Figure 5.1. Trend in greenhouse gas emissions per gas 1990-1998 (no T-correction)

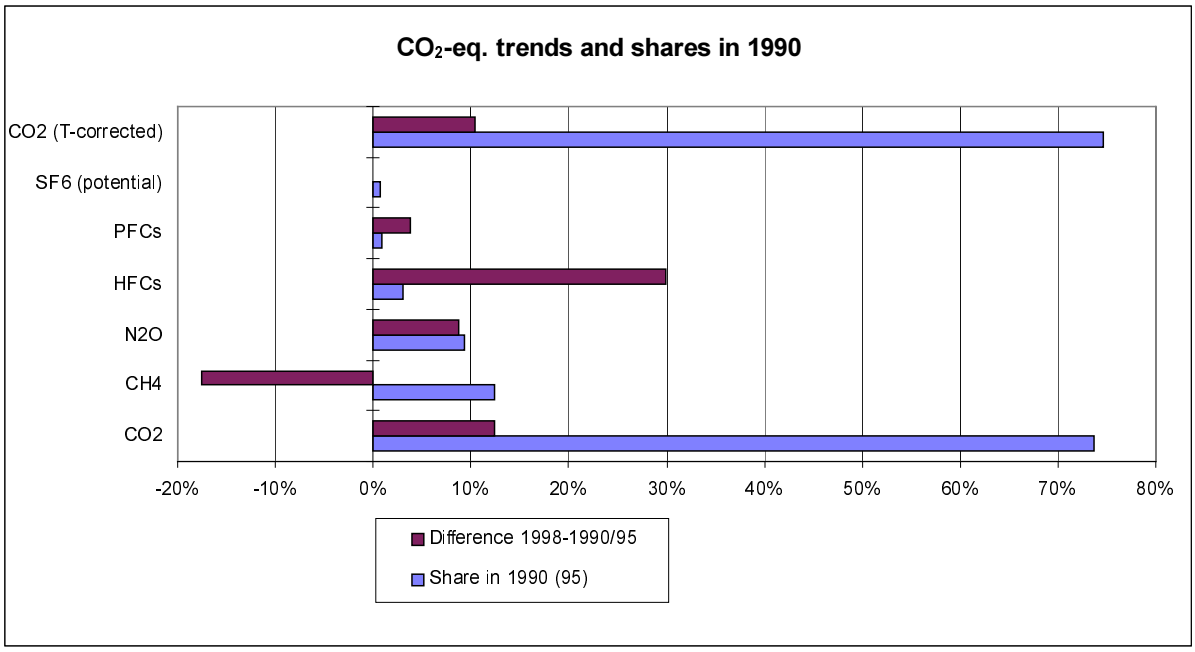

Figure 5.2. Shares and trends in greenhouse gas emissions per gas 1990-1998 (1995-1998 for new gases) (also showing CO_2 with temperature correction)

Table 5.2 Total greenhouse gas emissions in CO_2-eq. and indexed (with T-corr.) 1990-1998

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Emissions (Tg CO_2-eq)									
CO_2 (T-corrected)	167.6	167.3	169.5	168.6	172.1	179.7	180.5	185.6	185.1
CH_4	27.1	27.5	26.4	25.7	25.3	24.6	24.5	23.2	22.4
N_2O	20.4	20.7	21.5	21.3	21.9	22.4	22.3	22.7	22.2
HFCs	5.1	4.9	4.6	5.1	6.4	6.7	7.5	7.9	6.7
PFCs	2.5	2.4	2.2	2.2	2.2	2.1	2.1	2.2	2.2
SF_6 (potential)	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5
Total [group of six]	**224.1**	**224.2**	**225.6**	**224.4**	**229.4**	**237.0**	**238.3**	**243.0**	**239.9**
Index (1990 = 100)									
Index CO_2 (T-corrected)	*100*	99.8	101.1	100.6	102.7	107.2	107.6	110.7	110.4
Index CH_4	*100*	101.3	97.2	94.8	93.1	90.7	90.1	85.5	82.4
Index N_2O	*100*	101.7	105.2	104.6	107.4	109.7	109.1	111.3	108.7
Total [group of three]	**100**	**100.1**	**101.0**	**100.2**	**101.9**	**105.4**	**105.6**	**107.6**	**106.7**
Index ('90; new gases '95)									
Index [group of six composite]	**99.4**	**99.4**	**100.0**	**99.5**	**101.8**	**105.1**	**105.7**	**107.8**	**106.4**

Table 5.3 Emissions of precursor gases in kton and indexed 1990-1998 (1990=100)

Indirect gases and SO_2	1990	1991	1992	1993	1994	1995	1996	1997	1998
Emissions in kton									
Total NO_x	563.2	551.5	539.0	518.8	493.3	497.4	480.9	453.1	441.2
Total CO	1139.2	1022.4	966.3	948.5	905.1	909.1	836.0	749.3	724.0
Total NMVOC	499.8	460.4	436.1	403.1	387.6	369.7	347.8	316.5	301.5
Total SO_2	193.2	163.5	157.4	150.5	136.6	145.0	132.1	117.7	112.7
Index (1990=100)									
Index Total NO_x	100.0	97.9	95.7	92.1	87.6	88.3	85.4	80.5	78.3
Index Total CO	100.0	89.7	84.8	83.3	79.4	79.8	73.4	65.8	63.6
Index Total NMVOC	100.0	92.1	87.2	80.6	77.5	74.0	69.6	63.3	60.3
Index Total SO_2	100.0	84.6	81.5	77.9	70.7	75.1	68.4	61.0	58.3

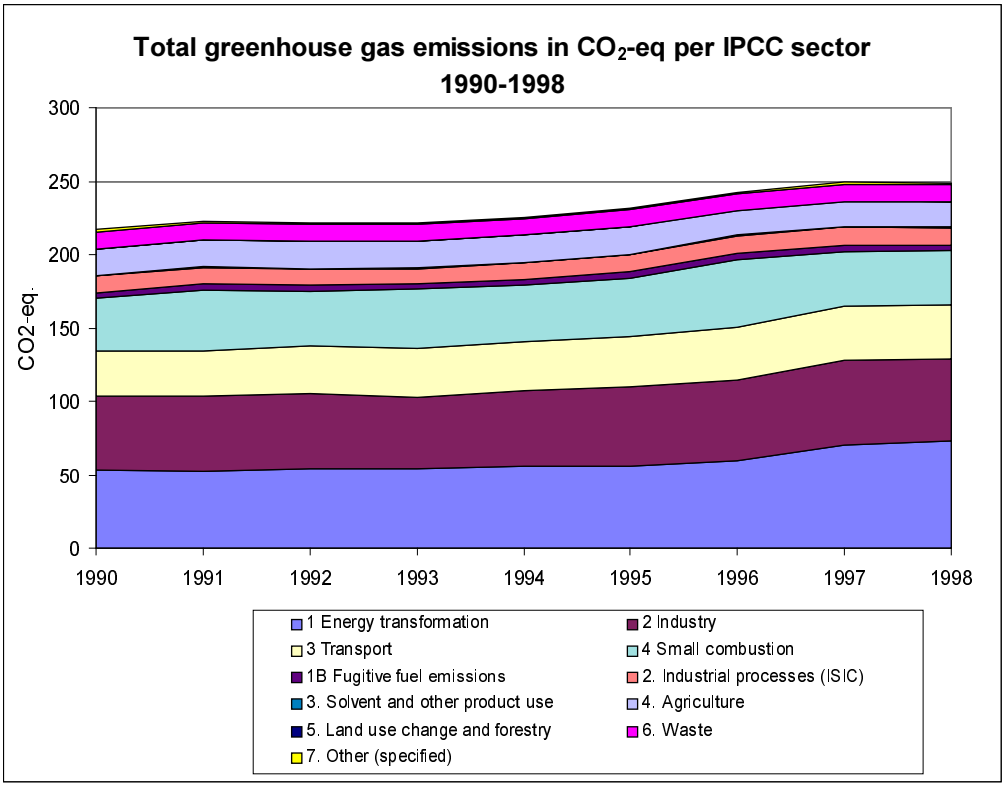

Figure 5.3. Trend in CO_2-eq. emissions per sector 1990-1998 (no T-correction)

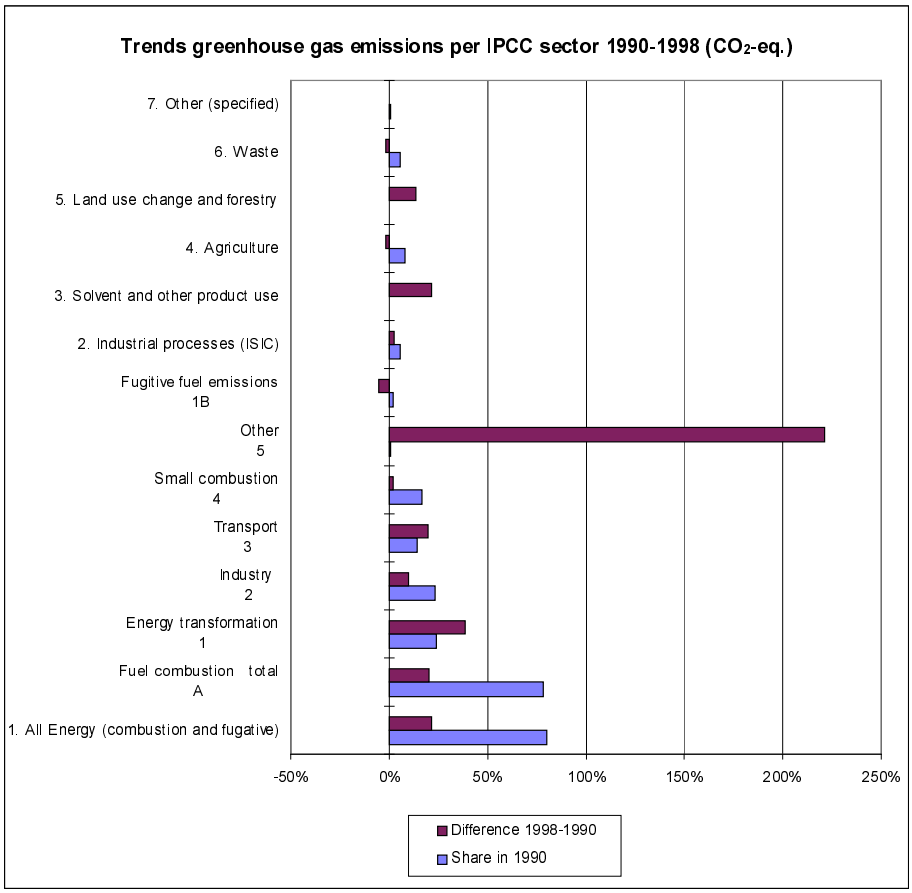

Figure 5.4. Shares and trends in CO_2-eq. emissions per sector 1990-1998 (1995-1998 for new gases) (no T-correction)

