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RIVM report 728001 009

Greenhouse Gas Emissions in the Netherlands: Summary Report 1990-1997 (IPCC Tables 7A)

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February 1999

A report on the International Commitments with respect to Greenhouse Gas Emission Inventories for the UN Framework Convention on Climate Change and for the European Union's Greenhouse Gas Monitoring Mechanism

This investigation has been performed by order and for the account of the Directorate-General for Environmental Protection, Department of Air and Energy, of the Netherlands' Ministry of Housing, Spatial Planning and the Environment, within the framework of project 728001, 'Climate change' and 773301, project title 'International emission reports'.

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Abstract

This report documents the 1998 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). From 1990 to 1997 emissions of CO_2 and N_2O increased (with a fluctuation of CO_2 in 1996 due to a very cold winter) by 14% and 10%, respectively, while in the same period CH_4 emissions decreased by 14%. Taking the 'new' gases, HFCs, PFCs and SF_6, for which 1995 is a reference year, emissions of HFCs decreased substantially in 1997 to a level 35% lower than in 1995, while emissions of PFCs and SF_6 (potential) remained at the same level. Overall CO_2-eq. emissions for all six gases increased in 1997 by 8% relative to the base year 1990 (1995 for the 'new' greenhouse gases) (6% when correcting for temperature).

Contents

Summary

This report documents the 1998 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). Due to limitations of data processing it was not possible to provide sectoral tables and other background documentation on the emissions reported. The report comprises only the *Summary Report Tables 7A* for 1990-1997 as defined in the *Revised 1996 IPCC Guidelines* (data for 1997 are preliminary). The historical emission data for 1990-1996 as reported in these tables differ slightly from the data reported in the previous submission. This is due to: (a) allocation to IPCC source categories as defined in the *Revised 1996 IPCC Guidelines* and (b) new insights/data resulting in an updated methodology and improved emission estimates as listed below:

- an increase in N_2O emissions of 1.9 Gg (or 600 Gg CO_2-eq.) from road transport in 1990 [and a decrease of 0.4 Gg in 1996];
- a decrease in total HFC/PFC/SF_6 emissions of about 400 Gg CO_2-eq. in 1995;
- a decrease in CO_2 emissions of 300 Gg from international bunkers in 1990.

The uncertainty in the emission estimates are indicative ('order of magnitude') only and based on expert judgement. Systematic calculations of the overall uncertainty per greenhouse gas have not yet been made. Our current overall estimates of uncertainty are ±2% for CO_2, ±25% for CH_4, ±35% for N_2O; ±50% for HFCs and SF_6; ±100% for PFCs; ±25% for CO, NO_x, and SO_2 and ±50% for NMVOC.

In 1997 the net total CO_2 emissions increased by 14% compared to those of 1990; when comparing temperature-corrected emissions the growth was 11%. The largest sectoral growth occurred in transport (almost 20%), which had contributed the most to the overall growth in national emissions. In 1997 correction of CO_2 emissions for the impact of climate variation on energy consumption for domestic space heating results in a increase of 2.3 Mton or 1.3% of the total national emissions, while temperature-corrected 1990 emissions are 6.3 Mton or 3.9% higher than uncorrected figures. Bunker emissions of CO_2 increased in 1997 by about 21% compared to 1990.

In 1997 total CH_4 emissions decreased by 14% compared to the 1990 level. Sectors contributing most to the decrease were the waste sector (almost -20%) and agricultural sector. In 1997 total N_2O emissions increased by about 10% compared to 1990 mainly due to an increase in the agricultural sector of almost 20% as a result of new manure-spreading practices. Industrial processes and transport emissions of N_2O increased by 6%. In road transport, increasing emissions due to the penetration of catalyst-equipped petrol cars were largely compensated by decreasing N_2O emissions calculated for diesel vehicles.

Compared to the 1995 level, total emissions of HFCs, PFCs and SF_6 decreased by about 20%. HFC and PFC emissions decreased in 1997 by about 10% compared to 1990. This was largely caused by a decrease in HFC-23 emissions as by-product of HCFC-22 production as a result of implementation of control technology and decreasing PFC emissions from aluminium production, respectively. The decrease in HFC-23 emissions (mainly due to reduced by-product emissions related to HCFC-22 production) was partially compensated by the increase in HFC-134a emissions.

Emissions of precursor gases CO, NMVOC and SO_2 in 1997 were reduced by about 30% compared to 1990; for NO_x this was about 20%.

In *Table 5.1* trends in national total (net) emissions are summarised for 1990-1997. Of the 'new' gases, HFCs, PFCs and SF_6, for which 1995 is a reference year, emissions of HFCs decreased substantially in 1997 to a level 35% lower than in 1995, while emissions of PFCs and SF_6 (potential) remained at the same level. Overall CO_2-eq. emissions for all six gases increased in 1997 by 8% relative to the base year 1990 (1995 for the 'new' greenhouse gases) (6% when correcting for temperature).

Samenvatting (Dutch)

Dit rapport over de Nederlandse inventarisatie van broeikasgasemissies is geschreven om te voldoen aan de nationale rapportageverplichtingen in 1998 in het kader van het Bewakingsmechanisme Broeikasgassen van de Europese Unie en van het Klimaatverdrag van de Verenigde Naties (UN-FCCC). Vanwege beperkingen bij de dataverwerking was het niet mogelijk om sectorale tabellen en andere achtergrondinformatie over de emissies op te nemen in dit rapport. Dit rapport bevat alleen de zgn. *Summary Report Tables 7A* voor de periode 1990-1997 zoals gedefinieerd in de in 1996 *Herziene IPCC Richtlijnen* (de cijfers voor 1997 zijn voorlopig). De hier gerapporteerde historische emissies voor 1990-1996 verschillen enigszins van de vorige rapportage in verband met: (a) sectorale toedeling aan IPCC-broncategorieën zoals gedefinieerd in de *Herziene IPCC Richtlijnen*, en (b) nieuwe inzichten of nieuwe getallen, leidend tot een verbeterde berekeningsmethodiek en verbeterde emissieschattingen:

- de N_2O-emissies uit wegverkeer zijn in 1990 nu 1.9 Gg (of 600 Gg CO_2-eq.) hoger [en in 1996 nu 0.4 Gg lager];
- de totale emissies van HFK/PFK/SF_6 in 1995 zijn nu ca. 400 Gg lager;
- de CO_2-emissies van internationale bunkers zijn in 1990 nu ca. 300 Gg lager.

De onzekerheid in de emissieschattingen zijn indicatief (orde-grootte-schattingen) gebaseerd op 'expert judgement'. Systematische berekening van de overall onzekerheid van de emissies per broeikasgas heeft nog niet plaatsgevonden. De huidige schatting van de onzekerheid per gas is voor CO_2 ±2%, CH_4 ±25%, N_2O ±35%; HFK's and SF_6: ±50%; PFK's: ±100%; CO, NO_x, SO_2: ±25%; NMVOS: ±50%.

De netto CO_2-emissies waren in 1997 14% hoger dan in 1990 (11% wanneer gecorrigeerd voor temperatuur). De grootste sectorale groei was in de transport sector (bijna 20%), die ook het meest aan de totale emissiegroei bijdroeg. In 1997 bedraagt de correctie op de CO_2-emissies voor de invloed van de jaarlijkse klimaatvariaties op het energiegebruik voor ruimteverwarming +2.3 Mton of 1.3% van de nationale totale emissies; in 1990 zijn de temperatuurgecorrigeerde CO_2-emissies 6.3 Mton of 3.9% hoger dan de ongecorrigeerde emissies. De bunkeremissies van CO_2 zijn in 1997 21% hoger dan in 1990.

In 1997 waren de methaanemissies 14% lager dan in 1990. De afvalsector (-20%) en de landbouwsector droegen het meest bij aan deze vermindering. De N_2O-emissies waren in 1997 ca. 10% gestegen ten opzichte van 1990, vooral als gevolg van een stijging van de landbouwemissies van bijna 20% als gevolg van de toepassing van een andere mestverwerkingstechniek. De N_2O-emissies van industriële processen en de transportsector stegen met 6%. In het wegtransport werden toenemende emissies als gevolg van de penetratie van met een katalysator uitgeruste benzine-auto's grotendeels gecompenseerd door de afname van emissies van diesel-voertuigen.

Vergeleken met 1995 zijn de totale emissies van HFK's, PFK's en SF_6 met ca. 20% gedaald. HKF- en PFK-emissies zijn met 10% gedaald ten opzichte van 1990. Dit is vooral een gevolg van verminderde emissies van HFK-23 als bijproduct van de productie van HCFK-22 door de inzet van bestrijdingstechnologie en verminderde PFK-emissies van aluminiumproductie. De verminderde HFK-23-emissies (vooral door reductie van de bijproductemissies van HCFK-22) werd gedeeltelijk gecompenseerd door een stijging in de emissies van HFK-134a.

In 1997 waren de emissies van CO, NMVOS en SO_2 ca. 30% lager dan in 1990; voor NO_x was dit ca. 20%.

In *Tabel 5.1* zijn de totale emissietrends 1990-1997 samengevat. Van de zgn. 'nieuwe' gassen HFK's, PFK's en SF_6, waarvoor 1995 het referentiejaar is, daalden de HFK-emissies aanmerkelijk met 35% in 1997 ten opzichte van 1995, terwijl de emissies van PFK's en SF_6 (potentieel) op hetzelfde niveau bleven. De totale CO_2-eq. emissies voor de zes gassen waren in 1997 8% hoger dan in het basisjaar 1990 (1995 voor de 'nieuwe' broeikasgassen); temperatuur-gecorrigeerd is deze stijging 6%.

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 1998 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). Due to limitations of data processing it was not possible to provide sectoral tables and other background documentation on the emissions reported. The report comprises only the Summary Report Tables 7A for 1990-1997 as defined in the *Revised 1996 IPCC Guidelines* (IPCC, 1997) (data for 1997 are preliminary). In the next edition we aim at providing also Sectoral Reports (IPCC Tables 1-6) as defined in the *Revised 1996 IPCC Guidelines*, possibly supplemented with information equivalent to the Standard Data Tables for sectors as described in the original *IPCC Guidelines* (IPCC, 1994).

The emission data for 1990-1996 as reported in these tables differ slightly from the data reported in the previous report (Spakman *et al.*, 1997b; VROM, 1998) due to:

- allocation to IPCC source categories as defined in the *Revised 1996 IPCC Guidelines*,
- new insights/data resulting in an updated methodology and improved emission estimates.

These differences are in summarised in Chapter 2.

The uncertainty in the emission estimates per gas are indicative ('order of magnitude') only, based on expert judgement of uncertainty in emission factors and activity data for the relevant sources. In the subsequent chapters the uncertainty estimate per sector is briefly described. Systematic calculations of the overall uncertainty per greenhouse gas have not yet been made. Our current overall estimates are

- for greenhouse gases:

CO_2	±2%	HFCs	±50%
CH_4	±25%	PFCs	±100%
N_2O	±35%	SF_6	±50%

- for precursor gases:

CO	±25%
NO_x	±25%
NMVOC	±50%
SO_2	±25%

We note that in all tables the same number of decimal digits are 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.

In Chapters 3 to 5 trends in emissions of greenhouse gas and precursor gases and their contribution to annual emissions are briefly discussed. IPCC Summary Report Tables 7A for 1990-1997 are provided in Appendix A, except for emissions of HFCs, PFCs and SF_6 which are provided in Appendix B. Please note that in these tables the figures may not also add up to the (sub)totals because of rounding. Appendix C contains the updated correspondence table for IPCC sectors and target groups defining the allocation of the Netherlands' target group emissions to the IPCC source categories according to the *Revised 1996 IPCC guidelines*.

2. Changes in methodology and definitions

In this chapter we outline the key differences compared with the previous submission reported by Spakman *et al.* (1997b).

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 Appendix C along with the updated correspondence table for emissions from target groups and IPCC source categories. In order to achieve better compliance with source category definitions in the *Revised 1996 IPCC Guidelines*, compared with the previous submission the following allocations of subcategories have been changed for the whole time series 1990-1997:

- Emissions from 'biomass burned for energy' are only estimated for residential fuelwood consumption. These emissions are therefore now recorded under [1A4b] (*Small combustion, residential*). In the previous report, these emissions were separately recorded under [1A6].
- Fossil fuel combustion within the waste sector is now allocated to [1A5a], whereas in the 1997 report they were allocated to [1A4a] (*Small combustion, commercial/institutional*).
- Emissions from [2] (industrial processes) are now broken down according to the revised definition of subcategories. Therefore the emissions as reported earlier are re-allocated: years 1990-1994: [2C]-> [2B], [2E] -> [2A], [2F]-> [2G]; for the ozone precursors and SO_2 all emissions are reported under [2G]; years 1995-1997: industrial processes allocated according to 2A, B, C, D, G.
- Combustion and process emissions from the construction sector formerly under [1A4a] (*Fuel combustion*) and [3] (*Process emissions*) have now been included under [1A2a-e] and [2G], respectively for the years 1995-1997 only; 1990-1994 emissions have not yet been re-allocated (e.g. CO_2 emissions of 0.6 Mton in 1990)].
- Emissions from [6C] (*Waste incineration*) are now included under [1A1a] (*Electricity and heat production*), since all waste incineration in the Netherlands is energy-related.
- As a consequence, there is no waste incineration without energy-production and emissions from source category [6C] (*Waste incineration (non energy)*) are now all zero.
- Emissions in [6D] includes all process emissions from waste management (excluding landfill emissions) as well as combustion emissions from waste water treatment plants (WWTP) [1995-1997 only; 1990-1994 emissions have not yet been re-allocated].
- CH_4 emissions from [7A] (*Drinking water treatment*) have now been included under [3D] (solvent and other product use, other) for the years 1995-1997 only; 1990-1994 emissions have not yet been re-allocated.
- Indirect N_2O emissions from all N-loading to surface water are continued to be reported separately under [7B], since this source does not fully match with the IPCC definition of indirect emissions from N used in agriculture (which according to the *Revised 1996 IPCC Guidelines* should be reported under [4D]), but also includes indirect emissions from N deposition from other non-agricultural sources.

