



**Australian Government**

---

**Department of the Environment and Water Resources**

**Australian Greenhouse Office**

# **NATIONAL GREENHOUSE GAS INVENTORY**

## **ANALYSIS OF RECENT TRENDS**

### **AND**

## **GREENHOUSE INDICATORS 1990 TO 2005**

**AUSTRALIAN GREENHOUSE OFFICE**

**DEPARTMENT OF THE ENVIRONMENT AND WATER RESOURCES**

**2007**

Published by the Australian Greenhouse Office in the Department of the Environment and Water Resources.

© Commonwealth of Australia 2007

ISBN: 978-1-921297-72-4

This work is copyright. Apart from any use as permitted under the Copyright Act 1968, no part may be reproduced by any process without prior written permission from the Commonwealth, available from the Department of the Environment and Water Resources. Requests and inquiries concerning reproduction and rights should be addressed to the Manager, Communications Team, Australian Greenhouse Office, Department of Environment and Water Resources, GPO Box 787, Canberra ACT 2601.

This document and supporting methodology workbooks are available on the Internet at the following address:

<http://www.greenhouse.gov.au/inventory>.

The Intergovernmental Panel on Climate Change *Guidelines for National Greenhouse Gas Inventories* are at:

<http://www.ipcc-nggip.iges.or.jp>.

Suggestions and comments would be appreciated. They should be addressed to the Manager, Australian National Greenhouse Gas Inventory, Emissions Analysis Team, Australian Greenhouse Office, Department of the Environment and Water Resources GPO Box 787, Canberra ACT 2601.

Neither the Australian Government nor the consultants responsible for undertaking this project accepts any responsibility and each disclaims any liability for the accuracy of, or inferences from, the material contained in this publication, or for any actions as a result of any person's or group's interpretations, deductions, conclusions or actions in reliance on this material

September 2007

## TABLE OF CONTENTS

Executive Summary.....	vii
Chapter 1.....	1
Introduction.....	1
Chapter 2.....	4
Trends in total emissions.....	4
2.1 National emissions totals.....	4
2.2 Sectoral emissions.....	5
Chapter 3.....	7
Macro Greenhouse Indicators.....	7
Chapter 4.....	10
Sectoral and subsectoral emissions and indicators.....	10
4.1 Energy.....	10
4.2 Stationary energy.....	14
4.3 Transport.....	23
4.4 Fugitive emissions from fuels.....	37
4.5 Industrial processes.....	39
4.6 Agriculture.....	41
4.7 Land Use, Land Use Change and Forestry.....	43
4.8 Waste.....	45
Glossary.....	47
References.....	52
Appendix 1 Emissions by sector and subsector 1990–2005.....	53
Appendix 2 Emissions by greenhouse gas and fuel type 1990–2005.....	60
Appendix 3 Changes in emissions by category and greenhouse gas 1990–2005.....	66
Appendix 4 Sectoral and subsectoral indicators 1990–2005.....	69
Appendix 5 Common reporting format trends table (Kyoto accounting) 1990–2005.....	76

## LIST OF FIGURES

Figure S1 Net CO <sub>2</sub> -equivalent emissions by sector, 1990–2005	viii
Figure 1. Trends in CO <sub>2</sub> -equivalent emissions by sector, 1990–2005 .....	4
Figure 2. CO <sub>2</sub> -equivalent emissions by sector in 2005 .....	6
Figure 3. Greenhouse gas emissions per capita, 1990–2005 .....	7
Figure 4. Greenhouse gas emissions per \$ of GDP, 1990–2005 .....	8
Figure 5. Emissions from the Energy sector by subsector, 1990–2005 .....	11
Figure 6. Stationary Energy Intensity, 1990–2005 <sup>(a)</sup> .....	12
Figure 7. Primary energy consumption by primary energy type, 1990–2005 .....	13
Figure 8. Total CO <sub>2</sub> -equivalent emissions by primary fuel type, 1990–2005 .....	14
Figure 9. CO <sub>2</sub> -equivalent emissions from electricity generation by fossil fuels, 1990–2005 .....	15
Figure 10. Share of electricity generation primary energy consumed by energy form, 1990–2005 .....	16
Figure 11. Share of electricity generation produced from each primary energy source, 2005 .....	17
Figure 12. Emissions intensity of electricity sent out, major fossil fuel power stations, 1996–2005 .....	18
Figure 13. Efficiency of major fossil-fuel power stations, 1996–2005 .....	18
Figure 14. Emissions intensity of electricity consumed, 1990–2005 .....	20
Figure 15. Emissions intensity of energy delivered by end-use sector, 1990–2005 .....	22
Figure 16. Emissions from household energy use per capita, 1990–2005 .....	22
Figure 17. Domestic transport emissions by mode, 1990–2005 .....	24
Figure 18. Road transport emissions by vehicle type, 1990–2005 .....	24
Figure 19. Domestic transport emissions by mode (other than passenger vehicles), 1990–2005 .....	25
Figure 20. Emissions per MJ of fuel consumed by road vehicle type, 1990–2005 .....	27
Figure 21. Emissions per MJ of fuel by Transport mode, 1990–2005 .....	28
Figure 22. Emissions per passenger-km by mode, 1991 to 2005 .....	34
Figure 23. Emissions per urban passenger-km by mode, 1991 to 2005 .....	35
Figure 24. Emissions per non-urban passenger-km by mode, 1991 to 2005 .....	35
Figure 25. Emissions per tonne-km by mode and vehicle type, 1991 to 2005 .....	36
Figure 26. Fugitive emissions by category, 1990–2005 .....	37
Figure 27. Share of coal production by category of mine and CH <sub>4</sub> emissions per tonne produced, 1990–2005 ..	38
Figure 28. Industrial Processes emissions by industry, 1990–2005 .....	40
Figure 29. Industrial commodity production or use, 1990–2005 .....	40
Figure 30. Agriculture sector emissions, 2005 .....	41
Figure 31. Crop-related emissions, 1990–2005 .....	42
Figure 32. Emissions from Land Use, Land Use Change and Forestry, 1990–2005 .....	43
Figure 33. Methane emissions from solid and liquid waste disposal, 1990–2005 .....	46
Figure 34. Per capita emissions from the Waste sector, 1990–2005 .....	46
Figure 35. Schematic diagram of electricity supply system .....	51

## LIST OF TABLES

Table S1 Change in total CO <sub>2</sub> -equivalent emissions by gas, 1990–2005	viii
Table S2 Change in CO <sub>2</sub> -equivalent emissions and removals by sector, 1990–2005	ix
Table 1. Change in total CO <sub>2</sub> -equivalent emissions for each gas, 1990–2005 (Kyoto accounting) .....	5
Table 2. Change in total CO <sub>2</sub> -equivalent emissions for each gas, 1990–2005 (UNFCCC) .....	5
Table 3. Change in CO <sub>2</sub> -equivalent emissions by sector, 1990–2005 .....	6
Table 4. Macro greenhouse indicators, 1990–2005 .....	9
Table 5. Change in CO <sub>2</sub> -equivalent emissions from the Energy sector, 1990–2005 .....	10
Table 6. CO <sub>2</sub> -equivalent emissions intensity for electricity generation fuels, 1990–2005 .....	15
Table 7. Losses from the electricity system, 1997–2005 .....	19
Table 8. Emissions intensity of Electricity Delivered .....	20
Table 9. Passenger vehicle parameters, 1991 to 2005 .....	28
Table 10. Domestic passenger transport task, 1991 to 2005 .....	29
Table 11. Freight transport task, 1991 to 2005 .....	29
Table 12. Occupancy, fuel consumption and emissions, passenger vehicles and buses .....	30
Table 13. Loading, fuel consumption and emissions, road freight vehicles .....	30
Table 14. Domestic air transport activity and greenhouse indicators .....	32
Table 15. Coastal shipping activity and greenhouse indicators .....	32
Table 16. Light rail activity and greenhouse indicators .....	33
Table 17. Passenger rail activity and greenhouse indicators .....	34
Table 18. Freight rail activity and greenhouse indicators .....	34
Table 19. Passenger and freight activity per capita, 1991 to 2005 .....	36

## **ACKNOWLEDGMENTS**

This document was prepared by Dr George Wilkenfeld (George Wilkenfeld and Associates).

## EXECUTIVE SUMMARY

This document analyses trends in Australia's greenhouse gas emissions from 1990 to 2005 and greenhouse indicators developed for the National Greenhouse Strategy.

The Inventories used for this analysis have been compiled according to the Kyoto accounting provisions relating to Australia's internationally agreed greenhouse emissions target. The accounting provisions for Kyoto differ from those under the United Nations Framework Convention on Climate Change (UNFCCC), most notably in the way forest sinks are treated.

**Under the Kyoto accounting provisions relating to Australia's internationally agreed target, Australia's net greenhouse gas emissions in 2005 totalled 559.1 Mt of carbon dioxide equivalent. Total net emissions were 2.2% (11.9 Mt) higher in 2005 than in 1990. There was virtually no change in emissions from 2004 to 2005.**

Between 1990 and 2005:

- emissions of carbon dioxide (CO<sub>2</sub>) increased by 1.9%
- methane (CH<sub>4</sub>) emissions decreased by 3.9%
- nitrous oxide (N<sub>2</sub>O) emissions increased by 22.8%
- other<sup>1</sup> greenhouse gas emissions increased by 56.1%.

As a result of these changes, the CO<sub>2</sub> share of total emissions declined from 73.6% to 73.4%.

### SECTORAL TRENDS

The sectors showing the greatest increase in emissions from 1990 to 2005 were Stationary Energy, Transport and Industrial Processes (Table S1 and Figure S1). Emissions from Agriculture were almost unchanged and emissions from Waste and Land Use, Land Use Change and Forestry were lower in 2005 than in 1990. The Solvent and Other Product Use sector does not appear in this analysis because all emissions from the sector are non-methane volatile organic compounds (NMVOCs), which are not assigned a global warming potential.

#### Energy

Within the Stationary Energy subsector, electricity generation accounted for the majority of the increase in emissions. Within the Transport subsector, emissions from passenger vehicles, trucks and light commercial vehicles accounted for most of the increase, along with passenger aircraft emissions, which were 76% higher in 2005 than in 1990. The only transport emissions to decline were those from shipping. Growth in Fugitive Emissions from venting in coal, oil and natural gas production was partly offset by a decline in leakage from natural gas distribution, by a reduction in flaring and by capture of coal mine waste gas.

---

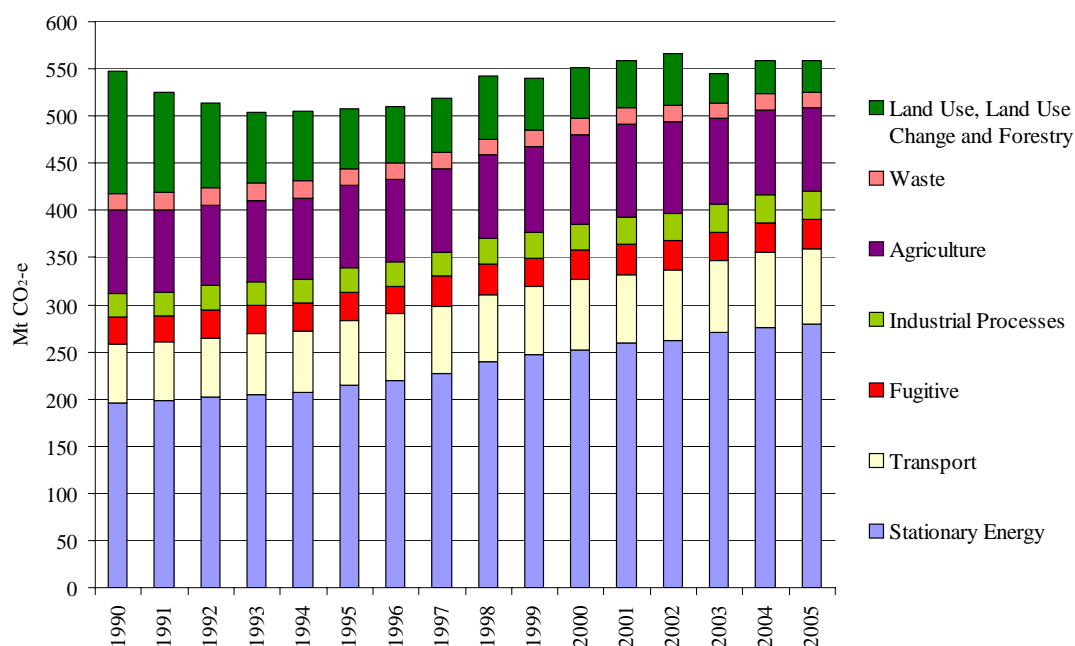
<sup>1</sup> Other emissions includes HFCs, PFCs, SF<sub>6</sub> and confidential Industrial Processes emissions reported as carbon dioxide equivalents (CO<sub>2</sub>-e)

**Table S1. Change in CO<sub>2</sub>-equivalent emissions and removals by sector, 1990–2005**

Sector	1990 Mt CO <sub>2</sub> -e	2005 Mt CO <sub>2</sub> -e	Change Mt CO <sub>2</sub> -e	% Change
1 Energy	287.0	391.0	104.1	36.3%
Stationary Energy	196.0	279.4	83.4	42.6%
Transport	61.9	80.4	18.5	29.9%
Fugitive Emissions	29.1	31.2	2.1	7.3%
2 Industrial Processes	25.3	29.5	4.2	16.5%
3 Solvent and Other Product Use <sup>(a)</sup>	NA	NA	NA	NA
4 Agriculture	87.7	87.9	0.2	0.2%
5 Land Use, Land Use Change & Forestry	128.9	33.7	-95.2	-73.9%
6 Waste	18.3	17.0	-1.3	-6.9%
Total net emissions	547.1	559.1	11.9	2.2%

Totals and percentages may not correspond exactly due to rounding.

(a) All emissions from this sector are NMVOCs, which cannot be converted into CO<sub>2</sub>-e.

**Figure S1. Net CO<sub>2</sub>-equivalent emissions by sector, 1990–2005**

### Industrial Processes

Emissions from the Industrial Processes sector in 2005 were 16.5% higher than in 1990. The largest increases were from the consumption of halocarbons. Perfluorocarbon emissions from aluminium production and CO<sub>2</sub> emissions from iron and steel were lower in 2005 than in 1990.

### Agriculture

In the Agriculture sector an increase in emissions associated with crop production and savanna burning was partly offset by a decline in livestock emissions (largely due to a decline in sheep numbers).



### Land Use, Land Use Change and Forestry (Kyoto accounting)

The Kyoto accounting provisions take into account emissions from deforestation, and the carbon sequestered in reforestation activities (i.e. plantations) established since 1990.

Strictly speaking, the credit for carbon sequestered in such plantations will be brought to account in 2008–12 only. However, the inclusion of an estimate in pre-2008 Inventories facilitates an understanding of Australia's emissions trends in relation to the 108% target.

Net emissions from this sector were 74% lower in 2005 than in 1990 due to a significant reduction in the area of forest conversion, but were 10% higher than in 2003, which was the low point of the period.

### Waste

Waste sector emissions were 6.9% lower in 2005 than in 1990 despite an increase in population, largely because of the effect of recovery of waste gas from landfills and wastewater facilities.

## GREENHOUSE INDICATORS

The greenhouse indicators include three macro indicators—total net national emissions, emissions per capita, and emissions per unit of Gross Domestic Product (GDP). The trends in these macro indicators are presented in Table S2.

**Table S2. Greenhouse macro indicators, 1990–2005 (Kyoto accounting)**

	Emissions (Mt CO <sub>2</sub> -e)	Tonnes CO <sub>2</sub> -e/capita	kg CO <sub>2</sub> -e/\$GDP
1990	547.1	32.3	0.99
1991	524.9	30.6	0.95
1992	513.4	29.5	0.93
1993	504.0	28.7	0.88
1994	505.7	28.5	0.85
1995	507.5	28.3	0.82
1996	510.7	28.1	0.79
1997	518.6	28.2	0.77
1998	542.6	29.2	0.77
1999	540.0	28.7	0.73
2000	551.5	29.0	0.72
2001	558.8	29.0	0.71
2002	566.6	29.0	0.70
2003	545.1	27.6	0.65
2004	559.1	28.0	0.64
2005	559.1	27.7	0.62

Total emissions were at their lowest point in 1993 and they were at a high point in 2002. In 2005 they were 2.2% higher than in 1990.

Emissions increased at an average rate of 0.1% per annum over the period while population increased at an average of 1.2% per annum, so emissions per capita declined at an average rate of 1.0% per annum. Emissions per capita were 32.3 tonnes CO<sub>2</sub>-e in 1990 and 27.7 tonnes CO<sub>2</sub>-e (14.4% lower) in 2005.

Economic activity grew at an average rate of 3.3% per annum between 1990 and 2005. Over the period emissions per dollar of GDP declined by 36.8%.

The falling trend in emissions per dollar of GDP is related to a number of factors, including:

- structural change in the economy—Gross Value Added from the services sector was 70% higher in 2005 than in 1990, whereas Gross Value Added from the more energy intensive manufacturing sector was about 23% higher
- the relatively small increase in Agriculture sector emissions
- the reduction in emissions from Land Use, Land Use Change and Forestry
- increasing recovery of CH<sub>4</sub> in the Fugitive Emissions and Waste sectors
- improvement in the average efficiency of energy use.

The reduction in Land Use, Land Use Change and Forestry emissions accounted for about 79% of the decline in emissions per dollar of GDP, and the increasing recovery of CH<sub>4</sub> in the Fugitive Emissions and Waste sectors accounted for another 2%. Further analysis would be necessary to establish the relative contribution of the other factors to the decline in emissions intensity of the economy.

## GENERAL NOTES

### ABBREVIATIONS

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ACG	Apelbaum Consulting Group
ADO	Automotive Diesel Oil
AGO	Australian Greenhouse Office
FAFC	Fleet average fuel consumption
FAI	Federal Chamber of Automotive Industries
GDP	Gross Domestic Product
GWP	Global Warming Potential
ICESD	Intergovernmental Committee on Ecologically Sustainable Development
IDF	Industrial Diesel Fuel
IPCC	Intergovernmental Panel on Climate Change
LCV	Light Commercial Vehicle
LPG	Liquefied petroleum gas
NAFC	National average fuel consumption (new passenger vehicles)
SME	Sheep Methane Equivalent
VKT	Vehicle-kilometres travelled

### UNITS

The units mainly used in the Inventory are joules (J), grams (g), tonnes (t), metres (m) and litres (l), together with their multiples. Standard metric prefixes used in the Inventory are:

kilo (k)	=	$10^3$ (thousand)
mega (M)	=	$10^6$ (million)
giga (G)	=	$10^9$
tera (T)	=	$10^{12}$
peta (P)	=	$10^{15}$

Emissions are generally expressed in gigagrams (Gg) or megatonnes (Mt).

gigagram (Gg)	= 1000 tonnes = 1 kilotonne (kt)
megatonne (Mt)	= 1 000 000 tonnes = 1000 Gg

### GASES

CF <sub>4</sub>	perfluoromethane (a PFC)
C <sub>2</sub> F <sub>6</sub>	perfluoroethane (a PFC)
CH <sub>4</sub>	methane
CO	carbon monoxide
CO <sub>2</sub>	carbon dioxide
HFCs	hydrofluorocarbons
N <sub>2</sub> O	nitrous oxide
NMVOC	non-methane volatile organic compounds
NO <sub>x</sub>	oxides of nitrogen
PFCs	perfluorocarbons
SF <sub>6</sub>	sulphur hexafluoride
SO <sub>2</sub>	sulphur dioxide

## GLOBAL WARMING POTENTIALS

This document expresses the emissions of CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, PFCs, HFCs and SF<sub>6</sub> in terms of their carbon dioxide equivalent (CO<sub>2</sub>-e). This is calculated by multiplying the actual mass of emissions by the appropriate Global Warming Potential (GWP).

CO<sub>2</sub> = 1  
 CH<sub>4</sub> = 21  
 N<sub>2</sub>O = 310  
 CF<sub>4</sub> = 6,500  
 C<sub>2</sub>F<sub>6</sub> = 9,200  
 SF<sub>6</sub> = 23,900

## DATA INDICATORS

In the tables, the following standard data indicators are used:

- NO (not occurring) when the activity or process does not occur in Australia
- NA (not applicable) when the activity occurs in Australia but the nature of the process does not result in emissions or removals
- NE (not estimated) where it is known that the activity occurs in Australia but there are no data or methodology available to derive an estimate of emissions
- C (confidential) where reporting could lead to the disclosure of confidential information.

## REPORTING YEAR

The Australian Inventory is compiled on a fiscal year basis as key data sources such as the national energy statistics are collected on this basis. The year 2005 refers to the Australian fiscal year from 1 July 2004 to 30 June 2005, and a similar format is used for other years. Time series consistency is maintained.

## CHAPTER 1

### INTRODUCTION

This report illustrates the main trends in Australia's greenhouse gas emissions over the period 1990 to 2005. It also contains enough background detail to enable specialist readers to follow trends in key subsectors. It updates the previously published *National Greenhouse Gas Inventory: Analysis of Trends and Greenhouse Indicators 1990 to 2004* (AGO 2006a).

This report also includes a set of greenhouse indicators. These were originally developed for the 1992 *National Greenhouse Response Strategy* (NGRS 1992), and were revised and extended for the 1998 *National Greenhouse Strategy* (NGS 1998). Regular monitoring of indicators helps highlight the trends in emissions and the drivers of those trends, and it also helps identify areas for further attention and review.

The appendices present information from the National Greenhouse Gas Inventory in a form intended to clarify trends over time. Emissions data for 2005 are taken directly from the *National Greenhouse Gas Inventory 2005* (DEW 2006). All values for 1990 to 2004 have been recalculated in the light of methodology changes and data revisions, and differ from previously published values for the same years.

Appendix 1 reports emissions of all greenhouse gases and calculates CO<sub>2</sub>-equivalent (CO<sub>2</sub>-e) totals for all sectors, key subsectors and certain combinations of subsectors, for each year from 1990 to 2005.

Appendix 2 reports the sectoral contributions to the emission of each greenhouse gas and to CO<sub>2</sub>-e totals, and summarises emissions by fuel type, for each year from 1990 to 2005.

Appendix 3 indexes each year's emissions to 1990, the reference year.

Appendix 4 presents key sectoral and subsectoral greenhouse indicators.

Appendix 5 summarises emissions for each year from 1990 to 2005 in the Kyoto Accounting Trends Table format used in the Inventory.

#### NATIONAL GREENHOUSE GAS INVENTORY TRENDS

Australia's National Greenhouse Accounts, prepared by the Australian Greenhouse Office each year, provide greenhouse gas emission estimates for the United Nations Framework Convention on Climate Change (UNFCCC) as well as track Australia's progress towards its internationally agreed target of limiting emissions to 108% of 1990 levels over the period 2008–12. The rules applying to the compilation of inventories for these two applications are similar for all sectors except for Land Use, Land Use Change and Forestry. The key difference for that sector is the accounting rules for forest sinks.

The emissions trends analyses in this report are based on the Kyoto reporting provisions.

Source and sink categories are grouped under six sectors, as defined by the Intergovernmental Panel on Climate Change (IPCC). These represent the main human activities that contribute to the release or capture of greenhouse gases into or from the atmosphere. They are:

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

This document disaggregates the Energy sector into Stationary Energy, Fugitive Emissions and Transport.

## GREENHOUSE INDICATORS

The National Greenhouse Strategy macro, sectoral and subsectoral indicators are listed below, together with the numbers of the figures or tables which illustrate the trends in those indicators. Tables numbered with a '4' prefix (e.g. 'Table 4-9') are in Appendix 4.

### Macro Indicators

Total emissions (CO <sub>2</sub> -e)	Figure 1
Total emissions per \$ Gross Domestic Product	Figure 4
Total emissions per capita	Figure 3

### Sectoral Indicators

All sectors	Total emissions from each sector	Figure 1
Energy	Energy emissions per capita	Figure 3
	Stationary Energy intensity	Figure 6
Energy supply	Emissions from energy by primary fuel type	Figure 8
Household energy	Emissions from household energy per capita	Figure 16
Industrial and commercial energy	Emissions per unit of energy delivered	Figure 15
Transport	Emissions per passenger-km by mode	Figure 22
	Emissions per freight tonne-km by mode	Figure 25
Transport and urban planning	Emissions per km travelled in urban areas by mode	Figure 23
Agriculture	Sheep methane equivalents per animal	Table 4-12
	N <sub>2</sub> O emissions index	Table 4-13
Natural environment	CO <sub>2</sub> -e from land use change	Figure 31
Waste	CH <sub>4</sub> emissions from landfill per capita	Figure 33

### Subsectoral Indicators

Electricity	Emissions from electricity production divided by electricity delivered to users	Figure 14
	Emissions from electricity production divided by electricity sent out	Figure 12
	Share of electricity generation produced from each primary energy source	Figure 11

	Efficiency of fossil-fuel electricity generation by fuel (sent out basis)	Figure 13
	Electricity generated from fossil fuel cogeneration plants	Table 4-20
	Percentage of electricity sent out lost in transmission, pumped storage, and distribution	Table 8
Natural gas	Energy from natural gas use as a percentage of total energy use	Table 4-8
Renewable energy	Electricity generated from each type of renewable energy source in each year	Table 4-21
Fugitive emissions	Quantity of CO <sub>2</sub> and CH <sub>4</sub> vented at oil and gas production facilities and gas production plants	Figure 26
	Quantity of CO <sub>2</sub> and CH <sub>4</sub> emitted by flaring at oil and gas production facilities and gas production plants	Figure 26
	Quantity of CH <sub>4</sub> emitted during gas transmission and distribution	Figure 26
	Net quantity of CH <sub>4</sub> vented at coal mines	Figure 27
Transport—passenger	New vehicle national average fuel consumption	Table 14
	Fleet average fuel consumption	Table 14
	Vehicle-kilometres and passenger-kilometres	Table 14
	Number of passenger vehicles	Table 14
	Emissions per vehicle-kilometre by fuel type	Table 14
	Motorised passenger-kilometres per capita	Table 21
	Motorised urban passenger-kilometres per capita	Table 21
	Share of motorised passenger kilometre (urban and non-urban) by mode and vehicle class	Table 4-28 Table 4-29
Transport—freight	Average commodity tonnes per vehicle-kilometre travelled by freight vehicle class	Table 25
	Total freight tonne-kilometre by mode and fuel type	Table 12
Industrial	Emissions and production from iron and steel industry	Figure 28 Figure 29
	Emissions and production from minerals industry	Figure 28 Figure 29
	Emissions and production aluminium industry	Figure 28 Figure 29
	Emissions and production from cement industry	Figure 28 Figure 29
Agriculture	Emissions from livestock and manure	Table 4-33
Forests	Net annual tonnes of CO <sub>2</sub> removed by plantations	Table 4-35
Land Use Change	Area of native vegetation cleared	Table 4-36

Taken together, the greenhouse indicators describe Australia's total greenhouse gas emissions and the emissions intensity of key parts of the economy. Changes over time in the indicators are due to a large number of factors, including the economic cycle, the effects of drought on agriculture, changes in the energy supply system and in the efficiency of energy use.

## CHAPTER 2

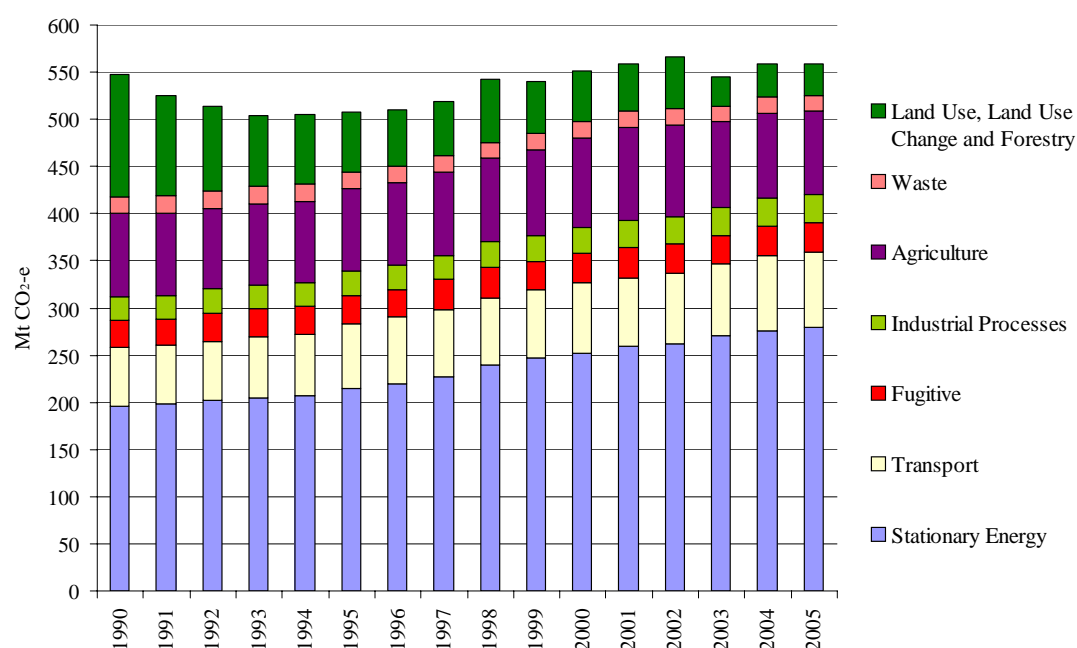
### TRENDS IN TOTAL EMISSIONS

#### 2.1 NATIONAL EMISSIONS TOTALS

##### KYOTO ACCOUNTING

Under Kyoto accounting provisions, Australia's net greenhouse gas emissions increased by 2.2% between 1990 and 2005—from 547.1 Mt to 559.1 Mt CO<sub>2</sub>-e (Figure 1, Table 1).

Figure 1. Trends in CO<sub>2</sub>-equivalent emissions by sector, 1990–2005





**Table 1. Change in total CO<sub>2</sub>-equivalent emissions for each gas, 1990–2005 (Kyoto accounting)**

Greenhouse Gases	1990 Mt CO <sub>2</sub> -e	2005 Mt CO <sub>2</sub> -e	1990 % of Total	2005 % of Total	Changes Mt CO <sub>2</sub> -e	% Change in Emissions
CO <sub>2</sub>	402.4	410.2	73.6%	73.4%	7.8	1.9%
CH <sub>4</sub>	117.5	112.9	21.5%	20.2%	-4.5	-3.9%
N <sub>2</sub> O	19.8	24.3	3.6%	4.3%	4.5	22.8%
Other (a)	7.5	11.7	1.4%	2.1%	4.2	56.1%
<b>Total CO<sub>2</sub>-e</b>	<b>547.1</b>	<b>559.1</b>	<b>100.0%</b>	<b>100.0%</b>	<b>11.9</b>	<b>2.2%</b>

Totals and percentages may not correspond exactly due to precision of underlying data. (a) HFCs, PFCs, SF<sub>6</sub> and confidential Industrial Processes emissions expressed as CO<sub>2</sub>-e.

## UNFCCC ACCOUNTING

As the international Inventory rules applying to the UNFCCC Inventories differ from those applying under Kyoto (notably in the treatment of forestry sinks), the levels and trends in emissions are different. Under the UNFCCC reporting provisions, Australia's net emissions in 2005 were 522.2 Mt, representing an increase of 4.5% (22.3 Mt) above 1990 levels (Table 2). All subsequent analyses in this document are based on the Kyoto reporting provisions.

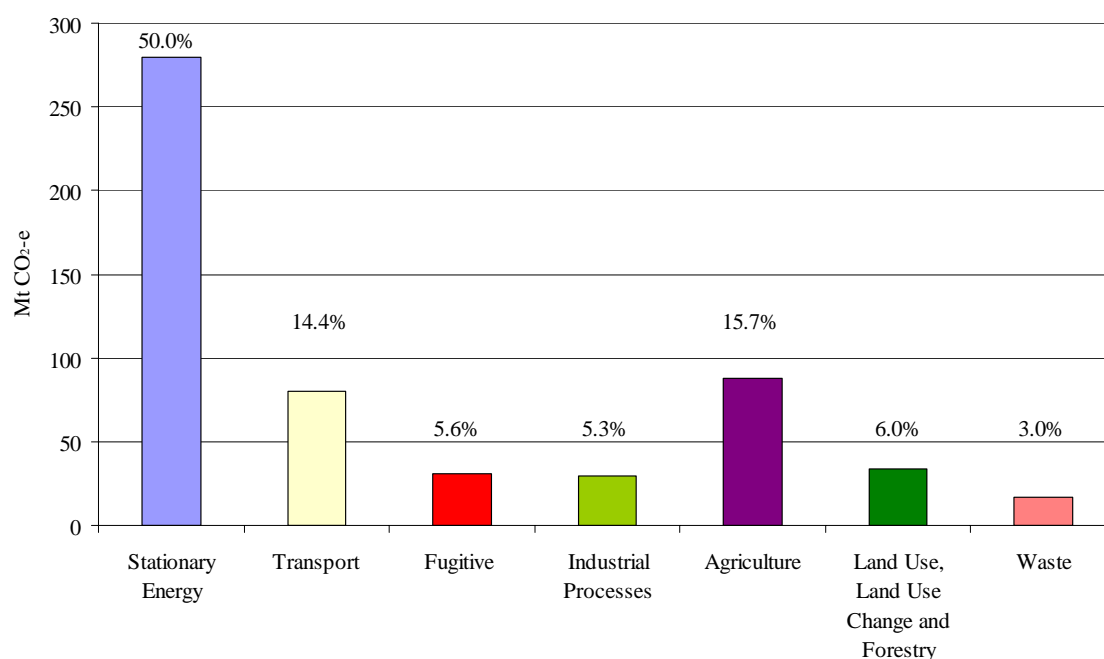
**Table 2. Change in total CO<sub>2</sub>-equivalent emissions for each gas, 1990–2005 (UNFCCC)**

Greenhouse Gases	1990 Mt CO <sub>2</sub> -e	2005 Mt CO <sub>2</sub> -e	1990 % of Total	2005 % of Total	Changes Mt	% Change in Emissions
CO <sub>2</sub>	353.2	372.0	70.7%	71.2%	18.8	5.3%
CH <sub>4</sub>	119.0	113.9	23.8%	21.8%	-5.1	-4.3%
N <sub>2</sub> O	20.2	24.6	4.0%	4.7%	4.4	21.6%
Other (a)	7.5	11.7	1.5%	2.2%	4.2	56.1%
<b>Total CO<sub>2</sub>-e</b>	<b>499.9</b>	<b>522.2</b>	<b>100.0%</b>	<b>100.0%</b>	<b>22.3</b>	<b>4.5%</b>

Totals and percentages may not correspond exactly due to precision of underlying data. (a) HFCs, PFCs, SF<sub>6</sub> and confidential Industrial Processes emissions expressed as CO<sub>2</sub>-e.

## 2.2 SECTORAL EMISSIONS

In 2005 Stationary Energy use accounted for 50.0% of total emissions, followed by Agriculture (15.7%), Transport (14.4%), Land Use, Land Use Change and Forestry (6.0%), Fugitive Emissions (5.6%). Industrial Processes (5.3%), and Waste (3.0%) (Figure 2). The Energy sector as a whole accounted for 69.9% of total emissions.

**Figure 2. CO<sub>2</sub>-equivalent emissions by sector in 2005**

## TRENDS

Between 1990 and 2005 Energy emissions increased by 104.1 Mt (36.3%), Industrial Processes emissions by 4.2 Mt (16.5%), and Agriculture emissions by 0.2 Mt (0.2%) (Table 3 and Figure 1). There was a reduction of 95.2 Mt (73.9%) in emissions from Land Use, Land Use Change and Forestry and a reduction of 1.3 Mt (6.9%) in Waste emissions. Table 3 summarises the emissions from each sector in 1990 and in 2005.

**Table 3. Change in CO<sub>2</sub>-equivalent emissions by sector, 1990–2005**

Sector	1990 Mt	2005 Mt	Change Mt	% Change
<b>1 Energy</b>	287.0	391.0	104.1	36.3%
Stationary Energy	196.0	279.4	83.4	42.6%
Transport	61.9	80.4	18.5	29.9%
Fugitive Emissions	29.1	31.2	2.1	7.3%
<b>2 Industrial Processes</b>	25.3	29.5	4.2	16.5%
<b>4 Agriculture</b>	87.7	87.9	0.2	0.2%
<b>5 Land Use, Land Use Change and Forestry</b>	128.9	33.7	-95.2	-73.9%
<b>6 Waste</b>	18.3	17.0	-1.3	-6.9%
<b>Total Net Emissions</b>	<b>547.1</b>	<b>559.1</b>	<b>11.9</b>	<b>2.2%</b>

Totals and percentages may not correspond exactly due to rounding.

## CHAPTER 3

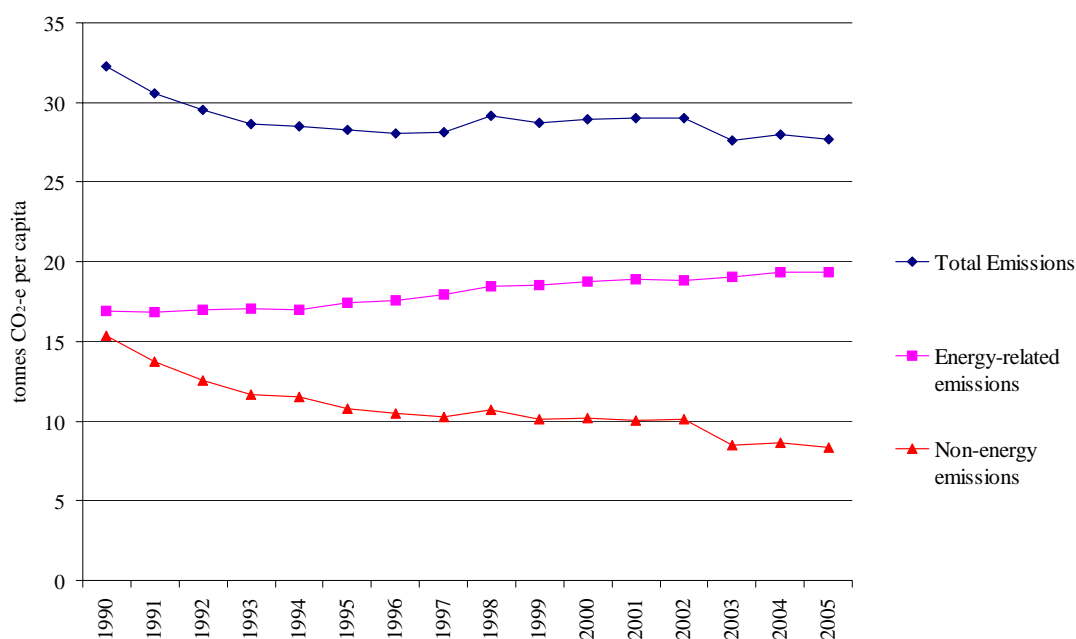
### MACRO GREENHOUSE INDICATORS

The macro greenhouse indicators are ‘total emissions’, ‘emissions per capita’, and ‘emissions per dollar of GDP’. These indicators are calculated based on the Kyoto accounting Inventories.

Total emissions were 2.2% higher in 2005 than in 1990, and 10.9% higher than the lowest point for the period, which occurred in 1993. Emissions increased at an average rate of about 0.1% per annum over the period while population increased at an average of 1.2% per annum, so emissions per capita declined at an average rate of 1.0% per annum. Emissions per capita were 32.3 tonnes CO<sub>2</sub>-e in 1990 and 27.7 tonnes CO<sub>2</sub>-e (14.4% lower) in 2005 (Table 4 and Figure 3).

Non-Energy emissions per capita declined by 45.9%, from 15.4 tonnes CO<sub>2</sub>-e in 1990 to 8.3 tonnes in 2005; while Energy-related emissions per capita increased by 14.2%, from 16.9 to 19.4 tonnes CO<sub>2</sub>-e.

**Figure 3. Greenhouse gas emissions per capita, 1990–2005**



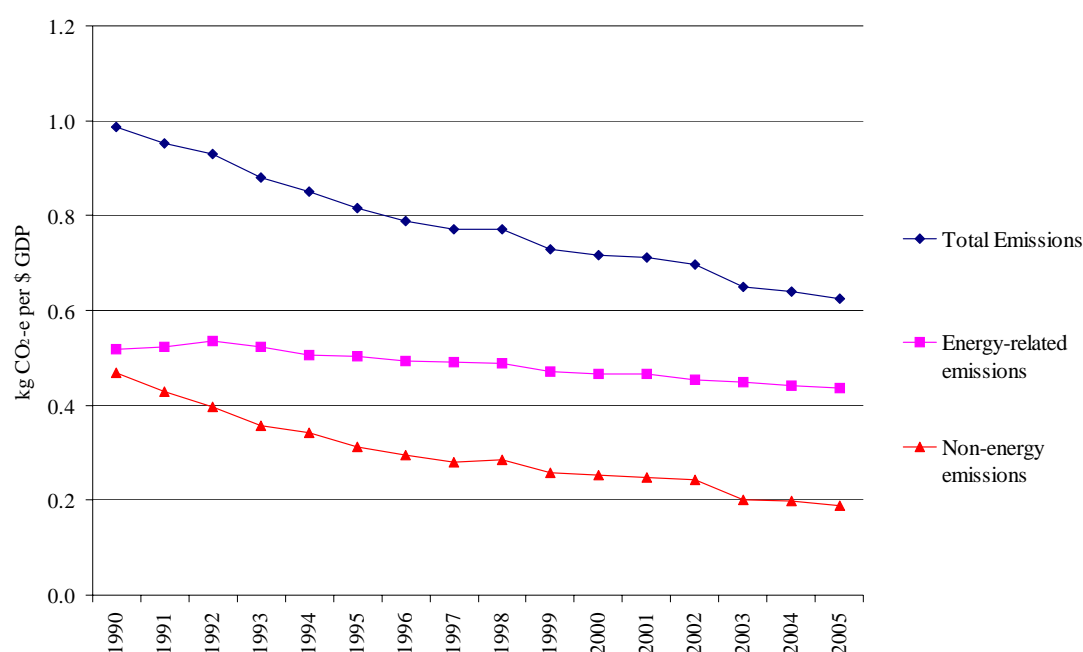
Emissions per dollar of GDP were 36.8% lower in 2005 than in 1990 (Table 4 and Figure 4). Emissions increased at 0.1% per annum while GDP grew at an average of 3.3% per annum, so the emissions intensity of the economy declined at an average rate of 3.0% per annum. Energy emissions per dollar of GDP declined by an average of 1.1% per annum, and non-Energy emissions per dollar of GDP declined at an average rate of 5.9% per annum.

The falling trend in emissions per unit of GDP is related to a number of factors, including:

- structural change in the economy—Gross Value Added from the services sector was 70% higher in 2005 than in 1990, whereas Gross Value Added from the more energy intensive manufacturing sector was about 23% higher
- the relatively small increase in Agriculture sector emissions
- the reduction in emissions from Land Use, Land Use Change and Forestry
- increasing recovery of CH<sub>4</sub> in the Fugitive Emissions and Waste sectors
- improvement in the average efficiency of energy use.

The reduction in Land Use, Land Use Change and Forestry emissions alone accounted for about 79% of the decline in emissions per dollar of GDP, and the increasing recovery of CH<sub>4</sub> in the Fugitive Emissions and Waste sectors accounted for another 2%. Further analysis would be necessary to establish the relative contribution of the other factors to the decline in emissions intensity of the economy.

**Figure 4. Greenhouse gas emissions per \$ of GDP, 1990–2005**



**Table 4. Macro greenhouse indicators, 1990–2005**

Macro Indicators	1990	1995	2000	2005	% Change 1990–2005
<b>Emissions (Mt CO<sub>2</sub>-e)</b>	<b>547.1</b>	<b>507.5</b>	<b>551.5</b>	<b>559.1</b>	<b>2.2%</b>
Energy emissions (Mt CO <sub>2</sub> -e)	287.0	313.4	357.6	391.0	36.3%
Emissions from other sectors (Mt CO <sub>2</sub> -e)	260.2	194.0	193.9	168.1	-35.4%
<b>Tonnes CO<sub>2</sub>-e/capita</b>	<b>32.3</b>	<b>28.3</b>	<b>29.0</b>	<b>27.7</b>	<b>-14.4%</b>
Tonnes CO <sub>2</sub> -e (Energy)/capita	16.9	17.5	18.8	19.4	14.2%
Tonnes CO <sub>2</sub> -e (Other)/capita	15.4	10.8	10.2	8.3	-45.9%
<b>kg CO<sub>2</sub>-e/\$ GDP</b>	<b>0.99</b>	<b>0.82</b>	<b>0.72</b>	<b>0.62</b>	<b>-36.8%</b>
kg CO <sub>2</sub> -e (Energy)/\$ GDP	0.52	0.50	0.44	0.44	-15.7%
kg CO <sub>2</sub> -e (Other)/\$ GDP	0.47	0.31	0.25	0.19	-60.0%
Population (millions) <sup>(a)</sup>	16.94	17.95	19.04	20.21	19.3%
\$M GDP <sup>(b)</sup>	554773	622057	769045	896568	61.6%

(b) Resident population at midpoint of financial year, ABS 310101. (c) Gross Domestic Product, chain volume measures, reference year 2004/05, ABS 5206033

## CHAPTER 4

### SECTORAL AND SUBSECTORAL EMISSIONS AND INDICATORS

#### 4.1 ENERGY

The Energy sector comprises Stationary Energy, Transport and Fugitive Emissions from fuels. Energy sector emissions were 391.0 Mt CO<sub>2</sub>-e in 2005, an increase of 104.1 Mt CO<sub>2</sub>-e (36.3%) from 1990 (Table 5, Figure 5). Stationary Energy showed a significantly higher increase in emissions from 1990 to 2005 (42.6%) than did Transport (29.9%). Fugitive Emissions increased by 7.3% over the period.