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Appendix A: Summary Reports 1990-1998 [IPCC Tables 7A]

Emissions of greenhouse gases in the Netherlands; IPCC Table 7A
YEAR: 1990

Greenhouse gas emissions and sinks (Gg)	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
TOTAL NET NATIONAL EMISSIONS	**161 400**	**167 600**	**1 292.3**	**65.8**	**563.2**	**1139.2**	**499.8**	**193.2**
1. All Energy (combustion and fugitive)	**159 500**	**165 700**	**213.5**	**7.3**	**549.2**	**981.8**	**267.6**	**166.9**
A. Fuel combustion total	159 040	165 310	34.8	7.3	548.1	975.6	220.1	159.1
1. Energy transformation	52 550	52 710	3.0	0.5	102.8	16.6	3.8	108.6
a Electricity and heat production	*42 190*	*42 350*	*2.7*	*0.4*	*83.0*	*12.5*	*3.3*	*49.1*
c Other transformation	*10 360*	*10 360*	*0.4*	*0.1*	*19.8*	*4.1*	*0.6*	*59.6*
2 Industry	41 440	42 210	4.0	0.1	65.7	114.2	4.7	26.2
a-e Only combustion	*32 090*	*32 860*	*4.0*	*0.1*	*65.7*	*114.2*	*4.7*	*26.2*
b from feedstocks	*9 350*	*9 350*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
3 Transport	28 560	28 560	7.8	6.6	336.9	748.9	200.5	20.0
4 Small combustion	35 360	40 700	20.0	0.1	42.7	95.9	11.0	4.3
a Commercial / Institutional	*8 720*	*9 980*	*1.1*	*0.0*	*12.6*	*3.0*	*1.0*	*2.7*
b Residential	*19 200*	*22 100*	*16.5*	*0.1*	*21.6*	*91.6*	*8.5*	*1.2*
c Agriculture / Forestry / Fishing	*7 440*	*8 620*	*2.3*	*0.0*	*8.6*	*1.3*	*1.6*	*0.4*
5 Other	1 130	1 130	0.0	0.0	0.0	0.0	0.0	0.0
a Waste sector (fossil fuel)	*30*	*30*						
b Other energy-use (statistical differences)	*1 100*	*1 100*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
B Fugative fuel emissions	420	420	178.8	0.0	1.1	6.2	47.6	7.8
2 Crude oil and natural gas: process emissions	420	420	178.8	0.0	1.1	6.2	47.6	7.8
2. Industrial processes	**1 900**	**1 900**	**3.4**	**31.5**	**13.5**	**153.6**	**130.4**	**26.0**
A Mineral products	730	730	0.0	0.0	0.0	0.0	0.0	0.0
B Chemical Industry	-	-	0.0	31.5	0.0	0.0	0.0	0.0
C Metal production	-	-	0.0	0.0	0.0	0.0	0.0	
D Other production	-	-	0.0	0.0	0.0	0.0	0.0	0.0
G Other	1 150	1 150	3.4	0.0	13.5	153.6	130.4	26.0
3. Solvent and other product use	**0.0**	**0.0**	**2.0**	**0.5**	**0.1**	**2.4**	**101.4**	**0.3**
4. Agriculture	**0.0**	**0.0**	**505.0**	**22.2**	**0.0**	**0.0**	**0.2**	**0.0**
A Enteric fermentation	-	-	402.0	0.0	0.0	0.0	0.0	0.0
B Manure management	-	-	103.0	0.7	0.0	0.0	0.0	0.0
C Agricultural soils	-	-	0.0	21.5	0.0	0.0	0.2	0.0
5. Land use change and forestry	**(-1 500)**	**(-1 500)**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
A Changes in woody biomass stocks	(-1 500)	(-1 500)	0.0	0.0	0.0	0.0	0.0	0.0
6. Waste	**-**	**1**	**568.4**	**0.5**	**0.3**	**1.4**	**0.2**	**0.0**
A Solid waste disposal on land	-	-	562.1	0.0	0.3	1.4	0.2	0.0
B Waste water handling	-	-	6.3	0.5	0.0	0.0	0.0	0.0
C Waste incineration (non-energy)	-	-						
D Other waste	-	1						
7. Other (specified)	**0**	**0**	**0.0**	**3.8**	**0.0**	**0.0**	**0.0**	**0.0**
B Polluted surface water	-	-	0.0	3.8	0.0	0.0	0.0	0.0

MEMO ITEMS:	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
A International bunkers	**40 100**	**40 100**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
S1a Marine Bunkers	35 600	35 600	NE	NE	NE	NE	NE	NE
S1b Air Bunkers	4 500	4 500	NE	NE	NE	NE	NE	NE
B CO2 from organic origin	**3 100**	**3 100**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
S2a Biomass burned for energy (residential)	1 540	1 540	NA	NA	NA	NA	NA	NA
S2b Waste incineration (organic fraction)	1 540	1 540	NA	NA	NA	NA	NA	NA
S2c Tobacco smoking	10	10	NA	NA	NA	NA	NA	NA
C Natural sources	**NE**	**NE**	**70.0**	**2.4**	**16.3**	**26.7**	**3.2**	**0.0**
S3b Nature	NE	NE	70.0	2.4	16.3	26.7	3.2	0.0

Emissions of greenhouse gases in the Netherlands; IPCC Table 7A

YEAR: 1991

Greenhouse gas emissions and sinks (Gg)	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
TOTAL NET NATIONAL EMISSIONS	**166 900**	**167 300**	**1 308.8**	**66.9**	**551.5**	**1,022.4**	**460.4**	**163.5**
1. All Energy (combustion and fugitive)	**165 300**	**165 700**	**223.9**	**6.9**	**537.9**	**891.3**	**247.5**	**140.9**
A. Fuel combustion total	164 850	165 240	35.8	6.9	536.7	883.1	200.1	131.2
1. Energy transformation	52 190	52 200	3.3	0.5	95.6	18.8	4.1	88.6
a Electricity and heat production	*41 550*	*41 560*	*2.9*	*0.4*	*75.3*	*14.6*	*3.5*	*38.9*
c Other transformation	*10 640*	*10 640*	*0.3*	*0.1*	*20.3*	*4.3*	*0.6*	*49.7*
2 Industry	42 660	42 710	3.5	0.1	60.4	108.3	4.3	17.5
a-e Only combustion	*32 020*	*32 070*	*3.5*	*0.1*	*60.4*	*108.3*	*4.3*	*17.5*
b from feedstocks	*10 640*	*10 640*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
3 Transport	28 550	28 550	6.9	6.2	336.2	658.4	180.3	21.0
4 Small combustion	40 380	40 710	22.0	0.1	44.5	97.5	11.4	4.1
a Commercial / Institutional	*10 290*	*10 370*	*1.1*	*0.0*	*10.6*	*2.9*	*0.9*	*2.6*
b Residential	*21 640*	*21 820*	*18.3*	*0.1*	*24.1*	*93.1*	*8.8*	*1.1*
c Agriculture / Forestry / Fishing	*8 460*	*8 530*	*2.7*	*0.0*	*9.8*	*1.5*	*1.8*	*0.4*
5 Other	1 070	1 070	0.0	0.0	0.0	0.0	0.0	0.0
a Waste sector (fossil fuel)	*30*	*30*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
b Other energy-use (statistical differences)	*1 040*	*1 040*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
B Fugative fuel emissions	460	460	188.1	0.0	1.2	8.2	47.4	9.7
2 Crude oil and natural gas: process emissions	460	460	188.1	0.0	1.2	8.2	47.4	9.7
2. Industrial processes	**1 500**	**1 500**	**3.5**	**32.3**	**13.1**	**127.4**	**120.9**	**22.4**
A Mineral products	740	740	0.0	0.0	0.0	0.0	0.0	0.0
B Chemical Industry	-	-	0.0	32.3	0.0	0.0	0.0	0.0
C Metal production	-	-	0.0	0.0	0.0	0.0	0.0	0.0
D Other production	-	-	0.0	0.0	0.0	0.0	0.0	0.0
G Other	790	790	3.5	0.0	13.1	127.4	120.9	22.4
3. Solvent and other product use	**100**	**100**	**2.0**	**0.5**	**0.1**	**2.4**	**91.7**	**0.2**
4. Agriculture	**-**	**-**	517.0	22.9	0.0	0.0	0.2	0.0
A Enteric fermentation	-	-	412.0	0.0	0.0	0.0	0.0	0.0
B Manure management	-	-	105.0	0.7	0.0	0.0	0.0	0.0
C Agricultural soils	-	-	0.0	22.2	0.0	0.0	0.2	0.0
5. Land use change and forestry	**(-1 600)**	**(-1 600)**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
A Changes in woody biomass stocks	(-1 600)	(-1 600)	0.0	0.0	0.0	0.0	0.0	0.0
6. Waste	**-**	**-**	562.4	0.5	0.3	1.4	0.2	0.0
A Solid waste disposal on land	-	-	556.1	0.0	0.3	1.4	0.2	0.0
B Waste water handling	-	-	6.3	0.5	0.0	0.0	0.0	0.0
C Waste incineration (non-energy)	-	-						
D Other waste	-	-	0.0	0.0	0.0	0.0	0.0	0.0
7. Other (specified)	**-**	**-**	0.0	3.8	0.0	0.0	0.0	0.0
B Polluted surface water	-	-	0.0	3.8	0.0	0.0	0.0	0.0

MEMO ITEMS:	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
A International bunkers	**41 300**	**41 300**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
S1a Marine Bunkers	36 300	36 300	NE	NE	NE	NE	NE	NE
S1b Air Bunkers	5 000	5 000	NE	NE	NE	NE	NE	NE
B CO2 from organic origin	**2 700**	**2 700**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
S2a Biomass burned for energy (residential)	1 550	1 550	NA	NA	NA	NA	NA	NA
S2b Waste incineration (organic fraction)	1 090	1 090	NA	NA	NA	NA	NA	NA
S2c Tobacco smoking	10	10	NA	NA	NA	NA	NA	NA
C Natural sources	**NE**	**NE**	**70.0**	**2.4**	**16.3**	**26.7**	**3.2**	**0.0**
S3b Nature	NE	NE	70.0	2.4	16.3	26.7	3.2	0.0