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

- 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 since the previous submission in greenhouse gases:

- For 1996 and 1997 the data collection/monitoring for industrial sources have changed compared to 1995 and earlier. This causes discontinuities at some sub-sectoral breakdowns. No attempts have been made to correct for this.
- Due to some inconsistencies in the emission database, for the years 1996 and 1997, only total CO_2 emissions from industrial fuel consumption [1A2] is reported, that is, without distinction between combustion and emissions from feedstock-use.
- CO_2 sequestration in sinks have been kept constant from 1995 onwards (in view of future changes to comply with Kyoto Protocol definition);
- CO_2 from marine bunkers now calculated using separate emission factors for heavy fuel oil and diesel oil, which results in decreased emissions by 100-300 Gg per year (0.3 Mton in 1990);
- N_2O transport 1990 up have now been calculated with an emission factor that depends on the emission factor for NO_x. Per combination of vehicle/fuel/catalyst type (none; first generation up to 1995; second generation introduced in 1996) a fixed ratio of N_2O:NO_x has been applied, whereas in previous reports the emission factor for N_2O per combination vehicle/fuel type/catalytic converter (one type only), respectively, was assumed to be constant in time, effectively increasing the N_2O emissions in 1990 by 1.9 Gg (or 600 Gg CO_2-eq.) (Klein, 1998);
- HFCs 1990 up - due to a full implementation of the actual emission calculation according to Spakman *et al.* (1997a), which refers to the method outlined by Matthijsen and Kroeze (1996);
- PFCs 1995 up - due to revised activity data on aluminium production; as a result total CO_2-eq. emissions in 1995 from the 'new' gases - including HFCs and SF_6 - decreased by about 400 Gg CO_2-eq. compared with the previous submission.

Changes since the previous submission in ozone precursors and SO_2:

- CO from transport and industry 1995 up
- NMVOC from commercials 1990-1994; all sectors 1995 up
- SO_2 from industry 1995 up; minor changes 1990-1994.

All figures comply with the *Environmental Balance 1998* (RIVM, 1998a,b) and with the *Annual emissions report 1998* describing emissions and waste 1995, 1996 and 1997 (VROM, 1999), except for HFC emissions due to the full implementation of the actual calculation method, and except for minor differences in CO_2 emissions from international bunkers in the second report. We recall that all data presented for 1997 are preliminary.

3. Trends in greenhouse gas emissions

In the next sections the trends in emissions per IPCC category are presented in tabular and graphic form. We recall that the data for 1997 are all preliminary data. The figures show both percentage change of emissions between 1997 and 1990 and the sector share in 1990. When interpreting the relevance of large changes for national total emissions, these shares should considered as well.

3.1. Emissions and sources of CO_2

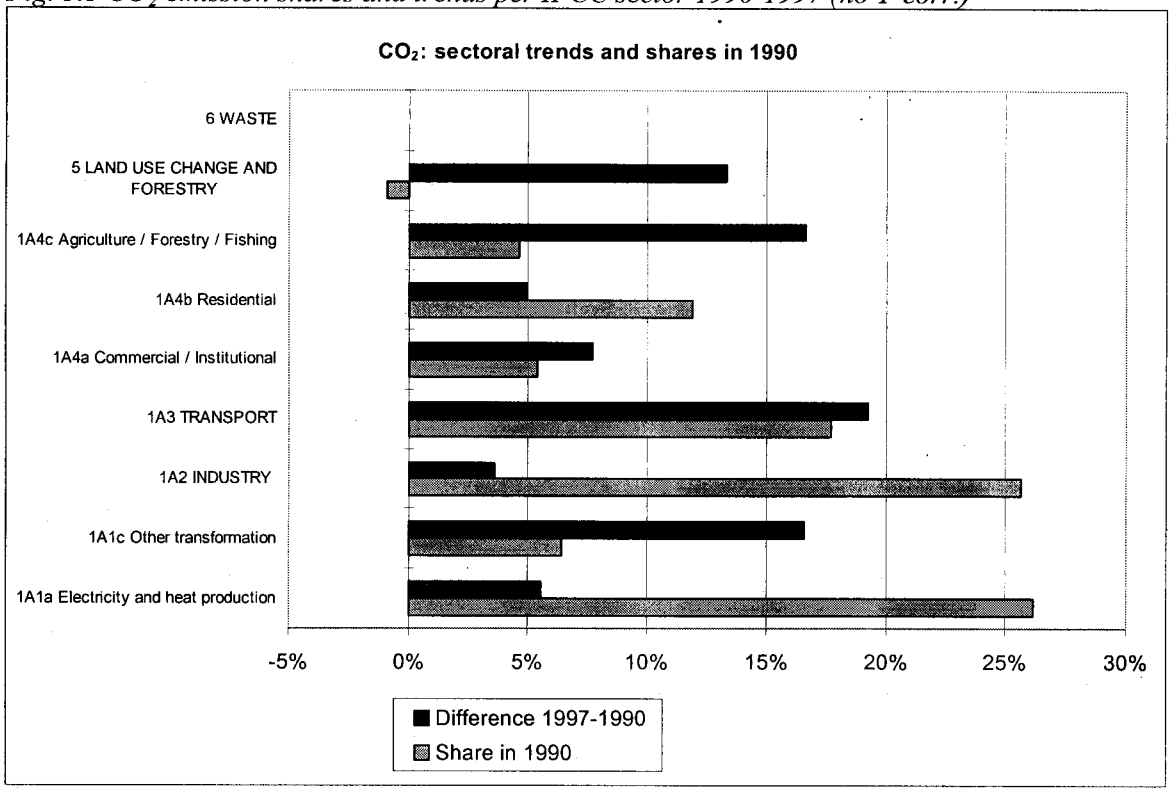
Trends in emissions per IPCC sector have been summarised in *Table 3.1*. In 1997 the net total CO_2 emissions increased by 14% compared to those for 1990; when comparing temperature-corrected emissions the growth was 11%. The largest sectoral growth occurred in transport (almost 20%), which had contributed the most to the overall growth in national emissions (*Figure 3.1*). Due to some inconsistencies in the emission database, for the years 1996 and 1997, in the IPCC Tables 7A in Appendix A only *total* CO_2 emissions from industrial fuel consumption [1A2] is reported without distinction between combustion and emissions from feedstock use.

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 estimated to be about 2% (uncertainty estimate with order of magnitude-factor of 1.5). The uncertainty is not well-known for other sources. However, due to the minor share from other sources, the uncertainty in the overall total will not be much larger than 2%. Figures for CO_2 sequestration in sinks (IPCC category 5) have been kept constant from 1995 onwards in view of future changes to comply with Kyoto Protocol definition.

Table 3.1 CO_2 emissions and sinks per IPCC sector 1990-1997 (no T-corr.) (1000 Gg)

	1990	1991	1992	1993	1994	1995	1996	1997
TOTAL NET NATIONAL EMISSIONS	**161.4**	**166.9**	**165.2**	**167.5**	**168.4**	**177.2**	**186.2**	**183.3**
1. All Energy (combustion and fugitive)	**159.5**	**165.3**	**163.8**	**166.3**	**166.9**	**173.9**	**182.5**	**179.4**
A Fuel combustion total	159.0	164.9	163.4	165.9	166.8	173.0	181.4	178.3
1a Electricity and heat production	42.2	41.6	43.3	43.2	44.8	43.7	44.9	44.5
1c Other transformation	10.4	10.6	10.9	10.6	11.2	12.3	12.5	12.1
2 Industry (including actual from feedstocks)	41.4	42.7	42.5	39.9	41.0	43.4	43.3	42.9
3 Transport	28.6	28.6	29.8	30.5	30.8	32.0	33.5	34.1
4a Commercial / Institutional	8.7	10.3	9.4	10.6	10.1	9.4	10.9	9.4
4b Residential	19.2	21.6	19.5	20.6	19.6	20.6	24.0	20.2
4c Agriculture / Forestry / Fishing	7.4	8.5	8.5	8.8	8.8	8.9	10.3	8.7
5 Other (statistical differences)	1.1	1.1	-0.4	1.7	0.6	2.5	2.0	6.5
B Fugitive fuel emissions								
1B Crude oil and natural gas	0.4	0.5	0.4	0.4	0.2	1.0	1.2	1.1
2. Industrial processes	**1.9**	**1.5**	**1.3**	**1.2**	**1.4**	**1.6**	**1.8**	**1.8**
3. Solvent and other product use	**0.0**	**0.1**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
5. Land use change and forestry	**(-1.5)**	**(-1.6)**	**(-1.6)**	**(-1.6)**	**(-1.7)**	**(-1.7)**	**(-1.7)**	**(-1.7)**
6. Waste	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.6**	**1.9**	**2.1**

Fig. 3.1 CO_2 emission shares and trends per IPCC sector 1990-1997 (no T-corr.)



Domestic energy consumption

In *Appendix C* the fossil energy balances for 1990-1997 are presented with sectoral energy consumption aggregated per IPCC sector and per fossil fuel type based on the Netherlands Energy Statistics (CBS, 1990-1998). Energy consumption in the construction sector, which according to IPCC guidelines should be included in 'Industry', is included in 'Commercial/institutional' since this sub-sector could not be separated out. Coke production is included in 'Industry'. Energy consumption in industry, agriculture and construction sectors includes fuel use for mobile off-road machinery; however, the emissions from mobile machinery are included in 'Transport'.

Temperature correction for CO_2

For national policy purposes, trends in CO_2 emissions are corrected for climate variation of energy consumption for 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. Currently, the temperature correction method as described in Spakman *et al.* (1997b) is being evaluated. The correction factor for space heating varies between -11% in 1996 to +20% in 1990. In 1997 CO_2 emissions were corrected by 2.3 Mton or 1.3% 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 1990-1997

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

International bunkers

In *Table 3.3* both energy consumption and CO_2 emissions from international bunkers are presented per detailed fuel type. Starting this year, more detailed emission factors have been used: per detailed fuel type instead of one emission factor for international marine bunkers and one for aviation bunkers. However, the effects of this recalculation are limited to a decrease of about 400 Gg in 1990, mainly due to a change in marine bunker emissions. Bunker emissions of CO_2 increased in 1997 by about 21% compared to 1990.

Table 3.3 Bunkers: energy consumption and CO_2 emissions 1990-1997

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

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

3.2. Emissions of CH_4

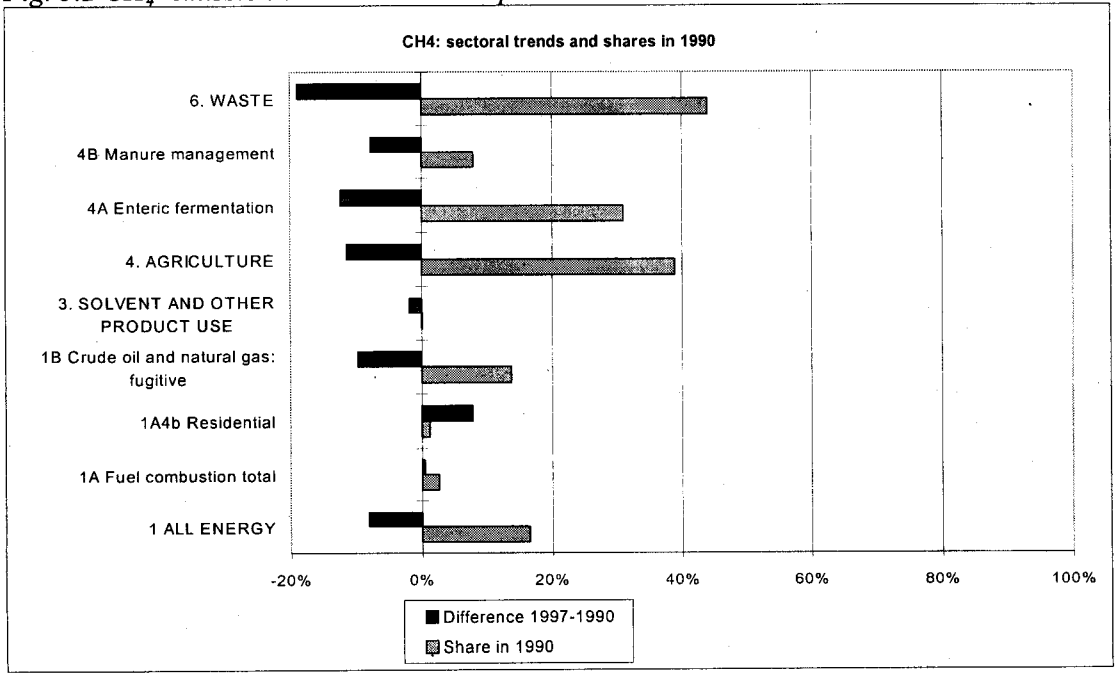
In 1997 total methane emissions decreased by 14% compared to the 1990 level (*Table 3.4*). Sectors contributing most to the decrease were the waste sector (almost -20%) and agricultural sector (*Figure 3.1*). Major determining factors for this decrease are less dumping in and high methane recovery rates from landfills and decreasing numbers of live-stock. Fugitive fuel emissions also contributed to the national total decrease.