**Table 5. Change in CO<sub>2</sub>-equivalent emissions from the Energy sector, 1990–2005**

Sector and Subsector	1990 Mt CO <sub>2</sub> -e	2005 Mt CO <sub>2</sub> -e	Change 1990–05 Mt CO <sub>2</sub> -e	Change 1990–05 %	% of Energy Sector Change
<b>1. Energy</b>	<b>287.0</b>	<b>391.0</b>	<b>104.1</b>	<b>36.3%</b>	<b>100.0%</b>
<b>1A Fuel Combustion Activities</b>	<b>257.9</b>	<b>359.8</b>	<b>101.9</b>	<b>39.5%</b>	<b>97.9%</b>
<b>1A1 Energy Industries</b>	<b>143.1</b>	<b>214.3</b>	<b>71.2</b>	<b>49.8%</b>	<b>68.5%</b>
Electricity generation	129.5	194.3	64.8	50.1%	62.3%
Other energy industries	13.6	20.1	6.4	47.0%	6.2%
<b>1A2 Manufacturing and Construction</b>	<b>37.1</b>	<b>43.7</b>	<b>6.6</b>	<b>17.8%</b>	<b>6.4%</b>
<b>1A3 Transport</b>	<b>61.9</b>	<b>80.4</b>	<b>18.5</b>	<b>29.9%</b>	<b>17.8%</b>
Road transport	54.1	70.7	16.5	30.5%	15.9%
Other transport	7.8	9.7	2.0	25.5%	1.9%
<b>1A4 Other Sectors</b>	<b>14.7</b>	<b>20.1</b>	<b>5.4</b>	<b>36.7%</b>	<b>5.2%</b>
<b>1A5 Other</b>	<b>1.0</b>	<b>1.2</b>	<b>0.2</b>	<b>15.4%</b>	<b>0.2%</b>
<b>Stationary Energy (1A less 1A3)</b>	<b>196.0</b>	<b>279.4</b>	<b>83.4</b>	<b>42.6%</b>	<b>80.2%</b>
<b>1B Fugitive</b>	<b>29.1</b>	<b>31.2</b>	<b>2.1</b>	<b>7.3%</b>	<b>2.1%</b>
Solid Fuels	16.1	21.6	5.5	34.1%	5.3%
Oil and Natural Gas	13.0	9.6	-3.4	-25.9%	-3.2%

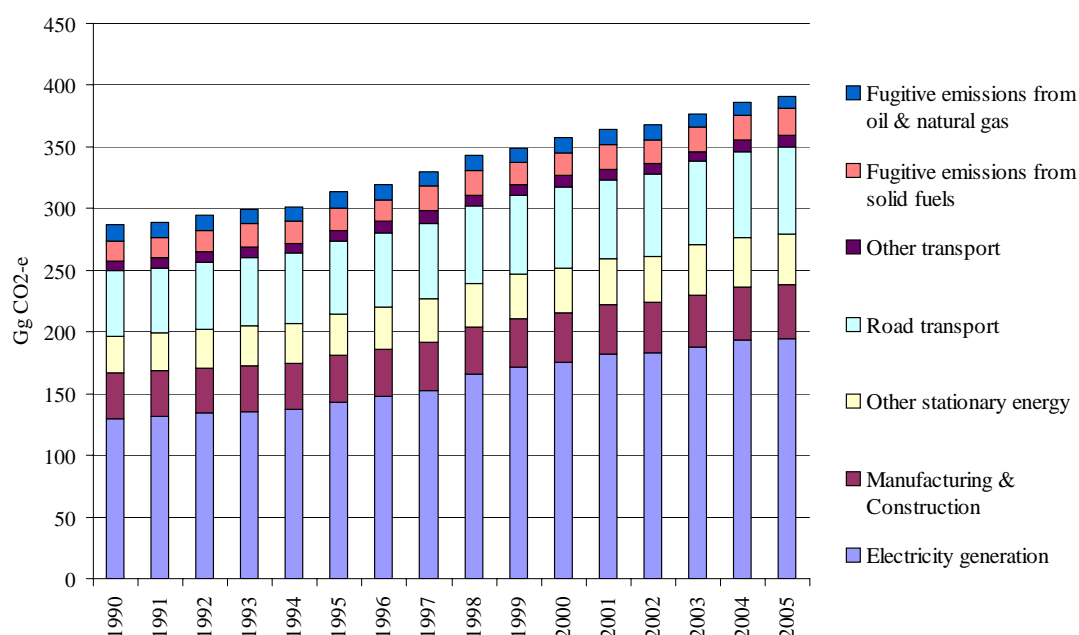
Totals and percentages may not correspond exactly due to rounding

At the subsectoral level, emissions from electricity generation increased by 50.1% (64.8 Mt) between 1990 and 2005 and this represented 68.5% of the total increase in Energy sector emissions. The next most significant increase was from road transport, which increased by 30.5% (16.5 Mt) and represented 17.8% of the growth in Energy sector emissions.

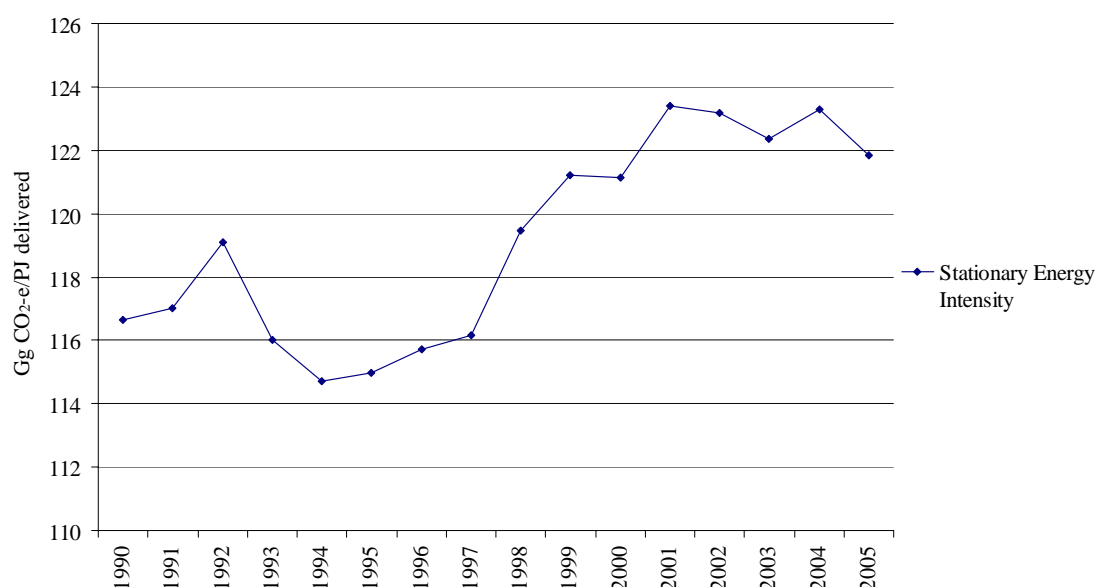
The pattern of annual change in Energy emissions has been variable. Between 2004 and 2005, emissions from electricity generation and road transport increased at much less than their long term average growth rates, while the increases in Manufacturing, Other Transport and Fugitive emissions were well above their long term average rates.

The rate of increase in overall Energy emissions averaged 1.8% per annum in the first half of the 1990s, then 2.8% per annum for the rest of the decade. Since 2001 it has averaged 1.8% per annum.

**Figure 5. Emissions from the Energy sector by subsector, 1990–2005**



The main Energy sector indicators are ‘energy emissions per capita’ (Figure 3) and ‘stationary energy intensity’ (Figure 6). Energy emissions per capita increased by 14.2% between 1990 and 2005, from 16.9 to 19.4 tonnes CO<sub>2</sub>-e (Table 4). The change in energy emissions per capita reflects two separate underlying factors—the rate of change in per capita energy consumption and the rate of change in the greenhouse gas intensity of each unit of energy used. Both of these factors increased more for Stationary Energy than for Transport Energy. The average greenhouse intensity of Stationary Energy was 4.5% higher in 2005 than in 1990 (Figure 6), although trending down since reaching a peak in 2000. The average greenhouse intensity of Transport fuel was 0.5% higher (Figure 21). Per capita consumption of Stationary Energy was 19.7% higher in 2005 than in 1990, whereas per capita consumption of Transport Energy was 8.9% higher.

**Figure 6. Stationary Energy Intensity, 1990–2005<sup>(a)</sup>**

(a) Emissions from stationary fuel combustion activities, divided by quantity of energy (including electricity) consumed by final users.

‘Stationary energy intensity’ is influenced by each of the following factors:

- the mix and emissions intensity of primary energy forms (e.g. coal, petroleum, natural gas and renewable energy)
- the efficiency of conversion to secondary energy forms (e.g. electricity generation)
- the energy losses incurred along the delivery chain (e.g. natural gas used in treatment and transmission, electricity used at power stations)
- the mix and emissions intensity of the energy forms delivered to users—most users receive a mix of primary forms (e.g. natural gas) and secondary forms (e.g. electricity)
- the combustion characteristics of the final energy conversion equipment (e.g. boilers).

‘Stationary energy intensity’ declined significantly between 1992 and 1994 (Figure 6) largely because of a reduction in the emissions intensity of electricity (see Figure 14) and an increase in the gas share of delivered energy (Appendix Table 4-8). After 1995 stationary energy intensity increased due to a shift in the energy used in the manufacturing, commercial and household sectors towards electricity (displacing petroleum fuels and coal rather than natural gas). The sharp rise in 1998 coincided with the commencement of the National Electricity Market, and a decline in the real price of electricity.

Until the late 1990s the growth in the emissions intensity of stationary energy use was linked strongly to the increasing emissions intensity of electricity consumed (Figure 14). Since then, however, stationary energy intensity has continued to rise despite reduction in the emissions intensity of electricity. This is due to the growth in the electricity share of final energy use outweighing any reduction in the greenhouse intensity of electricity supply. 2005 was the first year in which electricity accounted for more than half of energy delivered in the residential sector



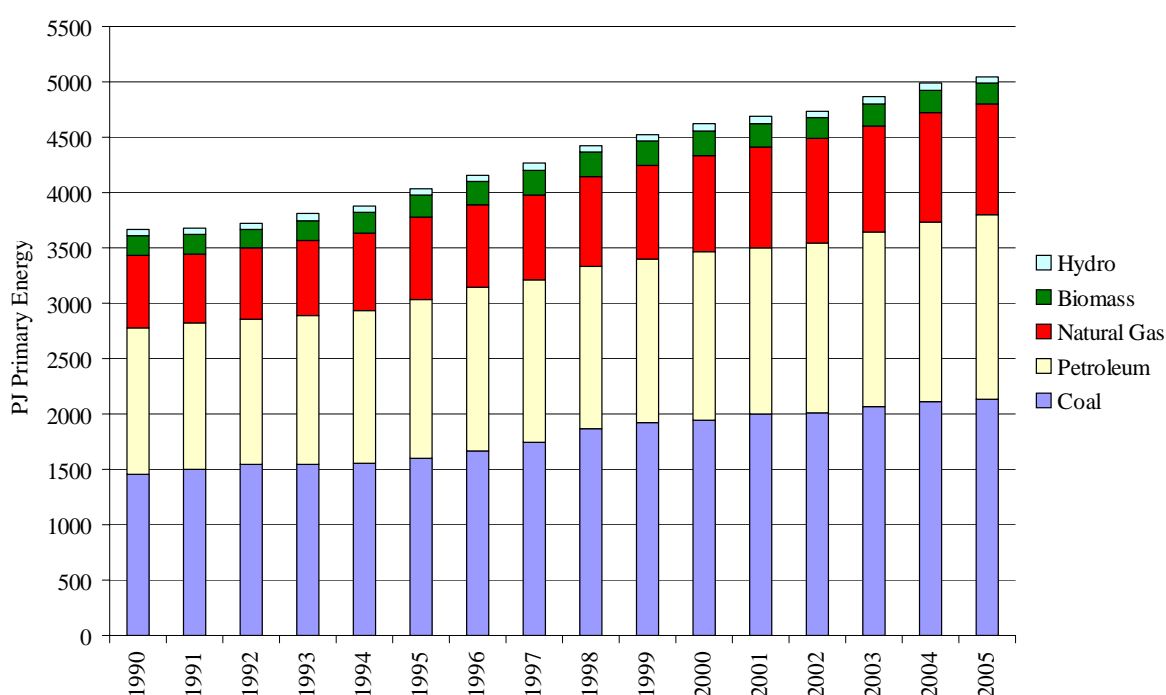
### EMISSIONS BY PRIMARY ENERGY TYPE

The Inventory reports the energy content of the primary fuels (coal, petroleum, natural gas and biomass) consumed that underlie the Fuel Combustion subsector emissions calculations (Figure 7). These energy values are based on ABARE data, but differ slightly from published values (e.g. ABARE 2005) because the Inventory subtracts the non-energy uses of fuels. The Inventory does not report the consumption of non-fuel renewable energy forms (e.g. hydro, solar or wind) because they do not give rise to emissions. The consumption of hydro was obtained from ABARE. The consumption of other renewable energy forms—wind and biogas—is covered in the later section dealing with electricity generation, but was so small as to be indistinguishable at the scale of Figure 7. Emissions from the combustion of each primary energy fuel are shown in Figure 8.

Total primary energy consumption was 37.9% higher in 2005 than in 1990—natural gas consumption was 54.3% higher, coal consumption 46.2% higher, petroleum consumption 25.9% higher, biomass consumption 9.2% higher and hydro consumption 4.9% higher.

The CO<sub>2</sub>-e intensity of the fossil fuels used in Australia differs widely between fuels (Appendix Table 4-5) and varies slightly from year to year. The average CO<sub>2</sub>-e intensity of coal was 0.6% lower in 2005 than in 1990, while the average intensity for petroleum and natural gas was 0.8% and 0.6% higher respectively. Coal increased its share of the primary energy mix from 39.8% to 42.2% over the period and its share of total fuel emissions from 51.6% to 53.8%. The contribution of natural gas to primary energy was 19.8% in 2005, up from 17.7% in 1990. The contribution of petroleum fuels (including LPG) declined from 36.1% of primary energy in 1990 to 33.0% in 2005.

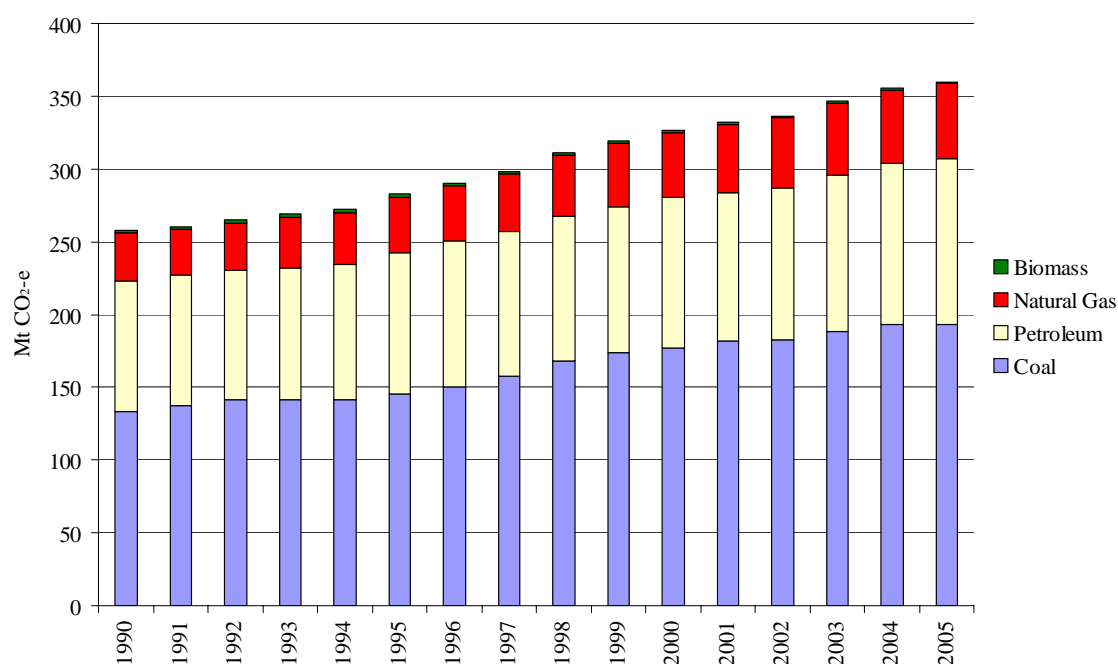
**Figure 7. Primary energy consumption by primary energy type, 1990–2005**



The consumption of renewable primary energy forms (biofuels and hydro) was 8.2% higher

in 2005 than in 1990. However, as total primary energy consumption increased by 37.9% over the period the renewable share of primary energy declined from 6.4% in 1990 to 5.0% in 2005 (after reaching a peak of 6.6% in 1997). Renewable energy accounted for 0.3% of emissions in 2005 (note that the Inventory includes only the CH<sub>4</sub> and N<sub>2</sub>O emissions from biomass combustion in aggregate emissions, not the CO<sub>2</sub> emissions).

**Figure 8. Total CO<sub>2</sub>-equivalent emissions by primary fuel type, 1990–2005**



## 4.2 STATIONARY ENERGY

In 2005, electricity generation dominated emissions from the Stationary Energy sector, accounting for 194.3 Mt CO<sub>2</sub>-e (69.57%) (Table 5). Industrial energy use (other energy industries, Manufacturing and Construction) accounted for 63.8 Mt (22.8%). Small Combustion (residential, commercial, institutional and agricultural energy use) accounted for 20.1 Mt (7.2%), and Other (military and lubricants) for 1.2 Mt (0.4%).

The emissions for each subsector represent only the combustion of the solid, liquid and gaseous fuels used in that subsector. The emissions associated with producing the electricity used in that subsector, which in most cases are far larger than the fuel-related emissions, are included in electricity generation. This means that the full contribution of each sector of the economy to energy-related greenhouse gas emissions cannot be determined from this analysis alone (see GWA 2007).

### EMISSIONS FROM ELECTRICITY SUPPLY

Emissions from electricity generation totalled 194.3 Mt CO<sub>2</sub>-e in 2005, which was 64.8 Mt (50.1%) higher than in 1990 (Figure 9). This section analyses the factors influencing the trend in emissions from electricity generation over the period 1990–2005. The major factor was the 58.7% increase in electricity consumption over the period. Another key factor was the change

in the contribution of each energy form, including hydroelectricity, to the total primary energy used in electricity generation (Figure 10).

The coal share of primary energy for electricity generation increased from 83.3% in 1990 to 84.0% in 2005. The introduction of the National Electricity Market in 1998 enabled brown coal power stations to increase their share of the electricity market in the eastern States in the short term due to their fuel price advantage at that time. This tended to increase electricity emissions in two ways:

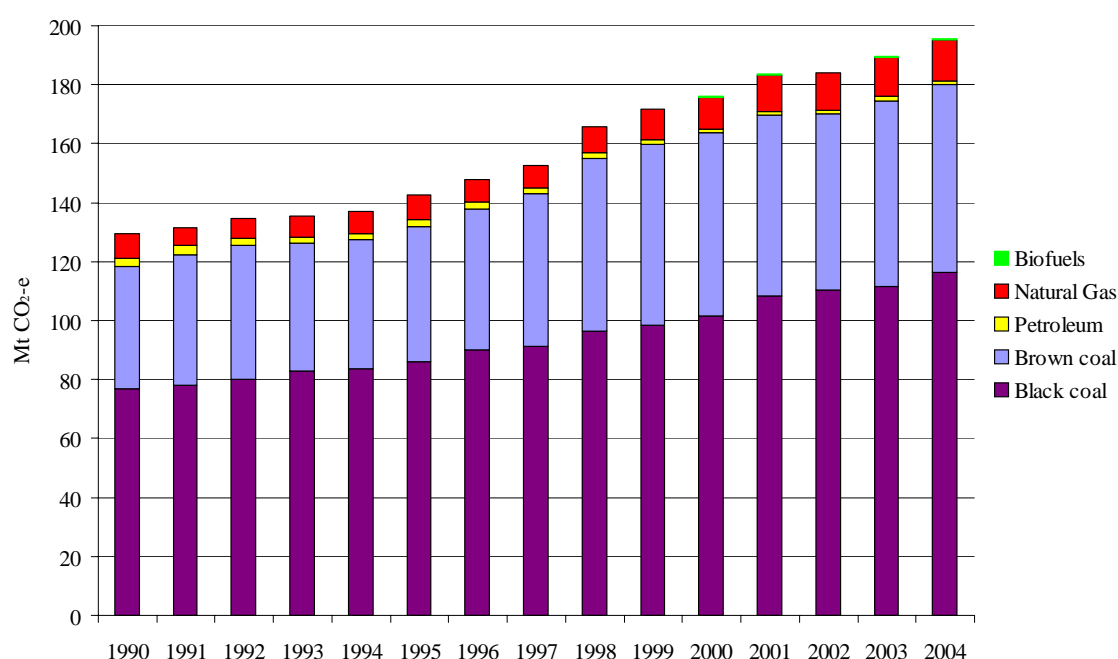
- brown coal has a higher CO<sub>2</sub>-e intensity than black coal (Table 6) and
- brown coal power stations have, on average, significantly lower thermal efficiency and higher auxiliary energy losses than black coal plant (Figure 13—see Glossary for explanation of electricity generation terms).

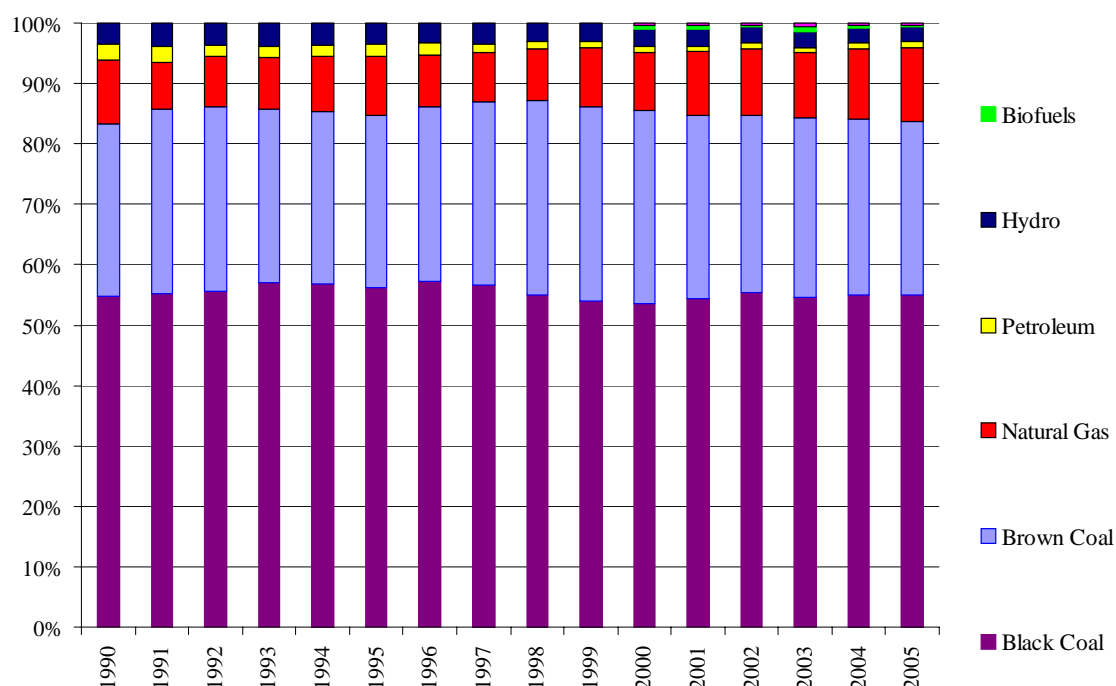
However, the brown coal share of electricity generation coal fell after 2000, and by 2005 it was back to its 1990 level.

**Table 6. CO<sub>2</sub>-equivalent emissions intensity for electricity generation fuels, 1990–2005**

Fuel	Gg CO <sub>2</sub> -e/PJ			
	1990	1995	2000	2005
Black coal	91.6	90.5	91.0	90.7
Brown coal	94.5	94.7	93.0	92.6
Petroleum	71.7	71.5	69.6	71.4
Natural gas	51.1	51.2	51.4	51.3
Biofuels	NA	NA	NA	NA
<b>All fuels</b>	<b>87.5</b>	<b>87.3</b>	<b>87.1</b>	<b>85.8</b>

**Figure 9. CO<sub>2</sub>-equivalent emissions from electricity generation by fossil fuels, 1990–2005**



**Figure 10. Share of electricity generation primary energy consumed by energy form, 1990–2005**

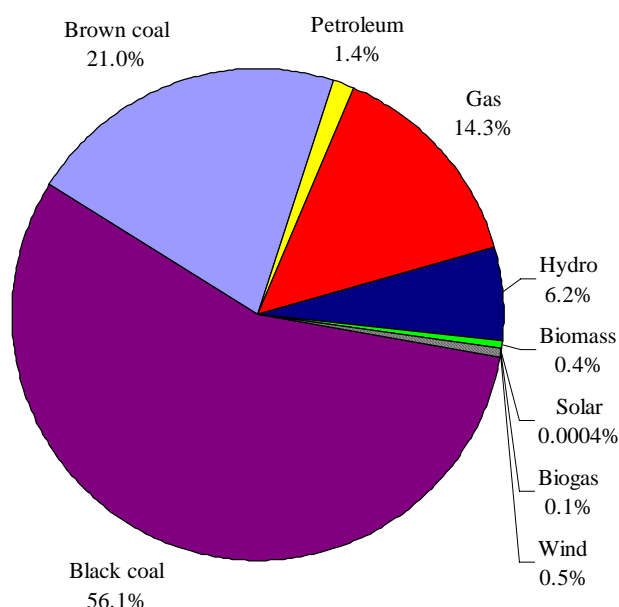
The natural gas share of primary energy consumed for electricity generation was 12.2% in 2005, compared with 10.5% in 1990. The gas share of generation fuel has grown steadily but unevenly since 1991, when it was at a low point of 7.9%. The petroleum share of electricity generation primary energy consumed was 1.0% in 2005, compared with 2.6% in 1990.

The hydro share of electricity generation primary energy was 2.4% in 2005, compared with 3.5% in 1990 and a peak of 3.8% in 1991 (Figure 10). Although the share fluctuated from year to year it showed a declining trend. Electricity production from the two main hydro regions—Tasmania and the Snowy Mountains—is constrained by long-term water availability. As a result, as national electricity consumption rises (it was 58.7% higher in 2005 than in 1990) the additional demand must be satisfied from non-hydro sources and the hydro share declines. On top of this longer-term trend there are short-term fluctuations in water availability and market factors influencing hydro production, which has declined in every year since 2001.

Hydro-electricity, like coal, is considered a primary energy form. The primary energy content is calculated as equal to the output of the secondary energy product, i.e. hydro-electricity. The electricity use at hydro power stations is minimal, so nearly all the electricity generated is sent out to the grid. For coal, the primary energy content is calculated by chemical analysis, and the energy content of the secondary energy product (thermal electricity) is typically about one third as great—the other two thirds of the energy in the coal is wasted as heat. Also, a significant share of electricity generated is used at the power station site (Table 7). Therefore in a mixed hydro and fossil fuel electricity system, the hydro share of energy sent out to the grid (7.1% in 2005) is higher than the hydro share of electricity generated (6.2% in 2005: Figure 11) and much higher than the hydro share of primary energy (2.4% in 2005: Figure 10).

The renewable share of electricity generation (hydro, biomass, biogas, solar and wind) fell from 8.2% in 2001 to 7.2% in 2005. Most of the decline was due to a fall in hydro generation; other renewables increased their share from 0.5% to 1.0% of generation.

**Figure 11. Share of electricity generation produced from each primary energy source, 2005**



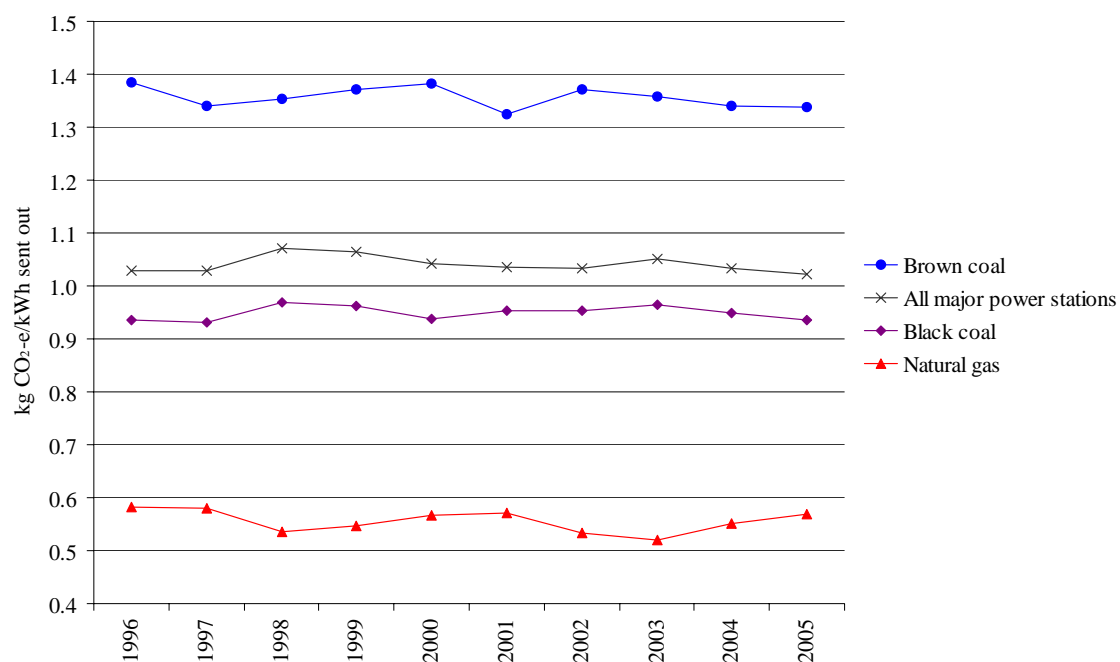
## EMISSIONS INTENSITY

The emissions intensity of electricity consumed ('delivered') varies with a number of factors—the fuel mix, the CO<sub>2</sub>-intensity of each fuel type, the efficiency with which power stations convert fuel to electricity, the proportion of generated electricity used on site, and the share of the electricity sent out from power stations that is lost as heat from wires and transformers. These factors can all vary independently from year to year. This is illustrated by the electricity subsectoral indicators—'share of electricity generation produced from each primary energy source' (Figure 11), 'emissions from electricity production divided by electricity sent out' (Figure 12, Appendix Table 4-17), 'efficiency of fossil-fuel electricity generation by fuel (sent out basis)' (Figure 13, Appendix Table 4-19), and the 'percentage of electricity sent out lost in transmission and distribution' (Table 7). Some of these indicators are calculated only from 1996, when the Electricity Supply Association of Australia began to report annual operating data in more detail.

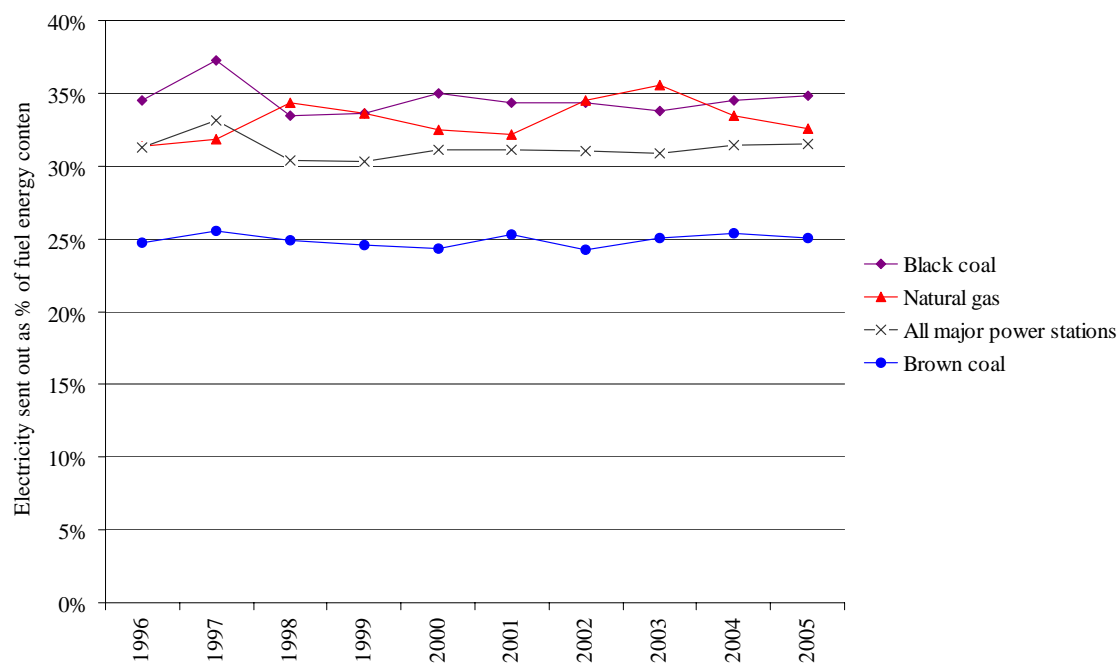
### Emissions intensity of electricity sent out

Figure 12 indicates the average emissions intensity of electricity sent out from the major fossil-fuel power stations. Emissions intensity of electricity sent out reflects two underlying factors—the emissions intensity of the fuel (Table 6) and the efficiency of the power station (Figure 13). The commissioning of new power stations and the retirement of old ones also had an effect.

**Figure 12. Emissions intensity of electricity sent out, major fossil fuel power stations, 1996–2005**



**Figure 13. Efficiency of major fossil-fuel power stations, 1996–2005**



### Efficiency of fossil-fuel power stations

The main indicator of the technical performance of fossil-fuel power stations is the efficiency with which they convert the energy in the fuel to electricity sent out from the power station. There was considerable variation in the efficiency of black coal and natural gas power stations from year to year, but brown coal power station efficiency remained fairly constant (Figure 13). Some new black coal and gas power stations came on line during the period; the same brown coal power stations remained in service throughout.

### Energy losses

Not all of the electricity generated is delivered to end users. In 2005 about 6.3% of electricity generated was used to operate power station auxiliary equipment, and a further 7.4% was lost as heat from the transmission and distribution systems. Table 7 illustrates the trend in the electricity indicator ‘percentage of electricity sent out lost (generated less power station auxiliary energy use) in transmission and distribution’. The difference between 100% and the percentage of electricity delivered to users indicates ‘total system losses’, i.e. the share of generated electricity that was lost from power station auxiliary energy use, transmission and distribution combined. Total system losses in 2005 were 13.8%, well below the peak during the period (14.3% in 2001).

**Table 7. Losses from the electricity system, 1997–2005**

Year	Electricity generated		Power Station auxiliary energy use		Transmission and distribution losses		Electricity delivered to users	
	GWh	%	GWh	%	GWh	%	GWh	%
1997	171,130	100.0%	5,945	3.5%	15,971	9.3%	149,214	87.2%
1998	182,260	100.0%	11,051	6.1%	13,919	7.6%	157,290	86.3%
1999	187,779	100.0%	11,962	6.4%	14,055	7.5%	161,762	86.1%
2000	195,326	100.0%	12,116	6.2%	15,574	8.0%	167,635	85.8%
2001	201,843	100.0%	12,688	6.3%	16,080	8.0%	173,075	85.7%
2002	204,205	100.0%	13,022	6.4%	14,904	7.3%	176,279	86.3%
2003	209,281	100.0%	12,623	6.0%	14,339	6.9%	182,319	87.1%
2004	218,963	100.0%	13,803	6.3%	18,002	8.2%	187,157	85.5%
2005	224,697	100.0%	14,208	6.3%	16,698	7.4%	193,791	86.2%

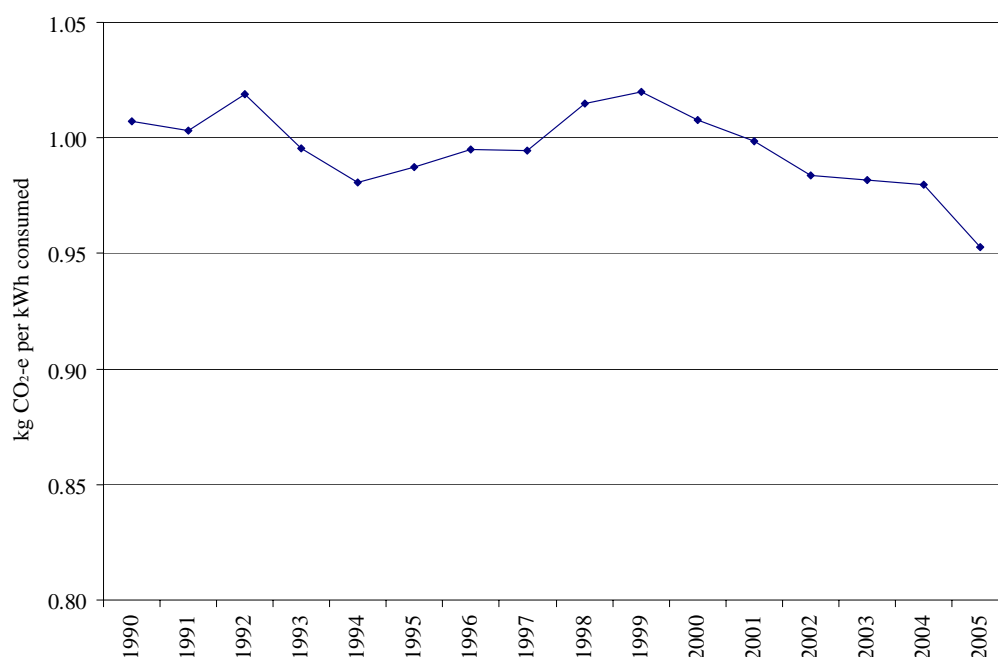
Source: Calculated from ESAA (Electricity in Australia)

### Emissions intensity of electricity consumed

The emissions intensity of electricity consumed in Australia was 0.953 kg CO<sub>2</sub>-e/kWh (264.6 Gg CO<sub>2</sub>-e/PJ delivered) in 2005, 5.4% lower than the 1990 value of 1.007 kg CO<sub>2</sub>-e/kWh (279.8 Gg CO<sub>2</sub>-e/PJ). The emissions intensity of electricity consumed declined during the early 1990s (Figure 14) despite the increase in the fuel share of coal (Figure 10), largely because of an increase in the thermal efficiency of black coal power stations. This trend reached its limit in 1994, after which intensity was driven upwards until 1999 by a decline in the thermal efficiency of black coal power stations, the increasing share of brown coal and the declining share of hydro. The emissions intensity of electricity consumed has been falling since, due to a fall in the emissions intensity of the fuel mix (Table 6) and a rise in thermal efficiency (Figure 13).

The emissions intensity in Figure 14 is the national average. Each State has a different emissions intensity for electricity and in the case of Tasmania, where electricity has been almost entirely produced from hydro-electricity, the emissions intensity in most years has been close to zero (Table 8). Individual State emissions intensities, which are complicated by the need to account for cross-border electricity flows, are estimated in GWA (2007).

**Figure 14. Emissions intensity of electricity consumed, 1990–2005**



**Table 8. Emissions intensity of Electricity Delivered**

State	kg CO <sub>2</sub> -e/kWh delivered			
	1990	1995	2000	2005
NSW, ACT	0.967	0.915	0.937	0.985
Victoria	1.427	1.363	1.418	1.333
Queensland	1.063	1.076	1.006	1.051
SA	0.884	0.954	1.010	0.947
WA (SWIS) <sup>a</sup>	1.035	1.014	0.999	0.896
Tasmania	0.067	0.007	0.007	0.049
NT	0.932	0.809	0.730	0.735

Source: GWA (2007). a. South West Interconnected System

### Industrial, commercial and household energy use

‘Emissions per unit of energy delivered’ is the greenhouse indicator for each sector of Stationary Energy use and for Stationary Energy as a whole. This indicator depends on the mix of energy types and the emissions intensity of each energy type.

The emissions intensity of electricity is much higher than for other delivered energy forms (e.g. natural gas), so the more electrified a sector (i.e. the higher the share of delivered energy that is electricity) the higher the emissions per unit of energy delivered for that sector.

The sectoral emissions intensities shown in Figure 15 account for all combustion emissions from energy use, including those from electricity generation. They also include the emissions



from mobile sources within the residential, commercial and industrial sectors, which are no longer reported separately.

The overall emissions intensity of Stationary Energy delivered was 4.5 higher in 2005 than in 1990 (Figure 15, Appendix Table 4-3). The intensities for the residential, commercial and industrial sectors were all higher, mainly because all sectors had a higher share of energy supplied as electricity (Appendix Table 4-8). The emissions intensity of the Transport sector energy increased only slightly, for the reasons discussed in the next section.

The commercial sector has the highest share of energy supplied as electricity (Appendix Table 4-8) and consequently the highest emissions intensity. However, electricity intensity has plateaued at around 69% since 2001, so the sector's emissions intensity has been falling with the fall in electricity-intensity. In 2005 the commercial sector's emissions intensity was 3.3% higher than in 1990, but 4.7% lower than the sector's peak, which occurred in 2001.

The residential and industrial sectors have a considerably lower proportion of electricity use than the commercial, but both the residential and industrial sectors have significant biomass use (Appendix Table 4-8), which helps to contain their emissions intensity because only non-CO<sub>2</sub> emissions are included in biomass intensity.

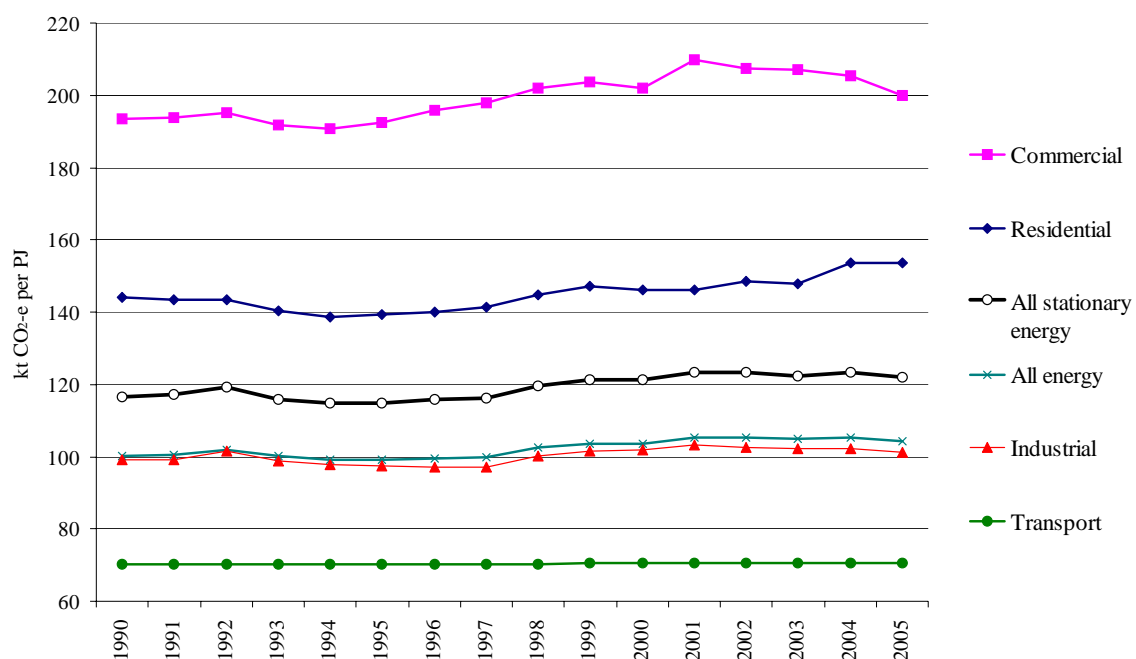
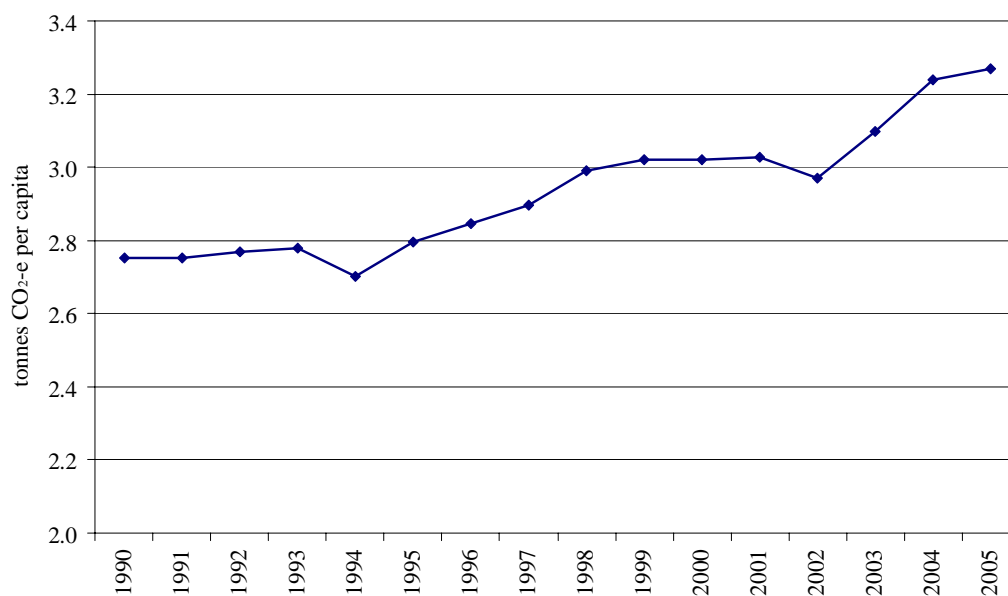
In the residential sector there was a gradual decline in emissions intensity from 1990 until 1994, due to a slight decline in electricity share and an increase in the share of natural gas (Appendix Table 4-8). Since the mid 1990s however, the electricity share of energy delivered in the residential sector has been rising, and exceeded 50% for the first time in 2005. Although the gas share has also been rising, this was at the expense not of electricity but of petroleum and biomass. Until 1998 the rise in electricity share was counteracted by declining electricity intensity, but since 2000 the growth in electricity share has been the dominant trend.