Emissions of greenhouse gases in the Netherlands; IPCC Table 7A

YEAR: 1992

Greenhouse gas emissions and sinks (Gg)	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
TOTAL NET NATIONAL EMISSIONS	**165 200**	**169 500**	**1 256**	**69.2**	**539.0**	**966.3**	**436.1**	**157.4**
1. All Energy (combustion and fugitive)	**163 800**	**168 100**	**199.1**	**7.9**	**525.9**	**861.6**	**237.5**	**138.3**
A. Fuel combustion total	163 440	167 760	36.0	7.9	524.6	855.9	194.1	126.8
1. Energy transformation	54 140	54 250	3.8	0.5	95.9	16.4	4.3	81.1
a Electricity and heat production	*43 250*	*43 360*	*3.4*	*0.4*	*78.0*	*15.1*	*3.8*	*32.9*
c Other transformation	*10 880*	*10 880*	*0.4*	*0.1*	*17.9*	*1.3*	*0.5*	*48.2*
2 Industry	42 510	42 960	4.9	0.1	61.4	114.8	5.8	20.0
a-e Only combustion	*32 990*	*33 440*	*4.9*	*0.1*	*61.4*	*114.8*	*5.8*	*20.0*
b from feedstocks	*9 520*	*9 520*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
3 Transport	29 830	29 830	6.8	7.2	325.5	626.4	172.4	21.4
4 Small combustion	37 330	41 090	20.6	0.1	41.8	98.3	11.6	4.2
a Commercial / Institutional	*9 380*	*10 280*	*1.0*	*0.0*	*10.1*	*3.2*	*1.2*	*2.9*
b Residential	*19 460*	*21 480*	*16.8*	*0.1*	*21.9*	*93.6*	*8.7*	*1.0*
c Agriculture / Forestry / Fishing	*8 490*	*9 330*	*2.7*	*0.0*	*9.8*	*1.5*	*1.8*	*0.3*
5 Other	-370	-370	0.0	0.0	0.0	0.0	0.0	0.0
a Waste sector (fossil fuel)	*30*	*30*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
b Other energy-use (statistical differences)	*-400*	*-400*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
B Fugative fuel emissions	370	370	163.1	0.0	1.3	5.7	43.4	11.6
2 Crude oil and natural gas: process emissions	370	370	163.1	0.0	1.3	5.7	43.4	11.6
2. Industrial processes	**1 300**	**1 300**	**3.7**	**30.4**	**12.7**	**101.1**	**115.4**	**18.8**
A Mineral products	750	750	0.0	0.0	0.0	0.0	0.0	0.0
B Chemical Industry	-	-	0.0	30.4	0.0	0.0	0.0	0.0
C Metal production	-	-	0.0	0.0	0.0	0.0	0.0	0.0
D Other production	-	-	0.0	0.0	0.0	0.0	0.0	0.0
G Other	520	520	3.7	0.0	12.7	101.1	115.4	18.8
3. Solvent and other product use	**100**	**100**	**2.0**	**0.5**	**0.1**	**2.2**	**82.8**	**0.1**
4. Agriculture	**-**	**-**	**505.0**	**26.2**	**0.0**	**0.0**	**0.2**	**0.0**
A Enteric fermentation	-	-	401.0	0.0	0.0	0.0	0.0	0.0
B Manure management	-	-	104.0	0.7	0.0	0.0	0.0	0.0
C Agricultural soils	-	-	0.0	25.5	0.0	0.0	0.2	0.0
5. Land use change and forestry	**(-1 600)**	**(-1 600)**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
A Changes in woody biomass stocks	(-1 600)	(-1 600)	0.0	0.0	0.0	0.0	0.0	0.0
6. Waste	**-**	**-**	**546.4**	**0.5**	**0.3**	**1.4**	**0.2**	**0.1**
A Solid waste disposal on land	-	-	540.1	-	0.3	1.4	0.2	0.0
B Waste water handling	-	-	6.3	0.5	0.0	0.0	0.0	0.1
C Waste incineration (non-energy)	-	-						
D Other waste	-	-	-	0.0	0.0	0.0	0.0	0.0
7. Other (specified)	**-**	**-**	**-**	**3.8**	**0.0**	**0.0**	**0.0**	**0.0**
B Polluted surface water	-	-	-	3.8	0.0	0.0	0.0	0.0

MEMO ITEMS:	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
A International bunkers	**42 400**	**42 400**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
S1a Marine Bunkers	36 500	36 500	NE	NE	NE	NE	NE	NE
S1b Air Bunkers	5 900	5 900	NE	NE	NE	NE	NE	NE
B CO2 from organic origin	**2 600**	**2 600**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
S2a Biomass burned for energy (residential)	1 580	1 580	NA	NA	NA	NA	NA	NA
S2b Waste incineration (organic fraction)	1 050	1 050	NA	NA	NA	NA	NA	NA
S2c Tobacco smoking	10	10	NA	NA	NA	NA	NA	NA
C Natural sources	**NE**	**NE**	**70.0**	**2.4**	**16.3**	**26.7**	**3.2**	**0.0**
S3b Nature	NE	NE	70.0	2.4	16.3	26.7	3.2	0.0

Emissions of greenhouse gases in the Netherlands; IPCC Table 7A

YEAR: 1993

Greenhouse gas emissions and sinks (Gg)	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
TOTAL NET NATIONAL EMISSIONS	**167 500**	**168 600**	**1 224.6**	**68.8**	**518.8**	**948.5**	**403.1**	**150.5**
1. All Energy (combustion and fugitive)	**166 300**	**167 400**	**192.3**	**7.9**	**505.0**	**846.0**	**223.0**	**133.6**
A. Fuel combustion total	165 900	167 020	34.3	7.9	504.0	840.0	181.1	122.2
1. Energy transformation	53 800	53 830	3.4	0.5	91.7	15.3	3.6	77.4
a Electricity and heat production	*43 160*	*43 190*	*3.0*	*0.4*	*74.1*	*14.1*	*3.2*	*25.4*
c Other transformation	*10 640*	*10 640*	*0.4*	*0.1*	*17.7*	*1.3*	*0.4*	*52.0*
2 Industry	39 920	40 040	3.2	0.1	54.6	139.1	2.9	17.6
a-e Only combustion	*31 210*	*31 330*	*3.2*	*0.1*	*54.6*	*139.1*	*2.9*	*17.6*
b from feedstocks	*8 710*	*8 710*	-	-	-	-	-	-
3 Transport	30 460	30 460	6.4	7.2	311.8	582.3	162.0	21.3
4 Small combustion	40 060	41 030	21.4	0.1	45.8	103.3	12.6	5.8
a Commercial / Institutional	*10 620*	*10 860*	*0.9*	*0.0*	*12.5*	*6.8*	*1.9*	*4.5*
b Residential	*20 640*	*21 150*	*17.7*	*0.1*	*23.2*	*94.9*	*8.8*	*1.0*
c Agriculture / Forestry / Fishing	*8 800*	*9 020*	*2.8*	*0.0*	*10.2*	*1.6*	*1.9*	*0.3*
5 Other	1 650	1 650	-	-	-	-	-	-
a Waste sector (fossil fuel)	*30*	*30*	-	-	-	-	-	-
b Other energy-use (statistical differences)	*1 620*	*1 620*	-	-	-	-	-	-
B Fugative fuel emissions	350	350	158.0	-	1.0	6.0	41.9	11.5
2 Crude oil and natural gas: process emissions	350	350	158.0	-	1.0	6.0	41.9	11.5
2. Industrial processes	**1 200**	**1 200**	**4.9**	**30.0**	**13.4**	**99.1**	**100.0**	**16.7**
A Mineral products	1 050	1 050	-	-	-	-	-	-
B Chemical Industry	-	-	-	30.0	-	-	-	-
C Metal production	-	-	-	-	-	-	-	-
D Other production	-	-	-	-	-	-	-	-
G Other	160	160	4.9	-	13.4	99.1	100.0	16.7
3. Solvent and other product use	**0.0**	**0.0**	**2.0**	**0.5**	**0.1**	**2.0**	**79.8**	**0.1**
4. Agriculture	0.0	0.0	497.0	26.2	-	-	0.2	-
A Enteric fermentation	-	-	393.0	-	-	-	-	-
B Manure management	-	-	104.0	0.8	-	-	-	-
C Agricultural soils	-	-	-	25.4	-	-	0.2	-
5. Land use change and forestry	**(-1 600)**	**(-1 600)**	**-**	**-**	**-**	**-**	**-**	**-**
A Changes in woody biomass stocks	(-1 600)	(-1 600)	-	-	-	-	-	-
6. Waste	**0**	**0**	**528.4**	**0.5**	**0.3**	**1.4**	**0.2**	**0.0**
A Solid waste disposal on land	-	-	522.1	-	0.3	1.4	0.2	0.0
B Waste water handling	-	-	6.3	0.5	-	-	-	0.0
C Waste incineration (non-energy)	-	-	-	-	-	-	-	-
D Other waste	-	-	-	-	-	-	-	-
7. Other (specified)	**-**	**-**	**-**	**3.8**	**-**	**-**	**-**	**-**
B Polluted surface water	-	-	-	3.8	-	-	-	-

MEMO ITEMS:	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
A International bunkers	**44 300**	**44 300**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
S1a Marine Bunkers	37 800	37 800	NE	NE	NE	NE	NE	NE
S1b Air Bunkers	6 500	6 500	NE	NE	NE	NE	NE	NE
B CO2 from organic origin	**3 300**	**3 300**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
S2a Biomass burned for energy (residential)	1 590	1 590	NA	NA	NA	NA	NA	NA
S2b Waste incineration (organic fraction)	1 670	1 670	NA	NA	NA	NA	NA	NA
S2c Tobacco smoking	10	10	NA	NA	NA	NA	NA	NA
C Natural sources	**NE**	**NE**	**70.0**	**2.4**	**16.3**	**26.7**	**3.2**	**-**
S3b Nature	NE	NE	70.0	2.4	16.3	26.7	3.2	-