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 25% (uncertainty estimate with order of magnitude-factor of 1.5).

Table 3.4 CH_4 emissions per IPCC sector 1990-1997 (Gg)

IPCC Sector	1990	1991	1992	1993	1994	1995	1996	1997
TOTAL NET NATIONAL EMISSIONS	**1292.3**	**1308.8**	**1256.2**	**1224.6**	**1203.0**	**1172.5**	**1180.8**	**1111.6**
1. All Energy (combustion and fugitive)	**213.5**	**223.9**	**199.1**	**192.3**	**202.3**	**209.3**	**230.7**	**196.2**
A Fuel combustion total	34.8	35.8	36.0	34.3	33.7	35.3	38.0	34.9
1 Energy	3.0	3.3	3.8	3.4	3.7	4.9	5.8	5.9
2 Industry	4.0	3.5	4.9	3.2	2.6	2.8	1.5	1.5
3 Transport	7.8	6.9	6.8	6.4	6.3	6.3	6.1	5.8
4 a Commercial / Institutional	1.1	1.1	1.0	0.9	1.4	0.6	1.4	1.2
4 b Residential	16.5	18.3	16.8	17.7	17.0	17.9	20.4	17.8
4 c Agriculture / Forestry / Fishing	2.3	2.7	2.7	2.8	2.8	2.8	2.8	2.7
B Fugitive fuel emissions	178.8	188.1	163.1	158.0	168.5	174.0	192.8	161.3
2 Crude oil and natural gas	178.8	188.1	163.1	158.0	168.5	174.0	192.8	161.3
2. Industrial processes	**3.4**	**3.5**	**3.7**	**4.9**	**5.3**	**5.0**	**5.8**	**5.2**
3. Solvent and other product use	**2.0**	**2.0**	**2.0**	**2.0**	**2.3**	**2.0**	**2.0**	**2.0**
4. Agriculture	**505.0**	**517.0**	**505.0**	**497.0**	**483.0**	**475.7**	**464.8**	**447.6**
A Enteric fermentation	402.0	412.0	401.0	393.0	382.0	376.7	365.8	352.6
B Manure management	103.0	105.0	104.0	104.0	101.0	99.0	99.0	95.0
5. Land use change and forestry	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
6. Waste	**568.4**	**562.4**	**546.4**	**528.4**	**510.2**	**480.5**	**477.6**	**460.6**
A Solid waste disposal on land	562.1	556.1	540.1	522.1	505.1	479.0	477.0	460.0
B Waste water handling	6.3	6.3	6.3	6.3	5.1	1.5	0.6	0.6

Fig. 3.2 CH_4 emission shares and trends per IPCC sector 1990-1997



3.3. Emissions of N_2O

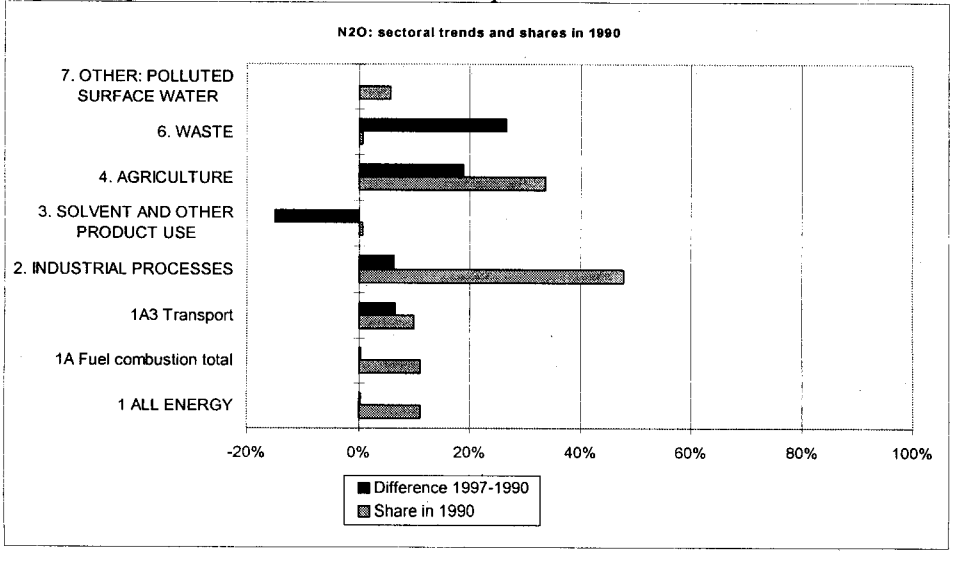
Emissions from road transport have been recalculated with emission factors depending on the emission factor for NO_x: a fixed ratio of N_2O:NO_x has now been applied (Klein, 1998). In previous reports the N_2O emission factors per vehicle/fuel type/catalytic converter (one type only), had been assumed to be constant in time. The effect of this recalculation is an increase of emissions in 1990 by 1.9 Gg (or 600 Gg CO_2-eq.) and a decrease in 1996 of 0.4 Gg compared to the previous submission: increasing emissions due to the penetration of catalyst-equipped petrol cars were largely compensated by decreasing N_2O emissions calculated for diesel vehicles. Total N_2O emissions increased by about 10% compared to 1990, mainly due to an increase in the agricultural sector of almost 20% as a result of shifting manure-spreading practices (*Table 3.5*). Industrial processes and transport emissions increased by 6%.

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 such as agriculture and road transport 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% (uncertainty estimate with order of magnitude-factor of 1.5).

Table 3.5 N_2O emissions per IPCC sector 1990-1997 (Gg)

IPCC Sector	1990	1991	1992	1993	1994	1995	1996	1997
TOTAL NET NATIONAL EMISSIONS	**65.8**	**66.9**	**69.2**	**68.8**	**70.7**	**72.2**	**72.1**	**72.1**
1. All Energy (combustion and fugitive)	**7.3**	**6.9**	**7.9**	**7.9**	**7.9**	**8.1**	**8.0**	**7.4**
A Fuel combustion total	7.3	6.9	7.9	7.9	7.5	8.1	8.0	7.4
1 Energy transformation	0.5	0.5	0.5	0.5	0.1	0.5	0.4	0.0
2 Industry	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
3 Transport	6.6	6.2	7.2	7.2	7.2	7.4	7.4	7.0
4 Small combustion	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
5 Other	0	0	0	0	0	0	0	0
B Fugitive fuel emissions	0.0	0.0	0.0	0.0	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**	**33.5**
3. Solvent and other product use	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.4**
4. Agriculture	**22.2**	**22.9**	**26.2**	**26.2**	**26.4**	**27.6**	**27.5**	**26.4**
5. Land use change and forestry	-							-
6. Waste	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.6**	**0.6**	**0.6**
7. Other (polluted surface water)	**3.8**	**3.8**	**3.8**	**3.8**	**3.8**	**3.8**	**3.8**	**3.8**

Fig. 3.3 N_2O emission shares and trends per IPCC sector 1990-1997



3.4. Emissions of fluorinated halocarbons

Actual emissions of HFCs have been recalculated due to full implementation of the calculation method described in Spakman *et al.* (1997a), following the method outlined by Matthijsen and Kroeze (1996). From 1995 onwards PFC emissions have also been revised due to updated activity data on aluminium production. The effect of this recalculation is largely found in PFC emissions, which are now in 1995 about 300 Gg CO_2-eq. lower than in the previous submission. As a result total CO_2-eq. emissions in 1995 from the 'new' gases decreased by about 400 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 actual HFC and PFC emissions decreased in 1997 by about 10% compared to 1990. This was largely caused a decrease in HFC-23 emissions due to HCFC-22 production and decreasing PFC emissions from aluminium production, respectively. However, compared to the 1995 level, total emissions of these three groups of gases decreased by about 20% (*Figure 3.4*). It clearly shows that decrease in HFC-23 emissions (mainly due to reduced by-product emissions related to HCFC-22 production as a result of implementation of control technology) was partially compensated by the increase in HFC-134a emissions.

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, 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).

Table 3.6 Potential emissions per compound of HFCs, PFCs and SF_6 1990-1997 (Gg CO_2-eq.)

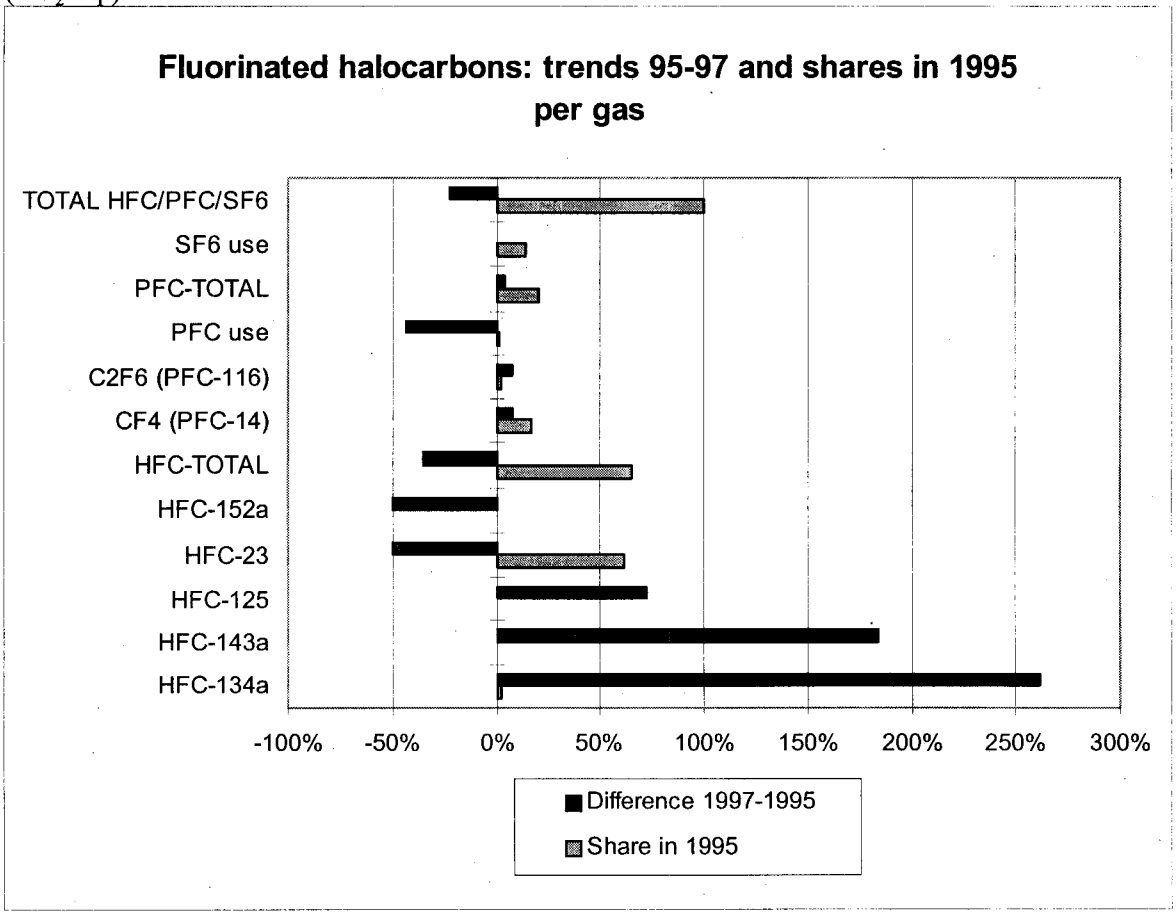
Compound	IPCC	GWP	1990	1991	1992	1993	1994	1995	1996	1997
HFC-134a	2F	1300	0	0	0	0	356	590	1 187	1 398
HFC-143a	2F	3800	0	0	0	0	0	129	315	350
HFC-125	2F	2800	0	0	0	0	0	140	286	274
HFC-23	2E	11700	0	0	0	0	0	0	0	0
HFC (unspecified)	2E	2000 (est.)	0	0	0	0	0	46	112	92
HFC-TOTAL			**0**	**0**	**0**	**0**	**356**	**905**	**1 900**	**2 114**
CF_4 (PFC-14)	2C	6500	0	0	0	0	0	0	0	0
C_2F_6 (PFC-116)	2C	9200	0	0	0	0	0	0	0	0
PFC use	2F	7200	0	0	0	0	0	166	94	94
PFC-TOTAL			**0**	**0**	**0**	**0**	**0**	**166**	**94**	**94**
SF_6	2F	23900	**1 386**	**1 386**	**1 410**	**1 434**	**1 458**	**1 458**	**1 458**	**1 458**
TOTAL HFC/PFC/SF_6			**1 386**	**1 386**	**1 410**	**1 434**	**1 814**	**2 529**	**3 451**	**3 665**

Table 3.7 Actual emissions per compound of HFCs, PFCs and potential SF_6 1990-1997 (Gg CO_2-eq.)