The growth in residential sector electricity demand has been unusually strong since 2002. The average rate of increase in household electricity use between 1990 and 2002 was 2.2% per annum, but averaged 6.1% per annum over the following 3 years. The increase from 2003 to 2004 alone was 7.5%, the highest recorded by ABARE since 1977.

The household energy greenhouse indicator, 'emissions from household energy per capita' was 2.75 tonnes CO<sub>2</sub>-e per capita in 1990, and 3.27 tonnes (18.8% higher) in 2005 (Figure 16). The indicator rose in all but two of the years since 1990.

The drivers for the increase were greater household energy use per capita (up 13.8% from 1990 to 2005) and increased electricity share of household energy use (from 42.9% in 1990 to 50.1% in 2005). The 5.4% fall in the emissions intensity of electricity consumed had only a minor downward effect on this indicator.

The indicator says nothing about the efficiency of energy use in households. If the efficiency of household energy equipment increased more rapidly than the increase in the amount of energy delivered to households, then the emissions per unit of useful energy services would have declined. This cannot be ascertained without further research.

**Figure 15. Emissions intensity of energy delivered by end-use sector, 1990–2005****Figure 16. Emissions from household energy use per capita, 1990–2005**

## 4.3 TRANSPORT

### TOTAL SECTOR AND MODE EMISSIONS

Emissions from domestic transport were 80.4 Mt CO<sub>2</sub>-e in 2005. This was 18.5 Mt (29.9%) more than in 1990. Cars and station wagons accounted for 54.3% of total transport emissions, trucks and light commercial vehicles for 31.7%, and road transport as a whole for 87.9%. Trends in emissions from the main transport modes are shown in Figure 17.

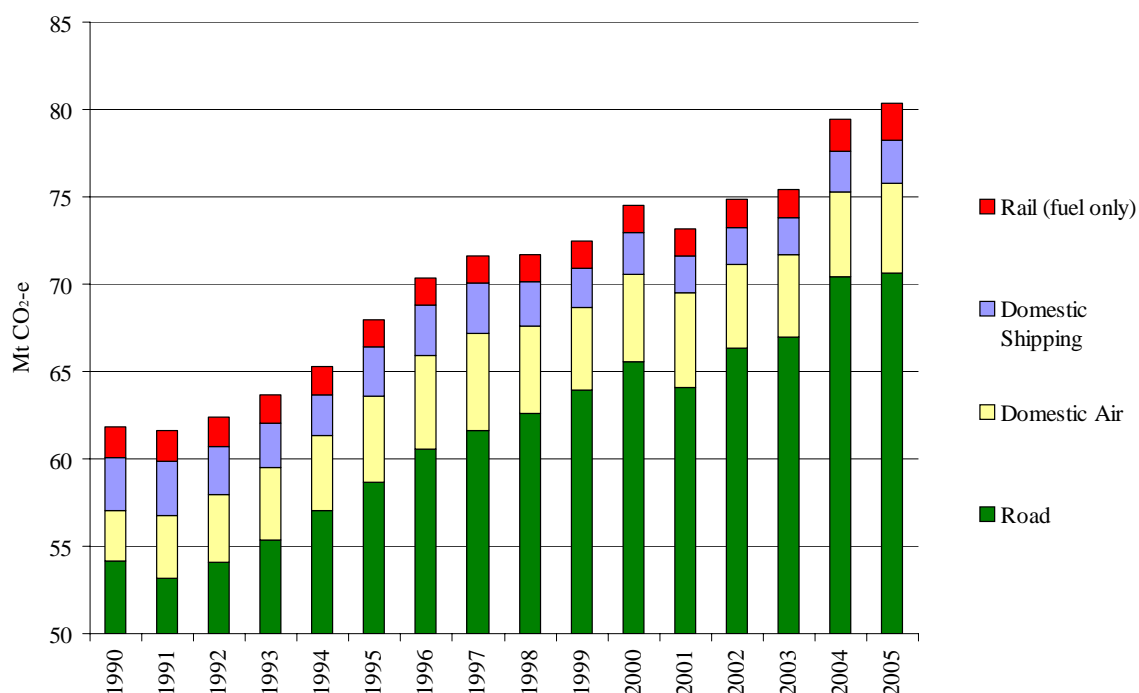
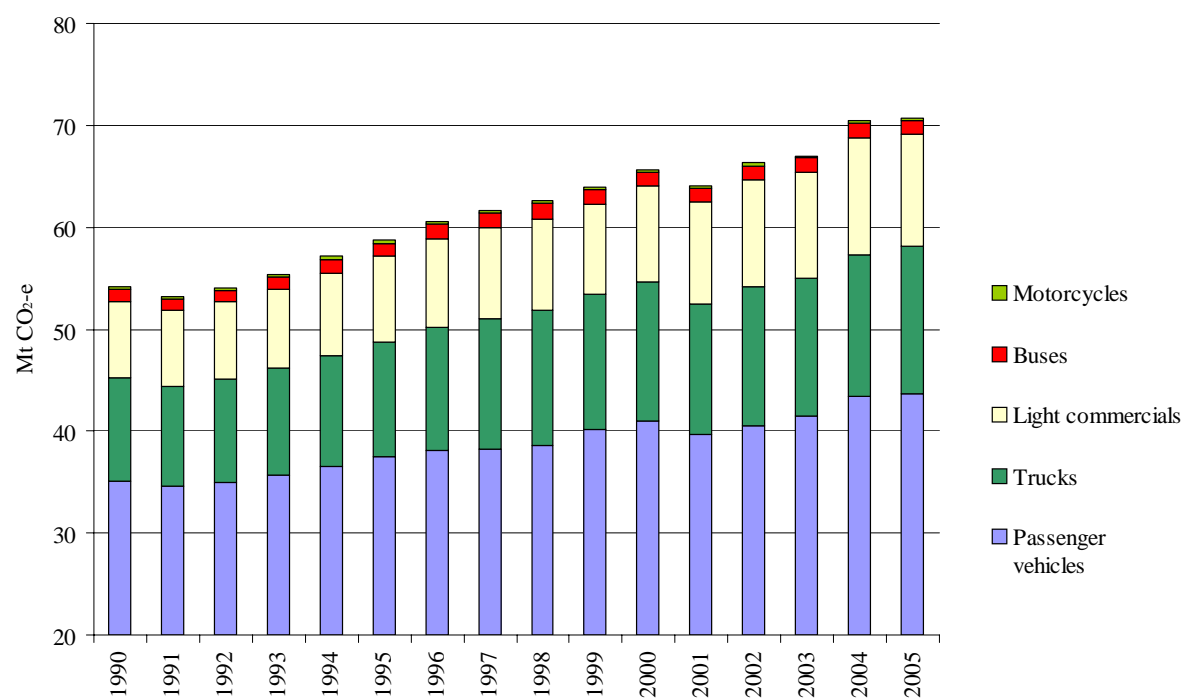
### Road transport

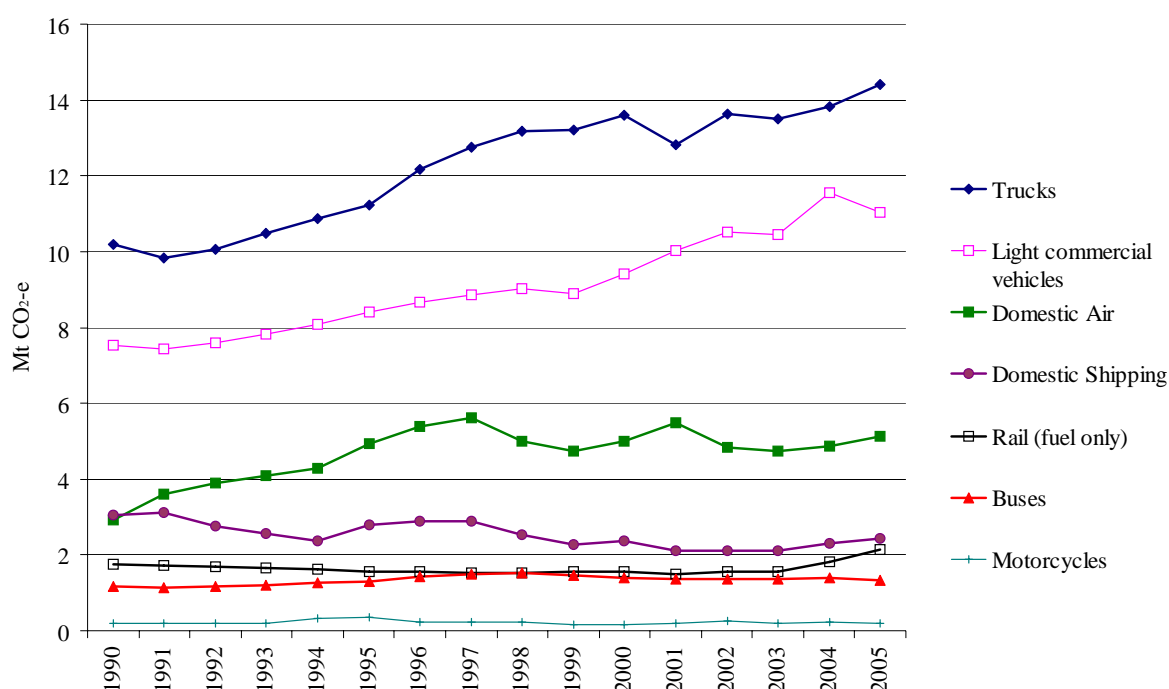
Emissions from road transport increased in most years, but showed small declines in 1991, and 2001 (Figure 18). Both passenger vehicle and truck emissions fell in those years. The average rate of increase in road transport emissions over the period 1990 to 2005 was 1.8% per annum, and road transport emissions in 2005 were 30.5% (16.5 Mt) higher than in 1990.

In 2005 passenger vehicle emissions increased by 0.6%, well below their average annual growth rate of 1.5%. In 2005 passenger vehicle emissions were 24.7% above the 1990 level.

Passenger vehicles account for such a large share of Transport sector emissions that they tend to dominate trend graphs. Figure 19 illustrates the trends in emissions for all modes other than passenger vehicles. Truck emissions declined in 1991 due to a recession-induced decline in truck travel. There were also declines in emissions in 2001 and 2003, years where economic growth was significantly lower than the preceding and following years (although still positive, unlike 1991). In 2005 truck emissions were 41.3% above the 1990 level.

Emissions from light commercial vehicles (LCVs) increased in every year except for small declines in 1991, 1999, 2003 and 2005. In 2005 they were 46.8% higher than in 1990. Emissions from buses were 13.9% higher in 2005 than in 1990, although well below their peak in 1998. Emissions from motorcycles were 5.1% lower than in 1990.

**Figure 17. Domestic transport emissions by mode, 1990–2005****Figure 18. Road transport emissions by vehicle type, 1990–2005**

**Figure 19. Domestic transport emissions by mode (other than passenger vehicles), 1990–2005**

### Domestic aviation

Emissions from aircraft increased by 92% between 1990 and 1997 (Figure 19). This period of rapid growth coincided with the entry of new airlines, fare discounting, a recovery in domestic air travel and growth in international tourism. The average rate of increase in domestic air transport emissions over the period 1990 to 1997 was nearly 10% per annum. Domestic air transport emissions fell by 15% from 1997 to 1999, increased sharply to 2001 (the year of the Sydney Olympics), and then declined again. By 2005 they were 76% (2.2 Mt) higher than in 1990, but still 8% below the 1997 peak.

### Rail

Emissions from rail fuel use gradually declined during the first half of the 1990s, but then stabilised (with a dip in 2001) before increasing again. They were 22% (0.4 Mt) higher in 2005 than in 1990. However, this gives an incomplete picture since emissions from electric rail are included not in Transport but in Stationary Energy. Rail electricity use increased by 31% over the same period, and total rail emissions including those from electricity increased by 27%.

### Shipping

Emissions from domestic shipping declined steadily over the period, despite small increases in some years. It is understood that this reflected a rise in the proportion of the fuel used in coastal navigation in Australia that was taken on at overseas ports (i.e. during the sections of the voyage that originated outside Australia). In 2005 emissions were 21% (0.6 Mt) lower than in 1990. The average rate of change in domestic shipping emissions over the period 1990 to 2005 was –1.5% per annum.

## SUBSECTORAL INDICATORS

The Transport subsectoral greenhouse indicators that involve emissions are calculated in two steps. The first step relates emissions to fuel use and the second step relates fuel use to the transport task (i.e. passenger-km for passenger modes and tonne-km for freight modes). For the period 1990 to 2005, reliable national estimates of the transport task are available for the years 1991, 1995, 1998, 1999, 2001, 2002, 2003, 2004 and 2005 (ACG 2007). Indicators have been calculated for 1991, 1995, 1998, 2001 and 2005.<sup>2</sup>

### Emissions intensity of fuels

Figure 20 shows the trend in emissions (in grams CO<sub>2</sub>-e) per energy unit (MJ) of fuel consumed by each road vehicle type between 1990 and 2005. This is derived from the Inventory by dividing the total CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from each vehicle type (expressed as mass of CO<sub>2</sub>-e) by the energy content of all fuels used by that vehicle type. If all the fuel used by a vehicle type were automotive gasoline, which has a CO<sub>2</sub> emission factor of 67.4 g/MJ, and there were no emissions of CH<sub>4</sub> or N<sub>2</sub>O, then the emissions intensity per unit of fuel used would be exactly 66.7 g/MJ (allowing for a carbon oxidation factor of 0.99). If there were significant use of fuels with a lower CO<sub>2</sub> intensity than automotive gasoline, such as Liquefied Petroleum Gas (LPG: 59.6 g CO<sub>2</sub>/MJ), the average would be lower. However, average emissions per MJ for each vehicle type exceed 66.7 g/MJ because:

- trucks and buses use mainly Automotive Diesel Oil (ADO) which has a higher CO<sub>2</sub> intensity than automotive gasoline (i.e. 69.9 g CO<sub>2</sub>/MJ or 69.2g CO<sub>2</sub>/MJ allowing for the carbon oxidation factor of 0.99))
- significant quantities of CH<sub>4</sub> and N<sub>2</sub>O are also emitted in addition to CO<sub>2</sub>, especially in the passenger vehicle fleet where the proportion of vehicles equipped with three-way catalytic converters rose significantly over the period.

Vehicles equipped with three-way catalytic converters produce more N<sub>2</sub>O per unit of fuel used than those equipped with two-way catalytic converters, or those without any pollution controls at all.

As older passenger vehicles dropped out of the fleet, the share of passenger vehicle fuel used in vehicles with three-way catalytic converters increased (as indicated by the unleaded share of gasoline consumption, which increased from 27% in 1990 to 100% in 2005). The resulting rise in N<sub>2</sub>O emissions increased the greenhouse gas intensity per unit of fuel used by passenger vehicles by about 1 g CO<sub>2</sub>-e/MJ (Figure 20). There were also increases in both the ADO and LPG shares of passenger vehicle fuel over the same period, but these influenced CO<sub>2</sub>-intensity in opposite directions and so largely cancelled each other out.

The emissions intensity of fuel used in heavy trucks was fairly constant for most of the period, because the fuel mix did not change (nearly all of it was ADO) and because heavy trucks do not use pollution control equipment.

The gradual increase in emissions intensity for medium trucks was associated with a decline in the share of petrol (automotive gasoline) in favour of ADO. According to the Inventory, the gasoline share of medium truck fuel declined from 4.1% in 1990 to 1.5% in 2005.

---

<sup>2</sup> These have been selected because the intervals are roughly even (4,3,3,4 years). Data for each of these years have been taken from ACG (2007) rather than from earlier ACG studies, to maintain internal consistency.

The decline in emissions intensity for bus fuel reflects an increase in the share of LPG, which has an emission factor of 60.2 g CO<sub>2</sub>/MJ, and natural gas, with an emission factor of 51.4 g CO<sub>2</sub>/MJ, at the expense of ADO, with a factor of 69.9 g CO<sub>2</sub>/MJ. Between 1990 and 2005 the combined LPG and natural gas share of bus fuel increased from 1.0% to 13.3%.

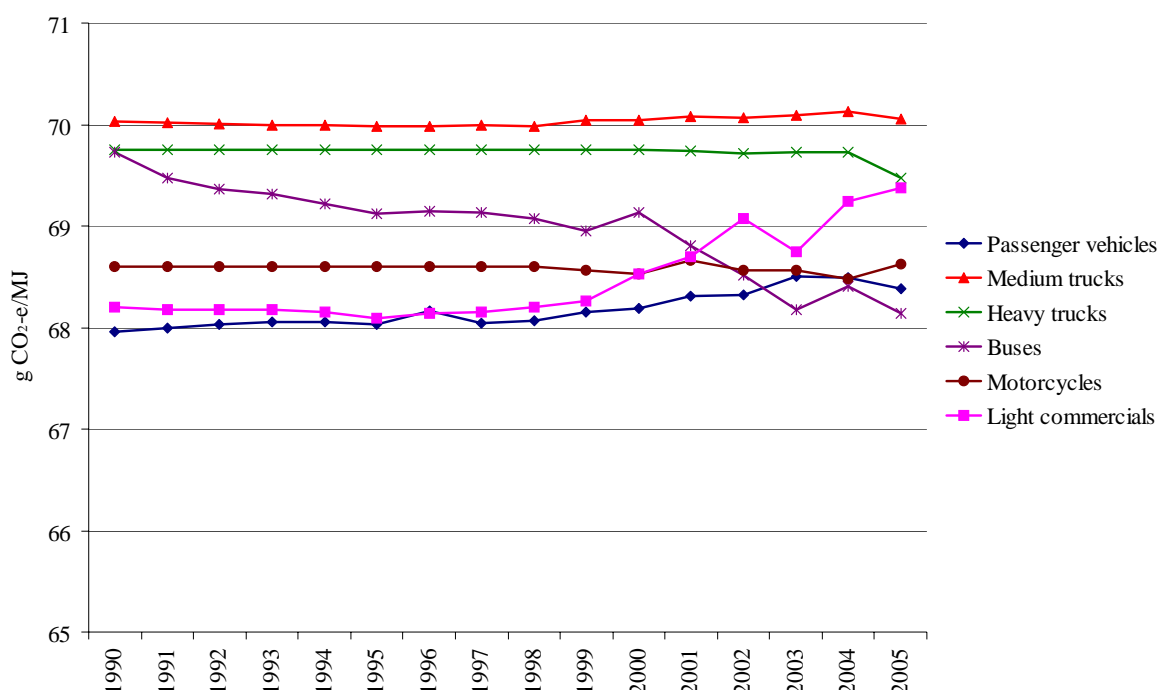
Figure 21 illustrates the trend in emissions intensity of fuel use by rail, air transport, shipping and the road transport sector as a whole. The increasing emissions intensity of road fuel use is due mainly to the changes in the passenger vehicle fleet already discussed.

The greenhouse gas intensity per unit of fuel used in domestic air transport has remained nearly constant. Unlike road transport, intensity in air transport has not been affected by changes in the mix of petroleum products used or in pollution control technology. Any changes in the greenhouse indicators are likely to be due solely to changes in the air transport task or changes in the fuel efficiency of aircraft.

The greenhouse gas intensity per unit of fuel used in rail transport has also remained nearly constant, but changes in the share of electricity in rail energy and in the emissions intensity of electricity also affect the rail indicators.

The increasing greenhouse gas intensity of fuel used by coastal shipping reflects the fact that coal increased its share of reported fuel use from 8.5% in 1990 to 17.8% in 2005.

**Figure 20. Emissions per MJ of fuel consumed by road vehicle type, 1990–2005**

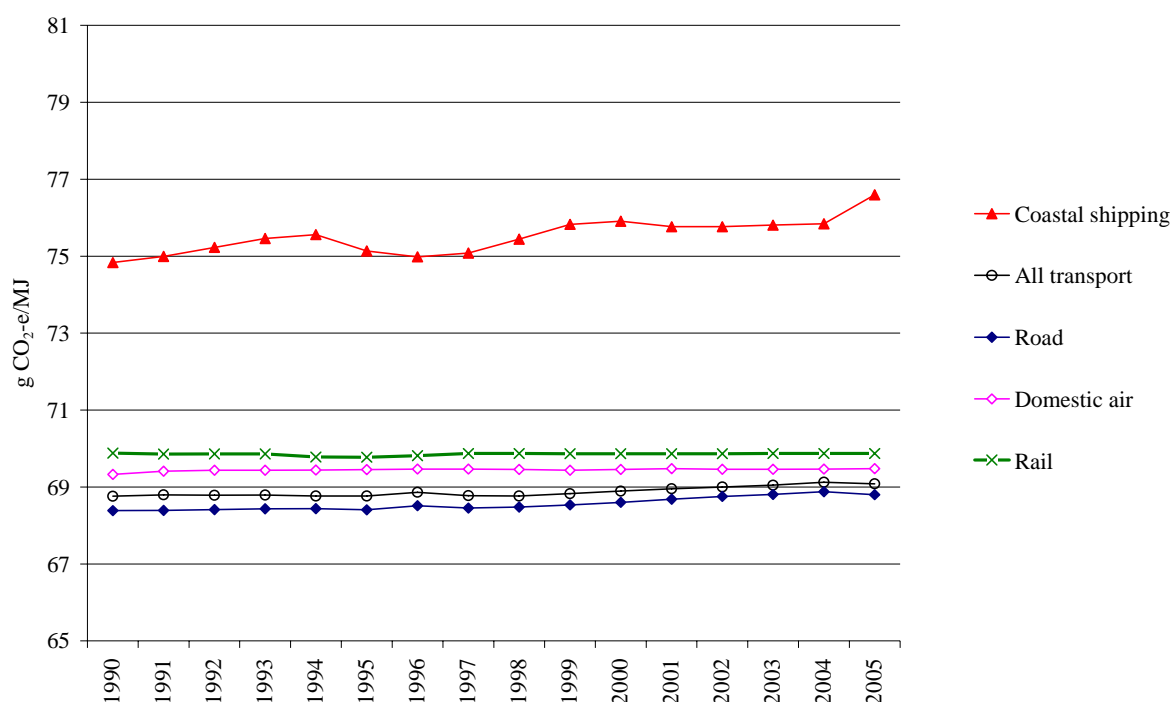


#### Passenger vehicle fuel efficiency

Between 1991 and 2005, passenger vehicle fuel consumption increased by 25.7%, vehicle travel increased by 32.6% and the fleet average rate of fuel consumption (FAFC) declined by 6.0% (Table 9). FAFC was highest for LPG-powered vehicles followed by diesel vehicles

and then petrol vehicles. LPG-powered vehicle FAFC declined significantly from 1995 to 2005.

**Figure 21. Emissions per MJ of fuel by Transport mode, 1990–2005**



**Table 9. Passenger vehicle parameters, 1991 to 2005**

Indicators	1991	1995	1998	2001	2005	Change 91 to 05
Vehicle-km travelled (millions) <sup>(a)</sup>	127,626	138,585	145,010	153,149	169,225	32.6%
Passenger-km (millions) <sup>(a)</sup>	211,461	227,461	233,616	243,684	262,025	23.9%
Passenger vehicles registered (thousand) <sup>(a)</sup>	7,853	8,768	9,561	9,836	10,937	39.3%
Fuel consumed (PJ) <sup>(b)</sup>	508.1	551.5	567.7	580.2	638.8	25.7%
Mt CO <sub>2</sub> -e emissions <sup>(b)</sup>	34.6	37.5	38.6	39.6	43.7	26.4%
FAFC (litres/100 km) – petrol vehicles <sup>(a)</sup>	11.6	11.5	11.4	11.0	10.8	-7.5%
FAFC (litres/100 km) – diesel vehicles <sup>(a)</sup>	12.7	12.7	12.9	13.6	12.3	-3.2%
FAFC (litres/100 km) – LPG vehicles <sup>(a)</sup>	NA	19.9	17.6	16.8	16.7	-16.3%
FAFC (litres/100 km) – all vehicles <sup>(a)</sup>	11.9	12.0	11.8	11.5	11.2	-6.0%

(a) ACG 2007 (b) DEW 2007.

### The transport task

The Australian passenger transport task in 1991, 1995, 1998, 2001 and 2005 is summarised in Table 10. Cars and station wagons accounted for 77.1% of passenger-km travelled in 2005, aircraft for 14.0% and buses for 4.9%. The road passenger task increased by 20.5% between 1991 and 2005, the air task by 178%, the sea task by 89.2% and the rail task by 14.8%.

The Australian freight transport task is summarised in Table 11. Road vehicles accounted for 39.9% of all freight tonne-km in 2005, followed by rail (37.2%) and coastal shipping (22.9%). The total freight task increased by 75.2% between 1991 and 2005. Road and rail increased their share of the freight task, increasing at 96.9% and 102.8% respectively, while sea freight, which was 22.9% higher than 1991 but below its 1998 peak, lost share.



**Table 10. Domestic passenger transport task, 1991 to 2005**

Transport Mode	Passenger-km (billion)					Share of total 2005	Change 91 to 05
	1991	1995	1998	2001	2005		
Passenger vehicles	211.5	227.5	233.6	243.7	262.0	77.1%	23.9%
Motorcycles	1.8	1.8	1.7	1.7	2.0	0.6%	13.2%
Buses	13.9	15.4	16.8	19.5	16.7	4.9%	20.5%
All road vehicles	227.1	244.6	252.2	264.9	280.8	82.6%	23.6%
Rail (heavy plus light)	9.8	9.9	10.2	11.4	11.2	3.3%	14.8%
Air	17.2	27.7	31.7	37.0	47.7	14.0%	178.0%
Sea	0.2	0.2	0.3	0.3	0.4	0.1%	89.2%
<b>Total</b>	<b>254.2</b>	<b>282.4</b>	<b>294.4</b>	<b>313.6</b>	<b>340.0</b>	<b>100.0%</b>	<b>33.8%</b>

Source: ACG (2007). The passenger-km performed by LCVs and trucks are treated as ancillary to their freight role, and are excluded from this calculation.

**Table 11. Freight transport task, 1991 to 2005**

Transport Mode	Tonne-km (billion)					Share of total 2005	Change 91 to 05
	1991	1995	1998	2001	2005		
Light commercial	4.8	5.7	6.6	7.7	8.7	1.7%	80.5%
Rigid Trucks	23.7	25.6	28.8	28.3	37.8	7.6%	59.5%
Articulated Trucks	72.6	89.4	105.9	116.0	152.6	30.6%	110.1%
All road vehicles	101.1	120.7	141.3	152.0	199.0	39.9%	96.9%
Rail	91.5	105.8	124.3	139.6	185.6	37.2%	102.8%
Air	0.13	0.20	0.24	0.25	0.28	0.06%	119.4%
Sea	96.5	112.0	120.9	105.2	114.0	22.9%	18.2%
<b>Total</b>	<b>289.2</b>	<b>338.7</b>	<b>386.8</b>	<b>397.0</b>	<b>499.0</b>	<b>100.0%</b>	<b>72.5%</b>

Source: ACG (2007). The freight tonne-km performed by passenger vehicles are ancillary to their passenger role, and are excluded from this calculation.

### Road transport

Emissions per kilometre of passenger vehicle travel (Table 12) are calculated by combining data on rates of fuel consumption (Table 9), the emissions intensity of fuel use (Figure 20) and the energy content of fuel types. The indicator declined for passenger vehicles for all fuel types because of gains in fuel efficiency. In the case of petrol vehicles, these fuel efficiency gains were offset slightly by increases in the greenhouse intensity of fuel use from the greater incidence of catalytic converters.

The Apelbaum Consulting Group (ACG 2007) reports fuel use (in MJ) per passenger-km for each vehicle type. Combining MJ fuel consumption per passenger-km with the greenhouse gas emissions per MJ gives greenhouse gas emissions per passenger-km (Table 12).

Changes in intensity from year to year reflect changes in the following factors:

- the share of fuel by type (e.g. gasoline, diesel, LPG and natural gas) and for passenger vehicles, the proportion of gasoline used in vehicles with catalytic converters
- fuel efficiency—if all else remains constant, emissions per passenger-km will decline as fuel efficiency increases

- average vehicle occupancy—if all else remains constant, emissions per passenger-km will decline as occupancy increases.

For passenger vehicles, fuel emissions intensity was higher in 2005 than in 1991 due to catalytic converters (Figure 20), fuel efficiency was higher but average occupancy was lower (Table 12). These factors more or less cancelled each other, with emissions intensity moving only from 165 to 166 g CO<sub>2</sub>-e/passenger-km.

For buses fuel emissions intensity was lower in 2005 than in 1991 due to a higher share of natural gas use (Figure 20) and average fuel consumption was also lower. However, the fall in average occupancy, especially for non-urban travel (Table 12), led to a 5.4% rise in emissions intensity, from 83 to 87 g CO<sub>2</sub>-e/passenger-km.

The laden VKT performed by road freight vehicles, the average loads carried, the average fuel consumption and the emissions intensity are summarised in Table 13. Emissions per tonne-km declined significantly for each mode between 1991 and 2005. For LCVs, this reflected an increase in average loadings as well as a fall on fuel consumption rates. For rigid trucks, loadings increased while fuel consumption remained fairly constant. For articulated trucks the average rate of fuel consumption increased by 6.9%, but loadings increased even more (by 33.4%).

**Table 12. Occupancy, fuel consumption and emissions, passenger vehicles and buses**

Indicator	Urban			Non-urban			Total		
	91	98	05	91	98	05	91	98	05
<b>Passenger motor vehicles</b>									
Emissions per petrol vehicle (g CO <sub>2</sub> -e/ vehicle-km) <sup>(b)</sup>	NR	NR	NR	NR	NR	NR	272	268	255
Emissions per diesel vehicle (g CO <sub>2</sub> -e/ vehicle-km) <sup>(b)</sup>	NR	NR	NR	NR	NR	NR	343	347	332
Emissions per LPG vehicle (g CO <sub>2</sub> -e/ vehicle-km) <sup>(b)</sup>	NR	NR	NR	NR	NR	NR	NR	274	259
Average occupancy (persons) <sup>(a)</sup>	1.58	NR	NR	1.83	NR	NR	1.66	1.61	1.55
Fuel consumption (litres/100 km) <sup>(a)</sup>	NR	NR	NR	NR	NR	NR	11.9	11.8	11.2
MJ/passenger-km <sup>(a)</sup>	2.56	2.70	2.48	2.17	1.94	2.32	2.43	2.45	2.43
g CO <sub>2</sub> -e/passenger-km <sup>(b)</sup>	174	184	170	148	132	159	165	167	166
<b>Buses</b>									
Average occupancy (persons) <sup>(a)</sup>	8.9	NR	NR	10.9	NR	NR	9.8	9.2	7.9
Fuel consumption (litres/100 km) <sup>(a)</sup>	NR	NR	NR	NR	NR	NR	30.6	27.6	26.7
MJ/passenger-km <sup>(a)</sup>	1.60	1.69	1.56	1.13	0.87	1.26	1.37	1.29	1.45
g CO <sub>2</sub> -e/passenger-km <sup>(b)</sup>	97	102	93	69	53	76	83	78	87

Source: (a) ACG 2007. (b) calculated by author. NR means not reported separately.

**Table 13. Loading, fuel consumption and emissions, road freight vehicles**

Indicator	1991	1995	1998	2001	2005	Change 91 to 2005
<b>Light commercial vehicles</b>						
Laden VKT (million) <sup>(a)</sup>	10,387	13,649	14,717	14,712	16,781	61.6%
tonne-km (million) <sup>(a)</sup>	4,836	5,716	6,615	7,675	8,727	80.5%

Average tonnes/laden VKT <sup>(a)</sup>	0.47	0.42	0.45	0.52	0.52	11.7%
Fuel consumption (litres/100 km) <sup>(a)</sup>	13.7	13.6	13.3	13.4	13.0	-4.9%
g CO <sub>2</sub> -e/tonne-km <sup>(b)</sup>	1514	1607	1412	1353	1294	-14.5%
<b>Rigid trucks</b>						
Laden VKT (million) <sup>(a)</sup>	4,384	4,652	4,835	4,824	5,433	23.9%
tonne-km (million) <sup>(a)</sup>	23,668	25,602	28,811	28,349	37,752	59.5%
Average tonnes/laden VKT <sup>(a)</sup>	5.40	5.50	5.96	5.88	6.95	28.7%
Fuel consumption (litres/100 km) <sup>(a)</sup>	27.4	28.1	28.2	28.0	27.6	0.9%
g CO <sub>2</sub> -e/tonne-km <sup>(b)</sup>	188.4	187.1	178.0	183.9	182.7	-3.0%
<b>Articulated trucks</b>						
Laden VKT (million) <sup>(a)</sup>	2,970	3,638	3,957	3,836	4,678	57.5%
tonne-km (million) <sup>(a)</sup>	72,609	89,412	105,859	115,988	152,564	110.1%
Average tonnes/laden VKT <sup>(a)</sup>	24.45	24.58	26.75	30.24	32.61	33.4%
Fuel consumption (litres/100 km) <sup>(a)</sup>	51.5	52.3	52.4	53.7	55.1	6.9%
g CO <sub>2</sub> -e/tonne-km <sup>(b)</sup>	77.2	75.1	69.8	64.7	60.2	-22.0%
<b>All road freight</b>						
Laden VKT (million) <sup>(a)</sup>	17,741	21,939	23,509	23,372	26,892	51.6%
tonne-km (million) <sup>(a)</sup>	101,113	120,730	141,285	152,013	199,043	96.9%
Average tonnes/laden VKT <sup>(a)</sup>	5.70	5.50	6.01	6.50	7.40	29.9%
g CO <sub>2</sub> -e/tonne-km <sup>(b)</sup>	172	171	155	152	138	-20.0%

Source: (a) ACG 2007 (b) calculated by author

### Air transport

Air transport activity and fuel intensity data for 1991, 1995, 1998 2001 and 2005 are summarised in Table 14. The number of passengers carried increased by 118% between 1991 and 2005, and passenger-km by 178%. Improved operating procedures, higher passenger load factors (from a low base following a protracted strike in the late 1980s) and the introduction of larger, more modern aircraft contributed to a 37.6% reduction in energy intensity per passenger tonne-km carried between 1991 and 2005. Since there was no significant change in the greenhouse gas intensity of fuel used, this translated directly into a 37.5% reduction in greenhouse gas intensity per passenger tonne-km and per freight tonne-km.

**Table 14. Domestic air transport activity and greenhouse indicators**

Indicator	1991	1995	1998	2001	2005	Change 91 to 05
Passengers (m) <sup>(a)</sup>	19.0	27.7	30.4	35.0	41.5	117.7%
Passenger-km (m) <sup>(a)</sup>	17151	27704	31743	37043	47680	178.0%
Average km/Passenger <sup>(b)</sup>	900	1000	1046	1059	1150	27.7%
Passenger tonne-km (m) <sup>(a)</sup>	1544	2493	2857	3334	4291	178.0%
Freight tonne-km (m) <sup>(b)(c)</sup>	129	197	239	247	283	119.4%
Total tonne-km (m) <sup>(b)(c)</sup>	1673	2690	3096	3581	4574	173.5%
MJ/pass-km <sup>(b)</sup>	2.98	2.52	2.35	2.29	1.86	-37.6%
MJ/tonne-km <sup>(b)</sup>	32.8	27.7	25.9	25.2	20.5	-37.6%
g CO <sub>2</sub> -e/MJ <sup>(b)</sup>	69.4	69.5	69.5	69.5	69.5	0.1%
g CO <sub>2</sub> -e/pass-km <sup>(b)</sup>	207	175	163	159	129	-37.5%
g CO <sub>2</sub> -e/tonne-km <sup>(b)</sup>	2275	1925	1795	1750	1422	-37.5%

(a) ACG (2007) (b) Calculated by author. (c) 11.1 passenger tonne-km = 1 mass tonne-km

### Shipping

Passenger-km carried by coastal shipping increased 89.2% between 1991 and 2005, freight carried increased 20.3% and freight tonne-km increased 18.2% (Table 15). Fuel consumed per passenger-km fell by 3.8% and fuel per tonne-km decreased by 11.1%.

**Table 15. Coastal shipping activity and greenhouse indicators**

Indicator	1991	1995	1998	2001	2005	Change 91 to 05
Passengers (m) <sup>(a)</sup>	14.8	15.0	17.5	20.1	20.8	40.3%
Passenger-km (m) <sup>(a)</sup>	200	235	272	300	379	89.2%
Average km/Passenger <sup>(b)</sup>	13.5	15.6	15.6	14.9	18.2	34.8%
Freight tonnes (m) <sup>(a)</sup>	44.2	49.19	52.5	52.0	53.7	21.4%
Freight tonne-km (m) <sup>(a)</sup>	96480	111970	120910	105160	114040	18.2%
MJ/pass-km <sup>(b)</sup>	4.20	4.16	4.24	3.55	4.04	-3.8%
MJ/tonne-km <sup>(b)</sup>	0.18	0.19	0.15	0.13	0.16	-11.1%
g CO <sub>2</sub> -e/MJ - small craft <sup>(b)</sup>	74.6	74.6	74.6	74.6	74.6	0.0%
g CO <sub>2</sub> -e/MJ - shipping <sup>(b)</sup>	75.2	75.5	76.1	77.1	78.7	4.6%
g CO <sub>2</sub> -e/passenger-km <sup>(b)</sup>	313	310	316	265	301	-3.8%
g CO <sub>2</sub> -e/tonne-km <sup>(b)</sup>	13.5	14.3	11.4	10.0	12.6	-7.0%

(a) ACG (2007). (b) Calculated by author

Nearly all of the passenger traffic is carried by ferries and other vessels powered mainly by ADO. Freight is generally carried in much larger vessels powered by fuel oil, industrial diesel fuel (IDF) or coal. Table 15 shows the different CO<sub>2</sub>-e intensities of fuel use associated with these two vessel types—small craft and other shipping respectively. The intensity for other shipping (78.7 g CO<sub>2</sub>-e/MJ in 2005) was higher than that for small craft (74.6 in 2005) because of the coal and heavier oil in the fuel mix.

The greenhouse gas intensity of freight carried by coastal shipping declined over the period, from 13.5 g CO<sub>2</sub>-e per tonne-km in 1991 to 12.6 g CO<sub>2</sub>-e per tonne-km in 2005, despite an increase in the CO<sub>2</sub>-intensity of the fuel. This may be partly due to an under-estimate of fuel used in coastal navigation, due to the growing tendency to bunker coastal vessels overseas.

## Rail

There are five main categories of rail transport:

- electric light rail (i.e. trams in Melbourne and Adelaide, light rail and monorail in Sydney)
- urban and outer-urban passenger rail (all-electric in Sydney, Melbourne and Brisbane, mainly electric in Perth and diesel fuelled in Adelaide)
- non-urban passenger rail (petroleum fuelled)
- government, or public, freight rail (both electric and petroleum fuelled)
- private freight rail (i.e. mineral railways, petroleum fuelled).

While the greenhouse gas intensity of the petroleum fuel used by rail is fairly consistent throughout Australia, the greenhouse gas intensity of the electricity used varies from State to State (Table 8). The greenhouse indicators for rail are presented as national averages, but they are calculated using State data.

The emissions intensity of light rail was higher in 2005 than in 1991, mainly due to a decline in average journey lengths, which implies a reduction in average loadings (Table 16). While passenger numbers increased by 22%, the average trip was 33.5% shorter. The increase in emissions intensity of light rail travel between 1991 and 2005 occurred despite a fall in the emissions intensity of electricity supply in Victoria, which accounts for the great majority of light rail travel. However, intensity in 2005 was lower than in 1998 and 2001.

For passenger heavy rail, emissions intensity per passenger-km for urban (mainly electric) operation was 2.8% higher in 2005 than in 1991. The intensity for non-urban operation (exclusively petroleum) increased by 3.9% (Table 17).

The emissions intensities for rail freight are summarised in Table 18. The higher intensity for public line freight reflects the lower proportion of bulk loads and the fact that a significant part of the energy is electric. For private lines, all freight is bulk and all fuel is petroleum. For both classes of rail freight, the significant decline in emissions intensity between 1991 and 2005 appears to be related to increased tonne-km, implying increased load factors.

**Table 16. Light rail activity and greenhouse indicators**

Indicator	1991	1995	1998	2001	2005	Change 91 to 05
Passengers (m) <sup>(a)</sup>	98.0	100.2	108.5	120.8	119.6	22.0%
Passenger-km (m) <sup>(a)</sup>	662.8	543.3	513.3	496.1	538.2	-18.8%
Average km/passenger <sup>(b)</sup>	6.8	5.4	4.7	4.1	4.5	-33.5%
g CO <sub>2</sub> -e/pass-km <sup>(b)</sup>	124	158	199	198	187	50.8%

(a) ACG 2007. (b) Calculated by author.

**Table 17. Passenger rail activity and greenhouse indicators**

Indicator	1991	1995	1998	2001	2005	Change 91 to 05
Passengers (m) <sup>(a)</sup>	414.5	416.4	446.3	502.2	486.6	17.4%
Passenger-km (m) <sup>(a)</sup>	9397	9454	9813	11000	10816	15.1%
Urban passenger-km (m) <sup>(a)</sup>	7030	7304	7622	8530	8626	22.7%
Non-urban passenger-km (m) <sup>(a)</sup>	2367	2150	2191	2470	2190	-7.5%
g CO <sub>2</sub> -e/urban pass-km <sup>(b)</sup>	135	129	141	136	139	2.8%
g CO <sub>2</sub> -e/non-urban pass-km <sup>(b)</sup>	63	60	75	68	65	3.9%
g CO <sub>2</sub> -e/combined pass-km <sup>(b)</sup>	117	113	126	120	124	6.1%

(a) ACG 2007. (b) Calculated by author.

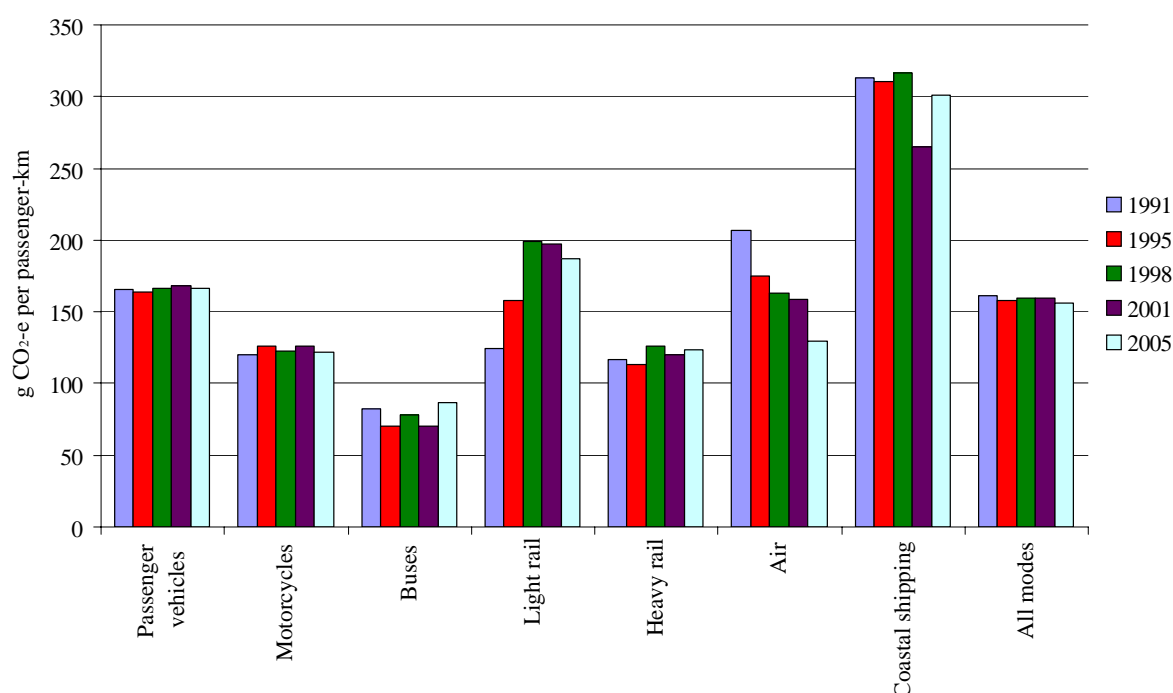
**Table 18. Freight rail activity and greenhouse indicators**

Indicator	1991	1995	1998	2001	2005	Change 91 to 05
<b>Private line rail</b>						
Freight tonne-km (million) <sup>(a)</sup>	38316	45569	53552	54039	79346	107.1%
g CO <sub>2</sub> -e per tonne-km <sup>(b)</sup>	8.3	6.8	6.1	6.3	5.4	-34.9%
<b>Public line rail</b>						
Freight tonne-km (million) <sup>(a)</sup>	53210	60220	70770	85530	106300	99.8%
g CO <sub>2</sub> -e per tonne-km <sup>(b)</sup>	31	30	25	21	20	-36.7%

(a) ACG 2007. (b) Calculated by author.