Emissions of greenhouse gases in the Netherlands; IPCC Table 7A

YEAR: 1994

Greenhouse gas emissions and sinks (Gg)	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
TOTAL NET NATIONAL EMISSIONS	**168 300**	**172 100**	**1 203.0**	**70.7**	**493.3**	**905.1**	**387.6**	**136.6**
1. All Energy (combustion and fugitive)	**166 900**	**170 700**	**202.3**	**7.9**	**482.4**	**799.9**	**216.8**	**120.2**
A. Fuel combustion total	166 750	170 490	33.7	7.5	481.9	792.2	174.5	109.5
1. Energy transformation	55 980	56 090	3.7	0.1	81.4	17.1	4.0	66.2
a Electricity and heat production	*44 790*	*44 900*	*3.4*	*0.1*	*64.3*	*15.9*	*3.5*	*17.4*
c Other transformation	*11 190*	*11 190*	*0.3*	*0.1*	*17.1*	*1.1*	*0.4*	*48.8*
2 Industry	40 950	41 350	2.6	0.1	54.4	114.3	2.6	16.2
a-e Only combustion	*31 800*	*32 200*	*2.6*	*0.1*	*54.4*	*114.3*	*2.6*	*16.2*
b from feedstocks	*9 150*	*9 150*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
3 Transport	30 800	30 800	6.3	7.2	304.4	559.9	156.5	21.7
4 Small combustion	38 460	41 690	21.2	0.1	41.7	101.0	11.5	5.4
a Commercial / Institutional	*10 140*	*10 940*	*1.4*	*0.0*	*9.5*	*4.0*	*0.8*	*4.2*
b Residential	*19 560*	*21 230*	*17.0*	*0.1*	*22.1*	*95.5*	*8.8*	*0.9*
c Agriculture / Forestry / Fishing	*8 760*	*9 520*	*2.8*	*0.0*	*10.1*	*1.6*	*1.9*	*0.3*
5 Other	560	560	0.0	0.0	0.0	0.0	0.0	0.0
a Waste sector (fossil fuel)	*30*	*30*						
b Other energy-use (statistical differences)	*530*	*530*						
B Fugative fuel emissions	190	190	168.5	0.4	0.5	7.6	42.3	10.6
2 Crude oil and natural gas: process emissions	190	190	168.5	0.4	0.5	7.6	42.3	10.6
2. Industrial processes	**1 400**	**1 400**	**5.3**	**31.6**	**10.4**	**101.7**	**88.2**	**16.2**
A Mineral products	1 050	1 050	0.0	0.0	0.0	0.0	0.0	0.0
B Chemical Industry	-	-	0.0	31.6	0.0	0.0	0.0	0.0
C Metal production	-	-	0.0	0.0	0.0	0.0	0.0	0.0
D Other production	-	-	0.0	0.0	0.0	0.0	0.0	0.0
G Other	390	390	5.3	0.0	10.4	101.7	88.2	16.2
3. Solvent and other product use	**0.0**	**0.0**	**2.3**	**0.5**	**0.1**	**2.1**	**82.3**	**0.2**
4. Agriculture	**0.0**	**0.0**	**483.0**	**26.4**	**0.0**	**0.0**	**0.2**	**0.0**
A Enteric fermentation	-	-	382.0	0.0	0.0	0.0	0.0	0.0
B Manure management	-	-	101.0	0.8	0.0	0.0	0.0	0.0
C Agricultural soils	-	-	0.0	25.6	0.0	0.0	0.2	0.0
5. Land use change and forestry	**(-1 700)**	**(-1 700)**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
A Changes in woody biomass stocks	(-1 700)	(-1 700)	0.0	0.0	0.0	0.0	0.0	0.0
6. Waste	**0**	**1**	**510.2**	**0.5**	**0.3**	**1.4**	**0.2**	**0.0**
A Solid waste disposal on land	-	-	505.1	0.0	0.3	1.4	0.2	0.0
B Waste water handling	-	-	5.1	0.5	0.0	0.0	0.0	0.0
C Waste incineration (non-energy)	-	-	0.0	0.0	0.0	0.0	0.0	0.0
D Other waste	-	1						
7. Other (specified)	-	-	**0.0**	**3.8**	**0.0**	**0.0**	**0.0**	**0.0**
B Polluted surface water	-	-	0.0	3.8	0.0	0.0	0.0	0.0

MEMO ITEMS:	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
A International bunkers	**42 800**	**42 800**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
S1a Marine Bunkers	36 100	36 100	NE	NE	NE	NE	NE	NE
S1b Air Bunkers	6 700	6 700	NE	NE	NE	NE	NE	NE
B CO2 from organic origin	**3 500**	**3 500**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
S2a Biomass burned for energy (residential)	1 610	1 610	NA	NA	NA	NA	NA	NA
S2b Waste incineration (organic fraction)	1 890	1 890	NA	NA	NA	NA	NA	NA
S2c Tobacco smoking	10	10	NA	NA	NA	NA	NA	NA
C Natural sources	**NE**	**NE**	**70.0**	**2.4**	**16.3**	**26.7**	**3.2**	**0.0**
S3b Nature	NE	NE	70.0	2.4	16.3	26.7	3.2	0.0

Emissions of greenhouse gases in the Netherlands; IPCC Table 7A

YEAR: 1995

Greenhouse gas emissions and sinks (Gg) not corrected	CO_2 T-corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
TOTAL NET NATIONAL EMISSIONS	**177 200**	**179 700**	**1 172.5**	**72.2**	**497.4**	**909.1**	**369.7**	**144.8**
1. All Energy (combustion and fugitive)	**173 900**	**176 400**	**209.3**	**8.1**	**485.4**	**811.6**	**216.7**	**129.1**
A. Fuel combustion total	172 960	175 490	35.3	8.1	484.7	802.1	173.8	118.7
1. Energy transformation	56 050	56 130	4.9	0.5	75.7	17.3	5.0	67.8
a Electricity and heat production	*43 740*	*43 820*	*0.8*	*0.4*	*55.0*	*8.3*	*0.8*	*16.6*
c Other transformation	*12 300*	*12 300*	*4.1*	*0.1*	*20.7*	*9.0*	*4.2*	*51.3*
2 Industry	43 430	43 710	2.8	0.1	52.4	120.5	2.8	15.7
a-e Only combustion	*33 510*	*33 790*	*2.8*	*0.1*	*52.4*	*120.5*	*2.8*	*15.7*
b from feedstocks	*9 920*	*9 920*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
3 Transport	32 030	32 030	6.3	7.4	314.9	563.7	154.2	31.0
4 Small combustion	38 930	41 100	21.3	0.1	41.7	100.6	11.9	4.2
a Commercial / Institutional	9 410	9 950	0.6	0.0	8.1	2.7	0.9	3.1
b Residential	20 640	21 760	17.9	0.1	23.3	96.3	9.0	0.7
c Agriculture / Forestry / Fishing	8 880	9 390	2.8	0.0	10.3	1.6	1.9	0.3
5 Other	2 520	2 520	0.0	0.0	0.0	0.0	0.0	0.0
a Waste sector (fossil fuel)	30	30	0.0	0.0	0.0	0.0	0.0	0.0
b Other energy-use (statistical differences)	2 490	2 490	0.0	0.0	0.0	0.0	0.0	0.0
B Fugative fuel emissions	970	970	174.0	0.0	0.7	9.5	42.8	10.3
2 Crude oil and natural gas: process emissions	970	970	174.0	0.0	0.7	9.5	42.8	10.3
2. Industrial processes	**1 600**	**1 600**	**5.0**	**31.6**	**9.2**	**94.8**	**79.5**	**14.8**
A Mineral products	1 130	1 130	0.1	0.0	2.4	3.0	0.5	3.2
B Chemical Industry	-	-	4.6	31.6	5.5	20.2	19.1	4.0
C Metal production	-	-	0.2	0.0	0.9	67.7	3.0	7.2
D Other production	90	90	0.0	0.0	0.1	3.2	7.8	0.0
G Other	350	350	0.1	0.0	0.3	0.7	49.1	0.4
3. Solvent and other product use	**0.0**	**0.0**	**2.0**	**0.5**	**0.1**	**2.1**	**71.7**	**0.0**
4. Agriculture	**0.0**	**0.0**	**475.7**	**27.6**	**0.0**	**0.0**	**0.2**	**0.0**
A Enteric fermentation	-	-	376.7	0.0	0.0	0.0	0.0	0.0
B Manure management	-	-	99.0	0.8	0.0	0.0	0.0	0.0
C Agricultural soils	-	-	0.0	26.8	0.0	0.0	0.2	0.0
5. Land use change and forestry	**(-1700)**	**(-1700)**						
A Changes in woody biomass stocks	(-1700)	(-1700)						
6. Waste	**1 600**	**1 600**	**480.5**	**0.6**	**2.7**	**0.5**	**1.7**	**0.9**
A Solid waste disposal on land	-	-	479.0	0.0	0.0	0.0	0.8	0.0
B Waste water handling	-	-	1.5	0.5	0.0	0.0	0.0	0.0
C Waste incineration (non-energy)	-	-	0.0	0.0	0.0	0.0	0.5	0.0
D Other waste	1 640	1 640	0.0	0.1	2.7	0.5	0.5	0.9
7. Other (specified)	**-**	**-**	**0.0**	**3.8**	**0.0**	**0.0**	**0.0**	**0.0**
B Polluted surface water	-	-	0.0	3.8	0.0	0.0	0.0	0.0

MEMO ITEMS:	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
A International bunkers	**44 200**	**44 200**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
S1a Marine Bunkers	36 500	36 500	NE	NE	NE	NE	NE	NE
S1b Air Bunkers	7 700	7 700	NE	NE	NE	NE	NE	NE
B CO2 from organic origin	**3 600**	**3 600**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
S2a Biomass burned for energy (residential)	1 640	1 640	NA	NA	NA	NA	NA	NA
S2b Waste incineration (organic fraction)	1 990	1 990	NA	NA	NA	NA	NA	NA
S2c Tobacco smoking	10	10	NA	NA	NA	NA	NA	NA
C Natural sources	**NE**	**NE**	**125.0**	**2.4**	**16.3**	**26.7**	**3.2**	**0.0**
S3b Nature	NE	NE	125.0	2.4	16.3	26.7	3.2	0.0