Compound	IPCC	GWP	1990	1991	1992	1993	1994	1995	1996	1997
HFC-134a	2F	1300	12	12	23	7	195	257	545	929
HFC-143a	2F	3800	10	10	10	10	24	47	90	132
HFC-125	2F	2800	20	20	20	20	55	81	120	139
HFC-23 *	2E	11700	5 101	4 820	4 540	5 066	6 271	6 271	6 271	3 136
HFC-152a	2E	140	1	1	1	4	3	3	3	2
HFC-TOTAL			**5 144**	**4 863**	**4 594**	**5 107**	**6 549**	**6 658**	**7 029**	**4 337**
CF_4 (PFC-14) **	2C	6500	2 012	1 981	1 771	1 778	1 794	1 685	1 786	1 820
C_2F_6 (PFC-116) **	2C	9200	285	280	251	252	254	239	253	258
PFC use	2F	7200	158	158	166	166	166	166	94	94
PFC-TOTAL			**2 456**	**2 420**	**2 187**	**2 196**	**2 214**	**2 089**	**2 133**	**2 171**
SF_6 use * **	2F	23900	**1 386**	**1 386**	**1 410**	**1 434**	**1 458**	**1 458**	**1 458**	**1 458**
TOTAL HFC/PFC/SF_6			**8 986**	**8 669**	**8 191**	**8 737**	**10 220**	**10 206**	**10 620**	**7 966**

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

Fig. 3.4 Shares and trends in actual emissions of fluorinated halocarbons 1995-1997 (SF_6 potential) (CO_2-eq.)



4. Trends in precursor gases

Figures that have been modified since the previous submission are: CO from transport and industry (1995 up); NMVOC from commercials (1990-1994) and from all sectors (1995 up); and SO_2 from industry (1995 up) and some minor changes (1990-1994). Trends in sectoral emissions of NO_x, CO, NMVOC and SO2 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 in 1997 the emissions were reduced by about 30% 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%. 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.

Fig. 3.5 Trends in total emissions of NO_x, CO, NMVOC and SO_2 1990-1997

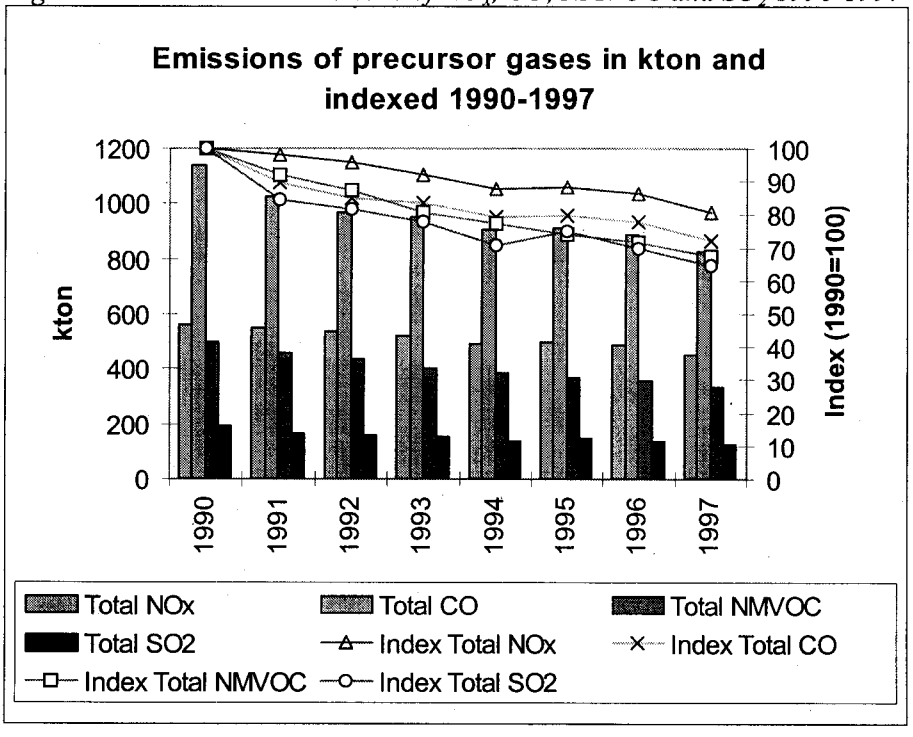


Table 4.1 CO emissions per IPCC sector 1990-1997 (Gg)

IPCC Sector	1990	1991	1992	1993	1994	1995	1996	1997
TOTAL NET NATIONAL EMISSIONS	**1139.2**	**1022.4**	**966.3**	**948.5**	**905.1**	**909.1**	**886.2**	**824.0**
1. All Energy (combustion and fugitive)	**981.8**	**891.3**	**861.6**	**846.0**	**799.9**	**811.6**	**711.9**	**648.3**
A Fuel combustion total	975.6	883.1	855.9	840.0	792.2	802.1	702.2	641.9
1 Energy transformation	16.6	18.8	16.4	15.3	17.1	17.3	46.1	24.1
2 Industry	114.2	108.3	114.8	139.1	114.3	120.5	31.4	32.0
3 Transport	748.9	658.4	626.4	582.3	559.9	563.7	522.1	483.5
4 Small combustion	95.9	97.5	98.3	103.3	101.0	100.6	102.6	102.2
5 Other	-	-	-	-	-	-	-	-
B Fugitive fuel emissions	6.2	8.2	5.7	6.0	7.6	9.5	9.7	6.4
2. Industrial processes	**153.6**	**127.4**	**101.1**	**99.1**	**101.7**	**94.8**	**171.6**	**173.1**
3. Solvent and other product use	**2.4**	**2.4**	**2.2**	**2.0**	**2.1**	**2.1**	**1.9**	**1.9**
4. Agriculture	-	-	-	-	-	-	-	-
5. Land use change and forestry	-	-	-	-	-	-	-	-
6. Waste	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**0.5**	**0.7**	**0.8**

Fig. 4.2 Shares and trends in CO emissions per IPCC sector 1990-1997

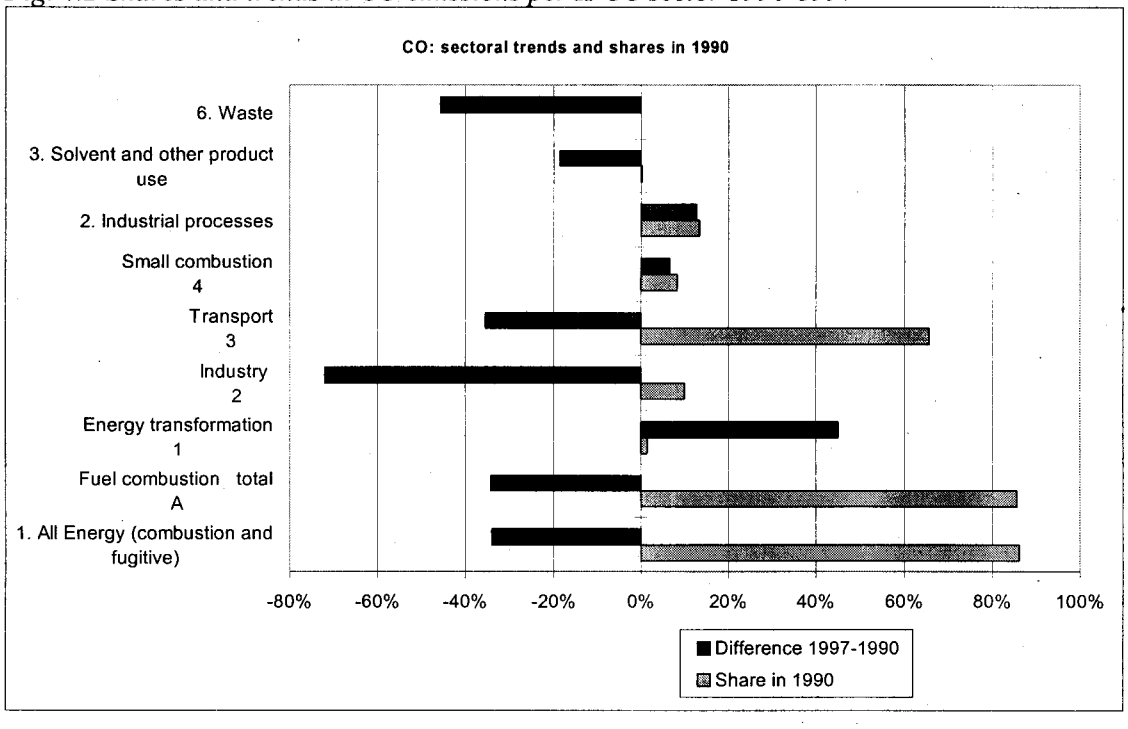


Table 4.2 NO_x emissions per IPCC sector 1990-1997 (Gg)

IPCC Sector	1990	1991	1992	1993	1994	1995	1996	1997
TOTAL NET NATIONAL EMISSIONS	**563.2**	**551.5**	**539.0**	**518.8**	**493.3**	**497.4**	**486.2**	**455.1**
1. All Energy (combustion and fugitive)	**549.2**	**537.9**	**525.9**	**505.0**	**482.4**	**485.4**	**466.5**	**434.6**
A Fuel combustion total	548.1	536.7	524.6	504.0	481.9	484.7	465.8	434.2
1 Energy transformation	102.8	95.6	95.9	91.7	81.4	75.7	71.3	56.1
2 Industry	65.7	60.4	61.4	54.6	54.4	52.4	46.0	45.5
3 Transport	336.9	336.2	325.5	311.8	304.4	314.9	301.7	291.2
4 Small combustion	42.7	44.5	41.8	45.8	41.7	41.7	46.8	41.4
5 Other	-	-	-	-	-	-	-	-
B Fugitive fuel emissions	1.1	1.2	1.3	1.0	0.5	0.7	0.6	0.4
2. Industrial processes	**13.5**	**13.1**	**12.7**	**13.4**	**10.4**	**9.2**	**17.9**	**18.4**
3. Solvent and other product use	**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**	**2.0**

Fig. 4.3 Shares and trends in NO_x emissions per IPCC sector 1990-1997

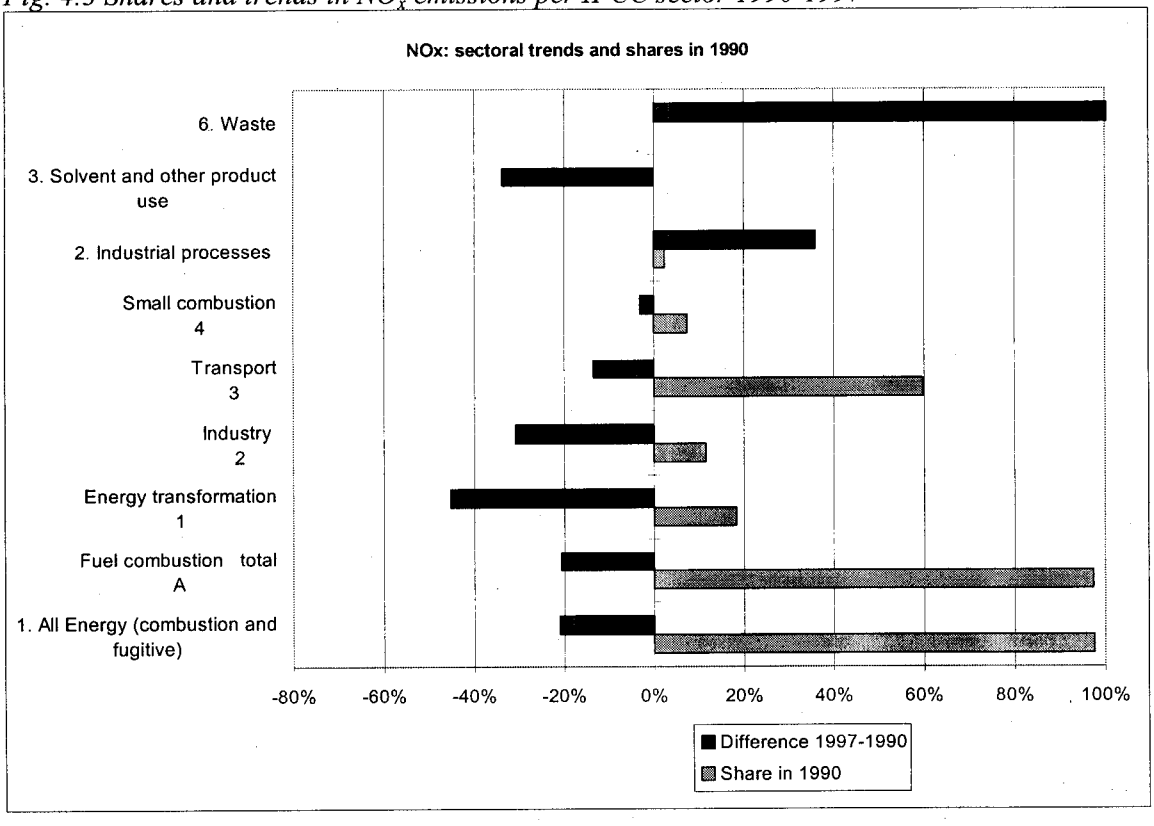


Table 4.3 NMVOC emissions per IPCC sector 1990-1997 (Gg)