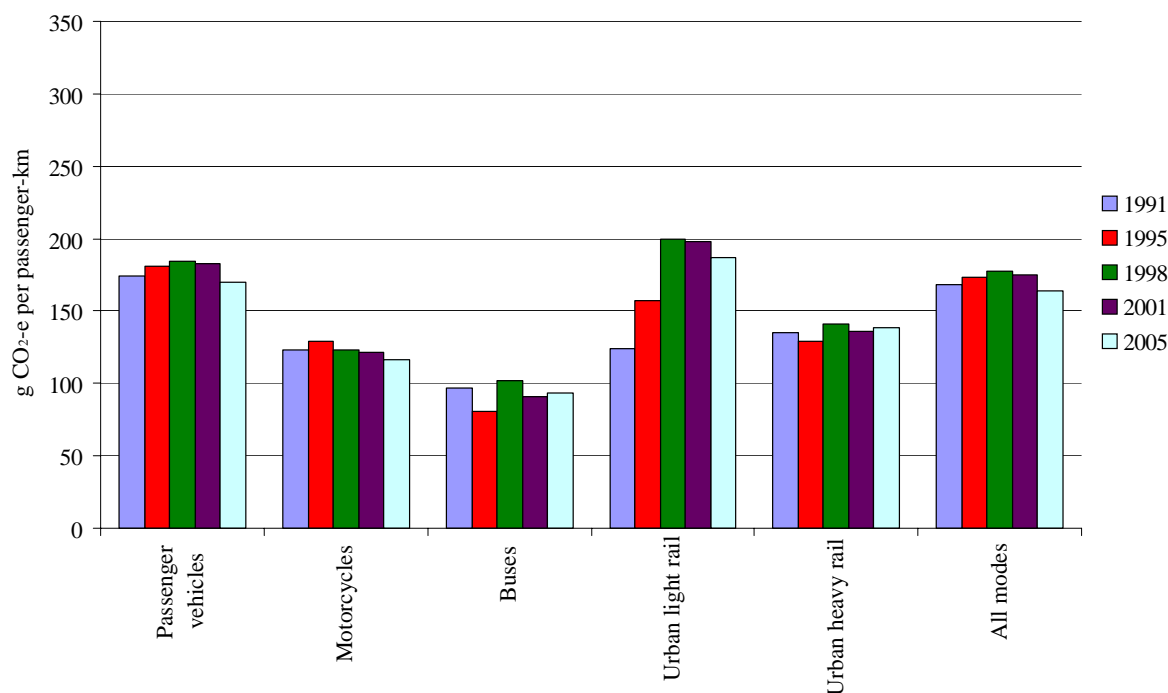
**OVERALL INDICATORS**

The emissions intensity per passenger-km by mode for all travel, urban travel and non-urban travel is summarised in Figures 22, 23, and 24. The mode share of urban travel remained

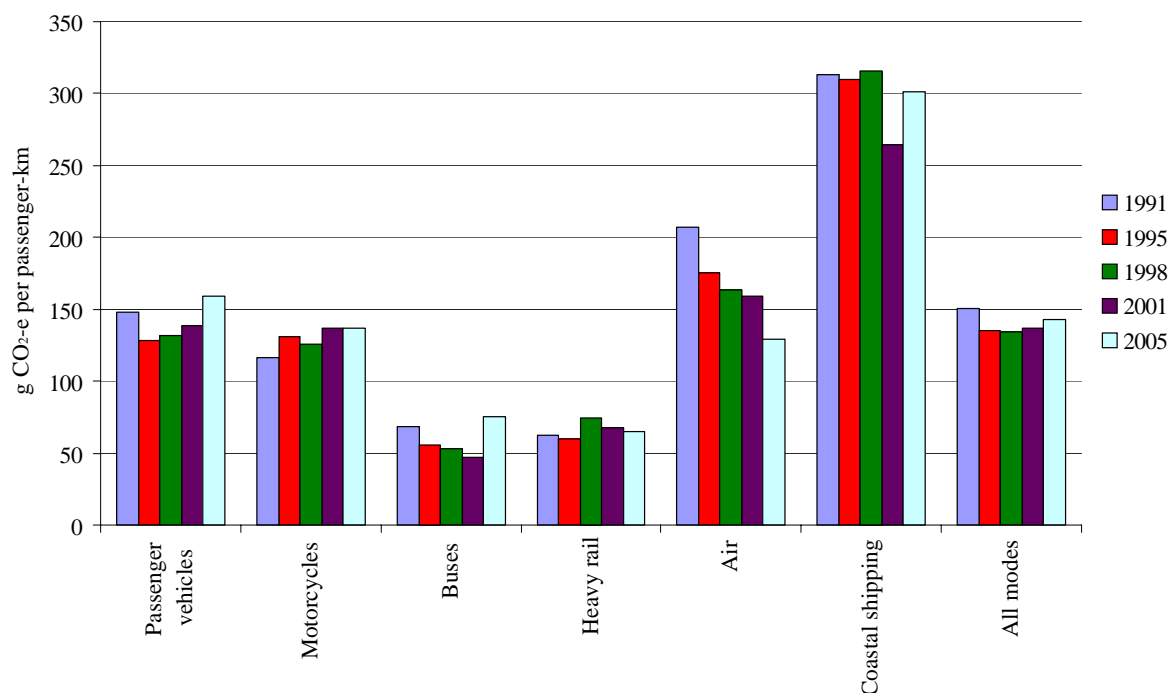
**Figure 22. Emissions per passenger-km by mode, 1991 to 2005**

fairly constant from 1991 to 2005, with passenger vehicles carrying about 90% of passenger-km in all years. The aircraft share of non-urban travel increased significantly between 1991 and 2005, from 17.7% to 35.9% of passenger-km, while the passenger vehicle share fell from 71.6% to 57.2%.

**Figure 23. Emissions per urban passenger-km by mode, 1991 to 2005**



**Figure 24. Emissions per non-urban passenger-km by mode, 1991 to 2005**



The weighted emissions intensity of the passenger task was 3.6% lower in 2005 than in 1991. The intensity of urban travel declined by 2.6%, while that of non-urban travel declined by 4.8% (Table 19).

The emissions intensity of freight is shown in Figure 25. The weighted greenhouse intensity of the freight task declined by 12.2% between 1991 and 2005, since the emissions intensity of the main freight modes (articulated trucks, rail and shipping) all declined.

**Figure 25. Emissions per tonne-km by mode and vehicle type, 1991 to 2005**

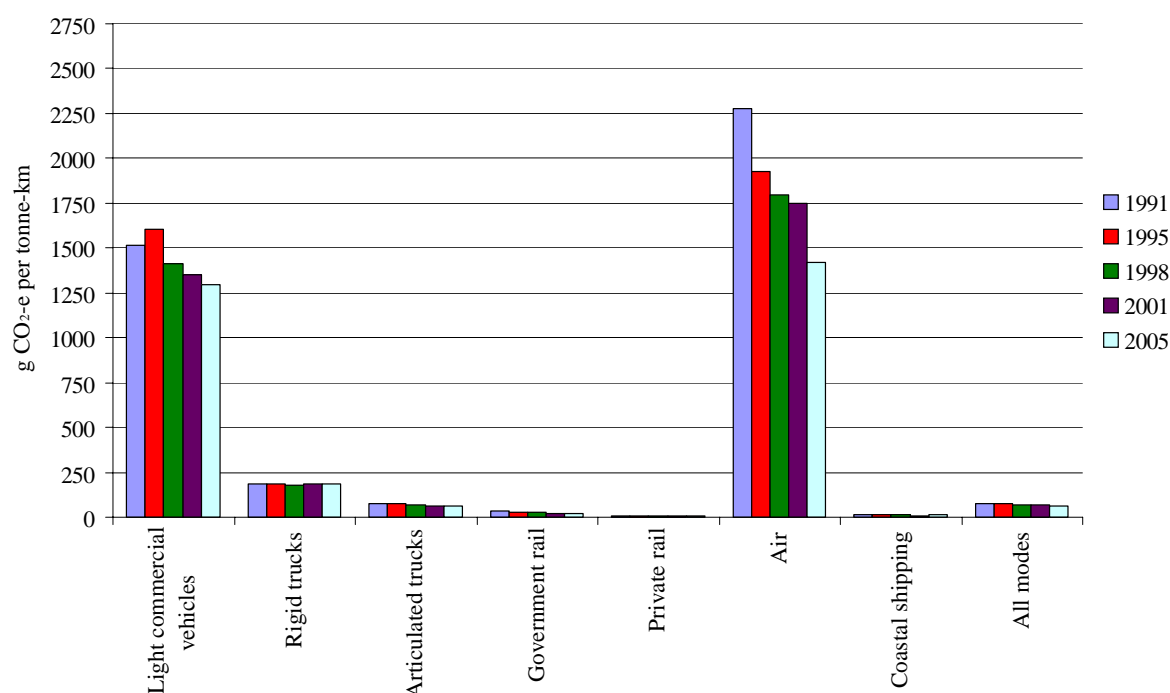


Table 19 summarises the changes in motorised transport activity per capita. No data was obtained on non-motorised trips, such as walking and cycling. Total passenger-km per capita increased by 13.7% between 1991 and 2005, with non-urban travel increasing more than urban. With the 3.6% reduction in emissions-intensity, the overall growth in passenger travel emissions per capita was 9.6%.

Freight per capita increased 22.3% between 1991 and 2005, but the 12.2% reduction in intensity held the increase in freight emissions per capita to 7.3%.

**Table 19. Passenger and freight activity per capita, 1991 to 2005**

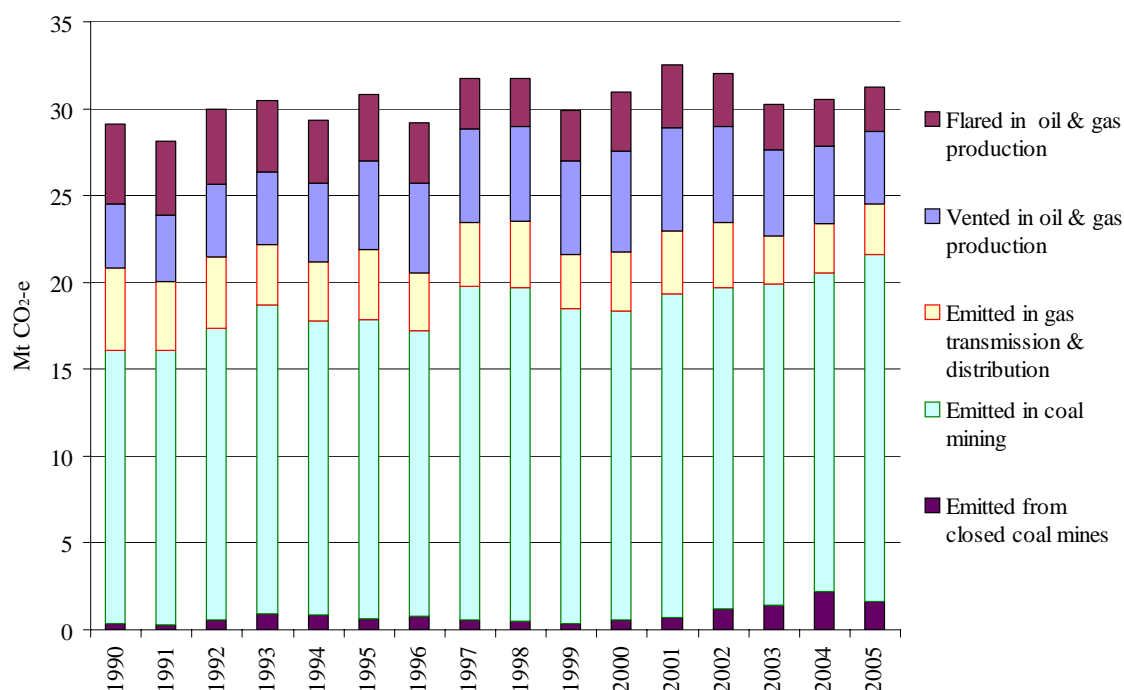
Indicator	1991	1995	1998	2001	2005	Change 91 to 05		
						Activity	Intensity	Emissions
<b>Passenger</b>								
Pass-km per capita (Urban)	9162	9403	9326	9578	10257	12.0%	-2.6%	9.1%
Pass-km per capita (Non-urban)	5645	6331	6493	6694	6571	16.4%	-4.8%	10.8%
Pass-km per capita (All)	14807	15734	15819	16272	16828	13.7%	-3.6%	9.6%
<b>Freight</b>								
Tonne-km per capita	16846	18867	20783	20599	24696	22.3%	-12.2%	7.3%



## 4.4 FUGITIVE EMISSIONS FROM FUELS

In 2005 Fugitive Emissions from fuels were 31.2 Mt CO<sub>2</sub>-e, 7.3% (2.1 Mt) higher than in 1990, but 1.3 Mt below the peak for the period which occurred in 2001. Flaring emissions from oil and gas production and venting from gas distribution were lower than in 1990, but venting emissions from oil and gas production and from coal mining (including from closed mines) were higher (Figure 26).

**Figure 26. Fugitive emissions by category, 1990–2005**



### COAL MINING

Net Fugitive CH<sub>4</sub> emissions from active coal mining (i.e. estimated emissions less CH<sub>4</sub> recovered) were 20.0 Mt CO<sub>2</sub>-e in 2005, an increase of 4.2 Mt CO<sub>2</sub>-e (27%) since 1990. Net Fugitive Emissions have been adjusted to take account of the amount recovered, and the emissions from combustion of recovered CH<sub>4</sub> are included in electricity generation emissions.

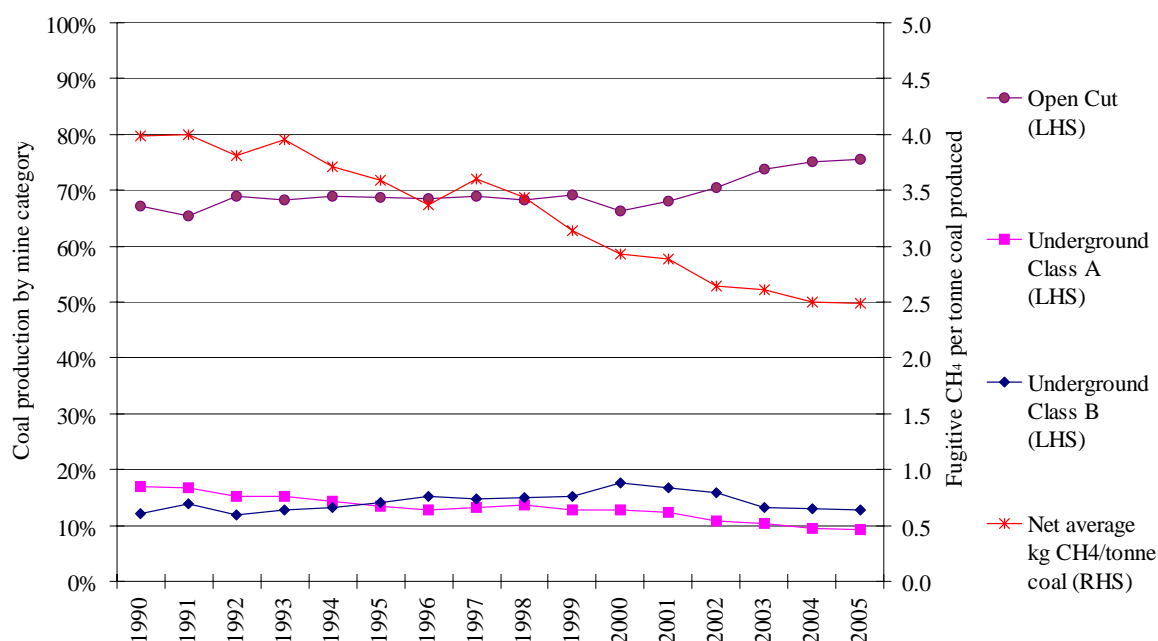
Net CH<sub>4</sub> emissions per tonne of coal produced were 38% lower in 2005 than in 1990 (Figure 27) due to two factors—a decline in the share of coal produced from the most gassy category of mine, Underground Class A, and an increase in the recovery of CH<sub>4</sub> at mine sites, for use in electricity generation.

The above values exclude emissions from closed coal mines, since these have no bearing on current coal mining activity. Emissions from closed mines increased from 0.4 Mt CO<sub>2</sub>-e in 1990 to 1.6 Mt in 2005.

## OIL AND NATURAL GAS

In 2005 emissions from the oil and natural gas systems were 9.6 Mt CO<sub>2</sub>-e, representing a reduction of 26% (3.4 Mt CO<sub>2</sub>-e) since 1990. There was a 1.5 Mt CO<sub>2</sub>-e net reduction in emissions from oil and gas production—a 45% (2.0 Mt) reduction in flaring, and a 14% (0.5 Mt) increase in venting. Venting emissions increased from 29% to 44% of production emissions over the period. Between 1990 and 2005 there was a 39% (1.8 Mt) reduction in emissions from natural gas transmission and distribution, mainly due to leakage reduction due to the relining of the Sydney gas system in the early 1990s.

**Figure 27. Share of coal production by category of mine and CH<sub>4</sub> emissions per tonne produced, 1990–2005**



## 4.5 INDUSTRIAL PROCESSES

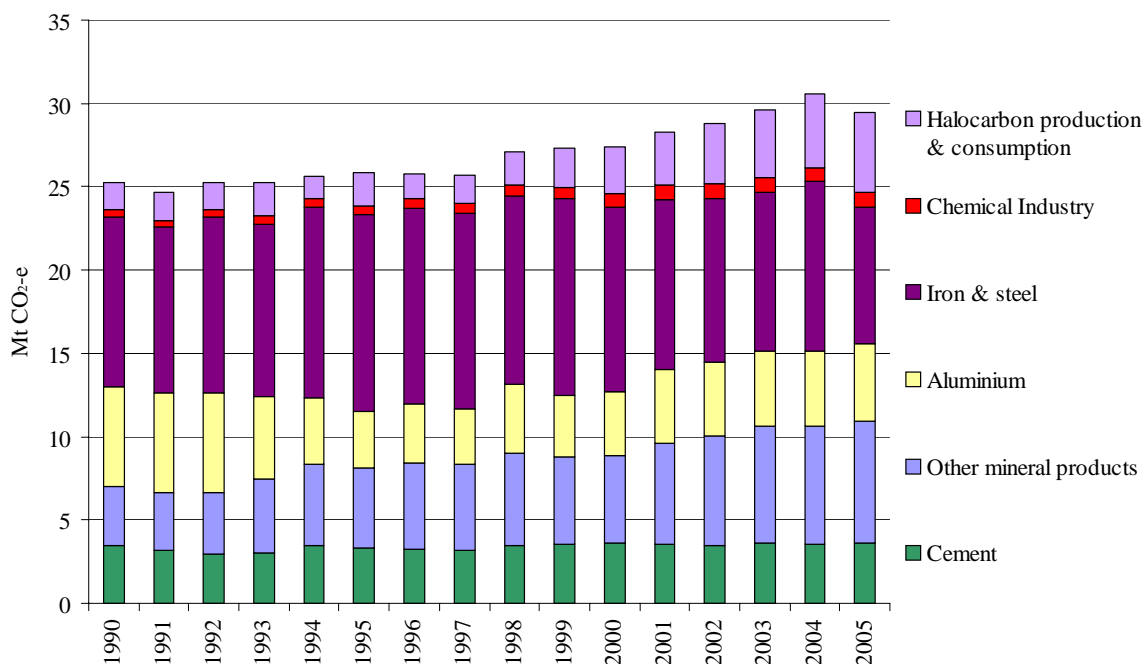
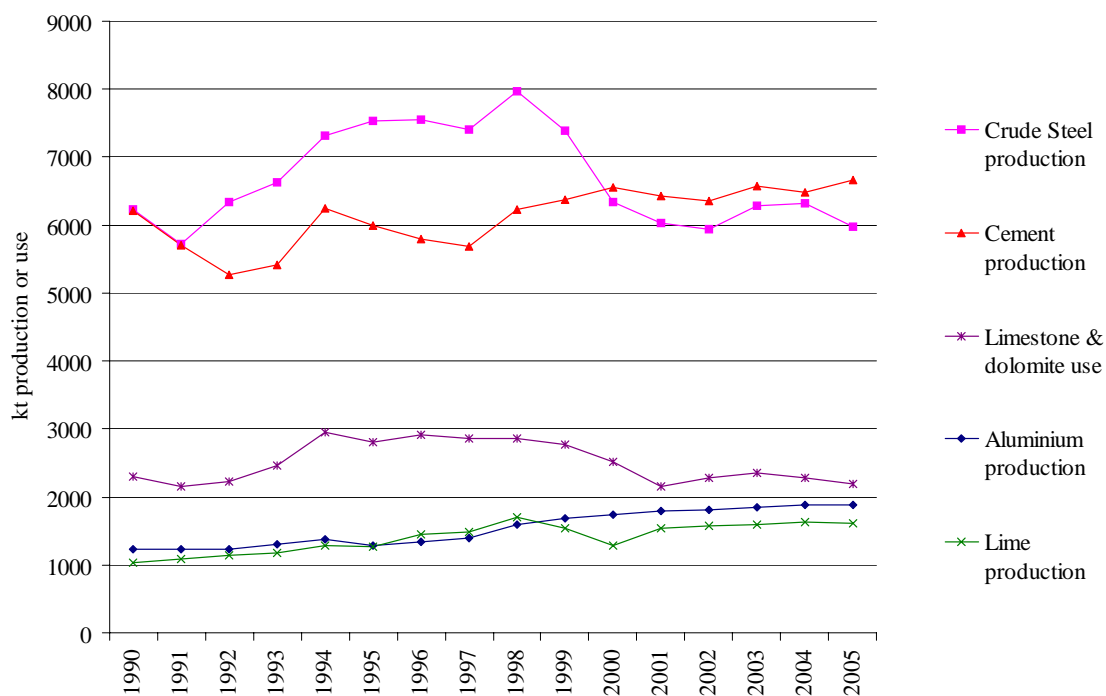
Industrial Process emissions in 2005 were 29.5 Mt CO<sub>2</sub>-e, 4.2 Mt (16.5%) higher than in 1990 but 3.6% lower than in 2004, the high point of the period. Identified (as distinct from confidential) CO<sub>2</sub> emissions returned to their 1990 levels after peaking in 2000, and there was a 2.4 Mt (60%) CO<sub>2</sub>-e reduction in PFC emissions. There was a 3.1 Mt CO<sub>2</sub>-e (190%) increase in emissions from the production and consumption of halocarbons and SF<sub>6</sub>, and a 3.4 Mt CO<sub>2</sub>-e (182%) increase in confidential emissions from the chemical and mineral products industries (comprising CO<sub>2</sub> from soda ash production and use, and Ammonia production and Magnesia production; and N<sub>2</sub>O from nitric acid production and from anaesthesia, aerosols and acetylene use). Emissions of SF<sub>6</sub>, CH<sub>4</sub> and identified N<sub>2</sub>O were low and virtually unchanged.

The reductions in PFC emissions were brought about by better management of the aluminium smelting process and a shift of production to smelters with lower PFC emission rates. Average PFC emissions per tonne of aluminium produced were 63% lower in 2005 than in 1990, although 71% higher than the low point in 1999. Emissions per tonne of crude steel produced were 17% lower in 2005 than in 1990.

The greenhouse indicators for Industrial Processes are the emissions and the production from the aluminium, iron and steel, chemicals, cement and other minerals processing industries. The emissions are shown in Figure 28 and the production data in Figure 29. The chemical industry production data cannot be shown because of confidentiality. Also shown in these figures are lime production, and limestone and dolomite use—the two major commodities in other minerals processing in terms of both their tonnage and greenhouse impact.

Between 1990 and 2005 emissions from the Iron and Steel industry fell by 2.1 Mt (20.5%) and emissions from the Aluminium industry fell by 1.3 Mt (22.1%), while emissions from Cement, Chemicals and Halocarbon and SF<sub>6</sub> Production and Consumption increased by 0.2 Mt (5.2%), 0.5 Mt (125%) and 3.1 Mt (190%) respectively. The largest increase in industrial process emissions was for Other Mineral Products, where emissions increased by 3.8 Mt (158%) between 1990 and 2005.

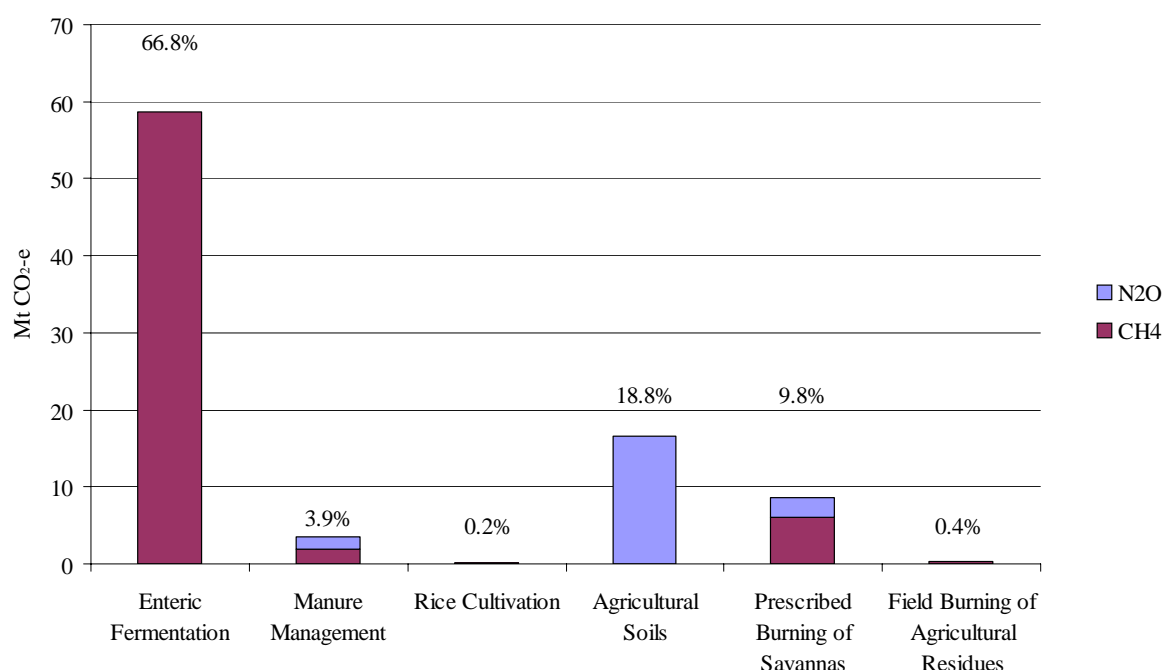
The estimates reported for the Industrial Processes sector do not provide a full account of the emissions associated with the individual industries concerned, especially aluminium, because they do not include the emissions from the industrial use of energy, especially electricity, which are included elsewhere in the inventory.

**Figure 28. Industrial Processes emissions by industry, 1990–2005****Figure 29. Industrial commodity production or use, 1990–2005**

## 4.6 AGRICULTURE

Agriculture produced an estimated 87.9 Mt CO<sub>2</sub>-e of emissions in 2005; this was only 0.2 Mt (0.2%) more than in 1990 but 11% below the peak for the period, in 2001. These emissions consisted principally of CH<sub>4</sub> from Enteric Fermentation by livestock and N<sub>2</sub>O from Agricultural Soils (the cultivation of agricultural soils, the use of nitrogen fertilisers on crops and improved pastures, and faecal and urine deposition from grazing animals onto pasture). These two sources together accounted for 85.6% (75.2 Mt CO<sub>2</sub>-e) of the total greenhouse gas emissions from Agriculture (Figure 30).

**Figure 30. Agriculture sector emissions, 2005**



The Agriculture sector is the dominant national source of both CH<sub>4</sub> and N<sub>2</sub>O, accounting for 60% (67.2 Mt CO<sub>2</sub>-e) and 85% (20.7 Mt CO<sub>2</sub>-e) respectively of the total national emissions of those gases. The sectoral greenhouse indicators for the Agriculture sector are ‘Sheep Methane Equivalents per animal’ and the ‘N<sub>2</sub>O emissions index’ (Appendix Tables 4-12 and 4-13) along with two subsectoral indicators—‘emissions from livestock and manure’, and ‘crop-related Agriculture emissions divided by crop area’ which are discussed below.

### LIVESTOCK EMISSIONS

Emissions from the Livestock subsector are calculated as the total of Enteric Fermentation and Manure Management. In 2005, Livestock subsector emissions were 62.1 Mt CO<sub>2</sub>-e, a decrease of 5.8% (3.8 Mt) since 1990 (Table 4-33). The great majority (98%) of these emissions were CH<sub>4</sub> with the remainder being N<sub>2</sub>O. Most of the emissions from Livestock arose from Enteric Fermentation (58.7 Mt), and the remainder from Manure Management systems (3.4 Mt) associated with intensive livestock industries.

Beef cattle (including free range and feedlot cattle) are the largest contributors of enteric CH<sub>4</sub> (59.7% in 2005) followed by sheep (24.5%) and dairy cattle (12.4%). Swine industries are the

major source of CH<sub>4</sub> from manure (63.8% in 2005), with cattle (33.8%) and poultry (2.2%) also contributing.

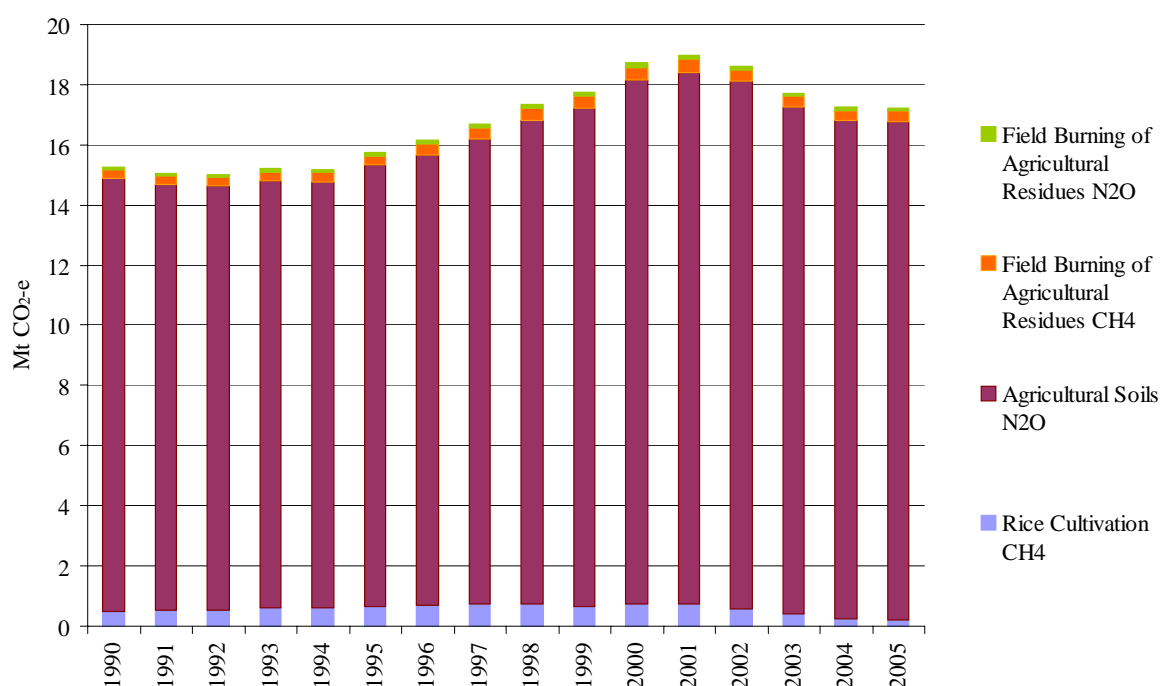
Livestock-related emissions peaked in 1991; the subsequent decline was a result of a reduction in sheep numbers. After 1996 emissions increased again, but there was a small reduction after 2001, with the commencement of another drought. There was a 40% reduction in sheep numbers between 1990 and 2005, and a 7% increase in total cattle numbers.

### CROP-RELATED EMISSIONS

In 2005, emissions from crop-related subsectors (CH<sub>4</sub> from rice cultivation, N<sub>2</sub>O from the application of fertiliser to agricultural soils, and CH<sub>4</sub> and N<sub>2</sub>O from the burning of crop residues) were estimated to be 17.2 Mt CO<sub>2</sub>-e, an increase of 12.9% (2.0 Mt) since 1990 (Figure 31).

Emissions per area of cropland and pasture could not be calculated because the ABS ceased publishing data on areas after 2003.

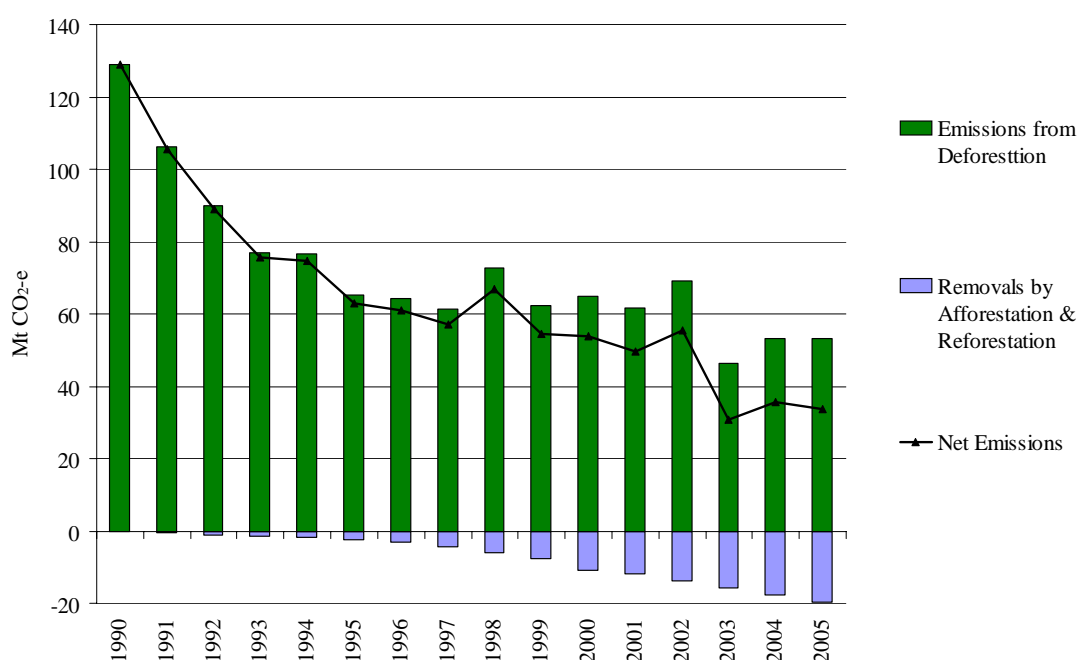
**Figure 31. Crop-related emissions, 1990–2005**



## 4.7 LAND USE, LAND USE CHANGE AND FORESTRY

According to the Kyoto accounting provisions land use, land use change and forestry activities constituted a net source of 33.7 Mt CO<sub>2</sub>-e in 2005, representing a 95.2 Mt (73.9%) reduction compared with 1990 (Figure 32).

**Figure 32. Emissions from Land Use, Land Use Change and Forestry, 1990–2005**



Note: The data for land use change for 2003, 2004 and 2005 will be revised with the next NCAS update.

### FORESTS

The total area of managed forest (managed native forests plus plantations) in Australia is estimated to have increased by 6.7% from 1990 to 2005.

Under Kyoto accounting, eligible reforestation activities are estimated to have sequestered approximately 19.6 Mt of CO<sub>2</sub> in 2005; the 1990 value was zero (Figure 32). Strictly speaking, the carbon sequestered in such plantations will be brought to account in 2008–12 only. However, the inclusion of an estimate in earlier Inventories facilitates an understanding of Australia's emissions trends in relation to the 108% target.

**LAND USE CHANGE (DEFORESTATION) INDICATORS**

CO<sub>2</sub> and other combustion products are emitted when aboveground biomass is burnt. CO<sub>2</sub> is also released from the soil and from the decay of the unburnt aboveground biomass. Significant quantities of carbon are taken up during the regrowth of vegetation following removal, but land use change is still a major net emitter.

Emissions from deforestation were 53.3 Mt in 2005, representing a 75.6 Mt (59%) reduction compared with 1990 (Figure 32). Given the 19.6 Mt CO<sub>2</sub> of carbon sequestered (see above), net emissions from deforestation, afforestation and reforestation were 33.7 Mt in 2005, 95.2 Mt (73.9%) lower than in 1990.



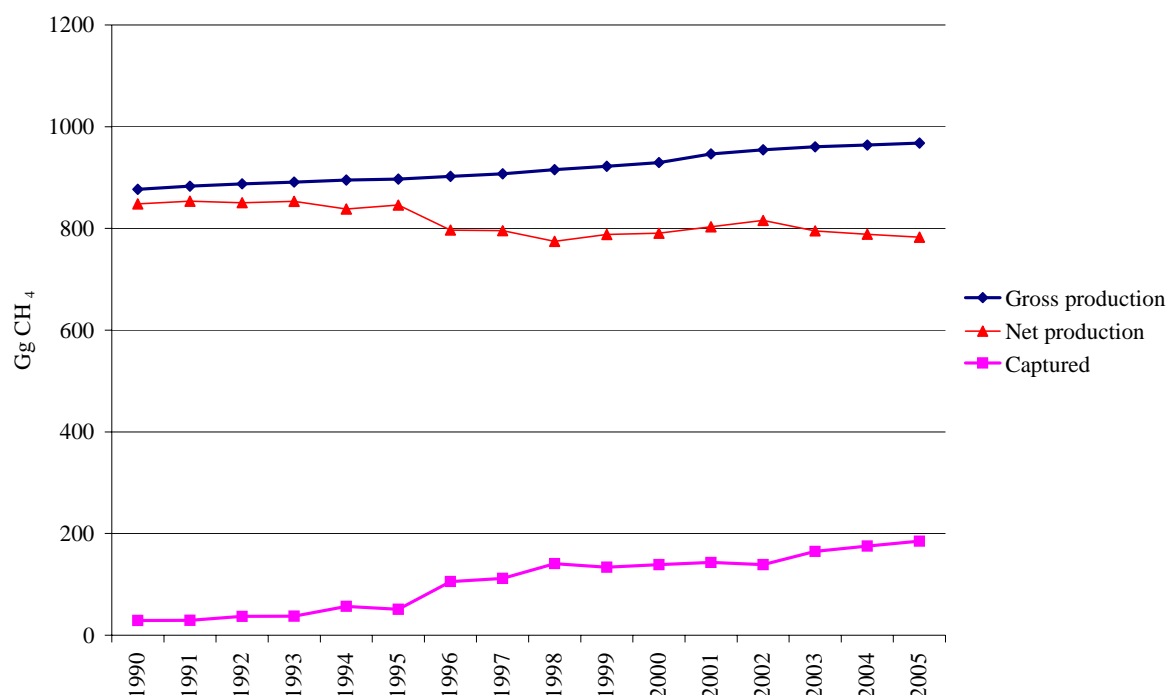
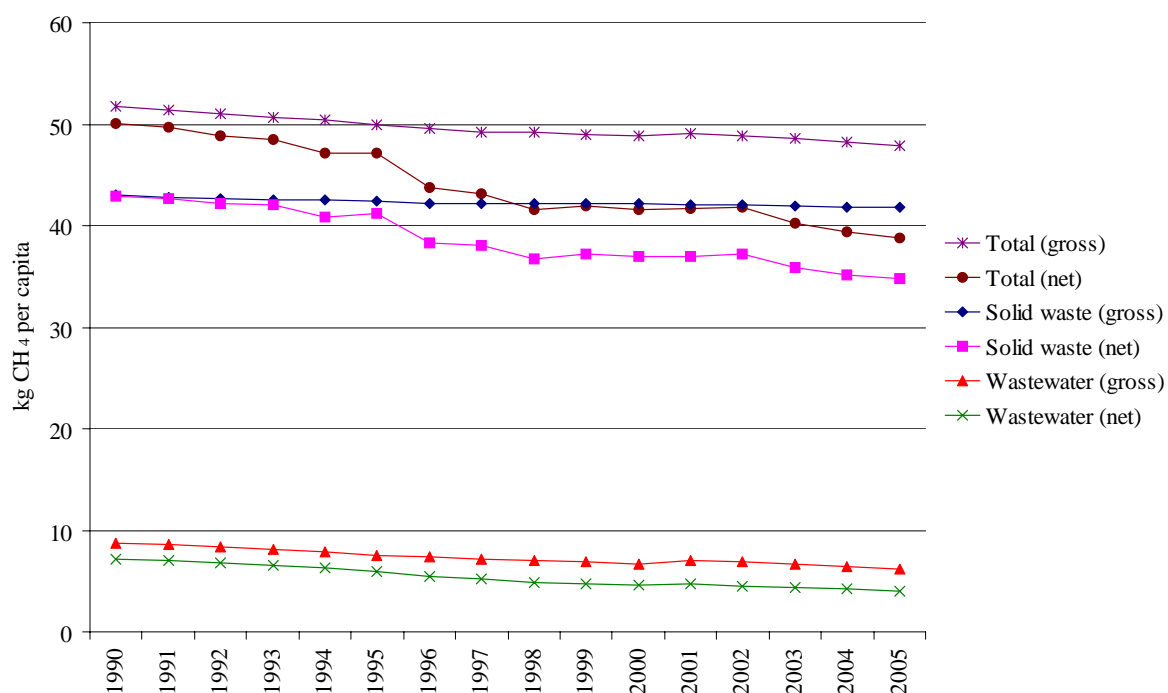
## 4.8 WASTE

Waste sector emissions comprise CH<sub>4</sub> emissions from Municipal Solid Waste Disposal on Land, CH<sub>4</sub> from Wastewater Disposal, N<sub>2</sub>O from Wastewater, and CO<sub>2</sub> emissions from Waste Incineration. These accounted for 84.7%, 12.0%, 2.7% and 0.1% respectively of the gross Waste sector emissions of 20.9 Mt CO<sub>2</sub>-e in 2005. About 3.9 Mt CO<sub>2</sub>-e of gross CH<sub>4</sub> emissions in 2005 were captured for electricity generation and flaring at landfills and wastewater plants, so net Waste sector emissions were 17.0 Mt CO<sub>2</sub>-e.

Over the period 1990 to 2005, gross CH<sub>4</sub> released from Municipal Solid Waste Disposal on Land declined by increased by 15.9%. Although population increased by 19.3%, this was offset by a decline in per capita waste disposal. Because waste degradation is a slow process, estimates of CH<sub>4</sub> generation are largely a reflection of waste disposal from up to 50 years earlier. Gross emissions from Wastewater, which are calculated directly from population estimates, increased by 19.3%.

Increasing CH<sub>4</sub> recovery has largely offset the growth of Waste sector emissions since the mid 1990s (Figure 33). Rates of CH<sub>4</sub> recovery from solid waste increased substantially from a negligible amount in 1990 to 16.8% of gross CH<sub>4</sub> production in 2005. For wastewater, estimated CH<sub>4</sub> recovery rates were higher throughout the period (ranging from 18.1% in 1990 to 34.9% in 2005) but the quantities recovered were much lower than for solid waste.

The Waste sector greenhouse indicator is 'CH<sub>4</sub> emissions from landfill per capita'. Gross CH<sub>4</sub> emissions from landfill per capita fell by 2.9 between 1990 and 2005, from 43.0 to 41.8 kg per capita. Because of the increase in the rate of CH<sub>4</sub> recovery for electricity generation, however, net emissions per capita declined 19%, from 42.9 kg to 34.7 kg (Figure 34).