Emissions of greenhouse gases in the Netherlands; IPCC Table 7A

YEAR: 1996

Greenhouse gas emissions and sinks (Gg)	CO_2 Not corrected	CO_2 T-corrected	CH_4	N2O	NO_x	CO	NMVOC	SO_2
TOTAL NATIONAL EMISSIONS	**184 700**	**180 500**	**1164. 5**	**71. 8**	**480. 9**	**836.0**	**347.8**	**132. 1**
1. All Energy (combustion and fugitive)	**181 100**	**176 800**	**214.4**	**7.7**	**461.2**	**661.7**	**200.2**	**113.2**
A Fuel combustion total	180 030	175 760	36.9	7.7	460.6	653.6	158.3	102.7
1 Energy & Transformation	57 040	56 920	5.7	0.4	70.7	45.5	7.0	63.7
a Electricity and heat production	*45 060*	*44 940*	*1.3*	*0.4*	*51.2*	*14.0*	*1.5*	*19.0*
c Other transformation: refineries	*11 980*	*11 980*	*4.4*	*0.1*	*19.5*	*31.5*	*5.5*	*44.7*
2 Industry	41 990	41 670	1.5	0.1	44.3	31.3	1.3	10.8
a-e Only combustion								
f. from feedstocks								
3 Transport	33 820	33 820	5.7	7.1	300.0	511.0	135.0	26.7
4 Small combustion	45 200	41 370	24.0	0.1	45.7	65.8	15.1	1.4
a Commercial / Institutional	*10 880*	*9 940*	*1.4*	*0.0*	*9.7*	*3.0*	*1.3*	*0.5*
b Residential	*24 030*	*22 010*	*19.9*	*0.1*	*25.7*	*61.2*	*11.9*	*0.6*
c Agriculture / Forestry / Fishing	*10 300*	*9 420*	*2.8*	*0.0*	*10.3*	*1.6*	*1.9*	*0.3*
5 Other	1 980	1 980	0.0	0.0	-	-	-	-
AWaste sector (fossil fuel)	*30*	*30*	*0.0*	*0.0*	-	-	-	-
b Other energy-use (statistical differences)	*1 950*	*1 950*	-	-	-	-	-	-
B Fugitive fuel emissions	1 060	1 060	177.5	0.0	0.6	8.2	41.9	10.5
2 Crude oil and natural gas: process emissions	*1 060*	*1 060*	*177.5*	*0.0*	*0.6*	*8.2*	*41.9*	*10.5*
2. Industrial processes (ISIC)	**1 800**	**1 800**	**5.8**	**31.7**	**17.9**	**171.6**	**73.5**	**17.9**
A Mineral products	930	930	0.1	-	1.2	1.1	0.4	2.8
B Chemical Industry	-	-	5.2	31.7	8.9	32.4	17.9	4.5
C Metal production	-	-	0.3	-	7.3	132.8	3.1	10.1
D Other production	440	440	0.1	0.0	0.2	4.5	6.0	0.1
G Other	390	390	0.1	-	0.2	0.9	46.0	0.4
3. Solvent and other product use	**0.0**	**0.0**	**2.0**	**0.5**	**0.1**	**1.9**	**72.3**	**0.2**
4. Agriculture	**-**	**-**	**464.8**	**27.5**	**-**	**-**	**-**	**-**
A Enteric fermentation	-	-	365.8	-	-	-	-	-
B Manure management	-	-	99.0	0.7	-	-	-	-
D Agricultural soils	-	-	-	26.8	-	-	-	-
5. Land use change and forestry	**(-1 700)**	**(-1 700)**	**-**	**-**	**-**	**-**	**-**	**-**
A Changes in woody biomass stocks	(-1 700)	(-1 700)	-	-	-	-	-	-
6. Waste	**1 900**	**1 900**	**477.6**	**0.6**	**1.8**	**0.7**	**1.8**	**0.9**
A Solid waste disposal on land	-	-	477.0	-	-	-	0.8	-
B Waste water handling	-	-	0.6	0.5	-	-	-	-
C Waste incineration (non-energy)	-	-	-	-	-	-	-	-
D Other waste	1 870	1 870	0.0	0.1	1.8	0.7	1.1	0.9
7. Other (specified)	**-**	**-**	**-**	**3.8**	**-**	**-**	**-**	**-**
B Polluted surface water	-	-	-	3.8	-	-	-	-

MEMO ITEMS:	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
A International bunkers	**45 500**	**45 500**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
S1a Marine Bunkers	37 200	37 200	NE	NE	NE	NE	NE	NE
S1b Air Bunkers	8 300	8 300	NE	NE	NE	NE	NE	NE
	-	-						
B CO2 from organic origin	**4 500**	**4 500**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
S2a Biomass burned for energy (residential, electr. pro)	1 040	1 040	NA	NA	NA	NA	NA	NA
S2b Waste incineration, landfills (organic fraction)	3 090	3 090	NA	NA	NA	NA	NA	NA
S2c Tobacco smoking	10	10	NA	NA	NA	NA	NA	NA
S2d WWTP	390	390	NA	NA	NA	NA	NA	NA
C Natural sources	**NE**	**NE**	**125.0**	**2.4**	**16.3**	**26.7**	**3.2**	**NE**
S3b Nature	NE	NE	125.0	2.4	16.3	26.7	3.2	NE

Emissions of greenhouse gases in the Netherlands; IPCC Table 7A

Year: 1997

Greenhouse gas emissions (Gg)	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
TOTAL NATIONAL EMISSIONS	**183 200**	**185 600**	**1105. 3**	**73. 3**	**453. 1**	**749.3**	**316.5**	**117. 7**
1. All Energy (combustion and fugitive)	**179 000**	**181 400**	**189.0**	**7.5**	**435.8**	**600.3**	**181.6**	**100.4**
A Fuel combustion total	178 010	180 350	30.1	7.5	435.0	592.7	145.7	90.3
1 Energy & Transformation	56 120	56 180	3.1	0.4	62.3	21.5	2.8	54.8
a Electricity and heat production	*44 130*	*44 190*	*1.3*	*0.3*	*44.7*	*16.3*	*1.5*	*12.6*
c Other transformation: refineries	*11 980*	*11 980*	*1.7*	*0.1*	*17.6*	*5.2*	*1.4*	*42.2*
2 Industry	44 540	44 700	1.6	0.1	42.6	33.4	2.3	11.5
a-e Only combustion								
f. from feedstocks								
3 Transport	34 350	34 350	5.3	6.9	292.7	475.3	126.9	22.6
4 Small combustion	36 670	38 790	20.2	0.1	37.4	62.5	13.6	1.4
a Commercial / Institutional	*8 870*	*9 380*	*0.6*	*0.0*	*6.8*	*1.6*	*0.8*	*0.6*
b Residential	*20 120*	*21 240*	*17.2*	*0.1*	*21.7*	*59.5*	*11.2*	*0.5*
c Agriculture / Forestry / Fishing	*7 680*	*8 170*	*2.4*	*0.0*	*8.9*	*1.4*	*1.6*	*0.2*
5 Other	6 340	6 340	0.0	0.0	-	-	-	-
AWaste sector (fossil fuel)	*20*	*20*	*0.0*	*0.0*	-	-	-	-
b Other energy-use (statistical differences)	*6 320*	*6 320*	-	-	-	-	-	-
B Fugitive fuel emissions	1 020	1 020	158.9	0.0	0.9	7.6	35.9	10.1
2 Crude oil and natural gas: process emissions	1 020	1 020	158.9	0.0	0.9	7.6	35.9	10.1
2. Industrial processes (ISIC)	**1 700**	**1 700**	**2.7**	**35.0**	**15.3**	**146.3**	**68.9**	**16.3**
A Mineral products	1 090	1 090	0.1	-	1.3	1.7	0.4	2.5
B Chemical Industry	280	280	2.5	35.0	6.9	31.5	16.1	3.9
C Metal production	-	-	0.0	-	7.0	110.8	3.1	9.5
D Other production	50	50	0.1	0.0	0.0	1.6	5.8	0.0
G Other	310	310	0.1	-	0.1	0.6	43.5	0.3
3. Solvent and other product use	**0.0**	**0.0**	**2.0**	**0.4**	**0.1**	**2.0**	**64.2**	**0.2**
4. Agriculture	**-**	**-**	**446.3**	**25.9**	**-**	**-**	**-**	**-**
A Enteric fermentation	-	-	352.6	-	-	-	-	-
B Manure management	-	-	93.7	0.7	-	-	-	-
D Agricultural soils	-	-	-	25.3	-	-	-	-
5. Land use change and forestry	**(-1 700)**	**(-1 700)**	**-**	**-**	**-**	**-**	**-**	**-**
A Changes in woody biomass stocks	(-1 700)	(-1 700)	-	-	-	-	-	-
6. Waste	**2 500**	**2 500**	**465.3**	**0.6**	**1.9**	**0.7**	**1.7**	**0.8**
A Solid waste disposal on land	-	-	464.0	-	-	-	0.8	-
B Waste water handling	-	-	1.3	0.6	-	-	-	-
C Waste incineration (non-energy)	-	-	-	-	-	-	-	-
D Other waste	2 480	2 480	0.0	0.1	1.9	0.7	0.9	0.8
7. Other (specified)	**-**	**-**	**-**	**3.8**	**-**	**-**	**-**	**-**
B Polluted surface water	-	-	-	3.8	-	-	-	-

MEMO ITEMS:	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
A International bunkers	**48 500**	**48 500**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
S1a Marine Bunkers	39 500	39 500	NE	NE	NE	NE	NE	NE
S1b Air Bunkers	9 000	9 000	NE	NE	NE	NE	NE	NE
B CO2 from organic origin	**5 100**	**5 100**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
S2a Biomass burned for energy (residential, electr.pro)	1 050	1 050	NA	NA	NA	NA	NA	NA
S2b Waste incineration, landfills (organic fraction)	3 650	3 650	NA	NA	NA	NA	NA	NA
S2c Tobacco smoking	10	10	NA	NA	NA	NA	NA	NA
S2d WWTP	380	380	NA	NA	NA	NA	NA	NA
C Natural sources	**NE**	**NE**	**125.0**	**2.4**	**16.3**	**26.7**	**3.2**	**NE**
S3b Nature	NE	NE	125.0	2.4	16.3	26.7	3.2	NE

Emissions of greenhouse gases in the Netherlands; IPCC Table 7A

YEAR: 1998 (preliminary data)