IPCC Sector	1990	1991	1992	1993	1994	1995	1996	1997
TOTAL NET NATIONAL EMISSIONS	**499.8**	**460.4**	**436.1**	**403.1**	**387.6**	**369.7**	**358.5**	**336.3**
1. All Energy (combustion and fugitive)	**267.6**	**247.5**	**237.5**	**223.0**	**216.8**	**216.7**	**208.9**	**195.1**
A Fuel combustion total	220.1	200.1	194.1	181.1	174.5	173.8	166.4	158.0
1 Energy transformation	3.8	4.1	4.3	3.6	4.0	5.0	7.0	7.0
2 Industry	4.7	4.3	5.8	2.9	2.6	2.8	1.4	1.4
3 Transport	200.5	180.3	172.4	162.0	156.5	154.2	145.4	137.4
4 Small combustion	11.0	11.4	11.6	12.6	11.5	11.9	12.7	12.2
5 Other	-	-	-	-	-	-	-	-
B Fugitive fuel emissions	47.6	47.4	43.4	41.9	42.3	42.8	42.5	37.1
2. Industrial processes	**130.4**	**120.9**	**115.4**	**100.0**	**88.2**	**79.5**	**76.3**	**71.0**
3. Solvent and other product use	**101.4**	**91.7**	**82.8**	**79.8**	**82.3**	**71.7**	**71.3**	**68.0**
4. Agriculture	**0.2**	**0.2**	**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**	**1.9**

Fig. 4.4 Shares and trends in NMVOC emissions per IPCC sector 1990-1997

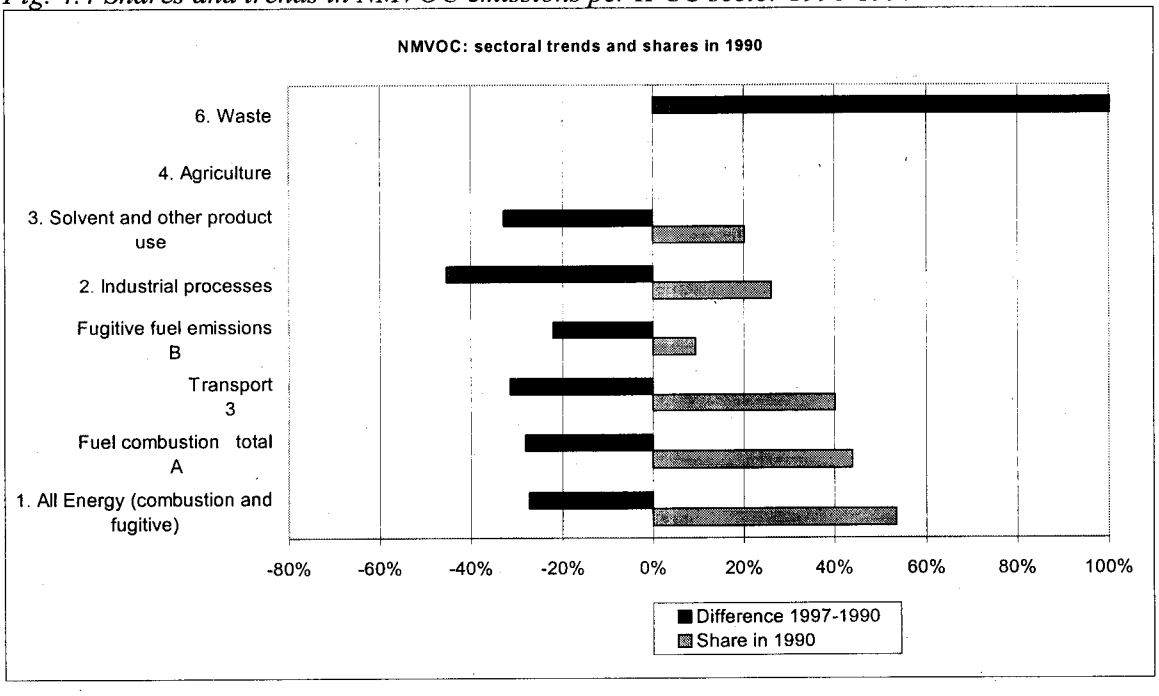
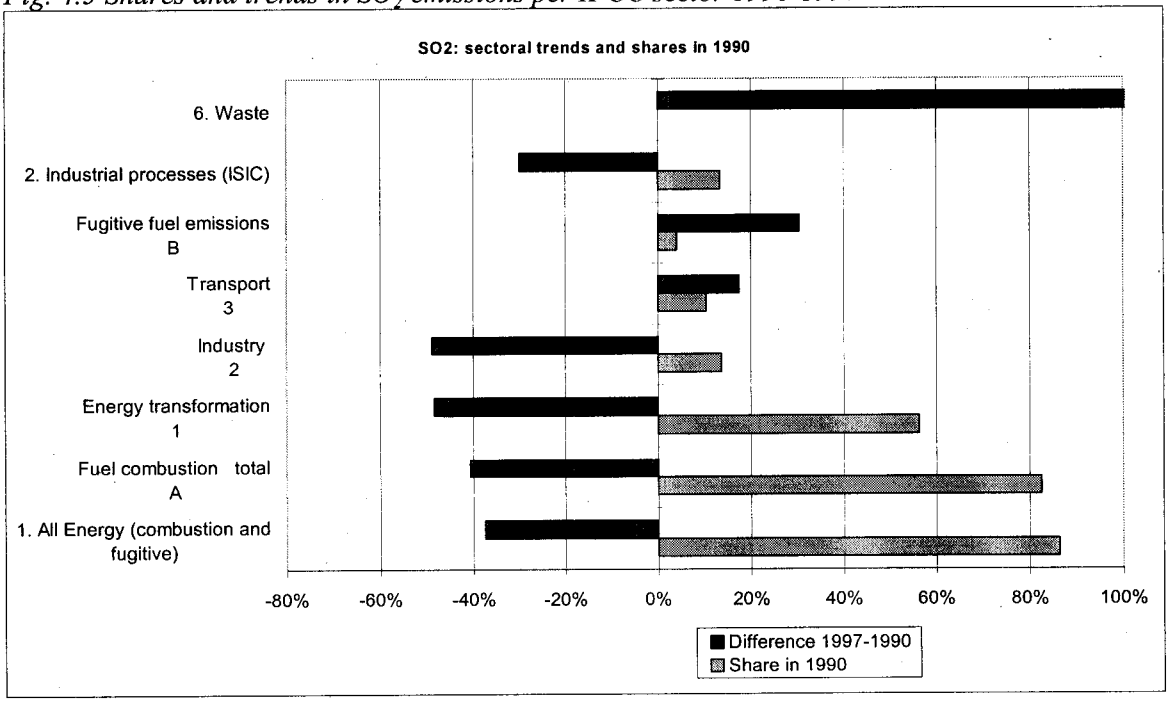


Table 4.4 SO_2 emissions per IPCC sector 1990-1997 (Gg)

IPCC Sector	1990	1991	1992	1993	1994	1995	1996	1997
TOTAL NET NATIONAL EMISSIONS	**193.2**	**163.5**	**157.4**	**150.5**	**136.6**	**145.0**	**135.0**	**124.4**
1. All Energy (combustion and fugitive)	**166.9**	**140.9**	**138.3**	**133.6**	**120.2**	**129.1**	**116.1**	**104.6**
A Fuel combustion total	159.1	131.2	126.8	122.2	109.5	118.7	105.7	94.5
1 Energy transformation	108.6	88.6	81.1	77.4	66.2	67.8	63.7	56.2
2 Industry	26.2	17.5	20.0	17.6	16.2	15.7	12.6	13.5
3 Transport	20.0	21.0	21.4	21.3	21.7	31.0	27.9	23.5
4 Small combustion	4.3	4.1	4.2	5.8	5.4	4.2	1.5	1.3
5 Other	-	-	-	-	-	-	-	-
B Fugitive fuel emissions	7.8	9.7	11.6	11.5	10.6	10.3	10.4	10.1
2. Industrial processes	**26.0**	**22.4**	**18.8**	**16.7**	**16.2**	**14.8**	**17.9**	**18.2**
3. Solvent and other product use	**0.3**	**0.2**	**0.1**	**0.1**	**0.2**	**0.0**	**0.0**	**0.0**
4. Agriculture	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.2**	**0.2**	**0.0**
5. Land use change and forestry	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
6. Waste	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**0.9**	**0.9**	**1.5**

Fig. 4.5 Shares and trends in SO_2 emissions per IPCC sector 1990-1997



5. Trends in total greenhouse gas emissions

In order to analyse the trend in total emissions of greenhouse gases and compare the contribution of the various gases, we converted all emissions of non-CO_2 direct greenhouse gases into CO_2-eq. using 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 national total (net) emissions are summarised for 1990-1997. The trends are also visualised in *Figures 5.1 and 5.2*, showing the relative contribution of each gas to annual total emissions. From 1990 to 1997 emissions of CO_2 and N_2O increased (with a fluctuation of CO_2 in 1996 due to a very cold winter) by 14% and 10%, respectively, while in the same period CH_4 emissions decreased by 14%. Taking the 'new' gases, for which 1995 is a reference year, emissions of HFCs decreased substantially in 1997 to a level 35% lower than in 1995, while emissions of PFCs and SF_6 (potential) remained at the same level. Overall CO_2-eq. emissions increased in 1997 by 8% relative to 1990 and 1995 for the 'old' and 'new' greenhouse gases, respectively (6% when correcting for temperature).

In *Table 5.2* the same emissions are presented but now with CO_2 emissions corrected for temperature in order to take out the climatic influence that partially masks the trends in emissions. With temperature correction CO_2-eq. emissions 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 the emissions from the 'small combustion sector' are clearly deviation from the trend.

Table 5.1 Total greenhouse gas emissions in CO_2-eq. and indexed (no T-corr.) 1990-1997

	1990	1991	1992	1993	1994	1995	1996	1997
Emissions (Tg CO_2-eq)								
CO_2	161.4	166.9	165.2	167.5	168.4	177.2	186.2	183.3
CH_4	27.1	27.5	26.4	25.7	25.3	24.6	24.8	23.3
N_2O	20.4	20.7	21.5	21.3	21.9	22.4	22.4	22.4
HFCs	5.1	4.9	4.6	5.1	6.5	6.7	7.0	4.3
PFCs	2.5	2.4	2.2	2.2	2.2	2.1	2.1	2.2
SF_6 (potential)	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5
Total [group of six]	**217.9**	**223.8**	**221.2**	**223.3**	**225.8**	**234.4**	**244.0**	**237.0**
Index (1990=100)								
Index CO_2	100	103.4	102.4	103.8	104.3	109.8	115.4	113.6
Index CH_4	100	101.3	97.2	94.8	93.1	90.7	91.4	86.0
Index N_2O	100	101.7	105.2	104.6	107.4	109.7	109.5	109.5
Total [group of three]	**100**	**103.0**	**102.0**	**102.7**	**103.2**	**107.3**	**111.7**	**109.6**
Index HFCs	100	94.5	89.3	99.3	127.3	129.4	136.7	84.3
Index PFCs	100	98.5	89.1	89.4	90.1	85.1	86.8	88.4
Index SF_6 (potential)	100	100.0	101.7	103.4	105.2	105.2	105.2	105.2
Index [group of six]	**100**	**102.7**	**101.5**	**102.5**	**103.6**	**107.6**	**111.9**	**108.7**
Index (1995 = 100)								
Index HFCs	77.3	73.0	69.0	76.7	98.4	100	105.6	65.1
Index PFCs	117.5	115.8	104.7	105.1	105.9	100	102.1	103.9
Index SF_6 (potential)	95.1	95.1	96.7	98.4	100.0	100	100.0	100.0
Index [group of new gases]	**88.0**	**84.9**	**80.3**	**85.6**	**100.1**	**100**	**104.1**	**78.1**
Index ('90; new gases '95)								
Index [group of six composite]	**99.4**	**102.1**	**101.0**	**101.9**	**103.0**	**107.0**	**111.3**	**108.1**

Fig. 5.1. Trend in greenhouse gas emissions per gas 1990-1997 (no T-correction)