**Figure 33. Methane emissions from solid and liquid waste disposal, 1990–2005****Figure 34. Per capita emissions from the Waste sector, 1990–2005**

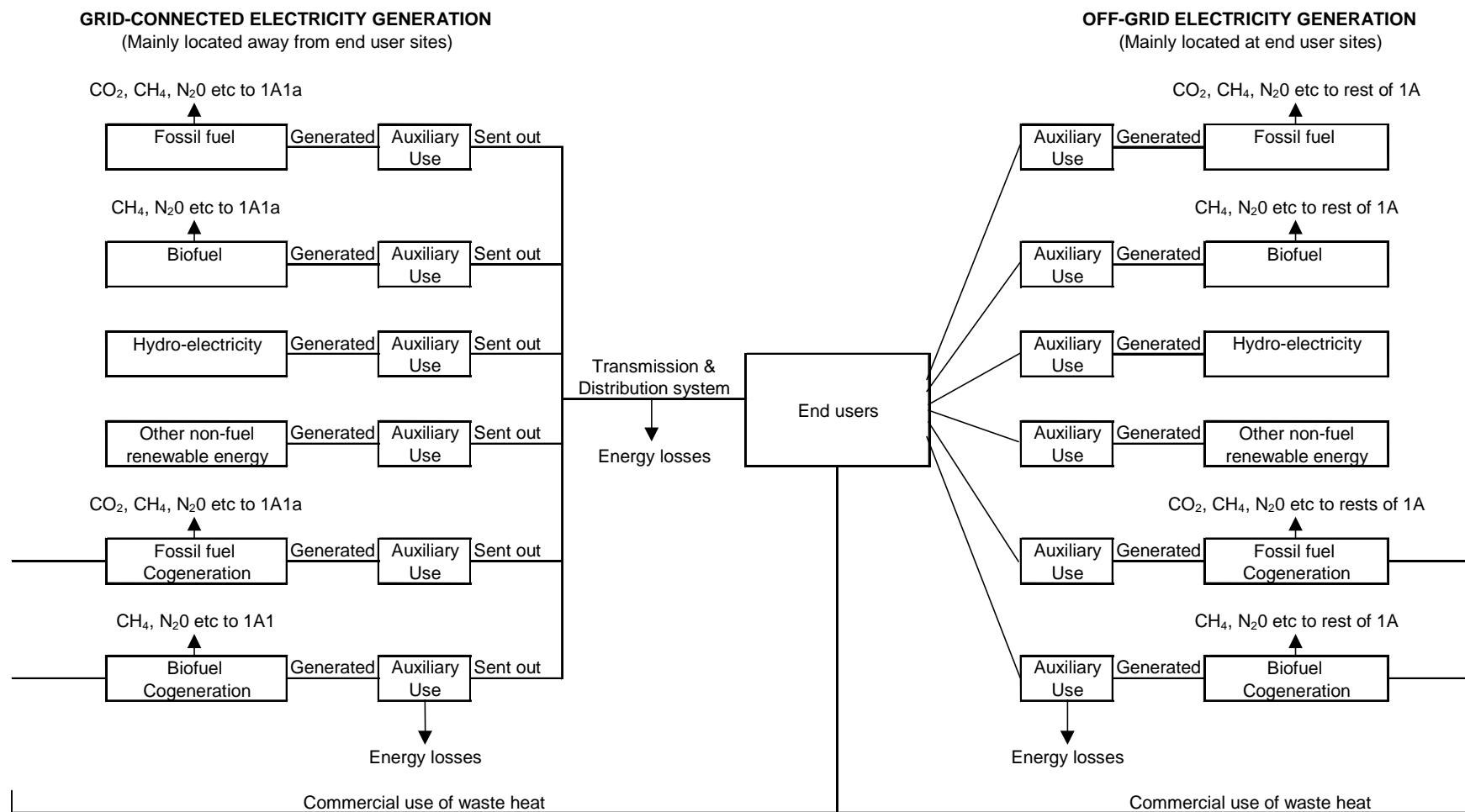
## GLOSSARY

Automotive diesel oil	(ADO) a middle distillate petroleum product used as a fuel in high speed diesel engines. It is mostly consumed in the Road and Rail Transport Sectors and Agriculture, Mining and Construction sectors.
Aviation	any domestic civil air transport activity, either commercial or general aviation (such as private, agricultural commuter and charter) services carrying freight or passengers. <i>International aviation</i> activities are reported but are not included in the National Inventory emissions total.
Automotive gasoline	unleaded and leaded petrol.
Auxiliary energy	the electricity generated by a power station that is used to operate auxiliary equipment such as pumps, crushers or fans. It represents the difference between electricity generated and electricity sent out (see diagram on page 80).
Bagasse	the fibrous residue of the sugar cane milling process; it is used as a fuel in sugar mills.
Black coal	consists of three main types: <i>Sub-bituminous coals</i> are the lowest grade black coal in Australia with a have high inherent moisture and high levels of volatile matter (42% to 49% on a dry mineral matter free basis). <i>Bituminous coals</i> have between 15% and 50% volatile matter and are high in carbonaceous matter. <i>Anthracite</i> , a hard coal containing a low level of volatile matter, is the highest grade coal but it is not produced in Australia.
Brown coal or lignite	a low grade coal having a high volatile matter content and high inherent moisture. Brown coal use in Australia is confined to the State of Victoria and almost exclusively limited to steam raising for electricity generation.
Distribution system	that part of a supply system devoted to distributing the final product to end users. For example, a natural gas system distribution system includes pipeline reticulation from the end of a high pressure transmission pipeline to the point of combustion on customers' premises.
Dolomite	a naturally occurring mineral ( $\text{CaCO}_3 \cdot \text{MgCO}_3$ ) which can be used to produce lime, iron and steel.
Emission factor	the quantity of greenhouse gases emitted per unit of some specified activity.
Emission intensity	the total emissions divided by the total energy content of the fuels or the total energy used in a sector. The overall emissions intensity of coal used in Australia, for example, is determined by the quantity and emission factors for each of the many types and grades of coal used. See also emission factors.
Enteric fermentation	the process in animals by which gases, including methane, are produced as a by-product of microbial fermentation associated with digestion of feed.
Flaring	the process of combusting unwanted or excess gases at a crude oil or gas production site, a gas processing plant or an oil refinery.
Forest	Parties are required to select single minimum values for land area, tree crown cover and tree height. The NCAS when assessing Australia's land

	use change emissions utilises a criteria of 20% tree crown cover, two metre minimum tree height, and a minimum of 0.2 hectares in land area for inclusion. These minimum criteria are within the ranges outlined in the Marrakech Accords.
Fuel oil	covers all residual (heavy) fuel oils including those obtained by blending.
Fugitive emissions	generally deliberate but not fully controlled emissions that typically result from leaks, including those from pump seals, pipe flanges and valve stems. Fugitive emissions also includes methane emitted from coal mine seams. During petroleum storage tank filling, venting loss of vapour is a fugitive emission.
Global warming potential	(GWP) represents the relative warming effect of a unit mass of a gas compared with the same mass of CO <sub>2</sub> over a specific period. Multiplying the actual amount of gas emitted by the GWP gives the CO <sub>2</sub> -equivalent emissions.
HFC	hydrofluorocarbons, used as substitutes for chlorofluorocarbons (CFC) and hydrochlorofluorocarbons (HCFC).
Industrial Diesel Fuel	(IDF) a petroleum product primarily consumed in the Rail and Water Transport Sectors.
Kyoto Protocol	The Kyoto Protocol to the Convention on Climate Change was developed through the UNFCCC negotiating process. The Protocol was negotiated in Kyoto, Japan, in 1997. It sets binding greenhouse gas emissions targets for UNFCCC developed country Parties that ratify the agreement.
Liquefied petroleum gas	(LPG) a light hydrocarbon fraction of the paraffin series. It occurs naturally, associated with crude oil and natural gas in many oil and gas deposits, and is also produced in the course of petroleum refinery processes. LPG consists of propane (C <sub>3</sub> H <sub>8</sub> ) and butane (C <sub>4</sub> H <sub>10</sub> ), or a mixture of the two. In Australia, LPG as marketed contains more propane than butane.
Lubricants	hydrocarbons that are rich in paraffin and not used as fuels. They are obtained by vacuum distillation of oil residues.
Manure	the animal waste, both faeces and urine, collected from yards and barns. Only the faecal component of manure is capable of producing methane.
Military transport	includes all activity by military land vehicles, aircraft and ships.
Mobile sources	sources of greenhouse gas emissions associated with mobile fuel combustion activities, regardless of the sector or industry for which the activity is undertaken. Includes all forms of air, road and sea transport of passengers, freight, for civilian and military purposes. The category <i>Other mobile sources</i> includes unregistered recreational or competition vehicles such as trail bikes and racing cars and miscellaneous mobile utility engines such as lawn-mowers and chain-saws.
Natural gas	consists primarily of methane (around 90 per cent, with traces of other gaseous hydrocarbons, as well as nitrogen and carbon dioxide) occurring naturally in underground deposits. As a transport fuel it is generally used in compressed or liquefied form.
Navigation	all civilian (non-military) marine transport of passengers and freight. Domestic marine transport consists of coastal shipping (freight and

	cruises), interstate and urban ferry services, commercial fishing, and small pleasure craft movements. International shipping using marine bunker fuel purchased in Australia is reported but not included in the National Inventory emissions total.
Passenger cars	all passenger vehicles which carry less than 10 passengers (including the driver). These consist of cars, station wagons, taxis, minibuses, four-wheel drive passenger vehicles and forward control passenger vehicles. Vehicles carrying more than 10 passengers are classed as buses.
PFC	perfluorocarbons, chemical compounds containing carbon and fluorine atoms only (eg CF <sub>4</sub> and C <sub>2</sub> F <sub>6</sub> )
Plantation	an area of managed forest where the trees have been planted.
Primary fuels	forms of energy obtained directly from nature. They can be non-renewable fuels such as coal, uranium, crude oil and condensate, naturally occurring LPG, ethane and natural gas, or conditionally renewable energy sources such as wood, bagasse, hydro electric systems and solar energy.
Rail transport	non-electric railway services for both passenger and freight movement. Emissions from electric railway services are included with emissions from electricity generation
Road transport	includes all on-road and off-road activity (on-road and off-road) by civilian (non-military) vehicles registered for road use.
Savanna	a grassland ecosystem with associated woody shrub and/or tree overstorey, the latter with projective foliage cover comprising less than 30% of the area. The OECD/IPCC category of 'savanna' is extended to include all non-agricultural grassland ecosystem types that experience burning in Australia.
Sink	any process or activity which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere. It includes chemical transformations in the atmosphere and uptake of the gases from the atmosphere by the underlying land and ocean surfaces.
Solid waste	waste from various activities; includes <i>Municipal solid waste</i> (waste from domestic premises and council activities largely associated with servicing residential areas; such as street sweepings, street tree lopping, parks and gardens and litter bins), <i>Commercial and industrial waste</i> , and <i>Building and demolition waste</i> .
Solvent	an organic liquid used to clean or to dissolve things.
Stationary Energy	all energy use excluding energy use in Transport
Stationary Energy intensity	emissions from Stationary Fuel Combustion activities, including electricity generation, divided by quantity of energy consumed by final users. Excludes biomass fuels and mobile source energy use.
Task (transport)	The quantification of the service performed by transport. The 'passenger task' is expressed as passenger-km (the product of number of passengers by the average distance each passenger travels) and the 'freight task' as tonne-km ( the product of the number of tonnes carried by the average distance each tonne is carried).

Thermal efficiency	the ratio of the outputs of a fuel-using electricity generating system (electrical energy generated plus commercially useful heat produced, if any) to the energy content of the fuel.
Transmission and storage	the oil and gas system that involves the transmission of raw and final product between the point of extraction and the distribution system. For oil, this may include transport along pipelines or by tanker (ship, rail or road).
UNFCCC	the United Nations Framework Convention on Climate Change entered into force in 1994. Parties to the Convention have agreed to work towards achieving the Convention's ultimate aim of stabilising 'greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system'.
Venting	the process of releasing gas into the atmosphere without combustion. This may be done either at the production site or at the refinery or stripping plants. It is done to dispose of non-commercial gas or to relieve system pressure.

**Figure 35. Schematic diagram of electricity supply system**

## REFERENCES

- ABARE (2007) *Energy in Australia 2006*, Australian Bureau of Agricultural and Resource Economics.
- ACG (2007) *Australian Transport Facts 2007*, Apelbaum Consulting Group, Melbourne.
- AGO (2006a) *National Greenhouse Gas Inventory: Analysis of Trends and Greenhouse Indicators 1990–2004*, Australian Greenhouse Office, Canberra.
- AGO (2006b) *AGO Factors and Methods Workbook December 2006*, Australian Greenhouse Office, Canberra.
- DEW (2007) *National Greenhouse Gas Inventory 2005*, Department of the Environment and Water Resources, Canberra.
- GWA (2007) *Australia's National Greenhouse Gas Inventory 1990, 1995, 2000 and 2005: End use analysis for energy emissions*, George Wilkenfeld and Associates and Energy Strategies, Australian Greenhouse Office, Canberra (Draft May 2007).
- NGRS (1992) *National Greenhouse Response Strategy*, Commonwealth of Australia, Canberra.
- NGS (1998) *National Greenhouse Strategy*, Commonwealth of Australia, Canberra.



## APPENDIX 1 EMISSIONS BY SECTOR AND SUBSECTOR 1990–2005

Table 1-1 National Greenhouse Gas Emissions, 1990–2005 (Kyoto Accounting), Gg

Year to June	CO <sub>2</sub>	CO <sub>2</sub>	Net CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other*	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
	Emissions	Removals	Emissions	Emissions	Emissions	Emissions	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other*	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other*	Total	Gg CO <sub>2</sub> -e	%
1990	402421	0	402421	5593.2	63.80	0.67	402421	117457	19778	7,471	547127	73.6%	21.5%	3.6%	1.4%	100.0%	NA	NA
1991	381892	485	381407	5551.1	62.97	0.68	381407	116572	19522	7,448	524949	72.7%	22.2%	3.7%	1.4%	100.0%	-22178	-4.1%
1992	371208	994	370214	5536.4	62.40	0.67	370214	116264	19343	7,571	513392	72.1%	22.6%	3.8%	1.5%	100.0%	-11557	-2.2%
1993	362595	1,501	361093	5511.2	63.56	0.54	361093	115735	19702	7,442	503973	71.6%	23.0%	3.9%	1.5%	100.0%	-9419	-1.8%
1994	366739	1,876	364863	5449.3	65.77	0.34	364863	114436	20390	5,977	505666	72.2%	22.6%	4.0%	1.2%	100.0%	1693	0.3%
1995	366861	2,459	364402	5513.0	68.64	0.25	364402	115772	21278	6,016	507469	71.8%	22.8%	4.2%	1.2%	100.0%	1803	0.4%
1996	373124	3,157	369967	5397.5	70.19	0.18	369967	113348	21760	5,658	510733	72.4%	22.2%	4.3%	1.1%	100.0%	3264	0.6%
1997	378324	4,487	373837	5552.4	72.11	0.16	373837	116600	22353	5,762	518552	72.1%	22.5%	4.3%	1.1%	100.0%	7819	1.5%
1998	402963	5,984	396978	5513.0	74.55	0.23	396978	115772	23110	6,764	542625	73.2%	21.3%	4.3%	1.2%	100.0%	24073	4.6%
1999	401352	7,613	393739	5500.7	78.38	0.15	393739	115514	24299	6,426	539978	72.9%	21.4%	4.5%	1.2%	100.0%	-2647	-0.5%
2000	411310	10,897	400413	5610.4	84.16	0.16	400413	117819	26089	7,183	551503	72.6%	21.4%	4.7%	1.3%	100.0%	11525	2.1%
2001	413387	11,915	401471	5775.9	87.70	0.23	401471	121294	27188	8,877	558831	71.8%	21.7%	4.9%	1.6%	100.0%	7327	1.3%
2002	424698	13,897	410801	5678.2	86.79	0.22	410801	119243	26906	9,634	566584	72.5%	21.0%	4.7%	1.7%	100.0%	7753	1.4%
2003	411543	15,845	395698	5420.2	80.84	0.22	395698	113824	25059	10,524	545105	72.6%	20.9%	4.6%	1.9%	100.0%	-21479	-3.8%
2004	427349	17,778	409570	5407.0	80.70	0.22	409570	113548	25016	10,954	559088	73.3%	20.3%	4.5%	2.0%	100.0%	13983	2.6%
2005	429805	19,609	410196	5377.2	78.37	0.23	410196	112922	24295	11,660	559074	73.4%	20.2%	4.3%	2.1%	100.0%	-13	0.0%
Change from 1990																	11948	2.2%

Table 1-2 Energy Emissions (Sector 1), 1990–2005, Gg

Year to June	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
	Emissions	Emissions	Emissions	Emissions	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	260136	1211.89	4.46	NA	260136	25450	1383	NA	286969	90.6%	8.9%	0.5%	NA	100.0%	NA	NA
1991	262477	1179.53	4.63	NA	262477	24770	1435	NA	288681	90.9%	8.6%	0.5%	NA	100.0%	1712	0.6%
1992	266762	1262.10	4.75	NA	266762	26504	1471	NA	294737	90.5%	9.0%	0.5%	NA	100.0%	6056	2.1%
1993	270765	1287.50	4.96	NA	270765	27038	1537	NA	299340	90.5%	9.0%	0.5%	NA	100.0%	4603	1.6%
1994	273650	1245.04	5.17	NA	273650	26146	1603	NA	301399	90.8%	8.7%	0.5%	NA	100.0%	2059	0.7%
1995	284355	1303.82	5.46	NA	284355	27380	1693	NA	313428	90.7%	8.7%	0.5%	NA	100.0%	12029	4.0%
1996	291444	1242.51	5.96	NA	291444	26093	1848	NA	319385	91.3%	8.2%	0.6%	NA	100.0%	5957	1.9%
1997	299442	1373.13	5.97	NA	299442	28836	1851	NA	330129	90.7%	8.7%	0.6%	NA	100.0%	10744	3.4%
1998	312381	1359.46	6.32	NA	312381	28549	1959	NA	342889	91.1%	8.3%	0.6%	NA	100.0%	12760	3.9%
1999	320784	1246.68	6.50	NA	320784	26180	2016	NA	348981	91.9%	7.5%	0.6%	NA	100.0%	6092	1.8%
2000	328983	1258.70	6.90	NA	328983	26433	2140	NA	357556	92.0%	7.4%	0.6%	NA	100.0%	8575	2.5%
2001	334925	1307.88	7.09	NA	334925	27465	2197	NA	364588	91.9%	7.5%	0.6%	NA	100.0%	7032	2.0%
2002	338855	1297.48	7.34	NA	338855	27247	2277	NA	368379	92.0%	7.4%	0.6%	NA	100.0%	3792	1.0%
2003	348084	1249.47	7.68	NA	348084	26239	2380	NA	376703	92.4%	7.0%	0.6%	NA	100.0%	8324	2.3%
2004	356825	1272.10	8.18	NA	356825	26714	2536	NA	386076	92.4%	6.9%	0.7%	NA	100.0%	9373	2.5%
2005	361092	1307.19	7.99	NA	361092	27451	2477	NA	391019	92.3%	7.0%	0.6%	NA	100.0%	4944	1.3%
Change from 1990															104050	36.3%

Table 1-3 Fuel Combustion Emissions (Subsector 1A), 1990–2005, Gg

Year to June	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
	Emissions	Emissions	Emissions	Emissions	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	254154	113.15	4.35	NA	254154	2376	1347	NA	257877	98.6%	0.9%	0.5%	NA	100.0%	NA	NA
1991	256729	115.54	4.52	NA	256729	2426	1401	NA	260556	98.5%	0.9%	0.5%	NA	100.0%	2679	1.0%
1992	260842	118.71	4.64	NA	260842	2493	1437	NA	264772	98.5%	0.9%	0.5%	NA	100.0%	4215	1.6%
1993	264864	120.52	4.85	NA	264864	2531	1505	NA	268899	98.5%	0.9%	0.6%	NA	100.0%	4127	1.6%
1994	267962	119.59	5.07	NA	267962	2511	1573	NA	272046	98.5%	0.9%	0.6%	NA	100.0%	3147	1.2%
1995	278482	117.93	5.36	NA	278482	2477	1662	NA	282620	98.5%	0.9%	0.6%	NA	100.0%	10574	3.9%
1996	285975	115.65	5.86	NA	285975	2429	1815	NA	290218	98.5%	0.8%	0.6%	NA	100.0%	7598	2.7%
1997	294150	113.68	5.90	NA	294150	2387	1828	NA	298365	98.6%	0.8%	0.6%	NA	100.0%	8147	2.8%
1998	306861	111.39	6.20	NA	306861	2339	1923	NA	311124	98.6%	0.8%	0.6%	NA	100.0%	12759	4.3%
1999	314808	107.78	6.42	NA	314808	2263	1991	NA	319063	98.7%	0.7%	0.6%	NA	100.0%	7939	2.6%
2000	322255	106.05	6.81	NA	322255	2227	2111	NA	326593	98.7%	0.7%	0.6%	NA	100.0%	7530	2.4%
2001	327755	102.55	6.99	NA	327755	2154	2166	NA	332074	98.7%	0.6%	0.7%	NA	100.0%	5481	1.7%
2002	332153	92.29	7.25	NA	332153	1938	2249	NA	336340	98.8%	0.6%	0.7%	NA	100.0%	4266	1.3%
2003	342088	94.75	7.60	NA	342088	1990	2356	NA	346434	98.7%	0.6%	0.7%	NA	100.0%	10094	3.0%
2004	351095	91.70	8.11	NA	351095	1926	2513	NA	355533	98.8%	0.5%	0.7%	NA	100.0%	9100	2.6%
2005	355538	85.67	7.92	NA	355538	1799	2454	NA	359792	98.8%	0.5%	0.7%	NA	100.0%	4258	1.2%
Change from 1990															101915	39.5%

**Table 1-4 Fuel Combustion—Stationary Sources Emissions (Subsector 1A less Transport), 1990–2005, Gg\***

Year to June	CO <sub>2</sub> Emissions	CH <sub>4</sub> Emissions	N <sub>2</sub> O Emissions	Other Emissions	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
					CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	193416	87.84	2.33	NA	193416	1845	724	NA	195985	98.7%	0.9%	0.4%	NA	100.0%	NA	NA
1991	196268	89.88	2.38	NA	196268	1887	737	NA	198893	98.7%	0.9%	0.4%	NA	100.0%	2908	1.5%
1992	199667	92.07	2.35	NA	199667	1934	730	NA	202330	98.7%	1.0%	0.4%	NA	100.0%	3437	1.7%
1993	202485	92.87	2.42	NA	202485	1950	749	NA	205185	98.7%	1.0%	0.4%	NA	100.0%	2854	1.4%
1994	204053	90.99	2.47	NA	204053	1911	766	NA	206729	98.7%	0.9%	0.4%	NA	100.0%	1545	0.8%
1995	211961	88.63	2.56	NA	211961	1861	794	NA	214616	98.8%	0.9%	0.4%	NA	100.0%	7887	3.8%
1996	217172	86.32	2.66	NA	217172	1813	825	NA	219810	98.8%	0.8%	0.4%	NA	100.0%	5193	2.4%
1997	224065	84.35	2.78	NA	224065	1771	862	NA	226699	98.8%	0.8%	0.4%	NA	100.0%	6889	3.1%
1998	236768	81.96	2.93	NA	236768	1721	909	NA	239398	98.9%	0.7%	0.4%	NA	100.0%	12699	5.6%
1999	243973	77.66	2.97	NA	243973	1631	922	NA	246526	99.0%	0.7%	0.4%	NA	100.0%	7128	3.0%
2000	249493	76.72	3.00	NA	249493	1611	929	NA	252033	99.0%	0.6%	0.4%	NA	100.0%	5507	2.2%
2001	256392	74.37	3.01	NA	256392	1562	934	NA	258888	99.0%	0.6%	0.4%	NA	100.0%	6855	2.7%
2002	259215	63.43	2.96	NA	259215	1332	918	NA	261465	99.1%	0.5%	0.4%	NA	100.0%	2577	1.0%
2003	268652	66.16	3.06	NA	268652	1389	950	NA	270992	99.1%	0.5%	0.4%	NA	100.0%	9527	3.6%
2004	273805	62.16	3.13	NA	273805	1305	969	NA	276079	99.2%	0.5%	0.4%	NA	100.0%	5088	1.9%
2005	277215	57.72	3.15	NA	277215	1212	975	NA	279402	99.2%	0.4%	0.3%	NA	100.0%	3323	1.2%
Change from 1990															83418	42.6%

\* Includes biomass fuels, military transport, lawnmowing

**Table 1-5 Electricity Generation Emissions (Part subsector 1A1a), 1990–2005, Gg**

Year to June	CO <sub>2</sub> Emissions	CH <sub>4</sub> Emissions	N <sub>2</sub> O Emissions	Other Emissions	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
					CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	129008	1.29	1.35	NA	129008	27	417	NA	129453	99.7%	0.0%	0.3%	NA	100.0%	NA	NA
1991	131191	1.29	1.40	NA	131191	27	432	NA	131651	99.7%	0.0%	0.3%	NA	100.0%	2198	1.7%
1992	134046	1.37	1.42	NA	134046	29	442	NA	134517	99.7%	0.0%	0.3%	NA	100.0%	2866	2.2%
1993	134947	1.35	1.42	NA	134947	28	439	NA	135415	99.7%	0.0%	0.3%	NA	100.0%	898	0.7%
1994	136523	1.37	1.45	NA	136523	29	445	NA	136997	99.7%	0.0%	0.3%	NA	100.0%	1582	1.2%
1995	142118	1.51	1.49	NA	142118	32	461	NA	142611	99.7%	0.0%	0.3%	NA	100.0%	5614	4.1%
1996	147124	1.46	1.56	NA	147124	31	483	NA	147637	99.7%	0.0%	0.3%	NA	100.0%	5027	3.5%
1997	152115	1.39	1.63	NA	152115	29	506	NA	152650	99.6%	0.0%	0.3%	NA	100.0%	5013	3.4%
1998	164864	3.81	1.78	NA	164864	80	553	NA	165497	99.6%	0.0%	0.3%	NA	100.0%	12847	8.4%
1999	170841	4.18	1.84	NA	170841	88	570	NA	171500	99.6%	0.1%	0.3%	NA	100.0%	6002	3.6%
2000	174580	7.54	1.88	NA	174580	158	583	NA	175321	99.6%	0.1%	0.3%	NA	100.0%	3822	2.2%
2001	181752	7.50	1.94	NA	181752	157	601	NA	182511	99.6%	0.1%	0.3%	NA	100.0%	7189	4.1%
2002	182439	8.55	1.93	NA	182439	180	598	NA	183217	99.6%	0.1%	0.3%	NA	100.0%	706	0.4%
2003	187423	8.78	1.98	NA	187423	184	614	NA	188222	99.6%	0.1%	0.3%	NA	100.0%	5005	2.7%
2004	192727	8.21	2.03	NA	192727	172	628	NA	193528	99.6%	0.1%	0.3%	NA	100.0%	5307	2.8%
2005	193470	8.02	2.04	NA	193470	168	631	NA	194270	99.6%	0.1%	0.3%	NA	100.0%	742	0.4%
Change from 1990															64818	50.1%

**Table 1-6 Manufacturing Industries and Construction Energy Emissions (Subsector 1A2), 1990–2005, Gg**

Year to June	CO <sub>2</sub> Emissions	CH <sub>4</sub> Emissions	N <sub>2</sub> O Emissions	Other Emissions	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
					CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	36862	2.00	0.64	NA	36862	42	200	NA	37104	99.3%	0.1%	0.5%	NA	100.0%	NA	NA
1991	36390	1.94	0.63	NA	36390	41	194	NA	36624	99.4%	0.1%	0.5%	NA	100.0%	-479	-1.3%
1992	36033	1.80	0.56	NA	36033	38	174	NA	36245	99.4%	0.1%	0.5%	NA	100.0%	-380	-1.0%
1993	36600	1.97	0.62	NA	36600	41	194	NA	36835	99.4%	0.1%	0.5%	NA	100.0%	591	1.6%
1994	37237	2.07	0.67	NA	37237	43	206	NA	37487	99.3%	0.1%	0.6%	NA	100.0%	652	1.8%
1995	38460	2.15	0.70	NA	38460	45	217	NA	38722	99.3%	0.1%	0.6%	NA	100.0%	1235	3.3%
1996	38474	2.23	0.74	NA	38474	47	229	NA	38750	99.3%	0.1%	0.6%	NA	100.0%	28	0.1%
1997	38435	2.27	0.77	NA	38435	48	240	NA	38722	99.3%	0.1%	0.6%	NA	100.0%	-28	-0.1%
1998	38280	2.28	0.78	NA	38280	48	242	NA	38570	99.2%	0.1%	0.6%	NA	100.0%	-152	-0.4%
1999	39128	2.27	0.78	NA	39128	48	241	NA	39416	99.3%	0.1%	0.6%	NA	100.0%	846	2.2%
2000	39949	2.24	0.76	NA	39949	47	237	NA	40233	99.3%	0.1%	0.6%	NA	100.0%	817	2.1%
2001	39153	2.11	0.72	NA	39153	44	223	NA	39420	99.3%	0.1%	0.6%	NA	100.0%	-814	-2.0%
2002	40621	2.10	0.70	NA	40621	44	218	NA	40883	99.4%	0.1%	0.5%	NA	100.0%	1463	3.7%
2003	41369	2.14	0.72	NA	41369	45	224	NA	41638	99.4%	0.1%	0.5%	NA	100.0%	755	1.8%
2004	42633	2.24	0.75	NA	42633	47	234	NA	42914	99.3%	0.1%	0.5%	NA	100.0%	1277	3.1%
2005	43436	2.30	0.76	NA	43436	48	237	NA	43721	99.3%	0.1%	0.5%	NA	100.0%	807	1.9%
Change from 1990															6618	17.8%

\* Includes biomass fuels

**Table 1-7 Other Stationary Energy Emissions (Balance of Subsector 1A1, all of subsectors 1A4, 1A5), 1990–2005, Gg\***

Year to June	CO <sub>2</sub> Emissions	CH <sub>4</sub> Emissions	N <sub>2</sub> O Emissions	Other Emissions	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
					CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	27546	84.54	0.34	NA	27546	1775	107	NA	29429	93.6%	6.0%	0.4%	NA	100.0%	NA	NA
1991	28687	86.64	0.36	NA	28687	1820	111	NA	30618	93.7%	5.9%	0.4%	NA	100.0%	1189	4.0%
1992	29588	88.90	0.37	NA	29588	1867	114	NA	31569	93.7%	5.9%	0.4%	NA	100.0%	951	3.1%
1993	30937	89.55	0.38	NA	30937	1881	117	NA	32934	93.9%	5.7%	0.4%	NA	100.0%	1365	4.3%
1994	30293	87.56	0.37	NA	30293	1839	114	NA	32246	93.9%	5.7%	0.4%	NA	100.0%	-689	-2.1%
1995	31384	84.97	0.37	NA	31384	1784	115	NA	33283	94.3%	5.4%	0.3%	NA	100.0%	1038	3.2%
1996	31574	82.62	0.37	NA	31574	1735	113	NA	33423	94.5%	5.2%	0.3%	NA	100.0%	139	0.4%
1997	33515	80.69	0.38	NA	33515	1695	117	NA	35326	94.9%	4.8%	0.3%	NA	100.0%	1904	5.7%
1998	33624	75.86	0.37	NA	33624	1593	113	NA	35331	95.2%	4.5%	0.3%	NA	100.0%	4	0.0%
1999	34004	71.20	0.36	NA	34004	1495	111	NA	35610	95.5%	4.2%	0.3%	NA	100.0%	279	0.8%
2000	34963	66.95	0.35	NA	34963	1406	109	NA	36478	95.8%	3.9%	0.3%	NA	100.0%	868	2.4%
2001	35488	64.76	0.36	NA	35488	1360	110	NA	36958	96.0%	3.7%	0.3%	NA	100.0%	479	1.3%
2002	36155	52.78	0.33	NA	36155	1108	102	NA	37365	96.8%	3.0%	0.3%	NA	100.0%	408	1.1%
2003	39860	55.24	0.36	NA	39860	1160	113	NA	41133	96.9%	2.8%	0.3%	NA	100.0%	3767	10.1%
2004	38444	51.72	0.34	NA	38444	1086	107	NA	39637	97.0%	2.7%	0.3%	NA	100.0%	-1496	-3.6%
2005	40308	47.40	0.35	NA	40308	995	107	NA	41411	97.3%	2.4%	0.3%	NA	100.0%	1773	4.5%
Change from 1990															11982	40.7%

\* Includes biomass fuels, military transport, lawnmowing

**Table 1-8 Transport Emissions (Subsector 1A3), 1990–2005, Gg\***

Year to June	CO <sub>2</sub> Emissions	CH <sub>4</sub> Emissions	N <sub>2</sub> O Emissions	Other Emissions	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
					CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	60737	25.31	2.01	NA	60737	532	624	NA	61892	98.1%	0.9%	1.0%	NA	100.0%	NA	NA
1991	60461	25.66	2.14	NA	60461	539	664	NA	61664	98.0%	0.9%	1.1%	NA	100.0%	-229	-0.4%
1992	61175	26.63	2.28	NA	61175	559	708	NA	62442	98.0%	0.9%	1.1%	NA	100.0%	778	1.3%
1993	62379	27.64	2.44	NA	62379	581	755	NA	63715	97.9%	0.9%	1.2%	NA	100.0%	1273	2.0%
1994	63909	28.59	2.60	NA	63909	600	807	NA	65317	97.8%	0.9%	1.2%	NA	100.0%	1602	2.5%
1995	66521	29.30	2.80	NA	66521	615	868	NA	68004	97.8%	0.9%	1.3%	NA	100.0%	2688	4.1%
1996	68803	29.33	3.19	NA	68803	616	990	NA	70409	97.7%	0.9%	1.4%	NA	100.0%	2405	3.5%
1997	70085	29.33	3.11	NA	70085	616	965	NA	71666	97.8%	0.9%	1.3%	NA	100.0%	1258	1.8%
1998	70093	29.43	3.27	NA	70093	618	1015	NA	71726	97.7%	0.9%	1.4%	NA	100.0%	59	0.1%
1999	70835	30.13	3.45	NA	70835	633	1069	NA	72537	97.7%	0.9%	1.5%	NA	100.0%	811	1.1%
2000	72762	29.33	3.81	NA	72762	616	1182	NA	74560	97.6%	0.8%	1.6%	NA	100.0%	2023	2.8%
2001	71362	28.18	3.97	NA	71362	592	1232	NA	73186	97.5%	0.8%	1.7%	NA	100.0%	-1374	-1.8%
2002	72938	28.86	4.29	NA	72938	606	1331	NA	74875	97.4%	0.8%	1.8%	NA	100.0%	1689	2.3%
2003	73435	28.59	4.54	NA	73435	600	1406	NA	75442	97.3%	0.8%	1.9%	NA	100.0%	567	0.8%
2004	77290	29.54	4.98	NA	77290	620	1544	NA	79454	97.3%	0.8%	1.9%	NA	100.0%	4012	5.3%
2005	78324	27.94	4.77	NA	78324	587	1479	NA	80389	97.4%	0.7%	1.8%	NA	100.0%	936	1.2%
Change from 1990															18497	29.9%

\* Excludes military transport, lawnmowing

**Table 1-9 Road Transport (Sector 1A3a) Emissions, 1990–2005, Gg**

Year to June	CO <sub>2</sub> Emissions	CH <sub>4</sub> Emissions	N <sub>2</sub> O Emissions	Other Emissions	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
					CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	53153	19.93	1.81	NA	53153	418	561	NA	54132	98.2%	0.8%	1.0%	NA	100.0%	NA	NA
1991	52141	20.38	1.91	NA	52141	428	594	NA	53163	98.1%	0.8%	1.1%	NA	100.0%	-969	-1.8%
1992	52973	21.33	2.06	NA	52973	448	638	NA	54060	98.0%	0.8%	1.2%	NA	100.0%	897	1.7%
1993	54229	22.29	2.21	NA	54229	468	686	NA	55383	97.9%	0.8%	1.2%	NA	100.0%	1324	2.4%
1994	55803	23.17	2.38	NA	55803	487	739	NA	57028	97.9%	0.9%	1.3%	NA	100.0%	1645	3.0%
1995	57365	23.78	2.55	NA	57365	499	790	NA	58655	97.8%	0.9%	1.3%	NA	100.0%	1627	2.9%
1996	59125	23.78	2.93	NA	59125	499	907	NA	60531	97.7%	0.8%	1.5%	NA	100.0%	1876	3.2%
1997	60223	23.77	2.85	NA	60223	499	882	NA	61604	97.8%	0.8%	1.4%	NA	100.0%	1073	1.8%
1998	61176	23.87	3.03	NA	61176	501	941	NA	62618	97.7%	0.8%	1.5%	NA	100.0%	1014	1.6%
1999	62405	24.49	3.22	NA	62405	514	998	NA	63917	97.6%	0.8%	1.6%	NA	100.0%	1299	2.1%
2000	63973	23.57	3.57	NA	63973	495	1108	NA	65576	97.6%	0.8%	1.7%	NA	100.0%	1659	2.6%
2001	62428	22.61	3.73	NA	62428	475	1155	NA	64057	97.5%	0.7%	1.8%	NA	100.0%	-1519	-2.3%
2002	64558	23.14	4.06	NA	64558	486	1259	NA	66303	97.4%	0.7%	1.9%	NA	100.0%	2246	3.5%
2003	65174	22.80	4.31	NA	65174	479	1336	NA	66988	97.3%	0.7%	2.0%	NA	100.0%	685	1.0%
2004	68464	23.40	4.74	NA	68464	491	1469	NA	70425	97.2%	0.7%	2.1%	NA	100.0%	3437	5.1%
2005	68795	21.77	4.51	NA	68795	457	1398	NA	70650	97.4%	0.6%	2.0%	NA	100.0%	226	0.3%
Change from 1990															16519	30.5%

Table 1-10 Other Domestic Transport Emissions (Balance of subsector 1A3), 1990–2005, Gg

Year to June	CO <sub>2</sub> Emissions	CH <sub>4</sub> Emissions	N <sub>2</sub> O Emissions	Other Emissions	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
					CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	7584	5.39	0.20	NA	7584	113	63	NA	7761	97.7%	1.5%	0.8%	NA	100.0%	NA	NA
1991	8320	5.29	0.23	NA	8320	111	70	NA	8501	97.9%	1.3%	0.8%	NA	100.0%	740	9.5%
1992	8202	5.30	0.22	NA	8202	111	69	NA	8382	97.8%	1.3%	0.8%	NA	100.0%	-119	-1.4%
1993	8150	5.35	0.22	NA	8150	112	69	NA	8331	97.8%	1.3%	0.8%	NA	100.0%	-51	-0.6%
1994	8106	5.42	0.22	NA	8106	114	69	NA	8288	97.8%	1.4%	0.8%	NA	100.0%	-43	-0.5%
1995	9156	5.51	0.25	NA	9156	116	78	NA	9349	97.9%	1.2%	0.8%	NA	100.0%	1061	12.8%
1996	9678	5.56	0.27	NA	9678	117	83	NA	9878	98.0%	1.2%	0.8%	NA	100.0%	529	5.7%
1997	9863	5.56	0.27	NA	9863	117	83	NA	10062	98.0%	1.2%	0.8%	NA	100.0%	184	1.9%
1998	8917	5.56	0.24	NA	8917	117	74	NA	9108	97.9%	1.3%	0.8%	NA	100.0%	-954	-9.5%
1999	8430	5.64	0.23	NA	8430	118	72	NA	8620	97.8%	1.4%	0.8%	NA	100.0%	-488	-5.4%
2000	8788	5.76	0.24	NA	8788	121	75	NA	8984	97.8%	1.3%	0.8%	NA	100.0%	364	4.2%
2001	8935	5.57	0.25	NA	8935	117	77	NA	9129	97.9%	1.3%	0.8%	NA	100.0%	145	1.6%
2002	8380	5.72	0.23	NA	8380	120	71	NA	8572	97.8%	1.4%	0.8%	NA	100.0%	-557	-6.1%
2003	8262	5.79	0.23	NA	8262	122	70	NA	8453	97.7%	1.4%	0.8%	NA	100.0%	-119	-1.4%
2004	8825	6.14	0.24	NA	8825	129	75	NA	9029	97.7%	1.4%	0.8%	NA	100.0%	576	6.8%
2005	9529	6.17	0.26	NA	9529	130	81	NA	9739	97.8%	1.3%	0.8%	NA	100.0%	710	7.9%
Change from 1990															1978	25.5%

Table 1-11 Fugitive Emissions from Fuels (Sector 1B), 1990–2005, Gg

Year to June	CO <sub>2</sub> Emissions	CH <sub>4</sub> Emissions	N <sub>2</sub> O Emissions	Other Emissions	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
					CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	5982	1098.73	0.12	NA	5982	23073	36	NA	29092	20.6%	79.3%	0.1%	NA	100.0%	NA	NA
1991	5747	1063.99	0.11	NA	5747	22344	34	NA	28125	20.4%	79.4%	0.1%	NA	100.0%	-967	-3.3%
1992	5920	1143.39	0.11	NA	5920	24011	34	NA	29965	19.8%	80.1%	0.1%	NA	100.0%	1840	6.5%
1993	5901	1166.98	0.11	NA	5901	24507	33	NA	30441	19.4%	80.5%	0.1%	NA	100.0%	475	1.6%
1994	5689	1125.46	0.10	NA	5689	23635	30	NA	29353	19.4%	80.5%	0.1%	NA	100.0%	-1088	-3.6%
1995	5873	1185.89	0.10	NA	5873	24904	31	NA	30808	19.1%	80.8%	0.1%	NA	100.0%	1455	5.0%
1996	5470	1126.86	0.11	NA	5470	23664	33	NA	29167	18.8%	81.1%	0.1%	NA	100.0%	-1641	-5.3%
1997	5292	1259.45	0.08	NA	5292	26448	24	NA	31764	16.7%	83.3%	0.1%	NA	100.0%	2597	8.9%
1998	5520	1248.07	0.11	NA	5520	26210	36	NA	31765	17.4%	82.5%	0.1%	NA	100.0%	1	0.0%
1999	5976	1138.90	0.08	NA	5976	23917	25	NA	29918	20.0%	79.9%	0.1%	NA	100.0%	-1847	-5.8%
2000	6729	1152.65	0.09	NA	6729	24206	29	NA	30963	21.7%	78.2%	0.1%	NA	100.0%	1045	3.5%
2001	7171	1205.32	0.10	NA	7171	25312	31	NA	32514	22.1%	77.8%	0.1%	NA	100.0%	1551	5.0%
2002	6702	1205.19	0.09	NA	6702	25309	28	NA	32039	20.9%	79.0%	0.1%	NA	100.0%	-474	-1.5%
2003	5996	1154.71	0.08	NA	5996	24249	24	NA	30270	19.8%	80.1%	0.1%	NA	100.0%	-1770	-5.5%
2004	5731	1180.40	0.08	NA	5731	24788	24	NA	30543	18.8%	81.2%	0.1%	NA	100.0%	273	0.9%
2005	5554	1221.52	0.07	NA	5554	25652	22	NA	31228	17.8%	82.1%	0.1%	NA	100.0%	685	2.2%
Change from 1990															2136	7.3%

Table 1-12 Industrial Processes Emissions (Sector 2), 1990–2005, Gg

Year to June	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other*	Net CO <sub>2</sub> -equivalent Emissions						Share of CO <sub>2</sub> -equivalent Emissions						Annual Change		
	Emissions	Emissions	Emissions	Emissions	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	PFC	Other**	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	PFC	Other**	Total	Gg CO <sub>2</sub> -e	%	
1990	17721	3.27	0.07	0.67	17721	69	22	3938	3532	25282	70.1%	0.3%	0.1%	15.6%	14.0%	100.0%	NA	NA	
1991	17111	3.01	0.07	0.68	17111	63	21	3941	3506	24643	69.4%	0.3%	0.1%	16.0%	14.2%	100.0%	-639	-2.5%	
1992	17575	3.30	0.07	0.67	17575	69	22	3935	3636	25237	69.6%	0.3%	0.1%	15.6%	14.4%	100.0%	595	2.4%	
1993	17723	3.33	0.07	0.54	17723	70	22	2833	4609	25257	70.2%	0.3%	0.1%	11.2%	18.2%	100.0%	20	0.1%	
1994	19535	3.72	0.08	0.34	19535	78	24	1848	4129	25614	76.3%	0.3%	0.1%	7.2%	16.1%	100.0%	357	1.4%	
1995	19708	3.80	0.08	0.25	19708	80	25	1309	4707	25828	76.3%	0.3%	0.1%	5.1%	18.2%	100.0%	214	0.8%	
1996	19978	3.88	0.08	0.18	19978	82	25	1206	4452	25743	77.6%	0.3%	0.1%	4.7%	17.3%	100.0%	-85	-0.3%	
1997	19862	3.80	0.08	0.16	19862	80	25	1061	4701	25729	77.2%	0.3%	0.1%	4.1%	18.3%	100.0%	-14	-0.1%	
1998	20259	3.96	0.08	0.23	20259	83	24	1536	5228	27130	74.7%	0.3%	0.1%	5.7%	19.3%	100.0%	1401	5.4%	
1999	20805	3.70	0.08	0.15	20805	78	25	988	5439	27334	76.1%	0.3%	0.1%	3.6%	19.9%	100.0%	205	0.8%	
2000	20095	3.33	0.07	0.16	20095	70	23	1110	6073	27371	73.4%	0.3%	0.1%	4.1%	22.2%	100.0%	36	0.1%	
2001	19338	3.10	0.06	0.23	19338	65	20	1554	7323	28300	68.3%	0.2%	0.1%	5.5%	25.9%	100.0%	929	3.4%	
2002	19063	3.08	0.06	0.22	19063	65	19	1507	8127	28780	66.2%	0.2%	0.1%	5.2%	28.2%	100.0%	481	1.7%	
2003	19005	3.30	0.06	0.22	19005	69	17	1468	9056	29615	64.2%	0.2%	0.1%	5.0%	30.6%	100.0%	835	2.9%	
2004	19530	3.30	0.06	0.22	19530	69	19	1486	9468	30571	63.9%	0.2%	0.1%	4.9%	31.0%	100.0%	956	3.2%	
2005	17720	3.12	0.06	0.23	17720	65	17	1567	10093	29463	60.1%	0.2%	0.1%	5.3%	34.3%	100.0%	-1109	-3.6%	
* Gg of PFCs, SF <sub>6</sub> HFCs																	Change from 1990	4181	16.5%