Greenhouse gas emissions (Gg)	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
TOTAL NATIONAL EMISSIONS	**181 400**	**185 100**	**1065. 4**	**71. 6**	**441. 2**	**724.0**	**301.5**	**112. 7**
1. All Energy (combustion and fugitive)	**177 600**	**181 300**	**179.6**	**7.1**	**424.1**	**569.6**	**172.5**	**97.3**
A Fuel combustion total	176 760	180 470	30.0	7.1	423.7	562.3	138.9	87.8
1 Energy & Transformation	58 480	58 580	3.6	0.4	59.9	23.6	3.2	51.7
a Electricity and heat production	*45 960*	*46 060*	*1.4*	*0.4*	*44.7*	*16.9*	*1.5*	*12.2*
c Other transformation: refineries	*12 520*	*12 520*	*2.2*	*0.1*	*15.2*	*6.7*	*1.7*	*39.5*
2 Industry	43 810	44 060	1.9	0.1	43.6	39.4	2.5	11.6
a-e Only combustion								
f. from feedstocks								
3 Transport	34 720	34 720	4.9	6.5	283.2	437.8	119.8	23.2
4 Small combustion	36 120	39 480	19.6	0.1	37.0	61.5	13.3	1.3
a Commercial / Institutional	*9 180*	*9 990*	*0.7*	*0.0*	*7.2*	*1.7*	*0.9*	*0.6*
b Residential	*19 140*	*20 920*	*16.4*	*0.0*	*20.7*	*58.4*	*10.8*	*0.5*
c Agriculture / Forestry / Fishing	*7 800*	*8 580*	*2.5*	*0.0*	*9.0*	*1.4*	*1.7*	*0.3*
5 Other	3 630	3 630	0.0	0.0	-	-	-	-
aWaste sector (fossil fuel)	*30*	*30*	*0.0*	*0.0*	-	-	-	-
b Other energy-use (statistical differences)	*3 610*	*3 610*	-	-	-	-	-	-
B Fugitive fuel emissions	810	810	149.6	-	0.4	7.3	33.7	9.5
2 Crude oil and natural gas: process emissions	*810*	*810*	*149.6*	-	*0.4*	*7.3*	*33.7*	*9.5*
2. Industrial processes (ISIC)	**1 500**	**1 500**	**2.6**	**33.8**	**15.1**	**151.9**	**63.8**	**14.5**
A Mineral products	1 110	1 110	0.1	-	1.3	1.7	0.4	2.5
B Chemical Industry	0	0	2.3	33.8	6.9	31.9	14.2	4.0
C Metal production	-	-	0.0	-	6.9	116.1	3.0	7.6
D Other production	50	50	0.1	0.0	0.0	1.6	5.6	0.0
G Other	310	310	0.1	-	0.1	0.6	40.6	0.3
3. Solvent and other product use	**0.0**	**0.0**	**1.9**	**0.4**	**0.1**	**2.0**	**63.8**	**0.0**
4. Agriculture	**-**	**-**	**435.1**	**25.9**	**-**	**-**	**-**	**-**
A Enteric fermentation	-	-	341.5	-	-	-	-	-
B Manure management	-	-	93.6	0.7	-	-	-	-
D Agricultural soils	-	-	-	25.2	-	-	-	-
5. Land use change and forestry	**(-1 700)**	**(-1 700)**	**-**	**-**	**-**	**-**	**-**	**-**
A Changes in woody biomass stocks	(-1 700)	(-1 700)	-	-	-	-	-	-
6. Waste	**2 300**	**2 300**	**446.2**	**0.6**	**1.9**	**0.4**	**1.4**	**0.8**
A Solid waste disposal on land	-	-	444.9	-	-	-	0.8	-
B Waste water handling	-	-	1.3	0.6	-	-	-	-
C Waste incineration (non-energy)	-	-	-	-	-	-	-	-
D Other waste	2 310	2 310	0.0	0.1	1.9	0.4	0.6	0.8
7. Other (specified)	**-**	**-**	**-**	**3.8**	**-**	**-**	**-**	**-**
B Polluted surface water	-	-	-	3.8	-	-	-	-

MEMO ITEMS:	CO_2 not corrected	CO_2 T-corrected	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
A International bunkers	**49 300**	**49 300**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
S1a Marine Bunkers	39 800	39 800	NE	NE	NE	NE	NE	NE
S1b Air Bunkers	9 500	9 500	NE	NE	NE	NE	NE	NE
B CO2 from organic origin	**5 000**	**5 000**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
S2a Biomass burned for energy (residential, electr. pro)	1 030	1 030	NA	NA	NA	NA	NA	NA
S2b Waste incineration, landfills (organic fraction)	3 610	3 610	NA	NA	NA	NA	NA	NA
S2c Tobacco smoking	10	10	NA	NA	NA	NA	NA	NA
S2d WWTP	380	380	NA	NA	NA	NA	NA	NA
C Natural sources	**NE**	**NE**	**125.0**	**2.4**	**16.3**	**26.7**	**3.2**	**NE**
S3b Nature	NE	NE	125.0	2.4	16.3	26.7	3.2	NE

Appendix B: Summary Report HFC/PFC/SF_6 1990-1998: Potential and actual emissions

Unit: Gg

IPCC Category	Compound	Potential/Actual	1990	1991	1992	1993	1994	1995	1996	1998	1998
2 TOTAL INDUSTRIAL PROCESSES* **											
	HFCs	P *	0.000	0.000	0.000	0.000	0.274	0.561	1.154	1.311	1.408
		A	0.460	0.436	0.426	0.474	0.658	0.854	1.148	1.365	1.343
	PFCs	P *	0.000	0.000	0.000	0.000	0.000	0.023	0.013	0.013	0.013
		A	0.363	0.357	0.323	0.324	0.327	0.308	0.315	0.321	0.321
	SF_6	P	0.058	0.058	0.059	0.060	0.061	0.061	0.061	0.061	0.061
		A **	0.058	0.058	0.059	0.060	0.061	0.061	0.061	0.061	0.061
2C Metal production											
	HFCs	P *	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		A	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PFCs	P *	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		A	0.341	0.335	0.300	0.301	0.304	0.285	0.302	0.308	0.308
	SF_6	P	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		A	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2E Prod. of halocarbons and SF6											
	HFCs	P	0.000	0.000	0.000	0.000	0.000	0.023	0.056	0.046	0.040
		A	0.441	0.417	0.398	0.459	0.560	0.560	0.615	0.599	0.480
	PFCs	P	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		A	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SF_6	P	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		A	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2F Other (specified)											
	HFCs	P	0.000	0.000	0.000	0.000	0.274	0.538	1.098	1.265	1.368
		A	0.019	0.019	0.028	0.015	0.098	0.294	0.533	0.765	0.863
	PFCs	P	0.000	0.000	0.000	0.000	0.000	0.023	0.013	0.013	0.013
		A	0.022	0.022	0.023	0.023	0.023	0.023	0.013	0.013	0.013
	SF_6	P	0.058	0.058	0.059	0.060	0.061	0.061	0.061	0.061	0.061
		A **	0.058	0.058	0.059	0.060	0.061	0.061	0.061	0.061	0.061

* Potential emissions of HFCs and PFCs exclude emissions of HFCs (notably HFC-23) and of PFCs as by-product of halocarbon production (notably HCFC-22) and aluminium production, respectively.
** SF_6: potential emissions.
*** FICs are not used in the Netherlands.

Uncertainty estimate (all years) (with uncertainty factor of 1.5):
CO_2: ±3%, CH_4: ±20%, N_2O: ±35%
CO, NO_x, SO_2 ±25% (possibly 10%); NMVOC: ±50%
HFCs and SF_6: ±50%;
PFCs: ±100%

Appendix C: Sectoral Tables for 1990 and 1996-1998

In this appendix sectoral details are presented based of the level of detail available in the present aggregation level of the emission database used for various reporting purposes. In practice, next years emissions calculations may not be always be performed at the same basic 'rapcode-category' source level as in the previous year. This is in particular the case for estimating the provisional emissions for the most recent year (in this case 1998). Subsequently, when aggregating emissions of specific rapcode to an IPCC subcategory, discontinuities may appear at that specific aggregation level, not visible at higher or other aggregation levels. Please also note that all data for 1998 are preliminary.

Table C.1. Sectoral report for energy

	IPCC description		Emissions				Diff. between years		
code	(CO_2 in Gg; Other compounds in Mg)	Gas	1990	1996	1997	1998	96/90	97/96	98/97
1A1a	Public Electricity and Heat Production	CO2	39500	45100	44100	46000	14%	-2%	4%
1A1b	Petroleum Refining	CO2	10200	10400	10400	10700	2%	0%	3%
1A1c	Manufacture of Solid Fuels and Other Energy Industries	CO2	1200	1500	1600	1800	25%	7%	13%
1A2a	Iron and Steel	CO2	5400	2200	2000	100	-59%	-9%	-95%
1A2b	Non-Ferrous Metals	CO2	100	100	100	1900	0%	0%	1800%
1A2c	Chemicals	CO2	16300	14100	12800	12400	-13%	-9%	-3%
1A2c2	Misc. chemicals	CO2	9400	14600	18100	17600	55%	24%	-3%
1A2d	Pulp, Paper and Print	CO2	1600	2100	2100	2100	31%	0%	0%
1A2e	Food Processing, Beverages and Tobacco	CO2	4000	4400	4100	4300	10%	-7%	5%
1A2f	Other industries	CO2	4900	4600	5200	5500	-6%	13%	6%
1A3a	Civil Aviation	CO2	500	300	300	300	-40%	0%	0%
1A3b	Road Transportation	CO2	25400	30400	30800	31200	20%	1%	1%
1A3c	Railways	CO2	100	100	100	100	0%	0%	0%
1A3d	Navigation (inland shipping)	CO2	900	800	800	800	-11%	0%	0%
1A3e	Other Transportation	CO2	2300	2300	2300	2300	0%	0%	0%
1A4a	Commercial/Institutional	CO2	7600	10900	8900	9200	43%	-18%	3%
1A4b	Residential	CO2	19200	24000	20100	19100	25%	-16%	-5%
1A4c	Agricultural/Forestry/Fisheries	CO2	7400	10300	7700	7800	39%	-25%	1%
1A5c	Other (statistical differences)	CO2	1100	2000	6300	3600	82%	215%	-43%
1B2	Oil and Natural Gas	CO2	300				-100%		
1B2a	Oil	CO2	200	700	700	800	250%	0%	14%
1B2c	Venting and flaring	CO2	100	300	300	0	200%	0%	-100%
1A1a	Public Electricity and Heat Production	CH4	570	1280	1350	1380	125%	5%	2%
1A1b	Petroleum Refining	CH4	360	720	280	290	100%	-61%	4%
1A1c	Manufacture of Solid Fuels and Other Energy Industries	CH4	2180	3700	1420	1930	70%	-62%	36%
1A2a	Iron and Steel	CH4	1700	120	60	0	-93%	-50%	-100%
1A2b	Non-Ferrous Metals	CH4	10	60	0	60	500%	-100%	
1A2c	Chemicals	CH4	1030	180	630	640	-83%	250%	2%
1A2d	Pulp, Paper and Print	CH4	110	180	100	100	64%	-44%	0%
1A2e	Food Processing, Beverages and Tobacco	CH4	540	480	260	260	-11%	-46%	0%
1A2f	Other industries	CH4	670	490	550	800	-27%	12%	45%
1A3a	Civil Aviation	CH4	80	50	50	50	-38%	0%	0%
1A3b	Road Transportation	CH4	7300	5280	4890	4570	-28%	-7%	-7%
1A3d	Navigation (inland shipping)	CH4	40	30	30	30	-25%	0%	0%
1A3e	Other Transportation	CH4	290	290	290	290	0%	0%	0%
1A4a	Commercial/Institutional	CH4	1070	1350	600	660	26%	-56%	10%
1A4b	Residential	CH4	16750	19870	17170	16450	19%	-14%	-4%
1A4c	Agricultural/Forestry/Fisheries	CH4	2330	2800	2440	2470	20%	-13%	1%
1B2a	Oil	CH4	280	240	310	270	-14%	29%	-13%
1B2b	Gas	CH4	78910	82080	67710	64500	4%	-18%	-5%
1B2c	Venting and flaring	CH4	99580	95220	90900	84800	-4%	-5%	-7%
1A1a	Public Electricity and Heat Production	N2O	380	370	340	360	-3%	-8%	6%
1A1b	Petroleum Refining	N2O	80	70	70	50	-13%	0%	-29%
1A2b	Non-Ferrous Metals	N2O	20	0	0	0	-100%		
1A2c	Chemicals	N2O	50	40	40	50	-20%	0%	25%
1A2e	Food Processing, Beverages and Tobacco	N2O	10	10	10	10	0%	0%	0%
1A2f	Other industries	N2O	30	20	10	20	-33%	-50%	100%
1A3a	Civil Aviation	N2O	30	20	20	20	-33%	0%	0%
1A3b	Road Transportation	N2O	4840	6390	6190	5770	32%	-3%	-7%
1A3c	Railways	N2O	20	20	20	20	0%	0%	0%
1A3d	Navigation (inland shipping)	N2O	190	180	190	190	-5%	6%	0%
1A3e	Other Transportation	N2O	500	500	500	500	0%	0%	0%