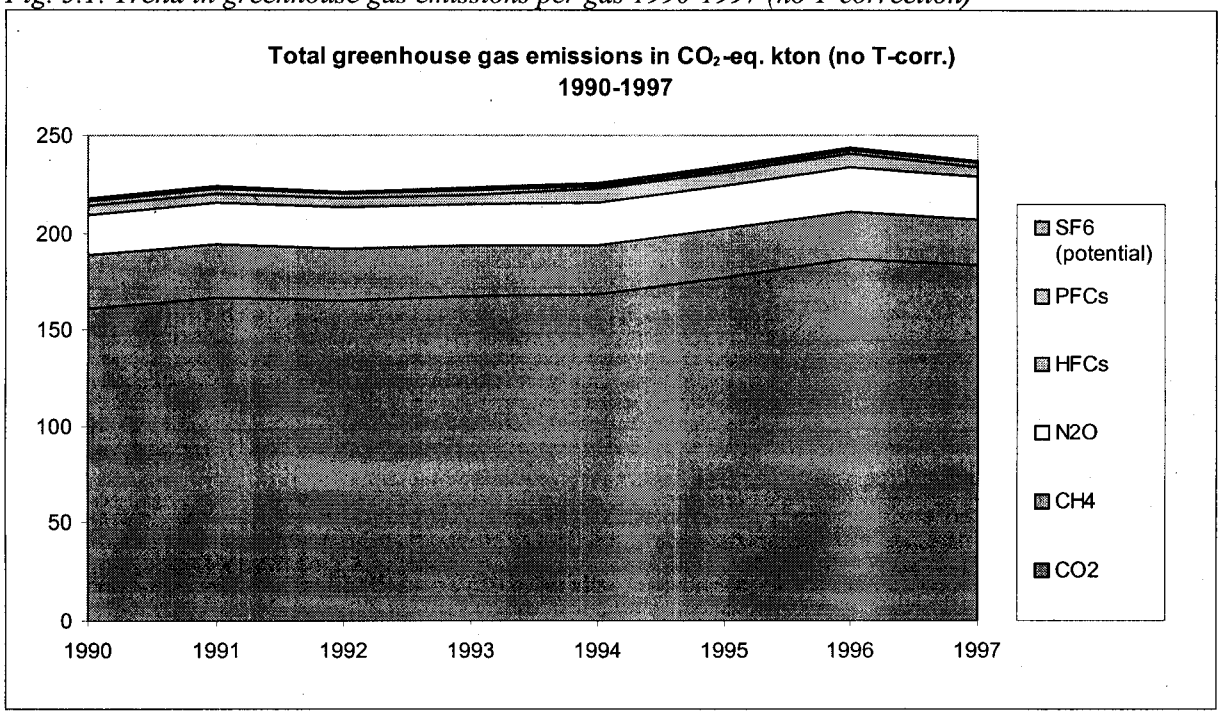


Fig. 5.2. Shares and trends in greenhouse gas emissions per gas 1990-1997 (1995-1997 for new gases) (also showing CO_2 with temperature correction)

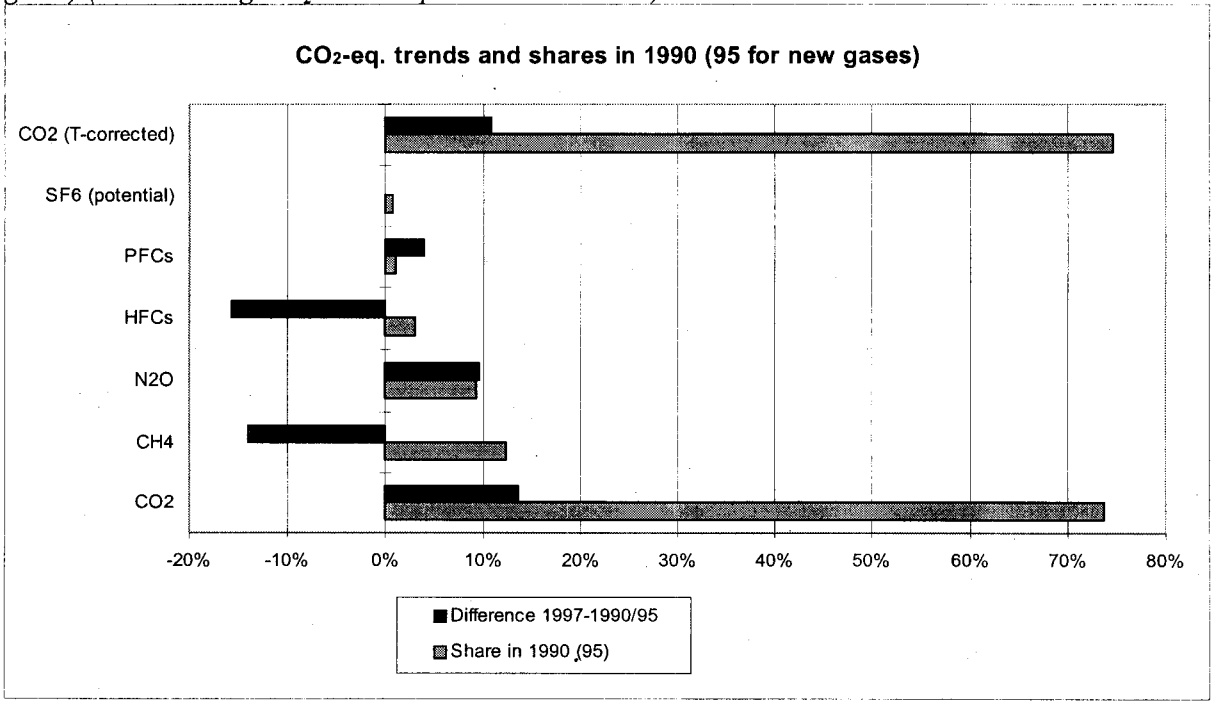


Table 5.2 Total greenhouse gas emissions in CO_2-eq. and indexed (with T-corr.) 1990-1997

	1990	1991	1992	1993	1994	1995	1996	1997
Emissions (Tg CO_2-eq)								
CO_2 *(T-corrected)*	167.6	167.3	169.5	168.6	172.1	179.7	181.9	185.7
CH_4	27.1	27.5	26.4	25.7	25.3	24.6	24.8	23.3
N_2O	20.4	20.7	21.5	21.3	21.9	22.4	22.4	22.4
HFCs	5.1	4.9	4.6	5.1	6.5	6.7	7.0	4.3
PFCs	2.5	2.4	2.2	2.2	2.2	2.1	2.1	2.2
SF_6 (potential)	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5
Total [group of six]	**224.1**	**224.2**	**225.5**	**224.4**	**229.5**	**236.9**	**239.7**	**239.4**
Index (1990 = 100)								
Index CO_2 (T-corrected)	100	99.8	101.1	100.6	102.7	107.2	108.5	110.8
Index CH_4	100	101.3	97.2	94.8	93.1	90.7	91.4	86.0
Index N_2O	100	101.7	105.2	104.6	107.4	109.7	109.5	109.5
Total [group of three]	**100**	**100.2**	**101.0**	**100.2**	**101.9**	**105.4**	**106.5**	**107.6**
Index ('90; new gases '95)								
Index [group of six composite]	**99.5**	**99.5**	**100.1**	**99.6**	**101.8**	**105.1**	**106.4**	**106.2**

Table 5.3 Emissions of precursor gases in kton and indexed 1990-1997 (1990=100)

Indirect gases and SO_2	1990	1991	1992	1993	1994	1995	1996	1997
Emissions in kton								
Total NO_x	563.2	551.5	539.0	518.8	493.3	497.4	486.2	455.1
Total CO	1139.2	1022.4	966.3	948.5	905.1	909.1	886.2	824.0
Total NMVOC	499.8	460.4	436.1	403.1	387.6	369.7	358.5	336.3
Total SO_2	193.2	163.5	157.4	150.5	136.6	145.0	135.0	124.4
Index (1990=100)								
Index Total NO_x	100.0	97.9	95.7	92.1	87.6	88.3	86.3	80.8
Index Total CO	100.0	89.7	84.8	83.3	79.4	79.8	77.8	72.3
Index Total NMVOC	100.0	92.1	87.2	80.6	77.5	74.0	71.7	67.3
Index Total SO_2	100.0	84.6	81.5	77.9	70.7	75.1	69.9	64.4

Fig. 5.3. Trend in CO_2-eq. emissions per sector 1990-1997 (no T-correction)

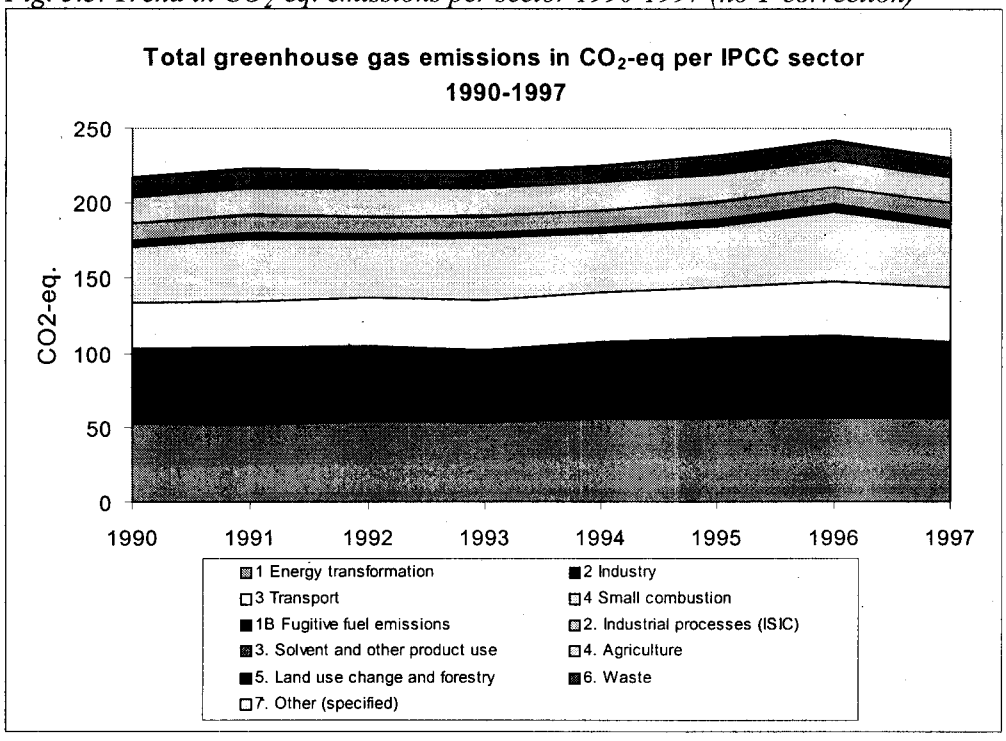
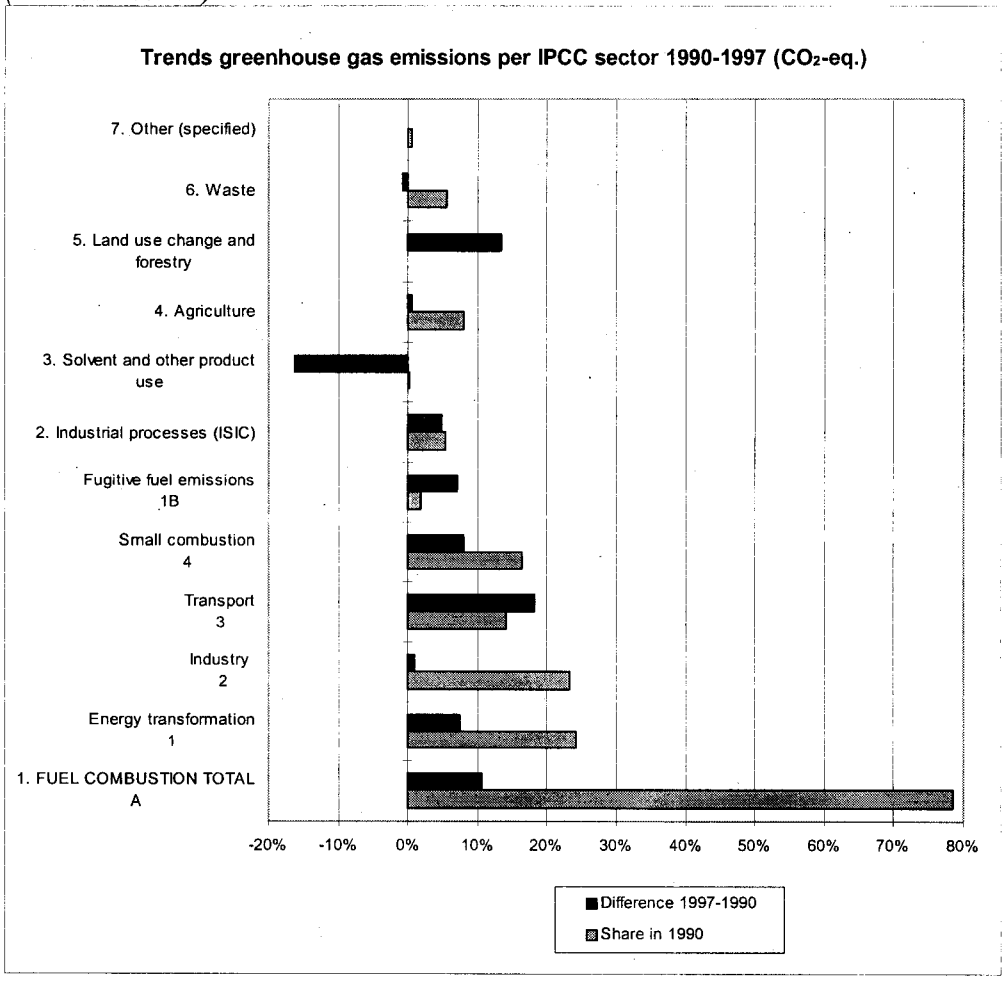


Fig. 5.4. Shares and trends in CO_2-eq. emissions per sector 1990-1997 (1995-1997 for new gases) (no T-correction)



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Appendix A: Summary Reports 1990-1997 [IPCC Tables 7A]

Year: 1990

Emissions of greenhouse gases in the Netherlands, year 1990.

Emissions of carbon dioxide are listed with and without temperature correction.