\* Gg of PFCs, SF<sub>6</sub>, HFCs\*\* Gg of CO<sub>2</sub>-e from SF<sub>6</sub> from metal production (included 1996-2000), HFCs and confidential CO<sub>2</sub> and N<sub>2</sub>O in chemical industry

Table 1-13 Agriculture Emissions (Sector 4), 1990–2005, Gg

Year to June	CO <sub>2</sub> Emissions	CH <sub>4</sub> Emissions	N <sub>2</sub> O Emissions	Other Emissions	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
					CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	0	3368.90	54.74	NA	0	70747	16969	NA	87716	0.0%	80.7%	19.3%	NA	100.0%	NA	NA
1991	0	3371.90	54.06	NA	0	70810	16760	NA	87570	0.0%	80.9%	19.1%	NA	100.0%	-146	-0.2%
1992	0	3300.59	53.77	NA	0	69312	16668	NA	85981	0.0%	80.6%	19.4%	NA	100.0%	-1589	-1.8%
1993	0	3258.51	54.91	NA	0	68429	17023	NA	85451	0.0%	80.1%	19.9%	NA	100.0%	-529	-0.6%
1994	0	3252.29	56.86	NA	0	68298	17627	NA	85925	0.0%	79.5%	20.5%	NA	100.0%	474	0.6%
1995	0	3266.19	59.73	NA	0	68590	18516	NA	87106	0.0%	78.7%	21.3%	NA	100.0%	1180	1.4%
1996	0	3261.98	60.78	NA	0	68502	18841	NA	87343	0.0%	78.4%	21.6%	NA	100.0%	237	0.3%
1997	0	3288.14	62.68	NA	0	69051	19429	NA	88480	0.0%	78.0%	22.0%	NA	100.0%	1138	1.3%
1998	0	3281.84	64.73	NA	0	68919	20066	NA	88985	0.0%	77.4%	22.6%	NA	100.0%	504	0.6%
1999	0	3369.55	68.37	NA	0	70761	21195	NA	91956	0.0%	77.0%	23.0%	NA	100.0%	2971	3.3%
2000	0	3461.11	73.65	NA	0	72683	22833	NA	95516	0.0%	76.1%	23.9%	NA	100.0%	3560	3.9%
2001	0	3565.80	77.02	NA	0	74882	23876	NA	98758	0.0%	75.8%	24.2%	NA	100.0%	3242	3.4%
2002	0	3469.40	75.89	NA	0	72857	23527	NA	96384	0.0%	75.6%	24.4%	NA	100.0%	-2374	-2.4%
2003	0	3297.12	69.91	NA	0	69240	21671	NA	90911	0.0%	76.2%	23.8%	NA	100.0%	-5473	-5.7%
2004	0	3256.90	69.03	NA	0	68395	21399	NA	89794	0.0%	76.2%	23.8%	NA	100.0%	-1117	-1.2%
2005	0	3197.87	66.88	NA	0	67155	20734	NA	87889	0.0%	76.4%	23.6%	NA	100.0%	-1905	-2.1%
Change from 1990															173	0.2%

Table 1-14 Agriculture—Livestock Related Emissions (Subsectors 4A, 4B), 1990–2005, Gg

Year to June	CO <sub>2</sub> Emissions	CH <sub>4</sub> Emissions	N <sub>2</sub> O Emissions	Other Emissions	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
					CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	0	3115.29	1.69	NA	0	65421	525	NA	65946	0.0%	99.2%	0.8%	NA	100.0%	NA	NA
1991	0	3121.92	1.88	NA	0	65560	582	NA	66142	0.0%	99.1%	0.9%	NA	100.0%	196	0.3%
1992	0	3062.47	2.15	NA	0	64312	667	NA	64978	0.0%	99.0%	1.0%	NA	100.0%	-1164	-1.8%
1993	0	2999.56	2.45	NA	0	62991	759	NA	63750	0.0%	98.8%	1.2%	NA	100.0%	-1228	-1.9%
1994	0	2932.61	2.71	NA	0	61585	841	NA	62425	0.0%	98.7%	1.3%	NA	100.0%	-1325	-2.1%
1995	0	2911.84	3.01	NA	0	61149	934	NA	62082	0.0%	98.5%	1.5%	NA	100.0%	-343	-0.5%
1996	0	2898.94	2.92	NA	0	60878	905	NA	61783	0.0%	98.5%	1.5%	NA	100.0%	-299	-0.5%
1997	0	2923.16	3.25	NA	0	61386	1006	NA	62392	0.0%	98.4%	1.6%	NA	100.0%	610	1.0%
1998	0	2923.67	3.52	NA	0	61397	1091	NA	62488	0.0%	98.3%	1.7%	NA	100.0%	96	0.2%
1999	0	2957.44	4.02	NA	0	62106	1246	NA	63352	0.0%	98.0%	2.0%	NA	100.0%	864	1.4%
2000	0	2972.05	4.26	NA	0	62413	1320	NA	63733	0.0%	97.9%	2.1%	NA	100.0%	381	0.6%
2001	0	2991.15	4.27	NA	0	62814	1324	NA	64138	0.0%	97.9%	2.1%	NA	100.0%	405	0.6%
2002	0	2924.62	4.26	NA	0	61417	1322	NA	62739	0.0%	97.9%	2.1%	NA	100.0%	-1399	-2.2%
2003	0	2890.53	4.32	NA	0	60701	1339	NA	62040	0.0%	97.8%	2.2%	NA	100.0%	-699	-1.1%
2004	0	2866.68	4.62	NA	0	60200	1432	NA	61633	0.0%	97.7%	2.3%	NA	100.0%	-407	-0.7%
2005	0	2886.56	4.82	NA	0	60618	1495	NA	62113	0.0%	97.6%	2.4%	NA	100.0%	480	0.8%
Change from 1990															-3833	-5.8%

Table 1-15 Agriculture—Crop, Soil and Fire Related Emissions (Subsectors 4C, 4D, 4E, 4F), 1990–2005, Gg

Year to June	CO <sub>2</sub> Emissions	CH <sub>4</sub> Emissions	N <sub>2</sub> O Emissions	Other Emissions	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
					CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	0	253.61	53.04	NA	0	5326	16444	NA	21769	0.0%	24.5%	75.5%	NA	100.0%	NA	NA
1991	0	249.98	52.19	NA	0	5250	16178	NA	21428	0.0%	24.5%	75.5%	NA	100.0%	-342	-1.6%
1992	0	238.13	51.62	NA	0	5001	16002	NA	21002	0.0%	23.8%	76.2%	NA	100.0%	-425	-2.0%
1993	0	258.95	52.46	NA	0	5438	16263	NA	21701	0.0%	25.1%	74.9%	NA	100.0%	699	3.3%
1994	0	319.68	54.15	NA	0	6713	16787	NA	23500	0.0%	28.6%	71.4%	NA	100.0%	1799	8.3%
1995	0	354.35	56.72	NA	0	7441	17582	NA	25023	0.0%	29.7%	70.3%	NA	100.0%	1524	6.5%
1996	0	363.04	57.86	NA	0	7624	17936	NA	25560	0.0%	29.8%	70.2%	NA	100.0%	537	2.1%
1997	0	364.98	59.43	NA	0	7665	18423	NA	26088	0.0%	29.4%	70.6%	NA	100.0%	528	2.1%
1998	0	358.17	61.21	NA	0	7522	18975	NA	26497	0.0%	28.4%	71.6%	NA	100.0%	409	1.6%
1999	0	412.11	64.35	NA	0	8654	19949	NA	28604	0.0%	30.3%	69.7%	NA	100.0%	2107	8.0%
2000	0	489.06	69.40	NA	0	10270	21513	NA	31783	0.0%	32.3%	67.7%	NA	100.0%	3179	11.1%
2001	0	574.65	72.75	NA	0	12068	22552	NA	34620	0.0%	34.9%	65.1%	NA	100.0%	2837	8.9%
2002	0	544.77	71.63	NA	0	11440	22205	NA	33645	0.0%	34.0%	66.0%	NA	100.0%	-975	-2.8%
2003	0	406.60	65.39	NA	0	8539	20333	NA	28871	0.0%	29.6%	70.4%	NA	100.0%	-4774	-14.2%
2004	0	390.22	64.41	NA	0	8195	19967	NA	28161	0.0%	29.1%	70.9%	NA	100.0%	-710	-2.5%
2005	0	311.31	62.06	NA	0	6537	19239	NA	25776	0.0%	25.4%	74.6%	NA	100.0%	-2385	-8.5%
Change from 1990															4007	18.4%

Table 1-16 Emissions from Land Use, Land Use Change and Forestry (Kyoto Accounting), 1990–2005, Gg

Year to June	CO <sub>2</sub>	CO <sub>2</sub>	Net CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
	Emissions	Removals	Emissions	Emissions	Emissions	Emissions	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	124,542	0	124,542	161.17	2.98	NA	124,542	3,385	925	NA	128,852	96.7%	2.6%	0.7%	NA	100.0%	NA	NA
1991	102,283	485	101,798	143.01	2.65	NA	101,798	3,003	821	NA	105,622	96.4%	2.8%	0.8%	NA	100.0%	-23230	-18.0%
1992	86,850	994	85,855	120.08	2.22	NA	85,855	2,522	689	NA	89,066	96.4%	2.8%	0.8%	NA	100.0%	-16556	-15.7%
1993	74,085	1,501	72,583	108.64	2.01	NA	72,583	2,281	624	NA	75,489	96.2%	3.0%	0.8%	NA	100.0%	-13578	-15.2%
1994	73,533	1,876	71,656	110.36	2.04	NA	71,656	2,318	633	NA	74,607	96.0%	3.1%	0.8%	NA	100.0%	-881	-1.2%
1995	62,771	2,459	60,312	93.55	1.73	NA	60,312	1,964	537	NA	62,813	96.0%	3.1%	0.9%	NA	100.0%	-11794	-15.8%
1996	61,677	3,157	58,520	92.52	1.71	NA	58,520	1,943	531	NA	60,994	95.9%	3.2%	0.9%	NA	100.0%	-1819	-2.9%
1997	58,991	4,487	54,505	91.70	1.70	NA	54,505	1,926	526	NA	56,957	95.7%	3.4%	0.9%	NA	100.0%	-4037	-6.6%
1998	70,295	5,984	64,310	93.24	1.73	NA	64,310	1,958	535	NA	66,803	96.3%	2.9%	0.8%	NA	100.0%	9847	17.3%
1999	59,733	7,613	52,120	92.43	1.71	NA	52,120	1,941	531	NA	54,592	95.5%	3.6%	1.0%	NA	100.0%	-12211	-18.3%
2000	62,203	10,897	51,306	96.71	1.79	NA	51,306	2,031	555	NA	53,892	95.2%	3.8%	1.0%	NA	100.0%	-700	-1.3%
2001	59,096	11,915	47,180	95.90	1.78	NA	47,180	2,014	550	NA	49,745	94.8%	4.0%	1.1%	NA	100.0%	-4148	-7.7%
2002	66,752	13,897	52,855	92.60	1.71	NA	52,855	1,945	532	NA	55,331	95.5%	3.5%	1.0%	NA	100.0%	5587	11.2%
2003	44,426	15,845	28,581	75.12	1.39	NA	28,581	1,577	431	NA	30,590	93.4%	5.2%	1.4%	NA	100.0%	-24741	-44.7%
2004	50,965	17,778	33,187	86.40	1.60	NA	33,187	1,814	496	NA	35,497	93.5%	5.1%	1.4%	NA	100.0%	4908	16.0%
2005	50,965	19,609	31,356	86.40	1.60	NA	31,356	1,814	496	NA	33,667	93.1%	5.4%	1.5%	NA	100.0%	-1831	-5.2%
Change from 1990																	-95185	-73.9%

Table 1-17 Waste Emissions (Sector 6), 1990–2005, Gg

Year to June	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Net CO <sub>2</sub> -equivalent Emissions					Share of CO <sub>2</sub> -equivalent Emissions					Annual Change	
	Emissions	Emissions	Emissions	Emissions	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other	Total	Gg CO <sub>2</sub> -e	%
1990	21	847.98	1.54	NA	21	17808	479	NA	18308	0.1%	97.3%	2.6%	NA	100.0%	NA	NA
1991	21	853.60	1.57	NA	21	17926	486	NA	18433	0.1%	97.2%	2.6%	NA	100.0%	125	0.7%
1992	22	850.32	1.59	NA	22	17857	492	NA	18370	0.1%	97.2%	2.7%	NA	100.0%	-63	-0.3%
1993	22	853.19	1.60	NA	22	17917	497	NA	18436	0.1%	97.2%	2.7%	NA	100.0%	66	0.4%
1994	22	837.92	1.62	NA	22	17596	502	NA	18120	0.1%	97.1%	2.8%	NA	100.0%	-315	-1.7%
1995	28	845.62	1.64	NA	28	17758	508	NA	18293	0.2%	97.1%	2.8%	NA	100.0%	173	1.0%
1996	24	796.63	1.66	NA	24	16729	515	NA	17268	0.1%	96.9%	3.0%	NA	100.0%	-1025	-5.6%
1997	28	795.62	1.68	NA	28	16708	521	NA	17257	0.2%	96.8%	3.0%	NA	100.0%	-11	-0.1%
1998	28	774.46	1.70	NA	28	16264	526	NA	16818	0.2%	96.7%	3.1%	NA	100.0%	-439	-2.5%
1999	29	788.30	1.72	NA	29	16554	532	NA	17115	0.2%	96.7%	3.1%	NA	100.0%	297	1.8%
2000	28	790.57	1.74	NA	28	16602	538	NA	17168	0.2%	96.7%	3.1%	NA	100.0%	53	0.3%
2001	28	803.25	1.76	NA	28	16868	545	NA	17441	0.2%	96.7%	3.1%	NA	100.0%	273	1.6%
2002	28	815.66	1.78	NA	28	17129	552	NA	17709	0.2%	96.7%	3.1%	NA	100.0%	268	1.5%
2003	28	795.16	1.80	NA	28	16698	559	NA	17285	0.2%	96.6%	3.2%	NA	100.0%	-424	-2.4%
2004	28	788.33	1.82	NA	28	16555	566	NA	17149	0.2%	96.5%	3.3%	NA	100.0%	-136	-0.8%
2005	28	782.68	1.85	NA	28	16436	572	NA	17037	0.2%	96.5%	3.4%	NA	100.0%	-112	-0.7%
Change from 1990															-1271	-6.9%

## **APPENDIX 2 EMISSIONS BY GREENHOUSE GAS AND FUEL TYPE 1990–2005**



Table 2-1 CO<sub>2</sub> Emissions by Source Category, 1990–2005, Gg

Year to June	Stationary Energy	Transport	Fugitive	Industrial Processes	Solvent	Agriculture	Land Use Change & Forestry	Waste	Total (net)
1990	193416	60737	5982	17721	0	0	124542	21.3	402421
1991	196268	60461	5747	17111	0	0	101798	21.4	381407
1992	199667	61175	5920	17575	0	0	85855	21.6	370214
1993	202485	62379	5901	17723	0	0	72583	21.7	361093
1994	204053	63909	5689	19535	0	0	71656	21.8	364863
1995	211961	66521	5873	19708	0	0	60312	27.5	364402
1996	217172	68803	5470	19978	0	0	58520	24.2	369967
1997	224065	70085	5292	19862	0	0	54505	28.0	373837
1998	236768	70093	5520	20259	0	0	64310	28.3	396978
1999	243973	70835	5976	20805	0	0	52120	28.8	393739
2000	249493	72762	6729	20095	0	0	51306	27.7	400413
2001	256392	71362	7171	19338	0	0	47180	27.8	401471
2002	259215	72938	6702	19063	0	0	52855	28.0	410801
2003	268652	73435	5996	19005	0	0	28581	28.1	395698
2004	273805	77290	5731	19530	0	0	33187	28.3	409570
2005	277215	78324	5554	17720	0	0	31356	28.4	410196

Table 2-3 CH<sub>4</sub> Emissions by Source Category, 1990–2005, Gg

Year to June	Stationary Energy	Transport	Fugitive	Industrial Processes	Solvent	Agriculture	Land Use Change & Forestry	Waste	Total
1990	87.8	25.3	1098.7	3.3	0.0	3368.9	161.2	848.0	5593.2
1991	89.9	25.7	1064.0	3.0	0.0	3371.9	143.0	853.6	5551.1
1992	92.1	26.6	1143.4	3.3	0.0	3300.6	120.1	850.3	5536.4
1993	92.9	27.6	1167.0	3.3	0.0	3258.5	108.6	853.2	5511.2
1994	91.0	28.6	1125.5	3.7	0.0	3252.3	110.4	837.9	5449.3
1995	88.6	29.3	1185.9	3.8	0.0	3266.2	93.5	845.6	5513.0
1996	86.3	29.3	1126.9	3.9	0.0	3262.0	92.5	796.6	5397.5
1997	84.4	29.3	1259.5	3.8	0.0	3288.1	91.7	795.6	5552.4
1998	82.0	29.4	1248.1	4.0	0.0	3281.8	93.2	774.5	5513.0
1999	77.7	30.1	1138.9	3.7	0.0	3369.6	92.4	788.3	5500.7
2000	76.7	29.3	1152.6	3.3	0.0	3461.1	96.7	790.6	5610.4
2001	74.4	28.2	1205.3	3.1	0.0	3565.8	95.9	803.2	5775.9
2002	63.4	28.9	1205.2	3.1	0.0	3469.4	92.6	815.7	5678.2
2003	66.2	28.6	1154.7	3.3	0.0	3297.1	75.1	795.2	5420.2
2004	62.2	29.5	1180.4	3.3	0.0	3256.9	86.4	788.3	5407.0
2005	57.7	27.9	1221.5	3.1	0.0	3197.9	86.4	782.7	5377.2

Table 2-5 N<sub>2</sub>O Emissions by Source Category, 1990–2005, Gg

Year to June	Stationary Energy	Transport	Fugitive	Industrial Processes	Solvent	Agriculture	Land Use Change & Forestry	Waste	Total
1990	2.33	2.01	0.12	0.07	0.00	54.74	2.98	1.54	63.80
1991	2.38	2.14	0.11	0.07	0.00	54.06	2.65	1.57	62.97
1992	2.35	2.28	0.11	0.07	0.00	53.77	2.22	1.59	62.40
1993	2.42	2.44	0.11	0.07	0.00	54.91	2.01	1.60	63.56
1994	2.47	2.60	0.10	0.08	0.00	56.86	2.04	1.62	65.77
1995	2.56	2.80	0.10	0.08	0.00	59.73	1.73	1.64	68.64
1996	2.66	3.19	0.11	0.08	0.00	60.78	1.71	1.66	70.19
1997	2.78	3.11	0.08	0.08	0.00	62.68	1.70	1.68	72.11
1998	2.93	3.27	0.11	0.08	0.00	64.73	1.73	1.70	74.55
1999	2.97	3.45	0.08	0.08	0.00	68.37	1.71	1.72	78.38
2000	3.00	3.81	0.09	0.07	0.00	73.65	1.79	1.74	84.16
2001	3.01	3.97	0.10	0.06	0.00	77.02	1.78	1.76	87.70
2002	2.96	4.29	0.09	0.06	0.00	75.89	1.71	1.78	86.79
2003	3.06	4.54	0.08	0.06	0.00	69.91	1.39	1.80	80.84
2004	3.13	4.98	0.08	0.06	0.00	69.03	1.60	1.82	80.70
2005	3.15	4.77	0.07	0.06	0.00	66.88	1.60	1.85	78.37

Table 2-2 Share of CO<sub>2</sub> Emissions by Source Category, 1990–2005

Year to June	Fuel Combustion Stationary Energy	Transport	Fugitive	Industrial Processes	Solvent	Agriculture	Land Use Change & Forestry	Waste	Total (net)
1990	48.1%	15.1%	1.5%	4.4%	0.0%	0.0%	30.9%	0.0%	100.0%
1991	51.5%	15.9%	1.5%	4.5%	0.0%	0.0%	26.7%	0.0%	100.0%
1992	53.9%	16.5%	1.6%	4.7%	0.0%	0.0%	23.2%	0.0%	100.0%
1993	56.1%	17.3%	1.6%	4.9%	0.0%	0.0%	20.1%	0.0%	100.0%
1994	55.9%	17.5%	1.6%	5.4%	0.0%	0.0%	19.6%	0.0%	100.0%
1995	58.2%	18.3%	1.6%	5.4%	0.0%	0.0%	16.6%	0.0%	100.0%
1996	58.7%	18.6%	1.5%	5.4%	0.0%	0.0%	15.8%	0.0%	100.0%
1997	59.9%	18.7%	1.4%	5.3%	0.0%	0.0%	14.6%	0.0%	100.0%
1998	59.6%	17.7%	1.4%	5.1%	0.0%	0.0%	16.2%	0.0%	100.0%
1999	62.0%	18.0%	1.5%	5.3%	0.0%	0.0%	13.2%	0.0%	100.0%
2000	62.3%	18.2%	1.7%	5.0%	0.0%	0.0%	12.8%	0.0%	100.0%
2001	63.9%	17.8%	1.8%	4.8%	0.0%	0.0%	11.8%	0.0%	100.0%
2002	63.1%	17.8%	1.6%	4.6%	0.0%	0.0%	12.9%	0.0%	100.0%
2003	67.9%	18.6%	1.5%	4.8%	0.0%	0.0%	7.2%	0.0%	100.0%
2004	66.9%	18.9%	1.4%	4.8%	0.0%	0.0%	8.1%	0.0%	100.0%
2005	67.6%	19.1%	1.4%	4.3%	0.0%	0.0%	7.6%	0.0%	100.0%

Table 2-4 Share of CH<sub>4</sub> Emissions by Source Category, 1990–2005

Year to June	Fuel Combustion Stationary Energy	Transport	Fugitive	Industrial Processes	Solvent	Agriculture	Land Use Change & Forestry	Waste	Total
1990	1.6%	0.5%	19.6%	0.1%	0.0%	60.2%	2.9%	15.2%	100.0%
1991	1.6%	0.5%	19.2%	0.1%	0.0%	60.7%	2.6%	15.4%	100.0%
1992	1.7%	0.5%	20.7%	0.1%	0.0%	59.6%	2.2%	15.4%	100.0%
1993	1.7%	0.5%	21.2%	0.1%	0.0%	59.1%	2.0%	15.5%	100.0%
1994	1.7%	0.5%	20.7%	0.1%	0.0%	59.7%	2.0%	15.4%	100.0%
1995	1.6%	0.5%	21.5%	0.1%	0.0%	59.2%	1.7%	15.3%	100.0%
1996	1.6%	0.5%	20.9%	0.1%	0.0%	60.4%	1.7%	14.8%	100.0%
1997	1.5%	0.5%	22.7%	0.1%	0.0%	59.2%	1.7%	14.3%	100.0%
1998	1.5%	0.5%	22.6%	0.1%	0.0%	59.5%	1.7%	14.0%	100.0%
1999	1.4%	0.5%	20.7%	0.1%	0.0%	61.3%	1.7%	14.3%	100.0%
2000	1.4%	0.5%	20.5%	0.1%	0.0%	61.7%	1.7%	14.1%	100.0%
2001	1.3%	0.5%	20.9%	0.1%	0.0%	61.7%	1.7%	13.9%	100.0%
2002	1.1%	0.5%	21.2%	0.1%	0.0%	61.1%	1.6%	14.4%	100.0%
2003	1.2%	0.5%	21.3%	0.1%	0.0%	60.8%	1.4%	14.7%	100.0%
2004	1.1%	0.5%	21.8%	0.1%	0.0%	60.2%	1.6%	14.6%	100.0%
2005	1.1%	0.5%	22.7%	0.1%	0.0%	59.5%	1.6%	14.6%	100.0%

Table 2-6 Share of N<sub>2</sub>O Emissions by Source Category, 1990–2005

Year to June	Fuel Combustion Stationary Energy	Transport	Fugitive	Industrial Processes	Solvent	Agriculture	Land Use Change & Forestry	Waste	Total
1990	3.7%	3.2%	0.2%	0.1%	0.0%	85.8%	4.7%	2.4%	100.0%
1991	3.8%	3.4%	0.2%	0.1%	0.0%	85.9%	4.2%	2.5%	100.0%
1992	3.8%	3.7%	0.2%	0.1%	0.0%	86.2%	3.6%	2.5%	100.0%
1993	3.8%	3.8%	0.2%	0.1%	0.0%	86.4%	3.2%	2.5%	100.0%
1994	3.8%	4.0%	0.1%	0.1%	0.0%	86.5%	3.1%	2.5%	100.0%
1995	3.7%	4.1%	0.1%	0.1%	0.0%	87.0%	2.5%	2.4%	100.0%
1996	3.8%	4.5%	0.2%	0.1%	0.0%	86.6%	2.4%	2.4%	100.0%
1997	3.9%	4.3%	0.1%	0.1%	0.0%	86.9%	2.4%	2.3%	100.0%
1998	3.9%	4.4%	0.2%	0.1%	0.0%	86.8%	2.3%	2.3%	100.0%
1999	3.8%	4.4%	0.1%	0.1%	0.0%	87.2%	2.2%	2.2%	100.0%
2000	3.6%	4.5%	0.1%	0.1%	0.0%	87.5%	2.1%	2.1%	100.0%
2001	3.4%	4.5%	0.1%	0.1%	0.0%	87.8%	2.0%	2.0%	100.0%
2002	3.4%	4.9%	0.1%	0.1%	0.0%	87.4%	2.0%	2.1%	100.0%
2003	3.8%	5.6%	0.1%	0.1%	0.0%	86.5%	1.7%	2.2%	100.0%
2004	3.9%	6.2%	0.1%	0.1%	0.0%	85.5%	2.0%	2.3%	100.0%
2005	4.0%	6.1%	0.1%	0.1%	0.0%	85.3%	2.0%	2.4%	100.0%

Table 2-7 PFC Emissions by Source Category, 1990–2005, Gg CO<sub>2</sub>-e

Year to June	Fuel Combustion		Fugitive	Industrial Processes	Solvent	Agriculture	Land Use Change & Forestry	Waste	Total (net)
	Stationary	Transport							
Energy									
1990	NA	NA	NA	3938	NA	NA	NA	NA	3938
1991	NA	NA	NA	3941	NA	NA	NA	NA	3941
1992	NA	NA	NA	3935	NA	NA	NA	NA	3935
1993	NA	NA	NA	2833	NA	NA	NA	NA	2833
1994	NA	NA	NA	1848	NA	NA	NA	NA	1848
1995	NA	NA	NA	1309	NA	NA	NA	NA	1309
1996	NA	NA	NA	1206	NA	NA	NA	NA	1206
1997	NA	NA	NA	1061	NA	NA	NA	NA	1061
1998	NA	NA	NA	1536	NA	NA	NA	NA	1536
1999	NA	NA	NA	988	NA	NA	NA	NA	988
2000	NA	NA	NA	1110	NA	NA	NA	NA	1110
2001	NA	NA	NA	1554	NA	NA	NA	NA	1554
2002	NA	NA	NA	1507	NA	NA	NA	NA	1507
2003	NA	NA	NA	1468	NA	NA	NA	NA	1468
2004	NA	NA	NA	1486	NA	NA	NA	NA	1486
2005	NA	NA	NA	1567	NA	NA	NA	NA	1567

Table 2-9 SF<sub>6</sub> Emissions by Source Category, 1990–2005, Gg CO<sub>2</sub>-e\*

Year to June	Fuel Combustion		Fugitive	Industrial Processes	Solvent	Agriculture	Land Use Change & Forestry	Waste	Total
	Stationary	Transport							
Energy									
1990	NA	NA	NA	521	NA	NA	NA	NA	521
1991	NA	NA	NA	521	NA	NA	NA	NA	521
1992	NA	NA	NA	521	NA	NA	NA	NA	521
1993	NA	NA	NA	521	NA	NA	NA	NA	521
1994	NA	NA	NA	521	NA	NA	NA	NA	521
1995	NA	NA	NA	521	NA	NA	NA	NA	521
1996	NA	NA	NA	530	NA	NA	NA	NA	530
1997	NA	NA	NA	527	NA	NA	NA	NA	527
1998	NA	NA	NA	525	NA	NA	NA	NA	525
1999	NA	NA	NA	525	NA	NA	NA	NA	525
2000	NA	NA	NA	523	NA	NA	NA	NA	523
2001	NA	NA	NA	521	NA	NA	NA	NA	521
2002	NA	NA	NA	521	NA	NA	NA	NA	521
2003	NA	NA	NA	521	NA	NA	NA	NA	521
2004	NA	NA	NA	521	NA	NA	NA	NA	521
2005	NA	NA	NA	521	NA	NA	NA	NA	521

\* Includes SF<sub>6</sub> emissions from Industrial Processes only: estimates of emissions from electrical distribution equipment are not considered sufficiently reliable to report in the NGGI

Table 2-11 CO<sub>2</sub>-e Emissions by Source Category, 1990–2005, Gg

Year to June	Fuel Combustion		Fugitive	Industrial Processes	Solvent	Agriculture	Land Use Change & Forestry	Waste	Total (net)
	Stationary	Transport							
Energy									
1990	195985	61892	29092	25282	0	87716	128852	18308	547127
1991	198893	61664	28125	24643	0	87570	105622	18433	524949
1992	202330	62442	29965	25237	0	85981	89066	18370	513392
1993	205185	63715	30441	25257	0	85451	75489	18436	503973
1994	206729	65317	29353	25614	0	85925	74607	18120	505666
1995	214616	68004	30808	25828	0	87106	62813	18293	507469
1996	219810	70409	29167	25743	0	87343	60994	17268	510733
1997	226699	71666	31764	25729	0	88480	56957	17257	518552
1998	239398	71726	31765	27130	0	88985	66803	16818	542625
1999	246526	72537	29918	27334	0	91956	54592	17115	539978
2000	252033	74560	30963	27371	0	95516	53892	17168	551503
2001	258888	73186	32514	28300	0	98758	49745	17441	558831
2002	261465	74875	32039	28780	0	96384	55331	17709	566584
2003	270992	75442	30270	29615	0	90911	30590	17285	545105
2004	276079	79454	30543	30571	0	89794	35497	17149	559088
2005	279402	80389	31228	29463	0	87889	33667	17037	559074

Table 2-8 HFC Emissions by Source Category, 1990–2005, Gg CO<sub>2</sub>-e

Year to June	Fuel Combustion		Fugitive	Industrial Processes	Solvent	Agriculture	Land Use Change & Forestry	Waste	Total (net)
	Stationary	Transport							
Energy									
1990	NA	NA	NA	1126	NA	NA	NA	NA	1126
1991	NA	NA	NA	1126	NA	NA	NA	NA	1126
1992	NA	NA	NA	1054	NA	NA	NA	NA	1054
1993	NA	NA	NA	1447	NA	NA	NA	NA	1447
1994	NA	NA	NA	814	NA	NA	NA	NA	814
1995	NA	NA	NA	1420	NA	NA	NA	NA	1420
1996	NA	NA	NA	950	NA	NA	NA	NA	950
1997	NA	NA	NA	1226	NA	NA	NA	NA	1226
1998	NA	NA	NA	1521	NA	NA	NA	NA	1521
1999	NA	NA	NA	1845	NA	NA	NA	NA	1845
2000	NA	NA	NA	2241	NA	NA	NA	NA	2241
2001	NA	NA	NA	2660	NA	NA	NA	NA	2660
2002	NA	NA	NA	3083	NA	NA	NA	NA	3083
2003	NA	NA	NA	3532	NA	NA	NA	NA	3532
2004	NA	NA	NA	3341	NA	NA	NA	NA	3341
2005	NA	NA	NA	4252	NA	NA	NA	NA	4252

Table 2-10 Confidential Emissions by Source Category, 1990–2005, Gg CO<sub>2</sub>-e\*

Year to June	Fuel Combustion		Fugitive	Industrial Processes	Solvent	Agriculture	Land Use Change & Forestry	Waste	Total
	Stationary	Transport							
Energy									
1990	NA	NA	NA	1885	NA	NA	NA	NA	1885
1991	NA	NA	NA	1859	NA	NA	NA	NA	1859
1992	NA	NA	NA	2061	NA	NA	NA	NA	2061
1993	NA	NA	NA	2641	NA	NA	NA	NA	2641
1994	NA	NA	NA	2794	NA	NA	NA	NA	2794
1995	NA	NA	NA	2766	NA	NA	NA	NA	2766
1996	NA	NA	NA	2973	NA	NA	NA	NA	2973
1997	NA	NA	NA	2949	NA	NA	NA	NA	2949
1998	NA	NA	NA	3183	NA	NA	NA	NA	3183
1999	NA	NA	NA	3069	NA	NA	NA	NA	3069
2000	NA	NA	NA	3309	NA	NA	NA	NA	3309
2001	NA	NA	NA	4143	NA	NA	NA	NA	4143
2002	NA	NA	NA	4522	NA	NA	NA	NA	4522
2003	NA	NA	NA	5002	NA	NA	NA	NA	5002
2004	NA	NA	NA	5062	NA	NA	NA	NA	5062
2005	NA	NA	NA	5321	NA	NA	NA	NA	5321

\* Includes confidential emissions from soda ash production and use (CO<sub>2</sub>), nitric acid production (N<sub>2</sub>O) and ammonia production (CO<sub>2</sub>)

Table 2-12 Share of CO<sub>2</sub>-e Emissions by Source Category, 1990–2005

Year to June	Fuel Combustion		Fugitive	Industrial Processes	Solvent	Agriculture	Land Use Change & Forestry	Waste	Total (net)
	Stationary	Transport							
Energy									
1990	35.8%	11.3%	5.3%	4.6%	0.0%	16.0%	23.6%	3.3%	100.0%
1991	37.9%	11.7%	5.4%	4.7%	0.0%	16.7%	20.1%	3.5%	100.0%
1992	39.4%	12.2%	5.8%	4.9%	0.0%	16.7%	17.3%	3.6%	100.0%
1993	40.7%	12.6%	6.0%	5.0%	0.0%	17.0%	15.0%	3.7%	100.0%
1994	40.9%	12.9%	5.8%	5.1%	0.0%	17.0%	14.8%	3.6%	100.0%
1995	42.3%	13.4%	6.1%	5.1%	0.0%	17.2%	12.4%	3.6%	100.0%
1996	43.0%	13.8%	5.7%	5.0%	0.0%	17.1%	11.9%	3.4%	100.0%
1997	43.7%	13.8%	6.1%	5.0%	0.0%	17.1%	11.0%	3.3%	100.0%
1998	44.1%	13.2%	5.9%	5.0%	0.0%	16.4%	12.3%	3.1%	100.0%
1999	45.7%	13.4%	5.5%	5.1%	0.0%	17.0%	10.1%	3.2%	100.0%
2000	45.7%	13.5%	5.6%	5.0%	0.0%	17.3%	9.8%	3.1%	100.0%
2001	46.3%	13.1%	5.8%	5.1%	0.0%	17.7%	8.9%	3.1%	100.0%
2002	46.1%	13.2%	5.7%	5.1%	0.0%	17.0%	9.8%	3.1%	100.0%
2003	49.7%	13.8%	5.6%	5.4%	0.0%	16.7%	5.6%	3.2%	100.0%
2004	49.4%	14.2%	5.5%	5.5%	0.0%	16.1%	6.3%	3.1%	100.0%
2005	50.0%	14.4%	5.6%	5.3%	0.0%	15.7%	6.0%	3.0%	100.0%

Table 2-13 CO<sub>2</sub>-e Emissions by Greenhouse Gas, 1990–2005, Gg

Year to June	Net Emissions (After removals)					Emissions from All Sources (Before removals)				
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other*	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other*	Total
1990	402421	117457	19778	7471	547127	402421	117457	19778	7471	547127
1991	381407	116572	19522	7448	524949	381892	116572	19522	7448	525434
1992	370214	116264	19343	7571	513392	371208	116264	19343	7571	514386
1993	361093	115735	19702	7442	503973	362595	115735	19702	7442	505474
1994	364863	114436	20390	5977	505666	366739	114436	20390	5977	507542
1995	364402	115772	21278	6016	507469	366861	115772	21278	6016	509928
1996	369967	113348	21760	5658	510733	373124	113348	21760	5658	513890
1997	373837	116600	22353	5762	518552	378324	116600	22353	5762	523039
1998	396978	115772	23110	6764	542625	402963	115772	23110	6764	548609
1999	393739	115514	24299	6426	539978	401352	115514	24299	6426	547591
2000	400413	117819	26089	7183	551503	411310	117819	26089	7183	562400
2001	401471	121294	27188	8877	558831	413387	121294	27188	8877	570746
2002	410801	119243	26906	9634	566584	424698	119243	26906	9634	580481
2003	395698	113824	25059	10524	545105	411543	113824	25059	10524	560949
2004	409570	113548	25016	10954	559088	427349	113548	25016	10954	576866
2005	410196	112922	24295	11660	559074	429805	112922	24295	11660	578683

\* PFCs, SF<sub>6</sub> and confidential CO<sub>2</sub> and N<sub>2</sub>O, as CO<sub>2</sub>-eTable 2-14 Share of CO<sub>2</sub>-e Emissions by Greenhouse Gas, 1990–2005

Year to June	Net Emissions (After removals)					Emissions from All Sources (Before removals)				
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other*	Total	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Other*	Total
1990	73.6%	21.5%	3.6%	1.4%	100.0%	73.6%	21.5%	3.6%	1.4%	100.0%
1991	72.7%	22.2%	3.7%	1.4%	100.0%	72.7%	22.2%	3.7%	1.4%	100.0%
1992	72.1%	22.6%	3.8%	1.5%	100.0%	72.2%	22.6%	3.8%	1.5%	100.0%
1993	71.6%	23.0%	3.9%	1.5%	100.0%	71.7%	22.9%	3.9%	1.5%	100.0%
1994	72.2%	22.6%	4.0%	1.2%	100.0%	72.3%	22.5%	4.0%	1.2%	100.0%
1995	71.8%	22.8%	4.2%	1.2%	100.0%	71.9%	22.7%	4.2%	1.2%	100.0%
1996	72.4%	22.2%	4.3%	1.1%	100.0%	72.6%	22.1%	4.2%	1.1%	100.0%
1997	72.1%	22.5%	4.3%	1.1%	100.0%	72.3%	22.3%	4.3%	1.1%	100.0%
1998	73.2%	21.3%	4.3%	1.2%	100.0%	73.5%	21.1%	4.2%	1.2%	100.0%
1999	72.9%	21.4%	4.5%	1.2%	100.0%	73.3%	21.1%	4.4%	1.2%	100.0%
2000	72.6%	21.4%	4.7%	1.3%	100.0%	73.1%	20.9%	4.6%	1.3%	100.0%
2001	71.8%	21.7%	4.9%	1.6%	100.0%	72.4%	21.3%	4.8%	1.6%	100.0%
2002	72.5%	21.0%	4.7%	1.7%	100.0%	73.2%	20.5%	4.6%	1.7%	100.0%
2003	72.6%	20.9%	4.6%	1.9%	100.0%	73.4%	20.3%	4.5%	1.9%	100.0%
2004	73.3%	20.3%	4.5%	2.0%	100.0%	74.1%	19.7%	4.3%	1.9%	100.0%
2005	73.4%	20.2%	4.3%	2.1%	100.0%	74.3%	19.5%	4.2%	2.0%	100.0%

\* Includes SF<sub>6</sub> from metal production from 1996 to 2000Table 2-15 CO<sub>2</sub> Emissions by Fossil Fuel 1990–2005\*

Year to June	Coal			Petroleum (includes LPG)			Gas			All fossil fuels		
	PJ Energy	Gg CO <sub>2</sub>	Gg/PJ	PJ Energy	Gg CO <sub>2</sub>	Gg/PJ	PJ Energy	Gg CO <sub>2</sub>	Gg/PJ	PJ Energy	Gg CO <sub>2</sub>	Gg/PJ
1990	1457	132673	91.1	1324	88262	66.7	649	33218	51.2	3430	254154	74.1
1991	1505	137194	91.1	1318	87956	66.7	617	31579	51.2	3441	256729	74.6
1992	1544	140650	91.1	1312	87423	66.6	640	32769	51.2	3496	260842	74.6
1993	1546	140787	91.1	1346	89571	66.6	674	34506	51.2	3566	264864	74.3
1994	1556	140912	90.5	1373	91265	66.5	699	35785	51.2	3628	267962	73.9
1995	1601	145091	90.6	1427	94976	66.5	750	38415	51.2	3779	278482	73.7
1996	1669	149914	89.8	1471	97940	66.6	745	38121	51.1	3885	285975	73.6
1997	1749	157126	89.8	1465	97551	66.6	769	39473	51.3	3983	294150	73.9
1998	1863	167538	89.9	1471	97889	66.5	810	41435	51.1	4145	306861	74.0
1999	1920	172913	90.1	1478	98309	66.5	851	43585	51.2	4249	314808	74.1
2000	1941	176271	90.8	1521	101234	66.6	873	44749	51.2	4335	322255	74.3
2001	1997	180969	90.6	1506	100258	66.6	908	46527	51.2	4411	327755	74.3
2002	2010	181771	90.4	1540	102579	66.6	934	47804	51.2	4483	332153	74.1
2003	2065	187891	91.0	1581	105281	66.6	953	48915	51.3	4598	342088	74.4
2004	2113	192331	91.0	1624	108140	66.6	987	50623	51.3	4724	351095	74.3
2005	2130	192827	90.5	1666	111397	66.9	1001	51314	51.2	4798	355538	74.1

\* Category 1A

Table 2-17 CH<sub>4</sub> Emissions by Fossil Fuel 1990–2005 \*

Year to June	Coal			Petroleum (includes LPG)			Gas			All fossil fuels		
	PJ Energy	Gg CH <sub>4</sub>	Mg/PJ**	PJ Energy	Gg CH <sub>4</sub>	Mg/PJ**	PJ Energy	Gg CH <sub>4</sub>	Mg/PJ**	PJ Energy	Gg CH <sub>4</sub>	Mg/PJ**
1990	1457	1.35	0.93	1324	28.06	21.19	649	1.37	2.11	3430	30.8	8.97
1991	1505	1.38	0.92	1318	28.31	21.47	617	1.40	2.27	3441	31.1	9.04
1992	1544	1.40	0.91	1312	29.26	22.29	640	1.53	2.39	3496	32.2	9.21
1993	1546	1.41	0.92	1346	30.32	22.53	674	1.63	2.42	3566	33.4	9.36
1994	1556	1.42	0.91	1373	31.31	22.81	699	1.69	2.41	3628	34.4	9.48
1995	1601	1.45	0.91	1427	32.07	22.47	750	1.87	2.50	3779	35.4	9.37
1996	1669	1.50	0.90	1471	32.06	21.79	745	1.91	2.56	3885	35.5	9.13
1997	1749	1.57	0.90	1465	32.00	21.85	769	1.88	2.45	3983	35.5	8.90
1998	1863	1.72	0.92	1471	32.14	21.85	810	4.18	5.16	4145	38.0	9.18
1999	1920	1.74	0.91	1478	32.84	22.22	851	4.58	5.38	4249	39.2	9.22
2000	1941	1.69	0.87	1521	32.11	21.11	873	5.78	6.61	4335	39.6	9.13
2001	1997	1.70	0.85	1506	30.99	20.58	908	5.71	6.29	4411	38.4	8.71
2002	2010	1.77	0.88	1540	31.74	20.61	934	7.21	7.72	4483	40.7	9.08
2003	2065	1.80	0.87	1581	31.70	20.05	953	5.76	6.04	4598	39.3	8.54
2004	2113	1.88	0.89	1624	32.66	20.11	987	6.74	6.83	4724	41.3	8.74
2005	2130	1.95	0.92	1666	31.14	18.69	1001	7.03	7.02	4798	40.1	8.36

\* Category 1A

\*\* Note units are Mg, not Gg

Table 2-16 Share of Energy and CO<sub>2</sub> Emissions by Fossil Fuel 1990–2005 \*