Table C.1. Sectoral report for energy (c'td).

	IPCC description		Emissions				Diff. between years		
code	(CO_2 in Gg; Other compounds in Mg)	Gas	1990	1996	1997	1998	96/90	97/96	98/97
1A4a	Commercial/Institutional	N2O	30	20	10	20	-33%	-50%	100%
1A4b	Residential	N2O	60	60	50	50	0%	-17%	0%
1A4c	Agricultural/Forestry/Fisheries	N2O	10	20	10	10	100%	-50%	0%
1A1a	Public Electricity and Heat Production	CO	6400	14000	16300	16900	119%	16%	4%
1A1b	Petroleum Refining	CO	4100	22800	1400	1400	456%	-94%	0%
1A1c	Manufacture of Solid Fuels and Other Energy Industries	CO	5500	8700	3900	5300	58%	-55%	36%
1A2a	Iron and Steel	CO	98000	800	800	100	-99%	0%	-88%
1A2b	Non-Ferrous Metals	CO	200	100	0	700	-50%	-100%	
1A2c	Chemicals	CO	6300	8500	12000	12100	35%	41%	1%
1A2d	Pulp, Paper and Print	CO	1000	1500	1300	1300	50%	-13%	0%
1A2e	Food Processing, Beverages and Tobacco	CO	5700	3400	2500	2500	-40%	-26%	0%
1A2f	Other industries	CO	3300	17000	16700	22700	415%	-2%	36%
1A3a	Civil Aviation	CO	4700	5400	5500	6000	15%	2%	9%
1A3b	Road Transportation	CO	711100	471800	435700	397500	-34%	-8%	-9%
1A3c	Railways	CO	300	300	400	300	0%	33%	-25%
1A3d	Navigation (inland shipping)	CO	11400	11700	12000	12100	3%	3%	1%
1A3e	Other Transportation	CO	21700	21700	21800	21800	0%	0%	0%
1A4a	Commercial/Institutional	CO	57900	3000	1600	1700	-95%	-47%	6%
1A4b	Residential	CO	68200	61200	59500	58400	-10%	-3%	-2%
1A4c	Agricultural/Forestry/Fisheries	CO	1300	1600	1400	1400	23%	-13%	0%
1B2	Oil and Natural Gas	CO	100				-100%		
1B2a	Oil	CO	1200	1800	1200	1200	50%	-33%	0%
1B2c	Venting and flaring	CO	4900	6300	6400	6000	29%	2%	-6%
1A1a	Public Electricity and Heat Production	NOx	76600	51200	44700	44700	-33%	-13%	0%
1A1b	Petroleum Refining	NOx	19800	16100	15000	11800	-19%	-7%	-21%
1A1c	Manufacture of Solid Fuels and Other Energy Industries	NOx	2600	3400	2700	3400	31%	-21%	26%
1A2a	Iron and Steel	NOx	8000	2000	2000	300	-75%	0%	-85%
1A2b	Non-Ferrous Metals	NOx	300	200	100	1700	-33%	-50%	1600%
1A2c	Chemicals	NOx	27900	19900	20000	20200	-29%	1%	1%
1A2d	Pulp, Paper and Print	NOx	2900	2100	2200	2100	-28%	5%	-5%
1A2e	Food Processing, Beverages and Tobacco	NOx	7500	7000	4700	5100	-7%	-33%	9%
1A2f	Other industries	NOx	19800	13000	13600	14200	-34%	5%	4%
1A3a	Civil Aviation	NOx	2100	2700	2800	3000	29%	4%	7%
1A3b	Road Transportation	NOx	255800	202400	191600	180400	-21%	-5%	-6%
1A3c	Railways	NOx	1600	1600	1700	1700	0%	6%	0%
1A3d	Navigation (inland shipping)	NOx	52800	57200	60300	61900	8%	5%	3%
1A3e	Other Transportation	NOx	36100	36100	36300	36300	0%	1%	0%
1A4a	Commercial/Institutional	NOx	11600	9700	6800	7200	-16%	-30%	6%
1A4b	Residential	NOx	20800	25700	21700	20700	24%	-16%	-5%
1A4c	Agricultural/Forestry/Fisheries	NOx	8600	10300	8900	9000	20%	-14%	1%
1B2	Oil and Natural Gas	NOx	800				-100%		
1B2a	Oil	NOx	100	300	400	300	200%	33%	-25%
1B2c	Venting and flaring	NOx	0	200	400	0			-100%
1A1a	Public Electricity and Heat Production	NMVOC	700	1500	1500	1500	114%	0%	0%
1A1b	Petroleum Refining	NMVOC	600	2200	400	400	267%	-82%	0%
1A1c	Manufacture of Solid Fuels and Other Energy Industries	NMVOC	1500	3300	1000	1300	120%	-70%	30%
1A2a	Iron and Steel	NMVOC	2800	100	800	0	-96%	700%	-100%
1A2b	Non-Ferrous Metals	NMVOC	0	0	0	800			
1A2c	Chemicals	NMVOC	900	200	800	800	-78%	300%	0%
1A2d	Pulp, Paper and Print	NMVOC	3000	100	100	100	-97%	0%	0%
1A2e	Food Processing, Beverages and Tobacco	NMVOC	500	400	200	200	-20%	-50%	0%
1A2f	Other industries	NMVOC	1200	500	400	600	-58%	-20%	50%
1A3a	Civil Aviation	NMVOC	1000	1200	1200	1300	20%	0%	8%
1A3b	Road Transportation	NMVOC	185300	122500	114400	107100	-34%	-7%	-6%
1A3c	Railways	NMVOC	100	100	100	100	0%	0%	0%
1A3d	Navigation (inland shipping)	NMVOC	4000	4200	4300	4400	5%	2%	2%
1A3e	Other Transportation	NMVOC	6900	6900	7000	7000	0%	1%	0%
1A4a	Commercial/Institutional	NMVOC	1600	1300	800	900	-19%	-38%	13%
1A4b	Residential	NMVOC	12700	11900	11200	10800	-6%	-6%	-4%
1A4c	Agricultural/Forestry/Fisheries	NMVOC	1600	1900	1600	1700	19%	-16%	6%
1B2	Oil and Natural Gas	NMVOC	4500				-100%		
1B2a	Oil	NMVOC	28700	18100	16600	15400	-37%	-8%	-7%
1B2b	Gas	NMVOC	7300	7900	6500	6000	8%	-18%	-8%
1B2c	Venting and flaring	NMVOC	14700	16000	12900	12200	9%	-19%	-5%

Table C.1. Sectoral report for energy (c'td)

code	IPCC description (CO_2 in Gg; Other compounds in Mg)	Gas	Emissions 1990	1996	1997	1998	Diff. between years 96/90	97/96	98/97
1A1a	Public Electricity and Heat Production	SO2	44100	19000	12600	12200	-57%	-34%	-3%
1A1b	Petroleum Refining	SO2	59600	44600	42100	39500	-25%	-6%	-6%
1A1c	Manufacture of Solid Fuels and Other Energy Industries	SO2	1100	100	100	0	-91%	0%	-100%
1A2a	Iron and Steel	SO2	7400	600	600	200	-92%	0%	-67%
1A2b	Non-Ferrous Metals	SO2	0	0	0	100			
1A2c	Chemicals	SO2	13000	7000	8500	8500	-46%	21%	0%
1A2d	Pulp, Paper and Print	SO2	200	100	100	100	-50%	0%	0%
1A2e	Food Processing, Beverages and Tobacco	SO2	1700	700	400	300	-59%	-43%	-25%
1A2f	Other industries	SO2	4500	2500	2000	2400	-44%	-20%	20%
1A3a	Civil Aviation	SO2	200	200	200	200	0%	0%	0%
1A3b	Road Transportation	SO2	12300	9400	4500	4700	-24%	-52%	4%
1A3c	Railways	SO2	100	100	100	100	0%	0%	0%
1A3d	Navigation (inland shipping)	SO2	14000	14500	15300	15600	4%	6%	2%
1A3e	Other Transportation	SO2	2500	2500	2500	2500	0%	0%	0%
1A4a	Commercial/Institutional	SO2	1500	500	600	600	-67%	20%	0%
1A4b	Residential	SO2	1100	600	500	500	-45%	-17%	0%
1A4c	Agricultural/Forestry/Fisheries	SO2	400	300	200	300	-25%	-33%	50%
1B2	Oil and Natural Gas	SO2	200	0	0	0	-100%		
1B2a	Oil	SO2	7500	10200	9900	9300	36%	-3%	-6%
1B2c	Venting and flaring	SO2	100	300	200	200	200%	-33%	0%