YEAR: 1990

Greenhouse gas emissions and sinks (Gg)	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOC	SO2
TOTAL NET NATIONAL EMISSIONS	**161 400**	**167 600**	**1292.3**	**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**	**2.0**	**0.5**	**0.1**	**2.4**	**101.4**	**0.3**
4. Agriculture	**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
D 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:	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOS	SO2
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

Year: 1991

Emissions of greenhouse gases in the Netherlands, year 1991.

Emissions of carbon dioxide are listed with and without temperature correction.

YEAR: 1991

Greenhouse gas emissions and sinks (Gg)	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOC	SO2
TOTAL NET NATIONAL EMISSIONS	**166 900**	**167 300**	**1308.8**	**66.9**	**551.5**	**1022.4**	**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
D 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:	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOS	SO2
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

Year: 1992

Emissions of greenhouse gases in the Netherlands, year 1992.

Emissions of carbon dioxide are listed with and without temperature correction.

YEAR: 1992

Greenhouse gas emissions and sinks (Gg)	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOC	SO2
TOTAL NET NATIONAL EMISSIONS	**165 200**	**169 500**	**1256.2**	**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
D 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	0.0	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	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:	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOS	SO2
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

Year: 1993

Emissions of greenhouse gases in the Netherlands, year 1993.

Emissions of carbon dioxide are listed with and without temperature correction.

YEAR: 1993

Greenhouse gas emissions and sinks (Gg)	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOC	SO2
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**	**2.0**	**0.5**	**0.1**	**2.0**	**79.8**	**0.1**
4. Agriculture	**0**	**0**	**497.0**	**26.2**	**-**	**-**	**0.2**	**-**
A Enteric fermentation	-	-	393.0	-	-	-	-	-
B Manure management	-	-	104.0	0.8	-	-	-	-
D 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:	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOS	SO2
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	-

Year: 1994

Emissions of greenhouse gases in the Netherlands, year 1994

Emissions of carbon dioxide are listed with and without temperature correction.

YEAR: 1994

Greenhouse gas emissions and sinks (Gg)	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOC	SO2
TOTAL NET NATIONAL EMISSIONS	**168 300**	**172 100**	**1203.0**	**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**	**2.3**	**0.5**	**0.1**	**2.1**	**82.3**	**0.2**
4. Agriculture	**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
D 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)								
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:	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOS	SO2
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

Year: 1995

Emissions of greenhouse gases in the Netherlands, year 1995.

Emissions of carbon dioxide are listed with and without temperature correction.

YEAR: 1995

Greenhouse gas emissions and sinks (Gg)	CO2 not corrected	CO2 corrected	CH4	N2O	NOx	CO	NMVOC	SO2
TOTAL NET NATIONAL EMISSIONS	**177 200**	**179 700**	**1172.5**	**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**	**2.0**	**0.5**	**0.1**	**2.1**	**71.7**	**0.0**
4. Agriculture	**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
D Agricultural soils	-	-	0.0	26.8	0.0	0.0	0.2	0.0
5. Land use change and forestry	**(-1 700)**	**(-1 700)**						
A Changes in woody biomass stocks	(-1 700)	(-1 700)						
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:	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOS	SO2
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

Year: 1996

Emissions of greenhouse gases in the Netherlands, year 1996

Emissions of carbon dioxide are listed with and without temperature correction.

YEAR: 1996

Greenhouse gas emissions : nd sinks (Gg)	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOC	SO2
TOTAL NET NATIONAL EMISSIONS	**186 200**	**181 900**	**1180.8**	**72.1**	**486.2**	**886.2**	**358.5**	**134.8**
1. All Energy (combustion and fugitive)	**182 500**	**178 200**	**230.7**	**8.0**	**466.5**	**711.9**	**208.9**	**116.1**
A Fuel combustion total	181 380	177 120	38.0	8.0	465.8	702.2	166.4	105.7
1 Energy transformation	57 360	57 240	5.8	0.4	71.3	46.1	7.0	63.7
a Electricity and heat production	*44 910*	*44 790*	*1.3*	*0.4*	*51.2*	*14.0*	*1.5*	*19.0*
c Other transformation	*12 450*	*12 450*	*4.5*	*0.1*	*20.2*	*32.1*	*5.5*	*44.7*
2 Industry	*43 310*	*43 010*	*1.5*	*0.1*	*46.0*	*31.4*	*1.4*	*12.6*
a-e Only combustion								
b from feedstocks								
3 Transport	33 530	33 530	6.1	7.4	301.7	522.1	145.4	27.9
4 Small combustion	45 200	41 370	24.5	0.1	46.8	102.6	12.7	1.5
a Commercial / Institutional	*10 870*	*9 940*	*1.4*	*0.0*	*9.7*	*3.0*	*1.3*	*0.5*
b Residential	*24 030*	*22 010*	*20.4*	*0.1*	*26.8*	*98.1*	*9.5*	*0.7*
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	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)	*1 950*	*1 950*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
B Fugative fuel emissions	1 160	1 160	192.8	0.0	0.6	9.7	42.5	10.4
2 *Crude oil and natural gas: process emissions*	*1 160*	*1 160*	*192.8*	*0.0*	*0.6*	*9.7*	*42.5*	*10.4*
2. Industrial processes	**1 800**	**1 800**	**5.8**	**31.7**	**17.9**	**171.6**	**76.3**	**17.9**
A Mineral products	930	930	0.1	0.0	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	0.0	7.3	132.8	3.1	10.1
D Other production	440	440	0.1	0.0	0.2	4.5	6.9	0.1
G Other	390	390	0.1	0.0	0.2	0.9	47.9	0.4
3. Solvent and other product use	**0**	**0**	**2.0**	**0.5**	**0.1**	**1.9**	**71.3**	**0.0**
4. Agriculture	**0**	**0**	**464.8**	**27.5**	**0.0**	**0.0**	**0.2**	**0.0**
A Enteric fermentation	-	-	365.8	0.0	0.0	0.0	0.0	0.0
B Manure management	-	-	99.0	[illegible]	0.0	0.0	0.0	0.0
D Agricultural soils	-	-	0.0	26.8	0.0	0.0	0.2	0.0
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	0.0	0.0	0.0	0.8	0.0
B Waste water handling	-	-	0.6	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	1 870	1 870	0.0	0.1	1.8	0.7	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:	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOS	SO2
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	**4 300**	**4 300**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
S2a Biomass burned for energy (residential)	1 650	1 650	NA	NA	NA	NA	NA	NA
S2b Waste incineration (organic fraction)	2 630	2 630	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

Year: 1997

Emissions of greenhouse gases in the Netherlands, year 1997

Emissions of carbon dioxide are listed with and without temperature correction.

YEAR: 1997

Greenhouse gas emissions and sinks (Gg)	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOC	SO2
TOTAL NET NATIONAL EMISSIONS	**183 300**	**185 700**	**1111.6**	**72.1**	**455.1**	**824.0**	**336.3**	**124.4**
1. All Energy (combustion and fugitive)	**179 300**	**181 700**	**196.2**	**7.4**	**434.6**	**648.3**	**195.1**	**104.6**
A Fuel combustion total	178 270	180 630	34.9	7.4	434.2	641.9	158.0	94.5
1 Energy transformation	56 600	56 660	5.9	0.0	56.1	24.1	7.0	56.2
a Electricity and heat production	44 530	44 590	1.3	0.0	36.7	14.3	1.7	15.2
c Other transformation	12 080	12 080	4.6	0.0	19.5	9.8	5.4	41.0
2 Industry	*42 930*	*43 090*	1.5	0.2	45.5	32.0	1.4	13.5
a-e Only combustion								
b from feedstocks								
3 Transport	*34 060*	*34 060*	5.8	7.0	291.2	483.5	137.4	23.5
4 Small combustion	*38 210*	*40 330*	21.7	0.1	41.4	102.2	12.2	1.3
a Commercial / Institutional	9 390	9 900	*1.2*	*0.0*	*8.4*	*2.6*	*1.2*	*0.4*
b Residential	20 150	21 270	*17.8*	*0.1*	*22.9*	*98.1*	*9.2*	*0.6*
c Agriculture / Forestry / Fishing	*8 680*	*9 170*	*2.7*	*0.0*	*10.0*	*1.6*	*1.8*	*0.3*
5 Other	*6 460*	*6 460*	0.0	0.0	0.0	0.0	0.0	0.0
a Waste sector (fossil fuel)	*40*	*40*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
b Other energy-use (statistical differences)	6 420	6 420	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
B Fugative fuel emissions	*1 080*	*1 080*	161.3	0.0	0.4	6.4	37.1	10.1
2 Crude oil and natural gas: process emissions	1 080	1 080	161.3	0.0	0.4	6.4	37.1	10.1
2. Industrial processes	**1 800**	**1 800**	**5.2**	**33.5**	**18.4**	**173.1**	**71.0**	**18,2**
A Mineral products	940	940	0.1	0.0	1.2	1.1	0.4	2.9
B Chemical Industry	-	-	4.7	33.5	9.5	34.3	16.2	4.7
C Metal production	-	-	0.3	0.0	7.2	132.1	3.1	10.1
D Other production	460	460	0.1	0.0	0.2	4.6	6.5	0.1
G Other	390	390	0.1	0.0	0.2	0.9	44.8	0.4
3. Solvent and other product use	**0**	**0**	**2.0**	**0.4**	**0.1**	**1.9**	**68.0**	**0.0**
4. Agriculture	**0**	**0**	**447.6**	**26.4**	**0.0**	**0.0**	**0.2**	**0.0**
A Enteric fermentation	-	-	352.6	0.0	0.0	0.0	0.0	0.0
B Manure management	-	-	95.0	0.7	0.0	0.0	0.0	0.0
D Agricultural soils	-	-	0.0	25.7	0.0	0.0	0.2	0.0
5. Land use change and forestry	**(-1 700)**	**(-1 700)**						
A Changes in woody biomass stocks	(-1 700)	(-1 700)						
6. Waste	**2 100**	**2 100**	**460.6**	**0.6**	**2.0**	**0.8**	**1.9**	**1.5**
A Solid waste disposal on land	-	-	460.0	0.0	0.0	0.0	0.8	0.0
B Waste water handling	0	0	0.6	0.5	0.0	0.0	0.0	0.0
C Waste incineration (non-energy)	-	-	0.0	0.0	0.0	0.0	0.6	0.0
D Other waste	2 140	2 140	0.0	0.1	2.0	0.8	0.5	1.5
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:	CO2 not corrected	CO2 T-corrected	CH4	N2O	NOx	CO	NMVOS	SO2
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	**4 900**	**4 900**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
S2a Biomass burned for energy (residential)	1 670	1 670	NA	NA	NA	NA	NA	NA
S2b Waste incineration (organic fraction)	3 200	3 200	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

Uncertainty estimate (all years) (with uncertainty factor of 1.5):
CO2: 2%; CH4: 25%; N2O: 35%
CO, NOX, SO2: 25%; NMVOC: 50%
HFCs, SF6: 50%; PFCs: 100%

Appendix B: Summary Report HFC/PFC/SF_6 1990-1997: Potential and actual emissions

IPCC Category	Compound	Potential/Actual	1990	1991	1992	1993	1994	1995	1996	1997
2 TOTAL INDUSTRIAL PROCESSES* **										
	HFCs	P *	0.000	0.000	0.000	0.000	0.274	0.561	1.154	1.311
		A	0.460	0.436	0.426	0.474	0.736	0.798	1.046	1.079
	PFCs	P *	0.000	0.000	0.000	0.000	0.000	0.023	0.013	0.013
		A	0.363	0.357	0.323	0.324	0.327	0.308	0.315	0.321
	SF6	P	0.058	0.058	0.059	0.060	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
2C Metal production										
	HFCs	P *	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
	PFCs	P *	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
	SF6	P	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
2E Prod. of halocarbons and SF6										
	HFCs	P	0.000	0.000	0.000	0.000	0.000	0.023	0.056	0.046
		A	0.441	0.417	0.398	0.459	0.560	0.560	0.560	0.280
	PFCs	P	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
	SF6	P	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
2F Other (specified)										
	HFCs	P	0.000	0.000	0.000	0.000	0.274	0.538	1.098	1.265
		A	0.019	0.019	0.028	0.015	0.176	0.238	0.486	0.799
	PFCs	P	0.000	0.000	0.000	0.000	0.000	0.023	0.013	0.013
		A	0.022	0.022	0.023	0.023	0.023	0.023	0.013	0.013
	SF6	P	0.058	0.058	0.059	0.060	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

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

Uncertainty estimate (with uncertainty factor of 1.5):
HFCs and SF_6: ±50%;
PFCs: ±100%

Appendix C: Correspondence between Netherlands Target Groups and IPCC Sectors according to the Revised IPCC Guidelines

Notes with Table C2:
* Not Applicable
** Not estimated
*** Included elsewhere

1) Of which cogeneration to be specified.
2) To be specified further into different modes/fuel types.
3) All waste incineration (except of WWTP) in the Netherlands is energy-related.
4) Source of anthropogenic N_2O. Since about 1/4 of N_2O from this source originates from non-agricultural sources, these emissions were not included under 4D but are reported separately under 7B.

a) Including biofuel combustion, except CO_2 from biofuels which are reported under S2.
b) Only CO_2 from biofuel (including biogas).
c) Only CO_2 from tobacco smoking.
d) Non-CO_2 from landfill gas combustion, which is mainly for energetic purposes (heat production).
e) Fossil fuel combustion by waste management facilities.
f) Including all CO_2 from fossil origin; excluding CO_2 from organic waste. Predominantly for energetic purposes (heat and electricity production), therefore reported under 1A1c.
g) Emissions from landfills, except for CO_2 from organic waste, which is reported under S2.
h) CO_2 from organic waste in landfills and from process emissions of WWTP
i) Not for CO_2, which is reported under S2.
j) CO_2 only.
k) N_2O only.
l) Not for CO_2.