Year to June	Coal		Petroleum		Gas		All Fossil Fuels	
	% PJ	% CO <sub>2</sub>	% PJ	% CO <sub>2</sub>	% PJ	% CO <sub>2</sub>	% PJ	% CO <sub>2</sub>
1990	42.5%	52.2%	38.6%	34.7%	18.9%	13.1%	100.0%	100.0%
1991	43.7%	53.4%	38.3%	34.3%	17.9%	12.3%	100.0%	100.0%
1992	44.2%	53.9%	37.5%	33.5%	18.3%	12.6%	100.0%	100.0%
1993	43.4%	53.2%	37.7%	33.8%	18.9%	13.0%	100.0%	100.0%
1994	42.9%	52.6%	37.8%	34.1%	19.3%	13.4%	100.0%	100.0%
1995	42.4%	52.1%	37.8%	34.1%	19.9%	13.8%	100.0%	100.0%
1996	43.0%	52.4%	37.9%	34.2%	19.2%	13.3%	100.0%	100.0%
1997	43.9%	53.4%	36.8%	33.2%	19.3%	13.4%	100.0%	100.0%
1998	45.0%	54.6%	35.5%	31.9%	19.5%	13.5%	100.0%	100.0%
1999	45.2%	54.9%	34.8%	31.2%	20.0%	13.8%	100.0%	100.0%
2000	44.8%	54.7%	35.1%	31.4%	20.1%	13.9%	100.0%	100.0%
2001	45.3%	55.2%	34.1%	30.6%	20.6%	14.2%	100.0%	100.0%
2002	44.8%	54.7%	34.3%	30.9%	20.8%	14.4%	100.0%	100.0%
2003	44.9%	54.9%	34.4%	30.8%	20.7%	14.3%	100.0%	100.0%
2004	44.7%	54.8%	34.4%	30.8%	20.9%	14.4%	100.0%	100.0%
2005	44.4%	54.2%	34.7%	31.3%	20.9%	14.4%	100.0%	100.0%

\* Category 1A

Table 2-18 Share of Energy and CH<sub>4</sub> Emissions by Fossil Fuel 1990–2005 \*

Year to June	Coal		Petroleum		Gas		All Fossil Fuels	
	% PJ	% CH <sub>4</sub>	% PJ	% CH <sub>4</sub>	% PJ	% CH <sub>4</sub>	% PJ	% CH <sub>4</sub>
1990	42.5%	4.4%	38.6%	91.2%	18.9%	4.4%	100.0%	100.0%
1991	43.7%	4.4%	38.3%	91.0%	17.9%	4.5%	100.0%	100.0%
1992	44.2%	4.3%	37.5%	90.9%	18.3%	4.8%	100.0%	100.0%
1993	43.4%	4.2%	37.7%	90.9%	18.9%	4.9%	100.0%	100.0%
1994	42.9%	4.1%	37.8%	91.0%	19.3%	4.9%	100.0%	100.0%
1995	42.4%	4.1%	37.8%	90.6%	19.9%	5.3%	100.0%	100.0%
1996	43.0%	4.2%	37.9%	90.4%	19.2%	5.4%	100.0%	100.0%
1997	43.9%	4.4%	36.8%	90.3%	19.3%	5.3%	100.0%	100.0%
1998	45.0%	4.5%	35.5%	84.5%	19.5%	11.0%	100.0%	100.0%
1999	45.2%	4.5%	34.8%	83.8%	20.0%	11.7%	100.0%	100.0%
2000	44.8%	4.3%	35.1%	81.1%	20.1%	14.6%	100.0%	100.0%
2001	45.3%	4.4%	34.1%	80.7%	20.6%	14.9%	100.0%	100.0%
2002	44.8%	4.3%	34.3%	78.0%	20.8%	17.7%	100.0%	100.0%
2003	44.9%	4.6%	34.4%	80.7%	20.7%	14.7%	100.0%	100.0%
2004	44.7%	4.6%	34.4%	79.1%	20.9%	16.3%	100.0%	100.0%
2005	44.4%	4.9%	34.7%	77.6%	20.9%	17.5%	100.0%	100.0%

Table 2-19 N<sub>2</sub>O Emissions by Fossil Fuel 1990–2005 \*

Year to June	Coal			Petroleum (includes LPG)			Gas			All Fossil Fuels		
	PJ Energy	Gg N <sub>2</sub> O	Mg/PJ*	PJ Energy	Gg N <sub>2</sub> O	Mg/PJ*	PJ Energy	Gg N <sub>2</sub> O	Mg/PJ*	PJ Energy	Gg N <sub>2</sub> O	Mg/PJ*
1990	1457	1.43	0.98	1324	2.25	1.70	649	0.07	0.10	3430	3.7	1.09
1991	1505	1.49	0.99	1318	2.37	1.80	617	0.06	0.10	3441	3.9	1.14
1992	1544	1.53	0.99	1312	2.51	1.91	640	0.07	0.10	3496	4.1	1.17
1993	1546	1.52	0.98	1346	2.67	1.98	674	0.07	0.10	3566	4.3	1.19
1994	1556	1.52	0.98	1373	2.84	2.07	699	0.07	0.10	3628	4.4	1.22
1995	1601	1.57	0.98	1427	3.05	2.14	750	0.08	0.10	3779	4.7	1.24
1996	1669	1.63	0.98	1471	3.44	2.34	745	0.08	0.10	3885	5.2	1.33
1997	1749	1.73	0.99	1465	3.35	2.29	769	0.08	0.10	3983	5.2	1.30
1998	1863	1.87	1.00	1471	3.51	2.39	810	0.08	0.10	4145	5.5	1.32
1999	1920	1.93	1.01	1478	3.69	2.49	851	0.09	0.10	4249	5.7	1.34
2000	1941	1.96	1.01	1521	4.06	2.67	873	0.09	0.10	4335	6.1	1.41
2001	1997	2.01	1.00	1506	4.22	2.80	908	0.09	0.10	4411	6.3	1.43
2002	2010	2.00	1.00	1540	4.55	2.95	934	0.10	0.11	4483	6.6	1.48
2003	2065	2.06	1.00	1581	4.81	3.04	953	0.10	0.11	4598	7.0	1.52
2004	2113	2.11	1.00	1624	5.24	3.23	987	0.11	0.11	4724	7.5	1.58
2005	2130	2.12	1.00	1666	5.05	3.03	1001	0.11	0.11	4798	7.3	1.52

\* Note units are Mg, not Gg

Table 2-21 CO<sub>2</sub>-e Emissions by Fossil Fuel 1990–2005

Year to June	Coal			Petroleum (includes LPG)			Gas			All Fossil Fuels		
	PJ Energy	Gg CO <sub>2</sub> -e	Gg/PJ	PJ Energy	Gg CO <sub>2</sub> -e	Gg/PJ	PJ Energy	Gg CO <sub>2</sub> -e	Gg/PJ	PJ Energy	Gg CO <sub>2</sub> -e	Gg/PJ
1990	1457	133146	91.40	1324	89547	67.64	649	33267	51.25	3430	255961	74.63
1991	1505	137685	91.47	1318	89286	67.73	617	31628	51.23	3441	258599	75.16
1992	1544	141153	91.44	1312	88815	67.67	640	32821	51.28	3496	262789	75.17
1993	1546	141286	91.39	1346	91035	67.64	674	34561	51.28	3566	266883	74.85
1994	1556	141415	90.86	1373	92803	67.61	699	35842	51.27	3628	270060	74.44
1995	1601	145609	90.93	1427	96594	67.68	750	38478	51.27	3779	280681	74.27
1996	1669	150452	90.16	1471	99680	67.77	745	38185	51.22	3885	288317	74.21
1997	1749	157695	90.16	1465	99263	67.78	769	39536	51.39	3983	296494	74.44
1998	1863	168153	90.24	1471	99653	67.73	810	41548	51.29	4145	309354	74.64
1999	1920	173548	90.39	1478	100141	67.75	851	43708	51.36	4249	317398	74.70
2000	1941	176914	91.16	1521	103167	67.83	873	44898	51.42	4335	324978	74.97
2001	1997	181627	90.96	1506	102217	67.87	908	46676	51.41	4411	330520	74.94
2002	2010	182428	90.76	1540	104654	67.97	934	47986	51.40	4483	335068	74.74
2003	2065	188567	91.34	1581	107437	67.95	953	49068	51.49	4598	345072	75.04
2004	2113	193023	91.35	1624	110452	68.00	987	50798	51.49	4724	354273	75.00
2005	2130	193525	90.86	1666	113617	68.19	1001	51495	51.42	4798	358637	74.75

Table 2-23 Contribution to CO<sub>2</sub>-e Emissions by CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, by Fossil Fuel 1990–2005

Year to June	Coal			Petroleum (includes LPG)			Gas			All Fossil Fuels		
	% CO <sub>2</sub>	% CH <sub>4</sub>	% N <sub>2</sub> O	% CO <sub>2</sub>	% CH <sub>4</sub>	% N <sub>2</sub> O	% CO <sub>2</sub>	% CH <sub>4</sub>	% N <sub>2</sub> O	% CO <sub>2</sub>	% CH <sub>4</sub>	% N <sub>2</sub> O
1990	99.64%	0.02%	0.33%	98.56%	0.66%	0.78%	99.85%	0.09%	0.06%	99.29%	0.25%	0.45%
1991	99.64%	0.02%	0.34%	98.51%	0.67%	0.82%	99.84%	0.09%	0.06%	99.28%	0.25%	0.47%
1992	99.64%	0.02%	0.34%	98.43%	0.69%	0.88%	99.84%	0.10%	0.06%	99.26%	0.26%	0.48%
1993	99.65%	0.02%	0.33%	98.39%	0.70%	0.91%	99.84%	0.10%	0.06%	99.24%	0.26%	0.49%
1994	99.64%	0.02%	0.33%	98.34%	0.71%	0.95%	99.84%	0.10%	0.06%	99.22%	0.27%	0.51%
1995	99.64%	0.02%	0.33%	98.32%	0.70%	0.98%	99.84%	0.10%	0.06%	99.22%	0.26%	0.52%
1996	99.64%	0.02%	0.34%	98.25%	0.68%	1.07%	99.83%	0.10%	0.06%	99.19%	0.26%	0.55%
1997	99.64%	0.02%	0.34%	98.28%	0.68%	1.05%	99.84%	0.10%	0.06%	99.21%	0.25%	0.54%
1998	99.63%	0.02%	0.34%	98.23%	0.68%	1.09%	99.73%	0.21%	0.06%	99.19%	0.26%	0.55%
1999	99.63%	0.02%	0.34%	98.17%	0.69%	1.14%	99.72%	0.22%	0.06%	99.18%	0.26%	0.56%
2000	99.64%	0.02%	0.34%	98.13%	0.65%	1.22%	99.67%	0.27%	0.06%	99.16%	0.26%	0.58%
2001	99.64%	0.02%	0.34%	98.08%	0.64%	1.28%	99.68%	0.26%	0.06%	99.16%	0.24%	0.59%
2002	99.64%	0.02%	0.34%	98.02%	0.64%	1.35%	99.62%	0.32%	0.06%	99.13%	0.26%	0.61%
2003	99.64%	0.02%	0.34%	97.99%	0.62%	1.39%	99.69%	0.25%	0.06%	99.14%	0.24%	0.63%
2004	99.64%	0.02%	0.34%	97.91%	0.62%	1.47%	99.66%	0.28%	0.06%	99.10%	0.24%	0.65%
2005	99.64%	0.02%	0.34%	98.05%	0.58%	1.38%	99.65%	0.29%	0.06%	99.14%	0.23%	0.63%

Table 2-20 Share of Energy and N<sub>2</sub>O Emissions by Fossil Fuel 1990–2005 \*

Year to June	Coal		Petroleum		Gas		All Fossil Fuels	
	% PJ	% N <sub>2</sub> O	% PJ	% N <sub>2</sub> O	% PJ	% N <sub>2</sub> O	% PJ	% N <sub>2</sub> O
1990	42.5%	38.3%	38.6%	60.0%	18.9%	1.7%	100.0%	100.0%
1991	43.7%	37.9%	38.3%	60.5%	17.9%	1.6%	100.0%	100.0%
1992	44.2%	37.3%	37.5%	61.1%	18.3%	1.6%	100.0%	100.0%
1993	43.4%	35.6%	37.7%	62.8%	18.9%	1.6%	100.0%	100.0%
1994	42.9%	34.4%	37.8%	64.0%	19.3%	1.6%	100.0%	100.0%
1995	42.4%	33.5%	37.8%	64.9%	19.9%	1.6%	100.0%	100.0%
1996	43.0%	31.7%	37.9%	66.8%	19.2%	1.5%	100.0%	100.0%
1997	43.9%	33.5%	36.8%	65.0%	19.3%	1.5%	100.0%	100.0%
1998	45.0%	34.2%	35.5%	64.3%	19.5%	1.5%	100.0%	100.0%
1999	45.2%	33.9%	34.8%	64.6%	20.0%	1.5%	100.0%	100.0%
2000	44.8%	32.1%	35.1%	66.5%	20.1%	1.5%	100.0%	100.0%
2001	45.3%	31.7%	34.1%	66.8%	20.6%	1.5%	100.0%	100.0%
2002	44.8%	30.1%	34.3%	68.4%	20.8%	1.5%	100.0%	100.0%
2003	44.9%	29.5%	34.4%	69.0%	20.7%	1.5%	100.0%	100.0%
2004	44.7%	28.2%	34.4%	70.3%	20.9%	1.4%	100.0%	100.0%
2005	44.4%	29.1%	34.7%	69.4%	20.9%	1.5%	100.0%	100.0%

\* Category 1A

Table 2-22 Share of Energy and CO<sub>2</sub>-e Emissions by Fossil Fuel 1990–2005

Year to June	Coal		Petroleum		Gas		All Fossil Fuels	
	% PJ	% CO <sub>2</sub> -e	% PJ	% CO <sub>2</sub> -e	% PJ	% CO <sub>2</sub> -e	% PJ	% CO <sub>2</sub> -e
1990	42.5%	52.0%	38.6%	35.0%	18.9%	13.0%	100.0%	100.0%
1991	43.7%	53.2%	38.3%	34.5%	17.9%	12.2%	100.0%	100.0%
1992	44.2%	53.7%	37.5%	33.8%	18.3%	12.5%	100.0%	100.0%
1993	43.4%	52.9%	37.7%	34.1%	18.9%	12.9%	100.0%	100.0%
1994	42.9%	52.4%	37.8%	34.4%	19.3%	13.3%	100.0%	100.0%
1995	42.4%	51.9%	37.8%	34.4%	19.9%	13.7%	100.0%	100.0%
1996	43.0%	52.2%	37.9%	34.6%	19.2%	13.2%	100.0%	100.0%
1997	43.9%	53.2%	36.8%	33.5%	19.3%	13.3%	100.0%	100.0%
1998	45.0%	54.4%	35.5%	32.2%	19.5%	13.4%	100.0%	100.0%
1999	45.2%	54.7%	34.8%	31.6%	20.0%	13.8%	100.0%	100.0%
2000	44.8%	54.4%	35.1%	31.7%	20.1%	13.8%	100.0%	100.0%
2001	45.3%	55.0%	34.1%	30.9%	20.6%	14.1%	100.0%	100.0%
2002	44.8%	54.4%	34.3%	31.2%	20.8%	14.3%	100.0%	100.0%
2003	44.9%	54.6%	34.4%	31.1%	20.7%	14.2%	100.0%	100.0%
2004	44.7%	54.5%	34.4%	31.2%	20.9%	14.3%	100.0%	100.0%
2005	44.4%	54.0%	34.7%	31.7%	20.9%	14.4%	100.0%	100.0%

Table 2-24 CH<sub>4</sub> Emissions by Biofuels 1990–2005

Year to June	Sectors 1A1-1A3, 1A5			Sector 1A4			All Sectors		
	PJ Energy	Gg CH <sub>4</sub>	Mg/PJ	PJ Energy	Gg CH <sub>4</sub>	Mg/PJ	PJ Energy	Gg CH <sub>4</sub>	Mg/PJ
1990	104.4	0.85	8.2	74.8	81.52	1089.8	179.2	82.37	459.7
1991	101.5	0.82	8.1	76.9	83.63	1087.5	178.4	84.45	473.4
1992	86.0	0.68	8.0	79.1	85.83	1085.1	165.1	86.51	524.0
1993	101.4	0.82	8.1	81.4	86.33	1060.6	182.8	87.15	476.8
1994	110.2	0.89	8.1	82.3	84.29	1024.2	192.5	85.18	442.5
1995	117.9	0.96	8.1	82.4	81.57	989.9	200.3	82.53	412.0
1996	127.9	1.05	8.2	82.8	79.13	955.7	210.7	80.19	380.6
1997	136.1	1.13	8.3	83.4	77.10	924.4	219.5	78.23	356.4
1998	139.2	1.16	8.3	82.5	72.19	875.0	221.7	73.34	330.8
1999	136.3	1.13	8.3	81.7	67.48	826.0	218.0	68.61	314.7
2000	142.7	3.42	24.0	81.0	63.06	778.5	223.7	66.48	297.3
2001	134.6	3.30	24.5	79.9	60.84	761.4	214.5	64.14	299.0
2002	125.2	2.80	22.4	65.6	48.78	743.6	190.8	51.58	270.3
2003	136.6	4.53	33.1	70.1	50.96	727.0	206.7	55.49	268.5
2004	136.2	2.99	21.9	66.8	47.42	709.9	203.0	50.41	248.3
2005	135.1	2.55	18.9	60.6	43.00	709.5	195.7	45.55	232.8

Table 2.25 N<sub>2</sub>O Emissions by Biofuels 1990–2005

Year to June	Sectors 1A1-1A3, 1A5			Sector 1A4			All Sectors		
	PJ Energy	Gg N <sub>2</sub> O	Mg/PJ	PJ Energy	Gg N <sub>2</sub> O	Mg/PJ	PJ Energy	Gg N <sub>2</sub> O	Mg/PJ
1990	104.4	0.43	4.1	74.8	0.17	2.3	179.2	0.60	3.4
1991	101.5	0.42	4.1	76.9	0.18	2.3	178.4	0.59	3.3
1992	86.0	0.35	4.1	79.1	0.18	2.3	165.1	0.54	3.2
1993	101.4	0.42	4.1	81.4	0.19	2.3	182.8	0.60	3.3
1994	110.2	0.45	4.1	82.3	0.18	2.2	192.5	0.64	3.3
1995	117.9	0.48	4.1	82.4	0.18	2.2	200.3	0.66	3.3
1996	127.9	0.52	4.1	82.8	0.18	2.2	210.7	0.70	3.3
1997	136.1	0.56	4.1	83.4	0.18	2.1	219.5	0.73	3.3
1998	139.2	0.57	4.1	82.5	0.17	2.1	221.7	0.74	3.3
1999	136.3	0.56	4.1	81.7	0.16	2.0	218.0	0.72	3.3
2000	142.7	0.55	3.8	81.0	0.16	2.0	223.7	0.70	3.1
2001	134.6	0.51	3.8	79.9	0.15	1.9	214.5	0.67	3.1
2002	125.2	0.48	3.9	65.6	0.13	1.9	190.8	0.61	3.2
2003	136.6	0.50	3.7	70.1	0.13	1.9	206.7	0.63	3.1
2004	136.2	0.52	3.9	66.8	0.13	1.9	203.0	0.65	3.2
2005	135.1	0.52	3.9	60.6	0.11	1.9	195.7	0.64	3.3

Table 2.26 CO<sub>2</sub>-e Emissions by Biomass Fuel 1990–2005 \*

Year to June	Sectors 1A1-1A3, 1A5			Sector 1A4			All Sectors		
	PJ Energy	Gg CO <sub>2</sub> -e	Gg/PJ**	PJ Energy	Gg CO <sub>2</sub> -e	Gg/PJ**	PJ Energy	Gg CO <sub>2</sub> -e	Gg/PJ**
1990	104.4	150.6	1.44	74.8	1765.6	23.60	179.2	1916.2	10.69
1991	101.5	146.3	1.44	76.9	1811.3	23.55	178.4	1957.6	10.97
1992	86.0	123.7	1.44	79.1	1859.1	23.50	165.1	1982.7	12.01
1993	101.4	146.1	1.44	81.4	1870.5	22.98	182.8	2016.6	11.03
1994	110.2	158.8	1.44	82.3	1827.2	22.20	192.5	1985.9	10.32
1995	117.9	170.0	1.44	82.4	1769.2	21.47	200.3	1939.2	9.68
1996	127.9	184.7	1.44	82.8	1717.3	20.74	210.7	1901.9	9.03
1997	136.1	196.7	1.45	83.4	1673.9	20.07	219.5	1870.5	8.52
1998	139.2	201.2	1.45	82.5	1568.6	19.01	221.7	1769.8	7.98
1999	136.3	197.0	1.44	81.7	1467.9	17.97	218.0	1664.9	7.64
2000	142.7	241.1	1.69	81.0	1373.3	16.95	223.7	1614.4	7.22
2001	134.6	228.5	1.70	79.9	1325.4	16.59	214.5	1553.9	7.24
2002	125.2	208.3	1.66	65.6	1063.3	16.21	190.8	1271.6	6.66
2003	136.6	250.1	1.83	70.1	1111.4	15.85	206.7	1361.4	6.59
2004	136.2	225.5	1.66	66.8	1034.7	15.49	203.0	1260.2	6.21
2005	135.1	216.2	1.60	60.6	938.2	15.48	195.7	1154.4	5.90

\* Excludes CO<sub>2</sub> from combustion of biomass

## **APPENDIX 3 CHANGES IN EMISSIONS BY CATEGORY AND GREENHOUSE GAS 1990–2005**

Table 3-1 Analysis of Change in CO<sub>2</sub> Emissions and Removals, 1990-2005

Sector or Subsector		% Change from Previous Year														Emissions Compared with 1990 (1990 = 1.000)																	
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	
Energy		0.9%	1.6%	1.5%	1.1%	3.9%	2.5%	2.7%	4.3%	2.7%	2.6%	1.8%	1.2%	2.7%	2.5%	1.2%	1.000	1.009	1.025	1.041	1.052	1.093	1.120	1.151	1.201	1.233	1.265	1.288	1.303	1.338	1.372	1.388	
	Stationary	1.5%	1.7%	1.4%	0.8%	3.9%	2.5%	3.2%	5.7%	3.0%	2.3%	2.8%	1.1%	3.6%	1.9%	1.2%	1.000	1.015	1.032	1.047	1.055	1.096	1.123	1.158	1.224	1.261	1.290	1.326	1.340	1.389	1.416	1.433	
	Transport	-0.5%	1.2%	2.0%	2.5%	4.1%	3.4%	1.9%	0.0%	1.1%	2.7%	-1.9%	2.2%	0.7%	5.2%	1.3%	1.000	0.995	1.007	1.027	1.052	1.095	1.133	1.154	1.154	1.166	1.198	1.175	1.201	1.209	1.273	1.290	
	Fugitive	-3.9%	3.0%	-0.3%	-3.6%	3.2%	-6.9%	-3.3%	4.3%	8.3%	12.6%	6.6%	-6.5%	-10.5%	-4.4%	-3.1%	1.000	0.961	0.990	0.986	0.951	0.982	0.914	0.885	0.923	0.999	1.125	1.199	1.120	1.002	0.958	0.928	
Industrial Processes*		-3.4%	2.7%	0.8%	10.2%	0.9%	1.4%	-0.6%	2.0%	2.7%	-3.4%	-3.8%	-1.4%	-0.3%	2.8%	-9.3%	1.000	0.966	0.992	1.000	1.102	1.112	1.127	1.121	1.143	1.174	1.134	1.091	1.076	1.072	1.102	1.000	
Solvents		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Agriculture		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Land Use Change & Forestry		-18.3%	-15.7%	-15.5%	-1.3%	-15.8%	-3.0%	-6.9%	18.0%	-19.0%	-1.6%	-8.0%	12.0%	-45.9%	16.1%	-5.5%	1.000	0.817	0.689	0.583	0.575	0.484	0.470	0.438	0.516	0.418	0.412	0.379	0.424	0.229	0.266	0.252	
Waste		0.7%	0.7%	0.7%	0.7%	26.0%	-12.1%	15.5%	1.2%	1.8%	-3.9%	0.5%	0.6%	0.6%	0.6%	0.5%	1.000	1.007	1.013	1.020	1.027	1.294	1.138	1.314	1.529	1.353	1.301	1.307	1.315	1.322	1.330	1.337	
Gross Emissions		-5.1%	-2.8%	-2.3%	1.1%	0.0%	1.7%	1.4%	6.5%	-0.4%	2.5%	0.5%	2.7%	-3.1%	3.8%	0.6%	1.000	0.949	0.922	0.901	0.911	0.912	0.927	0.940	1.001	0.997	1.022	1.027	1.055	1.023	1.062	1.068	
Removals		N/A	104.9%	51.0%	25.0%	31.1%	28.4%	42.1%	33.4%	27.2%	43.1%	9.3%	16.6%	14.0%	12.2%	10.3%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Net Emissions		-5.2%	-2.9%	-2.5%	1.0%	-0.1%	1.5%	1.0%	6.2%	-0.8%	1.7%	0.3%	2.3%	-3.7%	3.5%	0.2%	1.000	0.948	0.920	0.897	0.907	0.906	0.919	0.929	0.986	0.978	0.995	0.998	1.021	0.983	1.018	1.019	

\*\* Some CO<sub>2</sub> emissions reported as part of CO<sub>2</sub>-e for confidentiality reasonsTable 3-2 Analysis of Change in CH<sub>4</sub> Emissions, 1990-2005

Sector or Subsector	% Change from Previous Year															Emissions Compared with 1990 (1990 = 1.000)																
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	
Energy	-2.7%	7.0%	2.0%	-3.3%	4.7%	-4.7%	10.5%	-1.0%	-8.3%	1.0%	3.9%	-0.8%	-3.7%	1.8%	2.8%	1.000	0.973	1.041	1.062	1.027	1.076	1.025	1.133	1.122	1.029	1.039	1.079	1.071	1.031	1.050	1.079	
Stationary	2.3%	2.4%	0.9%	-2.0%	-2.6%	-2.6%	-2.3%	-2.8%	-5.2%	-1.2%	-3.1%	-14.7%	4.3%	-6.0%	-7.1%	1.000	1.023	1.048	1.057	1.036	1.009	0.983	0.960	0.933	0.884	0.873	0.847	0.722	0.753	0.708	0.657	
Transport	1.4%	3.8%	3.8%	3.4%	2.5%	0.1%	0.0%	0.3%	2.4%	-2.6%	-3.9%	2.4%	-0.9%	3.3%	-5.4%	1.000	1.014	1.052	1.092	1.129	1.157	1.159	1.163	1.190	1.139	1.113	1.140	1.129	1.167	1.104		
Fugitive	-3.2%	7.5%	2.1%	-3.6%	5.4%	-5.0%	11.8%	-0.9%	-8.7%	1.2%	4.6%	0.0%	-4.2%	2.2%	3.5%	1.000	0.968	1.041	1.062	1.024	1.079	1.026	1.146	1.136	1.037	1.049	1.097	1.097	1.051	1.074	1.112	
Industrial Processes	-8.0%	9.5%	1.2%	11.6%	2.0%	2.2%	-2.2%	4.1%	-6.4%	-9.9%	-7.0%	-0.9%	7.4%	-0.2%	-5.5%	1.000	0.920	1.008	1.020	1.139	1.162	1.188	1.162	1.210	1.133	1.020	0.949	0.941	1.011	1.009	0.954	
Solvents	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Agriculture	0.1%	-2.1%	-1.3%	-0.2%	0.4%	-0.1%	0.8%	-0.2%	2.7%	2.7%	3.0%	-2.7%	-5.0%	-1.2%	-1.8%	1.000	1.001	0.980	0.967	0.965	0.970	0.968	0.976	0.974	1.000	1.027	1.058	1.030	0.979	0.967	0.949	
Land Use Change & Forestry	-11.3%	-16.0%	-9.5%	1.6%	-15.2%	-1.1%	-0.9%	1.7%	-0.9%	4.6%	-0.8%	-3.4%	-18.9%	15.0%	0.0%	1.000	0.887	0.745	0.674	0.685	0.580	0.574	0.569	0.578	0.574	0.600	0.595	0.575	0.466	0.536	0.536	
Waste	0.7%	-0.4%	0.3%	-1.8%	0.9%	-5.8%	-0.1%	-2.7%	1.8%	0.3%	1.6%	1.5%	-2.5%	-0.9%	-0.7%	1.000	1.007	1.003	1.006	0.988	0.997	0.939	0.938	0.913	0.930	0.932	0.947	0.962	0.938	0.930	0.923	
Total Emissions	-0.8%	-0.3%	-0.5%	-1.1%	1.2%	-2.1%	2.9%	-0.7%	-0.2%	2.0%	2.9%	-1.7%	-4.5%	-0.2%	-0.6%	1.000	0.992	0.990	0.985	0.974	0.986	0.965	0.993	0.986	0.983	1.003	1.033	1.015	0.969	0.967	0.961	

Table 3-3 Analysis of Change in N<sub>2</sub>O Emissions, 1990-2005

Sector or Subsector	% Change from Previous Year															Emissions Compared with 1990 (1990 = 1.000)																
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	
Energy	3.7%	2.6%	4.5%	4.2%	5.6%	9.2%	0.2%	5.8%	2.9%	6.1%	2.7%	3.6%	4.5%	6.5%	-2.4%	1.000	1.037	1.064	1.111	1.159	1.224	1.336	1.338	1.416	1.457	1.547	1.588	1.646	1.721	1.833	1.790	
Stationary	1.9%	-1.1%	2.7%	2.1%	3.7%	4.0%	4.5%	5.4%	1.5%	0.7%	0.6%	-1.7%	3.5%	2.0%	0.7%	1.000	1.019	1.008	1.036	1.058	1.097	1.141	1.192	1.256	1.274	1.283	1.291	1.269	1.313	1.339	1.348	
Transport	6.4%	6.6%	6.7%	6.9%	7.6%	14.0%	-2.5%	5.1%	5.4%	10.6%	4.2%	8.0%	5.7%	9.8%	-4.2%	1.000	1.064	1.135	1.211	1.295	1.393	1.587	1.548	1.627	1.715	1.896	1.975	2.134	2.255	2.475	2.371	
Fugitive	-7.0%	1.5%	-4.1%	-9.3%	4.6%	6.0%	-27.6%	49.1%	-29.7%	15.5%	8.3%	-9.7%	-13.6%	-3.3%	-5.5%	1.000	0.930	0.944	0.905	0.821	0.838	0.910	0.659	0.982	0.691	0.798	0.864	0.780	0.674	0.652	0.616	
Industrial Processes*	-2.6%	6.2%	-2.2%	10.5%	2.9%	-0.5%	-0.3%	-3.8%	4.9%	-7.7%	-14.2%	-4.1%	-7.4%	7.6%	-8.8%	1.000	0.974	1.034	1.010	1.117	1.149	1.143	1.140	1.097	1.150	1.062	0.911	0.874	0.809	0.870	0.794	
Solvents	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Agriculture	-1.2%	-0.5%	2.1%	3.6%	5.0%	1.8%	3.1%	3.3%	5.6%	7.7%	4.6%	-1.5%	-7.9%	-1.3%	-3.1%	1.000	0.988	0.982	1.003	1.039	1.091	1.110	1.145	1.183	1.249	1.346	1.407	1.386	1.277	1.261	1.222	1.224
Land Use Change & Forestry	-11.3%	-16.0%	-9.5%	1.6%	-15.2%	-1.1%	-0.9%	1.7%	-0.9%	4.6%	-0.8%	-3.4%	-18.9%	15.0%	0.0%	1.000	0.887	0.745	0.674	0.685	0.580	0.574	0.569	0.578	0.574	0.600	0.595	0.575	0.466	0.536	0.536	
Waste	1.4%	1.3%	1.1%	1.0%	1.1%	1.4%	1.2%	1.0%	1.1%	1.2%	1.2%	1.3%	1.2%	1.3%	1.1%	1.000	1.014	1.027	1.038	1.049	1.060	1.074	1.088	1.099	1.111	1.124	1.138	1.153	1.166	1.181	1.194	
Total Emissions	-1.3%	-0.9%	1.9%	3.5%	4.4%	2.3%	2.7%	3.4%	5.1%	7.4%	4.2%	-1.0%	-6.9%	-0.2%	-2.9%	1.000	0.987	0.978	0.996	1.031	1.076	1.100	1.130	1.169	1.229	1.319	1.375	1.360	1.267	1.265	1.228	

\* N<sub>2</sub>O emissions reported as part of CO<sub>2</sub>-e for confidentiality reasonsTable 3-4 Analysis of Change in CO<sub>2</sub>-e Emissions, 1990-2005

Sector or Subsector		% Change from Previous Year															Emissions Compared with 1990 (1990 = 1.000)															
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Energy	Stationary	0.6%	2.1%	1.6%	0.7%	4.0%	1.9%	3.4%	3.9%	1.8%	2.5%	2.0%	1.0%	2.3%	2.5%	1.3%	1.000	1.006	1.027	1.043	1.050	1.092	1.113	1.150	1.195	1.216	1.246	1.270	1.284	1.313	1.345	1.363
	Transport	1.5%	1.7%	1.4%	0.8%	3.8%	2.4%	3.1%	5.6%	3.0%	2.2%	2.7%	1.0%	3.6%	1.9%	1.2%	1.000	1.015	1.032	1.047	1.055	1.095	1.122	1.157	1.222	1.258	1.286	1.321	1.334	1.383	1.409	1.426
Industrial Processes	Fugitive	-0.4%	1.3%	2.0%	2.5%	4.1%	3.5%	1.8%	0.1%	1.1%	2.8%	-1.8%	2.3%	0.8%	5.3%	1.2%	1.000	0.996	1.009	1.029	1.055	1.099	1.138	1.158	1.159	1.172	1.205	1.182	1.210	1.219	1.284	1.299
	Solvents	-3.3%	6.5%	1.6%	-3.6%	5.0%	-5.3%	8.9%	0.0%	-5.8%	3.5%	5.0%	-1.5%	-5.5%	0.9%	2.2%	1.000	0.967	1.030	1.046	1.009	1.059	1.003	1.092	1.092	1.028	1.064	1.118	1.101	1.040	1.050	1.073
Agriculture	Land Use Change & Forestry	-2.5%	2.4%	0.1%	1.4%	0.8%	-0.3%	-0.1%	5.4%	0.8%	0.1%	3.4%	1.7%	2.9%	3.2%	-3.6%	1.000	0.975	0.998	0.999	1.013	1.022	1.018	1.018	1.073	1.081	1.083	1.119	1.138	1.171	1.209	1.165
	Waste	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Emissions		-0.2%	-1.8%	-0.6%	0.6%	1.4%	0.3%	1.3%	0.6%	3.3%	3.9%	3.4%	-2.4%	-5.7%	-1.2%	-2.1%	1.000	0.998	0.980	0.974	0.980	0.993	0.996	1.009	1.014	1.048	1.089	1.126	1.099	1.036	1.024	1.002
		-18.0%	-15.7%	-15.2%	-1.2%	-15.8%	-2.9%	-6.6%	17.3%	-18.3%	-1.3%	-7.7%	11.2%	-44.7%	16.0%	-5.2%	1.000	0.820	0.691	0.586	0.579	0.487	0.473	0.442	0.518	0.424	0.418	0.386	0.429	0.237	0.275	0.261
		0.7%	-0.3%	0.4%	-1.7%	1.0%	-5.6%	-0.1%	-2.5%	1.8%	0.3%	1.6%	1.5%	-2.4%	-0.8%	-0.7%	1.000	1.007	1.003	1.007	0.990	0.999	0.943	0.943	0.919	0.935	0.938	0.953	0.967	0.944	0.937	0.931
		-4.1%	-2.2%	-1.8%	0.3%	0.4%	0.6%	1.5%	4.6%	-0.5%	2.1%	1.3%	1.4%	-3.8%	2.6%	0.0%	1.000	0.959	0.938	0.921	0.924	0.928	0.933	0.948	0.992	0.987	1.008	1.021	1.036	0.996	1.022	1.022



## **APPENDIX 4 SECTORAL AND SUBSECTORAL INDICATORS 1990–2005**

Table 4-1 Macro Indicators

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total emissions	Gg CO <sub>2</sub> -e	547127	524949	513392	503973	505666	507469	510733	518552	542625	539978	551503	558831	566584	545105	559088	559074
Emissions per capita	t CO <sub>2</sub> -e/capita	32.3	30.6	29.5	28.7	28.5	28.3	28.1	28.2	29.2	28.7	29.0	29.0	29.0	27.6	28.0	27.7
Emissions per \$ Gross Domestic Product	kg CO <sub>2</sub> -e/\$ GDP <sup>a</sup>	0.986	0.952	0.931	0.881	0.849	0.816	0.789	0.770	0.772	0.730	0.717	0.713	0.696	0.650	0.640	0.624

a. Chain volume measure, reference 2003/04

Table 4-2 Emissions from each sector

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Stationary energy	Gg CO <sub>2</sub> -e	195985	198893	202330	205185	206729	214616	219810	226699	239398	246526	252033	258888	261465	270992	276079	279402
Transport	Gg CO <sub>2</sub> -e	61892	61664	62442	63715	65317	68004	70409	71666	71726	72537	74560	73186	74875	75442	79454	80389
Fugitive emissions	Gg CO <sub>2</sub> -e	29092	28125	29965	30441	29353	30808	29167	31764	31765	29918	30963	32514	32039	30270	30543	31228
Industrial processes	Gg CO <sub>2</sub> -e	25282	24643	25237	25257	25614	25828	25743	25729	27130	27334	27371	28300	28780	29615	30571	29463
Solvents	Gg NMVOC	154	148	147	150	154	150	139	142	141	142	148	144	146	155	153	151
Agriculture	Gg CO <sub>2</sub> -e	87716	87570	85981	85451	85925	87106	87343	88480	88985	91956	95516	98758	96384	90911	89794	87889
Land use, land use change & forestry	Gg CO <sub>2</sub> -e	128852	105622	89066	75489	74607	62813	60994	56957	66803	54592	53892	49745	55331	30590	35497	33667
Waste	Gg CO <sub>2</sub> -e	18308	18433	18370	18436	18120	18293	17268	17257	16818	17115	17168	17441	17709	17285	17149	17037

Table 4.3 Energy Sectoral Indicators

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Energy Emissions per Capita	t CO <sub>2</sub> -e/capita	16.9	16.8	17.0	17.0	17.0	17.5	17.6	17.9	18.4	18.5	18.8	18.9	18.9	19.1	19.3	19.4
Stationary Energy Intensity <sup>a</sup>	Gg CO <sub>2</sub> -e/PJ used	116.6	117.0	119.1	116.0	114.7	115.0	115.7	116.2	119.5	121.2	121.1	123.4	123.2	122.4	123.3	121.8

<sup>a</sup> Includes mobile source energy used within the nominated sectors - data do not distinguish after 1999

Table 4.4 Emission from Energy Delivered by Fuel Type

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Coal	Gg CO <sub>2</sub> -e	133146	137685	141153	141286	141415	145609	150452	157695	168153	173548	176914	181627	182428	188567	193023	193525
Petroleum	Gg CO <sub>2</sub> -e	89547	89286	88815	91035	92803	96594	99680	99263	99653	100141	103167	102217	104654	107437	110452	113617
Natural Gas	Gg CO <sub>2</sub> -e	33267	31628	32821	34561	35842	38478	38185	39536	41548	43708	44898	46676	47986	49068	50798	51495
Biomass	Gg CO <sub>2</sub> -e	1916	1958	1983	2017	1986	1939	1902	1871	1770	1665	1614	1554	1272	1361	1260	1154

Table 4.5 Emissions from energy delivered per unit of energy used

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Coal	Gg CO <sub>2</sub> -e/PJ	91.4	91.5	91.4	91.4	90.9	90.9	90.2	90.2	90.2	90.4	91.2	91.0	90.8	91.3	91.4	90.9
Petroleum	Gg CO <sub>2</sub> -e/PJ	67.6	67.7	67.7	67.6	67.6	67.7	67.8	67.8	67.7	67.8	67.8	67.9	68.0	68.0	68.0	68.2
Natural Gas	Gg CO <sub>2</sub> -e/PJ	51.3	51.2	51.3	51.3	51.3	51.3	51.2	51.4	51.3	51.4	51.4	51.4	51.4	51.5	51.5	51.4
Biomass	Gg CO <sub>2</sub> -e/PJ	10.7	11.0	12.0	11.0	10.3	9.7	9.0	8.5	8.0	7.6	7.2	7.2	6.7	6.6	6.2	5.9

Table 4-6 Emissions from household energy use per capita

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Emissions per capita	t CO <sub>2</sub> -e/capita	2.75	2.75	2.77	2.78	2.70	2.80	2.85	2.90	2.99	3.02	3.02	3.03	2.97	3.10	3.24	3.27

Table 4-7 Emissions per unit of energy delivered

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Residential	Gg CO <sub>2</sub> -e/PJ	144.0	143.5	143.5	140.3	138.7	139.4	139.9	141.3	144.6	147.2	146.1	146.0	148.6	147.9	153.7	153.7
Commercial	Gg CO <sub>2</sub> -e/PJ	193.3	193.9	195.2	191.8	190.6	192.6	195.9	197.8	202.0	203.7	201.9	209.7	207.4	207.0	205.3	199.8
Industrial	Gg CO <sub>2</sub> -e/PJ	99.1	99.3	101.5	98.7	97.8	97.3	97.0	100.0	101.4	101.8	103.2	102.5	102.2	102.2	101.2	101.2
Transport	Gg CO <sub>2</sub> -e/PJ	70.3	70.3	70.4	70.3	70.3	70.2	70.4	70.3	70.4	70.5	70.6	70.6	70.6	70.6	70.7	70.6
All energy	Gg CO <sub>2</sub> -e/PJ	100.2	100.7	101.9	100.1	99.1	99.3	99.6	100.0	102.4	103.6	103.6	105.4	105.1	105.0	105.2	104.3

Table 4-8 Electricity, gas and biomass shares of energy delivered

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Residential - electricity share	PJ/PJ total energy delivered	42.9%	42.9%	42.1%	42.0%	42.2%	42.2%	42.0%	42.7%	43.2%	44.0%	44.2%	44.7%	46.1%	46.0%	48.6%	50.1%
Residential - gas share	PJ/PJ total energy delivered	27.8%	27.7%	28.3%	28.6%	28.2%	29.5%	30.4%	30.1%	30.4%	30.0%	30.3%	30.6%	32.2%	32.3%	31.8%	31.7%
Residential - biomass share	PJ/PJ total energy delivered	22.9%	23.2%	23.4%	23.2%	23.6%	22.7%	22.2%	21.9%	21.3%	21.1%	20.5%	19.9%	16.7%	16.8%	16.6%	14.0%
Commercial - electricity share	PJ/PJ total energy delivered	60.8%	61.4%	60.9%	61.3%	61.9%	62.3%	63.3%	64.2%	64.6%	64.8%	64.9%	69.0%	69.3%	69.3%	68.6%	68.4%
Commercial - gas share	PJ/PJ total energy delivered	22.9%	22.6%	23.5%	23.9%	23.6%	24.0%	23.7%	23.2%	23.5%	23.1%	22.6%	18.8%	18.4%	18.5%	18.4%	18.5%
Commercial - biomass share	PJ/PJ total energy delivered	0.5%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Industrial - electricity share	PJ/PJ total energy delivered	19.0%	19.1%	19.4%	19.1%	19.4%	19.1%	19.1%	19.0%	20.2%	20.5%	20.9%	21.6%	21.6%	21.2%	21.4%	21.5%
Industrial - gas share	PJ/PJ total energy delivered	30.8%	31.1%	31.9%	32.4%	32.9%	33.4%	33.3%	34.3%	34.5%	34.8%	35.2%	35.4%	35.7%	34.6%	34.3%	33.8%
Industrial - biomass share	PJ/PJ total energy delivered	8.9%	8.6%	7.3%	8.3%	8.8%	9.1%	9.8%	10.1%	10.1%	9.7%	9.2%	8.6%	8.0%	7.9%	7.8%	8.0%
Stationary energy - electricity share	PJ/PJ total energy delivered	27.5%	27.8%	28.0%	27.7%	27.9%	27.9%	28.2%	28.4%	29.3%	29.8%	30.1%	31.4%	31.6%	31.2%	31.8%	32.0%
Stationary energy - gas share	PJ/PJ total energy delivered	29.5%	29.6%	30.3%	30.8%	31.1%	31.7%	31.7%	32.3%	32.5%	32.6%	32.9%	32.6%	33.1%	32.4%	32.1%	31.7%
Stationary energy - biomass share	PJ/PJ total energy delivered	10.8%	10.7%	9.9%	10.5%	10.8%	10.9%	11.3%	11.4%	11.2%	10.9%	10.4%	9.8%	8.7%	8.7%	8.6%	8.3%
Transport - electricity share	PJ/PJ total energy delivered	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%

Table 4-9 Transport emissions per passenger-km

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Passenger vehicles	g CO <sub>2</sub> -e/passenger-km	NE	165	NE	NE	NE	164	NE	NE	167	NE	NE	168	NE	NE	NE	166
Motorcycles	g CO <sub>2</sub> -e/passenger-km	NE	120	NE	NE	NE	127	NE	NE	123	NE	NE	126	NE	NE	NE	122
Buses	g CO <sub>2</sub> -e/passenger-km	NE	83	NE	NE	NE	70	NE	NE	78	NE	NE	71	NE	NE	NE	87
Light rail	g CO <sub>2</sub> -e/passenger-km	NE	124	NE	NE	NE	158	NE	NE	199	NE	NE	198	NE	NE	NE	187
Heavy rail	g CO <sub>2</sub> -e/passenger-km	NE	117	NE	NE	NE	113	NE	NE	126	NE	NE	120	NE	NE	NE	124
Air	g CO <sub>2</sub> -e/passenger-km	NE	207	NE	NE	NE	175	NE	NE	163	NE	NE	159	NE	NE	NE	129
Coastal shipping	g CO <sub>2</sub> -e/passenger-km	NE	313	NE	NE	NE	310	NE	NE	316	NE	NE	265	NE	NE	NE	301
All modes	g CO <sub>2</sub> -e/passenger-km	NE	162	NE	NE	NE	158	NE	NE	160	NE	NE	159	NE	NE	NE	156