Table C.2. Sectoral report for industrial processes

code	IPCC description (CO_2 in Gg; Other compounds in Mg)	Gas	Emissions 1990	1996	1997	1998	Diff. between years 96/90	97/96	98/97
2A	Industrial processes Mineral products	CO2	700	900	1100	1100	29%	22%	0%
2B	Industrial processes Chemical industry	CO2	0	0	300	0			-100%
2D	Industrial processes Other production	CO2	200	400	0	0	100%	-100%	
2G	Industrial processes Other	CO2	900	400	300	300	-56%	-25%	0%
2A	Industrial processes Mineral products	CH4	210	110	140	140	-48%	27%	0%
2B	Industrial processes Chemical industry	CH4	3020	5190	2460	2290	72%	-53%	-7%
2C	Industrial processes Metal production	CH4	50	320	0	0	540%	-100%	
2D	Industrial processes Other production	CH4	10	50	50	50	400%	0%	0%
2G	Industrial processes Other	CH4	50	80	70	70	60%	-13%	0%
2B	Industrial processes Chemical industry	N2O	31530	31740	34980	33810	1%	10%	-3%
2D	Industrial processes Other production	N2O		0	0	0			
2A	Industrial processes Mineral products	CO	3900	1100	1700	1700	-72%	55%	0%
2B	Industrial processes Chemical industry	CO	17500	32400	31500	31900	85%	-3%	1%
2C	Industrial processes Metal production	CO	127100	132800	110800	116100	4%	-17%	5%
2D	Industrial processes Other production	CO	500	4500	1600	1600	800%	-64%	0%
2G	Industrial processes Other	CO	4500	900	600	600	-80%	-33%	0%
2A	Industrial processes Mineral products	NOx	1300	1200	1300	1300	-8%	8%	0%
2B	Industrial processes Chemical industry	NOx	10500	8900	6900	6900	-15%	-22%	0%
2C	Industrial processes Metal production	NOx	200	7300	7000	6900	3550%	-4%	-1%
2D	Industrial processes Other production	NOx	300	200	0	0	-33%	-100%	
2G	Industrial processes Other	NOx	1200	200	100	100	-83%	-50%	0%
2A	Industrial processes Mineral products	NMVOC	1000	400	400	400	-60%	0%	0%
2B	Industrial processes Chemical industry	NMVOC	33200	17900	16100	14200	-46%	-10%	-12%
2C	Industrial processes Metal production	NMVOC	4000	3100	3100	3000	-23%	0%	-3%
2D	Industrial processes Other production	NMVOC	10600	6000	5800	5600	-43%	-3%	-3%
2F	Industrial processes Production of Halocarbons&SF6	NMVOC	100	200	200	200	100%	0%	0%
2G	Industrial processes Other	NMVOC	74900	46000	43500	40600	-39%	-5%	-7%
2A	Industrial processes Mineral products	SO2	7500	2800	2500	2500	-63%	-11%	0%
2B	Industrial processes Chemical industry	SO2	7000	4500	3900	4000	-36%	-13%	3%
2C	Industrial processes Metal production	SO2	8200	10100	9500	7600	23%	-6%	-20%
2D	Industrial processes Other production	SO2	100	100	0	0	0%		
2G	Industrial processes Other	SO2	3100	400	300	300	-87%	-25%	0%

Table C.3. Sectoral report for solvents and other product use

	IPCC description		Emissions				Diff. between years		
code	(CO_2 in Gg; Other compounds in Mg)	Gas	1990	1996	1997	1998	96/90	97/96	98/97
3D	Chemical Products, Manufacture and Processing	CH4	2000	1970	1970	1930	-2%	0%	-2%
3D	Chemical Products, Manufacture and Processing	N2O	510	490	440	390	-4%	-10%	-11%
3D	Chemical Products, Manufacture and Processing	CO	2400	1900	2000	2000	-21%	5%	0%
3	Solvent and Other product use	NOx	100	100	100	100	0%	0%	0%
3A	Paint Application	NMVOC	55600	42500	36300	36300	-24%	-15%	0%
3B	Degreasing and Dry Cleaning	NMVOC	1000	600	400	400	-40%	-33%	0%
3D	Chemical Products, Manufacture and Processing	NMVOC	39200	29200	27500	27100	-26%	-6%	-1%
3D	Chemical Products, Manufacture and Processing	SO2	300	200	200	0	-33%	0%	-100%

Table C.4. Sectoral report for agriculture

	IPCC description		Emissions				Diff. between years		
code	(CO_2 in Gg; Other compounds in Mg)	Gas	1990	1996	1997	1998	96/90	97/96	98/97
4A1	Enteric Fermentation Cattle	CH4	388420	344200	300610	293690	-11%	-13%	-2%
4A10	Enteric Fermentation Other	CH4	9990	0	29190	27610	-100%		-5%
4A8	Enteric Fermentation Swine	CH4		21600	22800	20200		6%	-11%
4A9	Enteric Fermentation Poultry	CH4	3580				-100%		
4B1	Manure Management Cattle	CH4	58510				-100%		
4B13	Manure Management Other	CH4	1510	99000	93700	93600	6456%	-5%	0%
4B8	Manure Management Swine	CH4	33960				-100%		
4B9	Manure Management Poultry	CH4	9020				-100%		
4B1	Manure Management Cattle	N2O		400	450	450		13%	0%
4B13	Manure Management Other	N2O	700	10	0	0	-99%	-100%	
4B8	Manure Management Swine	N2O		230	160	160		-30%	0%
4B9	Manure Management Poultry	N2O		60	60	60		0%	0%
4D	Agricultural Soils	N2O	21500	26800	25260	25180	25%	-6%	0%
4D	Agricultural Soils	NMVOC	200	200	200	200	0%	0%	0%

Table C.5. Sectoral report for waste

	IPCC description		Emissions				Diff. between years		
code	(CO_2 in Gg; Other compounds in Mg)	Gas	1990	1996	1997	1998	96/90	97/96	98/97
6D	Waste, Other	CO2	1900	1900	2500	2300	0%	32%	-8%
6A1	Solid Waste Disposal on Land, Managed	CH4	562000	477000	463980	444900	-15%	-3%	-4%
6B3	Wastewater Handling	CH4	6310	560	1300	1300	-91%	132%	0%
6D	Waste, Other	CH4	10	10	10	10	0%	0%	0%
6B3	Wastewater Handling	N2O	470	490	550	550	4%	12%	0%
6D	Waste, Other	N2O	50	70	70	70	40%	0%	0%
6D	Waste, Other	CO	2200	700	700	400	-68%	0%	-43%
6D	Waste, Other	NOx	4400	1800	1900	1900	-59%	6%	0%
6A1	Solid Waste Disposal on Land, Managed	NMVOC	900	800	800	800	-11%	0%	0%
6D	Waste, Other	NMVOC	1300	1100	900	600	-15%	-18%	-33%
6D	Waste, Other	SO2	4900	900	800	800	-82%	-11%	0%

Table C.6. Sectoral report for other sources

	IPCC description		Emissions				Diff. between years		
code	(CO_2 in Gg; Other compounds in Mg)	Gas	1990	1996	1997	1998	96/90	97/96	98/97
7C	Other Causes	N2O	3800	3800	3800	3800	0%	0%	0%

Appendix D:

IPCC CO_2 Reference Approach calculation 1990-1998

A provisional calculation of the *IPCC Reference Approach* for CO_2 from energy use was made. Due to a current lack of information on the carbon content of crude oil, natural gas liquids and other refinery inputs, which is required for this reference calculation, this could only be done with *estimated figures* for the carbon content of refinery inputs.

The preliminary calculation was done using provisional emission factors for crude oil, refinery feedstocks and natural gas liquids based on USDOE information published in IPCC (2000): 72.7, 72.7 and 68.6 g CO_2/GJ, respectively. *Table D.1* presents the provisional reference calculation as well as the sum of reported sectoral energy related CO_2 emissions The latter include emissions associated with statistical difference in energy consumption, which the Netherlands presently assumes to represent unallocated sectoral fuel use. Comparison of annual differences shows that on average annual sectoral emissions are 1.3% higher.

Table D.1 Results of provisional Reference Approach calculation for CO_2 from energy use.

Year	Reference calculation (Tg CO_2)	o.w. feedstocks (Tg CO_2)	Reported (Tg CO_2)	Difference Rep/Calc (%)
1990	156.1	9.2	159.0	1.8%
1991	161.9	9.8	164.9	1.9%
1992	160.8	9.4	163.4	1.6%
1993	164.6	8.3	165.9	0.8%
1994	163.7	9.7	166.8	1.9%
1995	171.3	9.4	173.0	1.0%
1996	179.1	8.2	180.0	0.5%
1997	176.4	9.1	179.0	1.5%
1998	174.2	9.0	176.8	1.5%

Sources: energy: CBS; emission factors: Spakman *et al*. (1997) except for crude oil, refinery feedstocks and natural gas liquids.
Note: Preliminary calculation using provisional emission factors for crude oil, refinery feedstocks and natural gas liquids based on USDOE information published in IPCC (2000): 72.7, 72.7 and 68.6 g CO_2/GJ, respectively.

However, it should be stressed that these results are indeed preliminary, since the reference calculation for the Netherlands is quite sensitive for the crude oil input figures. This is related to the relatively high amounts of crude oil refined and oil products exported. A sensitivity analysis for four sets of carbon contents for crude oil showed that the annual average difference of sectoral and reference calculation may vary between 0.3% and 1.9% (see *Table D.2*).

Table D.2 Result of sensitivity analysis for CO_2 Reference Approach calculation for different values for crude oil and other refinery inputs.

	Set 1: IPCC (2000)	Set 2: NL petrol	Set 3: NL diesel	Set 4: NL diesel - 3 digits
EF for crude/NGL (g/GJ)	**72.7 & 68.6 for crude & NGL**	**72.3 g**	**73.0 g**	**73.3**
1990	1.8%	2.4%	1.4%	1.0%
1991	1.9%	2.5%	1.4%	1.0%
1992	1.6%	2.3%	1.3%	0.8%
1993	0.8%	1.5%	0.4%	-0.1%
1994	1.9%	2.5%	1.4%	0.9%
1995	1.0%	1.5%	0.4%	-0.1%
1996	0.5%	0.9%	-0.2%	-0.6%
1997	0.9%	1.3%	0.3%	-0.2%
1998	1.5%	1.9%	0.7%	0.3%
Average diff.:	**1.3%**	**1.9%**	**0.8%**	**0.3%**

Note: In Sets 2,3 and 4 the same factor was used for all refinery inputs.

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