Table C.1: Description of Netherlands' Target Group

Target Group	Subsectors included
Waste:	includes landfills and waste incineration; excluding Waste Water Treatment Plants (WWTP), which is a separate Target Group.
Construction:	construction of buildings and roads.
Residential:	energy use by residential dwellings and residential activities in households.
Drinking water:	drinking water production and distribution.
Energy:	public power generation, oil and gas exploration, production and transmission; excluding refineries and coke production; including joint ventures between industry and energy sector for co-generation.
Commercial:	commercial and public services; excluding drinking water production and distribution, including auto- and co-generators within the commercial sector.
Industry:	including coke production; excluding the construction sector; excluding energy production and processing; also excluding refineries, including auto- and co-generators within the industry.
Agriculture:	including fuel combustion; including indirect emissions from agricultural soils (including natural background emissions, since in measurements they cannot be distinguished from indirect emissions resulting from agricultural activities), including co-generators within the agriculture.
Refineries:	ibid.
Waste Water Treatment Plants	ibid.
Transport:	all modes of transport, including *all* LTO cycles of aircraft; including off-road vehicles, e.g. used for construction and agriculture
Other:	statistical differences (CO_2) and polluted surface water
Indirect:	actual emissions from feedstocks (CO_2)

Table C.2: Correspondence between Netherlands Target Groups and IPCC Sectors

Relation Target Groups - IPCC Sectors (cf. Revised 1996 IPCC Guidelines)

	Agriculture				Industry			Construction	Refineries		Energy sector			Transport		Residentials		Commercials		Drinking water		Waste Management				WWTP		Other		Bunkers		Nature	
	C	P	P	P	C	P	P	C	C	P	C	P	P	C	P	C	P	C	P	C	P	C	C	P	P	C	P	C	P	C	P	C	P
		Manure	Ferment.	other		Feedstock	Other					Flaring*.	FGD										(Bio-)Fun	Incin.	Landfill	Other					*	*	
Total national emissions																																
1. Energy (combustion and fugitive)																																
1A Fuel Combustion																																
1A1 Energy industries																																
1A1a Electricity and heat production 1)											E a)										W d)	W f)										
1A1c Other transformation 1)									R																							
1A2 Industry and construction (only energy) 1)																																
1A2a-e Industry - Combustion					I a)			C																								
1A2f Industry - Actual from feedstocks						I																										
1A3 Transport														T	T																	
1A3a Civil aviation														x	x																	
1A3b Road transportation 2)														x	x																	
1A3c Railways														x	x																	
1A3d Navigation														x	x																	
1A3e Other (specify)														x	x																	
1A4 Other sectors																		C		D												
1A4a Commercial/Institutional 1)																																
1A4b Residential 1)																R a)																
1A4c Agriculture/forestry/fishing 1)	A																															
1A5 Other																																
1A5a Stationary: Waste																					W e)											
1A5c Statistical differences																												O j)				
1B Fugitive emissions from Fuels																																
1B1 Solid fuels *																																
1B2 Oil and Natural Gas										R		E																				
2. Industrial processes							I																									
2A Mineral products							x																									
2B Chemical industry							x																									
2C Metal production							x																									
2D Other produsction							x																									
2E Production of halocarbons and sulphur hexafluoride							x																									
2F Consumption of halocarbons and sulphur hexafluoride							x																									
2G Other (specified)							x						E																			
3. Solvent and other product use								C									R		C													
3A Paint application ***								x									x		x													
3B Degreasing and dry cleaning ***																	x		x													
3C Chemical products, manufacture and processing ***																	x		x													
3D Other (specified)								x									x		x		D											
4. Agriculture																																
4A Enteric fermentation			A																													
4B Manure management 3)		A																														
4C Rice cultivation *																																
4D Agricultural soils				A																												
4E Prescribed Burning of Savannas *																																
4F Field Burning of Agricultural Residues *																																
4G Other (specified) *																																
5. Land-Use Change & Forestry																																
5A Changes in Forest and Other Woody Biomass Stocks																																
5B Forest and Grassland Coversion *																																
5C Abandonment of Managed Lands *																																
5D CO2 Emissions and Removals from Soil **																																
5E Other (specified) *																																
6. Waste																																
6A Solid Waste Disposal on Land																							W g)									
6B Wastewater handling																										WWi)						
6C Waste Incineration 3)																																
6D Other (specified)																								W	WW							
7. Other																																
7B Polluted surface water 4)																												O k)				
Memo items:																																
A. International bunkers																													B			
S1a Aviation																													x			
S1b Marine																													x			
B. CO2 - Organic origin																																
S2a CO2 emissions from biomass burned for energy / biofuels					I b) **						E b) **					R b)					W b)	W b)										
S2b CO2 process emissions from organic waste																							W h)			WWh)						
S2c CO2 from tobacco smoking																	R c)															
C. Natural sources																																
S3 Nature																																N l)

Appendix D: Fossil energy balances 1990-1997

Energy consumption in the Netherlands **1990** Unit: PJ

IPCC sector 1A			Coal and coal products	Crude oil & oil products	Natural	Other	TOTAL actual	TOTAL T-corr.
1	a	Electricity and heat production	250	2	232	-168	316	319
	b	Other energy sector and refineries	0	150	46	3	199	199
2	a-e	Industry: combust.& transformation	105	83	334	80	603	617
		Industry: feedstocks	5	246	95	21	367	367
3	b	Transport: road	0	352	0		352	352
		Transport: other	0	19	0	5	23	23
4	a	Commercial / Institutional	8	55	137	77	277	299
	b	Residential	1	10	329	64	404	456
	c	Agriculture / Forestry / Fishing	0	10	129	9	148	169
5	a	Waste sector	0	0	0		0	0
	b	Statistical differences	7	16	-13	4	14	14
TOTAL ENERGY CONSUMPTION			**375**	**942**	**1290**	**95**	**2702**	**2814**

Energy consumption in the Netherlands **1991** Unit: PJ

IPCC sector 1A			Coal and coal products	Crude oil & oil products	Natural	Other	TOTAL actual	TOTAL T-corr.
1	a	Electricity and heat production	227	4	273	-179	326	326
	b	Other energy sector and refineries	0	159	54	0	213	213
2	a-e	Industry: combust.& transformation	99	73	339	87	598	599
		Industry: feedstocks	4	256	102	18	380	380
3	b	Transport: road	0	355	0		355	355
		Transport: other	0	16	0	5	21	21
4	a	Commercial / Institutional	7	52	168	81	308	309
	b	Residential	1	10	374	66	450	453
	c	Agriculture / Forestry / Fishing	0	11	146	10	167	168
5	a	Waste sector	0	0	0	0	0	0
	b	Statistical differences	0	25	-14	7	18	18
TOTAL ENERGY CONSUMPTION			**338**	**961**	**1442**	**95**	**2836**	**2843**

Energy consumption in the Netherlands **1992** Unit: PJ

IPCC sector 1A			Coal and coal products	Crude oil & oil products	Natural	Other	TOTAL actual	TOTAL T-corr.
1	a	Electricity and heat production	225	2	282	-175	335	337
	b	Other energy sector and refineries	0	155	59	-3	211	211
2	a-e	Industry: combust.& transformation	99	102	336	89	626	634
		Industry: feedstocks	4	235	101	17	358	358
3	b	Transport: road	0	372	0		372	372
		Transport: other	0	14	0	5	19	19
4	a	Commercial / Institutional	7	51	154	86	298	314
	b	Residential	1	9	336	69	414	450
	c	Agriculture / Forestry / Fishing	0	12	148	10	170	185
5	a	Waste sector	0	0	0	0	0	0
	b	Statistical differences	-4	15	-20	8	-1	-1
TOTAL ENERGY CONSUMPTION			**332**	**967**	**1396**	**106**	**2802**	**2879**

Energy consumption in the Netherlands **1993** Unit: PJ

IPCC sector 1A			Coal and coal products	Crude oil & oil products	Natural gas	Other	TOTAL actual	TOTAL T-corr.
1	a	Electricity and heat production	221	2	297	-188	332	333
	b	Other energy sector and refineries	0	163	67	-3	227	227
2	a-e	Industry: combust.& transformation	104	101	326	105	635	637
		Industry: feedstocks	4	201	97	21	322	322
3	b	Transport: road		381			381	381
		Transport: other		10		5	15	15
4	a	Commercial / Institutional	9	53	166	88	316	320
	b	Residential	0	10	356	71	437	446
	c	Agriculture / Forestry / Fishing	0	12	153	10	175	179
5	a	Waste sector	0	0	0	0	0	0
	b	Statistical differences	9	26	-20	3	18	18
TOTAL ENERGY CONSUMPTION			**347**	**958**	**1440**	**113**	**2858**	**2878**

Energy consumption in the Netherlands **1994** Unit: PJ

IPCC sector 1A			Coal and coal products	Crude oil & oil products	Natural gas	Other	TOTAL actual	TOTAL T-corr.
1	a	Electricity and heat production	252	9	285	-205	341	343
	b	Other energy sector and refineries	0	165	68	-7	225	225
2	a-e	Industry: combust.& transformation	82	101	324	128	634	641
		Industry: feedstocks	18	211	103	19	350	350
3	b	Transport: road		386			386	386
		Transport: other		13		5	19	19
4	a	Commercial / Institutional	6	53	143	90	292	307
	b	Residential	1	8	339	73	421	451
	c	Agriculture / Forestry / Fishing	0	11	149	10	170	184
5	a	Waste sector	0	0	0	1	1	1
	b	Statistical differences	-9	25	-8	2	10	10
TOTAL ENERGY CONSUMPTION			**350**	**981**	**1402**	**116**	**2849**	**2916**

Energy consumption in the Netherlands **1995** Unit: PJ

IPCC sector 1A			Coal and coal products	Crude oil & oil products	Natural gas	Other	TOTAL actual	TOTAL T-corr.
1	a	Electricity and heat production	269	10	288	-226	342	344
	b	Other energy sector and refineries		166	72	-8	230	230
2	a-e	Industry: combust.& transformation	97	113	311	154	674	679
		Industry: feedstocks	4	201	109	22	336	336
3	b	Transport: road		396			396	396
		Transport: other		17		5	22	22
4	a	Commercial / Institutional	8	48	154	89	300	310
	b	Residential	0	6	361	78	445	465
	c	Agriculture / Forestry / Fishing	0	12	155	11	178	187
5	a	Waste sector	0	0	0	0	0	0
	b	Statistical differences	15	28	-17	-5	20	20
TOTAL ENERGY CONSUMPTION			**393**	**997**	**1433**	**119**	**2943**	**2988**

Energy consumption in the Netherlands **1996** Unit: PJ

IPCC sector 1A			Coal and coal products	Crude oil & oil products	Natural gas	Other	TOTAL actual	TOTAL T-corr.
1	a	Electricity and heat production	252	10	315	-263	315	313
	b	Other energy sector and refineries		161	91	10	262	262
2	a-e	Industry: combust.& transformation	96	108	314	159	676	671
		Industry: feedstocks	4	184	105	23	316	316
3	b	Transport: road		419			419	419
		Transport: other		15		6	20	20
4	a	Commercial / Institutional	9	50	180	105	343	327
	b	Residential	0	5	423	80	508	472
	c	Agriculture / Forestry / Fishing	0	12	171	11	194	178
5	a	Waste sector	0	0	0	1	1	1
	b	Statistical differences	28	29	-23	-4	30	30
TOTAL ENERGY CONSUMPTION			**388**	**993**	**1576**	**128**	**3085**	**3009**

Energy consumption in the Netherlands **1997** Unit: PJ

IPCC sector 1A			Coal and coal products	Crude oil & oil products	Natural gas	Other	TOTAL actual	TOTAL T-corr.
1	a	Electricity and heat production	240	8	333	-254	327	328
	b	Other energy sector and refineries	0	157	98	-16	239	239
2	a-e	Industry: combust.& transformation	105	303	416	183	1007	1010
		Industry: feedstocks					0	0
3	b	Transport: road		425			425	425
		Transport: other		16		6	22	22
4	a	Commercial / Institutional	9	47	160	116	332	341
	b	Residential	0	4	354	81	439	459
	c	Agriculture / Forestry / Fishing	0	12	139	12	163	172
5	a	Waste sector	0	0	0	0	0	0
	b	Statistical differences	30	62	-18	0	74	74
TOTAL ENERGY CONSUMPTION			**383**	**1034**	**1483**	**128**	**3028**	**3070**

Remarks:

1 Coke production is included in 2 (*Industry*).

2 In these tables, energy consumption from construction is included in 4a (*Commercial/institutional*). About 20 PJ of this concerns bitumen / asphalt. Emissions from construction however, are reported under 2 (*Industry*).

3 In these tables, energy consumption in industry, agriculture and construction includes fuel for mobile off-road machinery; however, emissions from mobile off-road machinery are included in 3 (*Transport*).

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