Table 4-10 Transport emissions per freight tonne-km

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Light commercial vehicles	g CO <sub>2</sub> -e/tonne-km	NE	1514	NE	NE	NE	1607	NE	NE	1412	NE	NE	1353	NE	NE	NE	1294
Rigid trucks	g CO <sub>2</sub> -e/tonne-km	NE	188	NE	NE	NE	187	NE	NE	178	NE	NE	184	NE	NE	NE	183
Articulated trucks	g CO <sub>2</sub> -e/tonne-km	NE	77	NE	NE	NE	75	NE	NE	70	NE	NE	65	NE	NE	NE	60
Government rail	g CO <sub>2</sub> -e/tonne-km	NE	31	NE	NE	NE	30	NE	NE	25	NE	NE	21	NE	NE	NE	20
Private rail	g CO <sub>2</sub> -e/tonne-km	NE	8.3	NE	NE	NE	6.8	NE	NE	6.1	NE	NE	6	NE	NE	NE	5.4
Air	g CO <sub>2</sub> -e/tonne-km	NE	2275	NE	NE	NE	1925	NE	NE	1795	NE	NE	1750	NE	NE	NE	1422
Coastal shipping	g CO <sub>2</sub> -e/tonne-km	NE	14	NE	NE	NE	14	NE	NE	11	NE	NE	10	NE	NE	NE	13
All modes	g CO <sub>2</sub> -e/tonne-km	NE	72	NE	NE	NE	73	NE	NE	67	NE	NE	67	NE	NE	NE	64

Table 4-11 Transport emissions per passenger-km (urban)

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Passenger vehicles	g CO <sub>2</sub> -e/passenger-km	NE	174	NE	NE	NE	181	NE	NE	184	NE	NE	183	NE	NE	NE	170
Motorcycles	g CO <sub>2</sub> -e/passenger-km	NE	123	NE	NE	NE	129	NE	NE	123	NE	NE	122	NE	NE	NE	117
Buses	g CO <sub>2</sub> -e/passenger-km	NE	97	NE	NE	NE	81	NE	NE	102	NE	NE	91	NE	NE	NE	93
Urban light rail	g CO <sub>2</sub> -e/passenger-km	NE	124	NE	NE	NE	158	NE	NE	199	NE	NE	198	NE	NE	NE	187
Urban heavy rail	g CO <sub>2</sub> -e/passenger-km	NE	135	NE	NE	NE	129	NE	NE	141	NE	NE	136	NE	NE	NE	139
All modes	g CO <sub>2</sub> -e/passenger-km	NE	168	NE	NE	NE	173	NE	NE	178	NE	NE	175	NE	NE	NE	164

Table 4-12 Sheep methane equivalents per animal

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
SME units/animal	SME units (averaged)	2.07	2.11	2.17	2.26	2.34	2.42	2.47	2.50	2.53	2.54	2.58	2.63	2.69	2.72	2.73	2.73

Table 4-13 N<sub>2</sub>O emissions index

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
N <sub>2</sub> O emissions index	NEI units (averaged)	41.5	41.5	40.8	41.1	40.9	39.4	38.4	39.9	42.5	45.4	48.3	50.1	50.8	50.4	NA	NA

Table 4-14 CO<sub>2</sub>-e from land use change (Kyoto accounting)

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Net emissions from land use change	Gg CO <sub>2</sub> -e	128.9	105.6	89.1	75.5	74.6	62.8	61.0	57.0	66.8	54.6	53.9	49.7	55.3	30.6	35.5	33.7

Table 4-15 CH<sub>4</sub> emissions from landfill per capita

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Net emissions from solid waste	kg CO <sub>2</sub> -e/capita	42.9	42.7	42.2	42.0	40.9	41.2	38.3	38.0	36.8	37.2	36.9	37.0	37.2	35.9	35.2	34.7

Table 4-16 Emissions from electricity production divided by electricity delivered to users

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Emissions intensity of electricity consumed	kg CO <sub>2</sub> -e/kWh delivered	1.007	1.003	1.019	0.995	0.981	0.987	0.995	0.994	1.015	1.020	1.008	0.999	0.984	0.982	0.980	0.953

Table 4-17 Emissions from electricity production divided by electricity sent out

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Black coal power stations	kg CO <sub>2</sub> -e/kWh sent out	NE	NE	NE	NE	NE	NE	0.936	0.932	0.968	0.963	0.939	0.952	0.954	0.964	0.948	0.936
Brown coal power stations	kg CO <sub>2</sub> -e/kWh sent out	NE	NE	NE	NE	NE	NE	1.385	1.340	1.354	1.370	1.382	1.324	1.371	1.358	1.340	1.338
Natural gas - large power stations only	kg CO <sub>2</sub> -e/kWh sent out	NE	NE	NE	NE	NE	NE	0.583	0.581	0.536	0.547	0.566	0.572	0.534	0.519	0.552	0.569
All major power stations	kg CO <sub>2</sub> -e/kWh sent out	NE	NE	NE	NE	NE	NE	1.028	1.028	1.072	1.063	1.042	1.036	1.032	1.051	1.034	1.021

Table 4-18 Share of electricity generation produced from each primary energy source

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Black coal		NE	NE	NE	NE	NE	NE	56.8%	58.6%	55.7%	56.0%	57.0%	57.4%	58.4%	57.7%	59.8%	58.1%
Brown coal		NE	NE	NE	NE	NE	NE	25.9%	26.1%	30.0%	28.0%	27.4%	26.6%	25.9%	26.8%	25.7%	25.8%
Petroleum		NE	NE	NE	NE	NE	NE	0.5%	0.3%	0.4%	0.6%	0.2%	0.3%	0.3%	0.3%	0.1%	0.0%
Gas		NE	NE	NE	NE	NE	NE	7.3%	5.0%	5.3%	6.7%	7.0%	7.6%	7.7%	7.5%	7.0%	8.8%
Hydro		NE	NE	NE	NE	NE	NE	9.5%	10.0%	8.6%	8.7%	8.3%	8.1%	7.6%	7.7%	7.3%	7.2%

Table 4-19 Efficiency of fossil-fuel electricity generation by fuel (sent out basis)

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Black coal power stations	PJ electricity sent out/PJ fuel	NE	NE	NE	NE	NE	NE	34.5%	37.3%	33.5%	33.6%	35.0%	34.4%	34.4%	33.8%	34.5%	34.8%
Brown coal power stations	PJ electricity sent out/PJ fuel	NE	NE	NE	NE	NE	NE	24.7%	25.5%	24.9%	24.6%	24.4%	25.3%	24.3%	25.1%	25.4%	25.0%
Natural gas - large power stations only	PJ electricity sent out/PJ fuel	NE	NE	NE	NE	NE	NE	31.3%	31.8%	34.4%	33.6%	32.5%	32.1%	34.5%	35.6%	33.4%	32.6%
All major power stations	PJ electricity sent out/PJ fuel	NE	NE	NE	NE	NE	NE	31.3%	33.1%	30.4%	30.3%	31.1%	31.1%	31.0%	30.9%	31.4%	31.5%

Table 4-20 Electricity generated from fossil fuel cogeneration plants

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Cogeneration in electricity supply sector	GWh generated	NE	NE	NE	NE	NE	NE	NE	NE	NE	6742	NE	NE	NE	NE	NE	NE
Cogeneration in other sectors	GWh generated	NE	NE	NE	NE	NE	NE	NE	NE	NE	2780	NE	NE	NE	NE	NE	NE
Non-cogeneration (all sectors, all energy types)	GWh generated	NE	NE	NE	NE	NE	NE	NE	NE	NE	188853	NE	NE	NE	NE	NE	NE

Table 4-21 Electricity generated from renewable energy

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Hydro	GWh generated	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	16778	16028	16306	15750	15611
Biomass	GWh generated	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	600	722	796	870	944
Biogas	GWh generated	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	300	333	315	296	278
Wind	GWh generated	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	200	278	278	602	1250

Table 4-22 Percentage of electricity sent out lost in transmission, pumped storage, and distribution

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Share of electricity sent out lost in T&D		NE	NE	NE	NE	NE	NE	NE	9.7%	8.1%	8.0%	8.5%	8.5%	7.8%	7.3%	8.8%	7.9%
Share of electricity generated lost in auxiliaries, T&D		NE	NE	NE	NE	NE	NE	NE	12.8%	13.7%	13.9%	14.2%	14.3%	13.7%	12.9%	14.5%	13.8%

Table 4-23 Energy from primary fuels as a percentage of total energy use

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Coal	PJ/PJ total energy	39.8%	40.9%	41.5%	40.6%	40.1%	39.7%	40.2%	41.0%	42.1%	42.4%	42.0%	42.6%	42.5%	42.4%	42.4%	42.2%
Petroleum	PJ/PJ total energy	36.1%	35.8%	35.3%	35.3%	35.4%	35.3%	35.4%	34.3%	33.3%	32.6%	32.9%	32.1%	32.5%	32.5%	32.6%	33.0%
Natural Gas	PJ/PJ total energy	17.7%	16.8%	17.2%	17.7%	18.0%	18.6%	17.9%	18.0%	18.3%	18.6%	18.9%	19.4%	19.7%	19.6%	19.8%	19.8%
Hydro	PJ/PJ total energy	1.5%	1.6%	1.5%	1.6%	1.5%	1.4%	1.4%	1.5%	1.3%	1.3%	1.3%	1.3%	1.2%	1.2%	1.1%	1.1%
Biomass	PJ/PJ total energy	4.9%	4.9%	4.4%	4.8%	5.0%	5.0%	5.1%	5.1%	5.0%	4.8%	4.8%	4.6%	4.0%	4.2%	4.1%	3.9%

Table 4-24 Fugitive Emissions

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Venting in oil and gas production	Mt CO <sub>2</sub> -e	3.70	3.87	4.18	4.21	4.51	5.10	5.19	5.32	5.44	5.43	5.79	5.98	5.52	4.92	4.44	4.21
Flaring in oil and gas production	Mt CO <sub>2</sub> -e	4.58	4.22	4.29	4.06	3.65	3.83	3.43	2.96	2.80	2.91	3.41	3.61	3.09	2.67	2.71	2.54
Emissions during gas transmission and distribution	Mt CO <sub>2</sub> -e	4.70	3.94	4.14	3.46	3.44	4.02	3.33	3.74	3.82	3.07	3.41	3.59	3.75	2.74	2.82	2.87
Net emissions at coal mines	Mt CO <sub>2</sub> -e	15.75	15.78	16.80	17.78	16.88	17.19	16.46	19.15	19.23	18.13	17.78	18.62	18.46	18.50	18.39	20.00

Table 4-25 Passenger vehicle fuel consumption

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New vehicle national average fuel consumption	litres/100km	8.92	8.82	8.88	8.93	8.93	8.76	8.62	8.47	8.43	8.36	8.34	8.28	8.23	NA	10.87	NA
Fleet average fuel consumption - petrol	litres/100km	NE	11.64	NE	NE	NE	11.5	NE	NE	11.36	NE	NE	10.97	NE	NE	NE	10.77
Fleet average fuel consumption - diesel	litres/100km	NE	12.7	NE	NE	NE	12.7	NE	NE	12.85	NE	NE	13.6	NE	NE	NE	12.29
Fleet average fuel consumption - LPG	litres/100km	NE	NE	NE	NE	NE	19.9	NE	NE	17.6	NE	NE	16.8	NE	NE	NE	16.7
Fleet average fuel consumption - all fuels	litres/100km	NE	11.93	NE	NE	NE	12.0	NE	NE	11.82	NE	NE	11.49	NE	NE	NE	11.22

Table 4-26 Passenger vehicle emissions rates

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Emissions per vehicle-kilometre - petrol	g CO <sub>2</sub> -e/km	NE	272	NE	NE	NE	270	NE	NE	268	NE	NE	260	NE	NE	NE	255
Emissions per vehicle-kilometre - diesel	g CO <sub>2</sub> -e/km	NE	343	NE	NE	NE	343	NE	NE	347	NE	NE	366	NE	NE	NE	332
Emissions per vehicle-kilometre - LPG	g CO <sub>2</sub> -e/km	NE	NE	NE	NE	NE	310	NE	NE	274	NE	NE	258	NE	NE	NE	259

Table 4-27 Passenger transport activity

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Vehicle-kilometres travelled	Million VKT	NE	127626	NE	NE	NE	138585	NE	NE	145010	NE	NE	153149	NE	NE	NE	169225
Passenger-kilometres travelled	Million Pass-km	NE	211461	NE	NE	NE	227461	NE	NE	233616	NE	NE	243684	NE	NE	NE	262025
Number of passenger vehicles registered	Thousand PMVs	NE	7853	NE	NE	NE	8768	NE	NE	9561	NE	NE	9836	NE	NE	NE	10937
Motorised passenger-kilometres per capita	Pass-km/capita	NE	14807	NE	NE	NE	15734	NE	NE	15819	NE	NE	16272	NE	NE	NE	16828
Motorised urban passenger-kilometres per capita	Pass-km/capita	NE	9162	NE	NE	NE	9403	NE	NE	9326	NE	NE	9578	NE	NE	NE	10257

Table 4-28 Share of urban motorised passenger kilometre by mode and vehicle class

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Passenger vehicles		NE	90.3%	NE	NE	NE	89.5%	NE	NE	89.8%	NE	NE	88.8%	NE	NE	NE	89.8%
Motorcycles		NE	0.7%	NE	NE	NE	0.7%	NE	NE	0.7%	NE	NE	0.7%	NE	NE	NE	0.7%
Buses		NE	4.3%	NE	NE	NE	5.2%	NE	NE	4.9%	NE	NE	5.7%	NE	NE	NE	5.2%
Light rail		NE	0.4%	NE	NE	NE	0.3%	NE	NE	0.3%	NE	NE	0.3%	NE	NE	NE	0.2%
Heavy rail		NE	4.3%	NE	NE	NE	4.3%	NE	NE	4.3%	NE	NE	4.6%	NE	NE	NE	4.1%

Table 4-29 Share of non-urban motorised passenger kilometre by mode

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Passenger vehicles		NE	71.6%	NE	NE	NE	67.2%	NE	NE	64.4%	NE	NE	61.8%	NE	NE	NE	57.2%
Motorcycles		NE	0.8%	NE	NE	NE	0.5%	NE	NE	0.5%	NE	NE	0.4%	NE	NE	NE	0.4%
Buses		NE	7.3%	NE	NE	NE	5.8%	NE	NE	6.9%	NE	NE	7.0%	NE	NE	NE	4.5%
Heavy rail		NE	2.4%	NE	NE	NE	1.9%	NE	NE	1.8%	NE	NE	0.0%	NE	NE	NE	1.6%
Air		NE	17.7%	NE	NE	NE	24.4%	NE	NE	26.3%	NE	NE	1.9%	NE	NE	NE	35.9%
Coastal shipping		NE	0.2%	NE	NE	NE	0.2%	NE	NE	0.2%	NE	NE	28.7%	NE	NE	NE	0.3%

Table 4-30 Average loading of road freight vehicles

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Light Commercial Vehicles	Commodity tonnes per VKT	NE	0.47	NE	NE	NE	0.42	NE	NE	0.45	NE	NE	0.52	NE	NE	NE	0.52
Rigid trucks	Commodity tonnes per VKT	NE	5.4	NE	NE	NE	5.5	NE	NE	6.0	NE	NE	5.9	NE	NE	NE	6.9
Articulated trucks	Commodity tonnes per VKT	NE	24.4	NE	NE	NE	24.6	NE	NE	26.8	NE	NE	30.2	NE	NE	NE	32.6
All road freight vehicles	Commodity tonnes per VKT	NE	5.7	NE	NE	NE	5.5	NE	NE	6.0	NE	NE	6.5	NE	NE	NE	7.4

Table 4-31 Emissions from industrial processes

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Aluminium	Gg CO <sub>2</sub> -e	5956	5961	5951	4943	3975	3387	3530	3357	4156	3703	3874	4414	4482	4474	4508	4642
Other mineral products	Gg CO <sub>2</sub> -e	3545	3486	3743	4452	4876	4779	5166	5139	5516	5255	5214	6073	6525	7059	7101	7317
Iron & steel	Gg CO <sub>2</sub> -e	10255	9980	10600	10365	11458	11787	11729	11693	11260	11799	11098	10162	9835	9580	10146	8149
Halocarbon production & consumption	Gg CO <sub>2</sub> -e	1647	1647	1575	1968	1335	1941	1480	1753	2046	2370	2764	3181	3604	4053	4405	4773
Chemical Industry	Gg CO <sub>2</sub> -e	416	386	445	524	485	575	595	601	676	688	800	928	847	864	857	938
Cement	Gg CO <sub>2</sub> -e	3463	3183	2923	3005	3484	3358	3244	3185	3475	3520	3621	3541	3488	3584	3555	3644

Table 4-32 Production and use of industrial commodities

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Aluminium production	Gg	1235	1236	1234	1301	1380	1285	1331	1395	1589	1686	1742	1788	1809	1855	1877	1890
Crude steel production	Gg	6223	5714	6345	6636	7320	7526	7548	7414	7961	7393	6345	6027	5933	6282	6312	5977
Cement production	Gg	6205	5712	5264	5422	6249	5998	5795	5684	6232	6369	6557	6425	6354	6566	6492	6657
Lime production	Gg	1035	1081	1132	1182	1287	1265	1457	1484	1701	1534	1277	1533	1569	1593	1624	1617
Limestone & dolomite use	Gg	2308	2162	2223	2462	2951	2810	2918	2868	2862	2776	2523	2163	2275	2362	2273	2190

Table 4-33 Emissions from livestock and manure

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Emissions from livestock and manure	Gg CO <sub>2</sub> -e	65.9	66.1	65.0	63.7	62.4	62.1	61.8	62.4	62.5	63.4	63.7	64.1	62.7	62.0	61.6	62.1

Table 4-34 Non-livestock emissions (excluding savanna burning) divided by crop area

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Emissions from crops	t CO <sub>2</sub> -e/Ha	0.88	0.89	0.90	0.90	0.89	0.87	0.84	0.81	0.79	0.78	0.78	0.79	0.77	0.74	NA	NA

Table 4-35 Land Use, Land Use Change and Forestry (Kyoto Accounting)

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Net annual tonnes of CO <sub>2</sub> removed by plantations	Gg CO <sub>2</sub> -e	0.0	0.5	1.0	1.5	1.9	2.5	3.2	4.5	6.0	7.6	10.9	11.9	13.9	15.8	17.8	19.6
Net emissions from managed forests	Gg CO <sub>2</sub> -e	128.9	105.6	89.1	75.5	74.6	62.8	61.0	57.0	66.8	54.6	53.9	49.7	55.3	30.6	35.5	33.7

Table 4-36 Land Use Change

Indicator	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Areas of land Converted to Forest	Ha	81,435	82,224	74,002	70,151	69,255	48,653	48,653	48,653	63,065	63,065	78,588	78,588	119,858	83,051	71,460	60,112
Area of native vegetation cleared	Ha																

## **APPENDIX 5 COMMON REPORTING FORMAT TRENDS TABLE (KYOTO ACCOUNTING) 1990–2005**



**TABLE 1 EMISSIONS TRENDS (CO<sub>2</sub>) - Kyoto Accounting**  
(Sheet 1 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997
					(Gg)				
1. Energy	260136.06	260136.06	262476.53	266761.67	270764.82	273650.39	284355.02	291444.33	299442.03
A. Fuel Combustion (Sectoral Approach)	254153.61	254153.61	256729.13	260841.90	264863.72	267961.78	278481.88	285974.54	294150.17
1. Energy Industries	142605.80	142605.80	145853.53	149192.42	150967.56	151897.15	157747.43	162415.79	169020.43
2. Manufacturing Industries and Construction	36861.68	36861.68	36389.64	36032.99	36600.27	37237.25	38459.52	38473.61	38435.18
3. Transport	60737.23	60737.23	60461.14	61174.81	62378.89	63908.75	66520.59	68803.04	70085.32
4. Other Sectors	12908.51	12908.51	13003.21	13371.13	13820.90	13769.72	14475.20	14888.61	15181.76
5. Other	1040.40	1040.40	1021.60	1070.55	1096.10	1148.93	1279.13	1393.49	1427.48
B. Fugitive Emissions from Fuels	5982.45	5982.45	5747.40	5919.77	5901.10	5688.61	5873.14	5469.79	5291.86
1. Solid Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	5982.45	5982.45	5747.40	5919.77	5901.10	5688.61	5873.14	5469.79	5291.86
2. Industrial Processes	19606.39	19606.39	18969.78	19635.93	20364.25	22328.22	22473.84	22951.22	22810.82
A. Mineral Products	5122.80	5122.80	4809.83	4605.89	4815.46	5566.78	5371.34	5375.55	5437.02
B. Chemical Industry	406.82	406.82	377.18	436.90	517.52	476.82	567.43	584.96	592.03
C. Metal Production	12191.59	12191.59	11923.70	12532.58	12390.38	13491.02	13769.37	13956.37	13894.73
D. Other Production	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Production of Halocarbons and SF <sub>6</sub>									
F. Consumption of Halocarbons and SF <sub>6</sub>									
G. Other <sup>(1)</sup>	1885.19	1885.19	1859.08	2060.56	2641.09	2793.61	2765.71	2972.87	2948.51
3. Solvent and Other Product Use	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. Agriculture									
A. Enteric Fermentation									
B. Manure Management									
C. Rice Cultivation									
D. Agricultural Soils									
E. Prescribed Burning of Savannas									
F. Field Burning of Agricultural Residues									
G. Other									
5. Land Use, Land-Use Change and Forestry	124542.27	124542.27	101798.19	85855.38	72583.49	71656.25	60311.56	58519.63	54504.63
A. Afforestation and reforestation <sup>(2)</sup>	0.00	0.00	485.20	994.33	1501.45	1876.27	2459.23	3157.15	4486.75
B. Land use change (deforestation)	124542.27	124542.27	102283.39	86849.71	74084.95	73532.52	62770.79	61676.78	58991.38
6. Waste	21.27	21.27	21.41	21.56	21.70	21.84	27.53	24.20	27.95
A. Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Waste-water Handling									
C. Waste Incineration	21.27	21.27	21.41	21.56	21.70	21.84	27.53	24.20	27.95
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other (as specified in Summary 1.A)	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total CO <sub>2</sub> emissions including net CO <sub>2</sub> from LUCF	404306.00	404306.00	383265.91	372274.54	363734.46	367656.71	367167.95	372939.38	376785.43
Total CO <sub>2</sub> emissions excluding net CO <sub>2</sub> from LUCF	279763.73	279763.73	281467.72	286419.16	291150.96	296000.46	306856.39	314419.75	322280.80
Memo Items:									
International Bankers	6395.80	6395.80	6371.81	6579.12	6972.58	7357.26	8527.61	9022.70	9017.56
Aviation	4338.88	4338.88	4513.21	4788.83	5191.92	5342.82	5849.26	6302.65	6530.03
Marine	2056.91	2056.91	1858.60	1790.29	1780.67	2014.44	2678.35	2720.05	2487.52
Multilateral Operations	NA	NA	NA	NA	NA	NA	NA	NA	NA
CO <sub>2</sub> Emissions from Biomass	14760.10	14760.10	14652.58	13414.64	15002.18	15923.34	16676.92	17656.86	18486.20

1. Speciated emissions from Ammonia Production, Nitric Acid Production, Magnesia Production, Soda Ash Production and Use, Acetylene Use, Titanium Dioxide Production, and the Use of N<sub>2</sub>O in Aerosols and Anaesthesia are confidential and reported as CO<sub>2</sub>-e

2. Greenhouse sinks credits are accounted for in 2008-12 only. The values provided are only an indicative estimate of sequestration in reforestation activities

**TABLE 1 EMISSIONS TRENDS (CO<sub>2</sub>) - Kyoto Accounting**  
(Sheet 1 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1998	1999	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	(Gg)								%
<b>1. Energy</b>	<b>312381.34</b>	<b>320784.09</b>	<b>328983.40</b>	<b>334925.31</b>	<b>338855.17</b>	<b>348084.04</b>	<b>356825.48</b>	<b>361091.92</b>	<b>38.81</b>
A. Fuel Combustion (Sectoral Approach)	306861.38	314807.88	322254.73	327754.54	332153.00	342087.79	351094.75	355538.39	39.89
1. Energy Industries	181734.23	187950.58	192071.45	198905.03	199898.41	206748.87	211439.60	213461.68	49.69
2. Manufacturing Industries and Construction	38280.37	39127.61	39949.49	39152.64	40620.94	41369.14	42633.34	43436.31	17.84
3. Transport	70093.07	70835.03	72761.51	71362.25	72938.31	73435.31	77289.67	78323.78	28.96
4. Other Sectors	15432.77	15662.04	16198.27	17044.17	17437.80	19276.93	18414.34	19116.93	48.10
5. Other	1320.95	1232.62	1274.01	1290.46	1257.54	1257.54	1317.81	1199.68	15.31
B. Fugitive Emissions from Fuels	5519.96	5976.21	6728.67	7170.77	6702.17	5996.25	5730.73	5553.53	-7.17
1. Solid Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	5519.96	5976.21	6728.67	7170.77	6702.17	5996.25	5730.73	5553.53	-7.17
<b>2. Industrial Processes</b>	<b>23441.18</b>	<b>23874.07</b>	<b>23403.94</b>	<b>23480.47</b>	<b>23585.41</b>	<b>24007.25</b>	<b>24591.93</b>	<b>23040.66</b>	<b>17.52</b>
A. Mineral Products	5808.73	5706.04	5526.15	5471.73	5490.06	5640.73	5593.26	5640.58	10.11
B. Chemical Industry	669.07	680.93	791.13	921.11	838.97	855.23	847.94	929.01	128.36
C. Metal Production	13780.86	14418.49	13777.98	12945.10	12734.16	12508.89	13088.41	11150.36	-8.54
D. Other Production	NE	NE	NE	NE	NE	NE	NE	NE	NA
E. Production of Halocarbons and SF <sub>6</sub>									
F. Consumption of Halocarbons and SF <sub>6</sub>									
G. Other <sup>(1)</sup>	3182.52	3068.61	3308.67	4142.54	4522.23	5002.40	5062.33	5320.71	182.24
<b>3. Solvent and Other Product Use</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
<b>4. Agriculture</b>									
A. Enteric Fermentation									
B. Manure Management									
C. Rice Cultivation									
D. Agricultural Soils									
E. Prescribed Burning of Savannas									
F. Field Burning of Agricultural Residues									
G. Other									
<b>5. Land Use, Land-Use Change and Forestry</b>	<b>64310.19</b>	<b>52120.22</b>	<b>51306.37</b>	<b>47180.23</b>	<b>52854.96</b>	<b>28581.35</b>	<b>33187.05</b>	<b>31356.50</b>	<b>-74.82</b>
A. Afforestation and reforestation <sup>(2)</sup>	-5984.36	-7613.28	-10896.94	-11915.30	-13896.91	-15844.85	-17778.26	-19608.81	NA
B. Land use change (deforestation)	70294.55	59733.49	62203.31	59095.52	66751.87	44426.20	50965.31	50965.31	-59.08
<b>6. Waste</b>	<b>28.28</b>	<b>28.77</b>	<b>27.66</b>	<b>27.80</b>	<b>27.96</b>	<b>28.12</b>	<b>28.28</b>	<b>28.43</b>	<b>33.66</b>
A. Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Waste-water Handling									
C. Waste Incineration	28.28	28.77	27.66	27.80	27.96	28.12	28.28	28.43	33.66
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>7. Other (as specified in Summary LA)</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total CO<sub>2</sub> emissions including net CO<sub>2</sub> from LUCF</b>	<b>400160.99</b>	<b>396807.15</b>	<b>403721.37</b>	<b>405613.81</b>	<b>415323.50</b>	<b>400700.77</b>	<b>414632.74</b>	<b>415517.51</b>	<b>2.77</b>
<b>Total CO<sub>2</sub> emissions excluding net CO<sub>2</sub> from LUCF</b>	<b>335850.79</b>	<b>344686.93</b>	<b>352415.00</b>	<b>358433.58</b>	<b>362468.54</b>	<b>372119.42</b>	<b>381445.69</b>	<b>384161.01</b>	<b>37.32</b>
									NA
<b>Memo Items:</b>									
<b>International Bunkers</b>	<b>9439.73</b>	<b>9708.72</b>	<b>10090.74</b>	<b>10384.77</b>	<b>9523.98</b>	<b>8683.11</b>	<b>8768.45</b>	<b>9762.95</b>	<b>52.65</b>
Aviation	7222.52	7257.66	7320.36	7782.71	6684.38	5915.04	5977.42	6768.44	55.99
Marine	2217.21	2451.06	2770.38	2602.06	2839.60	2768.08	2791.02	2994.51	45.58
<b>Multilateral Operations</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
<b>CO<sub>2</sub> Emissions from Biomass</b>	<b>18773.67</b>	<b>18527.73</b>	<b>18747.84</b>	<b>17968.81</b>	<b>16120.37</b>	<b>17236.14</b>	<b>17218.26</b>	<b>16568.50</b>	<b>12.25</b>

1. Speciated emissions from Ammonia Production, Nitric Acid Production, Magnesia Production, Soda Ash Production and Use, Acetylene Use, Titanium Dioxide Production, and the Use of N<sub>2</sub>O in Aerosols and Anaesthesia are confidential and reported as CO<sub>2</sub>-e

2. Greenhouse sinks credits are accounted for in 2008-12 only. The values provided are only an indicative estimate of sequestration in reforestation activities

**TABLE 1 EMISSIONS TRENDS (CH<sub>4</sub>)**  
(Sheet 2 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997
					(Gg)				
<b>Total CH<sub>4</sub> emissions</b>	<b>5593.21</b>	<b>5593.21</b>	<b>5551.06</b>	<b>5536.39</b>	<b>5511.18</b>	<b>5449.34</b>	<b>5512.97</b>	<b>5397.52</b>	<b>5552.40</b>
<b>1. Energy</b>	<b>1211.89</b>	<b>1211.89</b>	<b>1179.53</b>	<b>1262.10</b>	<b>1287.50</b>	<b>1245.04</b>	<b>1303.82</b>	<b>1242.51</b>	<b>1373.13</b>
A. Fuel Combustion (Sectoral Approach)	113.15	113.15	115.54	118.71	120.52	119.59	117.93	115.65	113.68
1. Energy Industries	2.10	2.10	2.14	2.27	2.36	2.39	2.60	2.62	2.62
2. Manufacturing Industries and Construction	2.00	2.00	1.94	1.80	1.97	2.07	2.15	2.23	2.27
3. Transport	25.31	25.31	25.66	26.63	27.64	28.59	29.30	29.33	29.33
4. Other Sectors	83.69	83.69	85.76	87.97	88.51	86.50	83.83	81.41	79.41
5. Other	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.06	0.06
B. Fugitive Emissions from Fuels	1098.73	1098.73	1063.99	1143.39	1166.98	1125.46	1185.89	1126.86	1259.45
1. Solid Fuels	767.35	767.35	766.24	826.60	890.72	845.58	850.46	819.92	939.99
2. Oil and Natural Gas	331.38	331.38	297.75	316.79	276.26	279.87	335.43	306.94	319.46
<b>2. Industrial Processes</b>	<b>3.27</b>	<b>3.27</b>	<b>3.01</b>	<b>3.30</b>	<b>3.33</b>	<b>3.72</b>	<b>3.80</b>	<b>3.88</b>	<b>3.80</b>
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	0.44	0.44	0.40	0.41	0.32	0.40	0.38	0.45	0.43
C. Metal Production	2.83	2.83	2.60	2.89	3.01	3.32	3.42	3.43	3.37
D. Other Production									
E. Production of Halocarbons and SF <sub>6</sub>									
F. Consumption of Halocarbons and SF <sub>6</sub>									
G. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE
<b>3. Solvent and Other Product Use</b>									
<b>4. Agriculture</b>	<b>3368.90</b>	<b>3368.90</b>	<b>3371.90</b>	<b>3300.59</b>	<b>3258.51</b>	<b>3252.29</b>	<b>3266.19</b>	<b>3261.98</b>	<b>3288.14</b>
A. Enteric Fermentation	3041.95	3041.95	3048.50	2987.56	2921.67	2852.08	2829.68	2815.96	2836.58
B. Manure Management	73.35	73.35	73.42	74.91	77.89	80.53	82.16	82.97	86.58
C. Rice Cultivation	23.36	23.36	24.94	25.72	28.69	28.87	30.89	33.56	34.44
D. Agricultural Soils	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Prescribed Burning of Savannas	221.07	221.07	216.08	203.23	220.41	281.15	313.38	318.57	318.15
F. Field Burning of Agricultural Residues	9.18	9.18	8.96	9.17	9.85	9.66	10.07	10.91	12.40
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>5. Land Use, Land-Use Change and Forestry</b>	<b>161.17</b>	<b>161.17</b>	<b>143.01</b>	<b>120.08</b>	<b>108.64</b>	<b>110.36</b>	<b>93.55</b>	<b>92.52</b>	<b>91.70</b>
A. Afforestation and reforestation	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Land use change (deforestation)	161.17	161.17	143.01	120.08	108.64	110.36	93.55	92.52	91.70
<b>6. Waste</b>	<b>847.98</b>	<b>847.98</b>	<b>853.60</b>	<b>850.32</b>	<b>853.19</b>	<b>837.92</b>	<b>845.62</b>	<b>796.63</b>	<b>795.62</b>
A. Solid Waste Disposal on Land	726.17	726.17	733.38	732.86	739.06	726.38	738.96	697.42	700.43
B. Waste-water Handling	121.81	121.81	120.22	117.46	114.13	111.55	106.66	99.21	95.19
C. Waste Incineration	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>7. Other (as specified in Summary I.A)</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Memo Items:</b>									
<b>International Bunkers</b>	<b>0.12</b>	<b>0.12</b>	<b>0.10</b>	<b>0.10</b>	<b>0.10</b>	<b>0.11</b>	<b>0.15</b>	<b>0.14</b>	<b>0.18</b>
Aviation	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Marine	0.11	0.11	0.09	0.09	0.09	0.10	0.14	0.14	0.17
<b>Multilateral Operations</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
<b>CO<sub>2</sub> Emissions from Biomass</b>									

TABLE 1 EMISSIONS TRENDS (CH<sub>4</sub>)

(Sheet 2 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1998	1999	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	(Gg)								%
<b>Total CH<sub>4</sub> emissions</b>	<b>5512.95</b>	<b>5500.67</b>	<b>5610.43</b>	<b>5775.92</b>	<b>5678.21</b>	<b>5420.17</b>	<b>5407.02</b>	<b>5377.25</b>	<b>-3.86</b>
<b>1. Energy</b>	1359.46	1246.68	1258.70	1307.88	1297.48	1249.47	1272.10	1307.19	7.86
A. Fuel Combustion (Sectoral Approach)	111.39	107.78	106.05	102.55	92.29	94.75	91.70	85.67	-24.29
1. Energy Industries	5.12	5.50	8.96	8.89	9.96	10.26	9.71	9.60	356.11
2. Manufacturing Industries and Construction	2.28	2.27	2.24	2.11	2.10	2.14	2.24	2.30	14.92
3. Transport	29.43	30.13	29.33	28.18	28.86	28.59	29.54	27.94	10.39
4. Other Sectors	74.51	69.84	65.47	63.33	51.33	53.72	50.16	45.78	-45.30
5. Other	0.05	0.05	0.05	0.04	0.04	0.04	0.05	0.04	8.45
B. Fugitive Emissions from Fuels	1248.07	1138.90	1152.65	1205.32	1205.19	1154.71	1180.40	1221.52	11.18
1. Solid Fuels	937.90	881.28	873.99	920.41	937.13	949.50	979.80	1029.11	34.11
2. Oil and Natural Gas	310.17	257.62	278.66	284.91	268.06	205.21	200.60	192.41	-41.94
<b>2. Industrial Processes</b>	<b>3.96</b>	<b>3.70</b>	<b>3.33</b>	<b>3.10</b>	<b>3.08</b>	<b>3.30</b>	<b>3.30</b>	<b>3.12</b>	<b>-4.64</b>
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	0.35	0.34	0.44	0.35	0.36	0.44	0.41	0.41	-5.52
C. Metal Production	3.60	3.36	2.90	2.75	2.71	2.87	2.88	2.70	-4.50
D. Other Production									
E. Production of Halocarbons and SF <sub>6</sub>									
F. Consumption of Halocarbons and SF <sub>6</sub>									
G. Other	IE	IE	IE	IE	IE	IE	IE	IE	NA
<b>3. Solvent and Other Product Use</b>									
<b>4. Agriculture</b>	<b>3281.84</b>	<b>3369.55</b>	<b>3461.11</b>	<b>3565.80</b>	<b>3469.40</b>	<b>3297.12</b>	<b>3256.90</b>	<b>3197.87</b>	<b>-5.08</b>
A. Enteric Fermentation	2833.44	2864.75	2877.88	2894.55	2827.19	2794.85	2773.72	2794.21	-8.14
B. Manure Management	90.22	92.69	94.18	96.60	97.43	95.68	92.95	92.35	25.91
C. Rice Cultivation	34.50	31.94	35.30	35.13	28.06	19.01	11.28	10.29	-55.96
D. Agricultural Soils	NE	NE	NE	NE	NE	NE	NE	NE	NA
E. Prescribed Burning of Savannas	310.65	367.19	440.52	525.78	505.15	375.68	367.98	289.36	30.89
F. Field Burning of Agricultural Residues	13.01	12.98	13.24	13.73	11.56	11.90	10.95	11.66	27.01
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>5. Land Use, Land-Use Change and Forestry</b>	<b>93.24</b>	<b>92.43</b>	<b>96.71</b>	<b>95.90</b>	<b>92.60</b>	<b>75.12</b>	<b>86.40</b>	<b>86.40</b>	<b>-46.39</b>
A. Afforestation and reforestation	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Land use change (deforestation)	93.24	92.43	96.71	95.90	92.60	75.12	86.40	86.40	-46.39
<b>6. Waste</b>	<b>774.46</b>	<b>788.30</b>	<b>790.57</b>	<b>803.25</b>	<b>815.66</b>	<b>795.16</b>	<b>788.33</b>	<b>782.68</b>	<b>-7.70</b>
A. Solid Waste Disposal on Land	684.43	700.08	703.42	712.33	726.93	709.24	703.58	702.00	-3.33
B. Waste-water Handling	90.03	88.22	87.16	90.91	88.73	85.92	84.75	80.67	-33.77
C. Waste Incineration	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>7. Other (as specified in Summary I.A)</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Memo Items:</b>									
<b>International Bunkers</b>	0.12	0.13	0.15	0.14	0.16	0.16	0.15	0.18	55.87
Aviation	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	262.06
Marine	0.11	0.12	0.13	0.13	0.14	0.14	0.14	0.15	39.80
<b>Multilateral Operations</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>CO<sub>2</sub> Emissions from Biomass</b>									

**TABLE 1 EMISSIONS TRENDS (N<sub>2</sub>O)**  
(Sheet 3 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997
	(Gg)								
<b>Total N<sub>2</sub>O emissions</b>	<b>63.80</b>	<b>63.80</b>	<b>62.97</b>	<b>62.40</b>	<b>63.56</b>	<b>65.77</b>	<b>68.64</b>	<b>70.19</b>	<b>72.11</b>
<b>1. Energy</b>	<b>4.46</b>	<b>4.46</b>	<b>4.63</b>	<b>4.75</b>	<b>4.96</b>	<b>5.17</b>	<b>5.46</b>	<b>5.96</b>	<b>5.97</b>
A. Fuel Combustion (Sectoral Approach)	4.35	4.35	4.52	4.64	4.85	5.07	5.36	5.86	5.90
1. Energy Industries	1.43	1.43	1.49	1.52	1.52	1.53	1.58	1.64	1.73
2. Manufacturing Industries and Construction	0.64	0.64	0.63	0.56	0.62	0.67	0.70	0.74	0.77
3. Transport	2.01	2.01	2.14	2.28	2.44	2.60	2.80	3.19	3.11
4. Other Sectors	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26
5. Other	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
B. Fugitive Emissions from Fuels	0.12	0.12	0.11	0.11	0.11	0.10	0.10	0.11	0.08
1. Solid Fuels	NE	NE	NE	NE	NE	NE	NE	NE	NE
2. Oil and Natural Gas	0.12	0.12	0.11	0.11	0.11	0.10	0.10	0.11	0.08
<b>2. Industrial Processes</b>	<b>0.07</b>	<b>0.07</b>	<b>0.07</b>	<b>0.07</b>	<b>0.07</b>	<b>0.08</b>	<b>0.08</b>	<b>0.08</b>	<b>0.08</b>
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	IE	IE	IE	IE	IE	IE	IE	IE	IE
C. Metal Production	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08
D. Other Production									
E. Production of Halocarbons and SF <sub>6</sub>									
F. Consumption of Halocarbons and SF <sub>6</sub>									
G. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE
<b>3. Solvent and Other Product Use</b>									
<b>4. Agriculture</b>	<b>54.74</b>	<b>54.74</b>	<b>54.06</b>	<b>53.77</b>	<b>54.91</b>	<b>56.86</b>	<b>59.73</b>	<b>60.78</b>	<b>62.68</b>
A. Enteric Fermentation									
B. Manure Management	1.69	1.69	1.88	2.15	2.45	2.71	3.01	2.92	3.25
C. Rice Cultivation									
D. Agricultural Soils	46.38	46.38	45.67	45.47	45.79	45.71	47.32	48.30	49.87
E. Prescribed Burning of Savannas	6.34	6.34	6.20	5.83	6.33	8.10	9.04	9.17	9.14
F. Field Burning of Agricultural Residues	0.32	0.32	0.31	0.32	0.35	0.35	0.36	0.38	0.42
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>5. Land Use, Land-Use Change and Forestry</b>	<b>2.98</b>	<b>2.98</b>	<b>2.65</b>	<b>2.22</b>	<b>2.01</b>	<b>2.04</b>	<b>1.73</b>	<b>1.71</b>	<b>1.70</b>
A. Afforestation and reforestation	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Land use change (deforestation)	2.98	2.98	2.65	2.22	2.01	2.04	1.73	1.71	1.70
<b>6. Waste</b>	<b>1.54</b>	<b>1.54</b>	<b>1.57</b>	<b>1.59</b>	<b>1.60</b>	<b>1.62</b>	<b>1.64</b>	<b>1.66</b>	<b>1.68</b>
A. Solid Waste Disposal on Land									
B. Waste-water Handling	1.54	1.54	1.57	1.59	1.60	1.62	1.64	1.66	1.68
C. Waste Incineration	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>7. Other (as specified in Summary 1.A)</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Memo Items:</b>									
<b>International Bunkers</b>	<b>0.19</b>	<b>0.19</b>	<b>0.19</b>	<b>0.20</b>	<b>0.21</b>	<b>0.22</b>	<b>0.25</b>	<b>0.27</b>	<b>0.27</b>
Aviation	0.13	0.13	0.14	0.15	0.16	0.16	0.18	0.19	0.20
Marine	0.06	0.06	0.05	0.05	0.05	0.06	0.07	0.08	0.07
<b>Multilateral Operations</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
<b>CO<sub>2</sub> Emissions from Biomass</b>									

TABLE 1 EMISSIONS TRENDS (N<sub>2</sub>O)  
(Sheet 3 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1998	1999	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	(Gg)								%
<b>Total N<sub>2</sub>O emissions</b>	<b>74.55</b>	<b>78.38</b>	<b>84.16</b>	<b>87.70</b>	<b>86.79</b>	<b>80.84</b>	<b>80.70</b>	<b>78.37</b>	<b>22.84</b>
<b>1. Energy</b>	<b>6.32</b>	<b>6.50</b>	<b>6.90</b>	<b>7.09</b>	<b>7.34</b>	<b>7.68</b>	<b>8.18</b>	<b>7.99</b>	<b>79.02</b>
A. Fuel Combustion (Sectoral Approach)	6.20	6.42	6.81	6.99	7.25	7.60	8.11	7.92	82.17
1. Energy Industries	1.88	1.93	1.97	2.03	2.02	2.08	2.13	2.14	49.74
2. Manufacturing Industries and Construction	0.78	0.78	0.76	0.72	0.70	0.72	0.75	0.76	18.40
3. Transport	3.27	3.45	3.81	3.97	4.29	4.54	4.98	4.77	137.14
4. Other Sectors	0.25	0.25	0.24	0.25	0.22	0.24	0.23	0.22	-10.04
5. Other	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	49.43
B. Fugitive Emissions from Fuels	0.11	0.08	0.09	0.10	0.09	0.08	0.08	0.07	-38.37
1. Solid Fuels	NE	NE	NE	NE	NE	NE	NE	NE	NA
2. Oil and Natural Gas	0.11	0.08	0.09	0.10	0.09	0.08	0.08	0.07	-38.37
<b>2. Industrial Processes</b>	<b>0.08</b>	<b>0.08</b>	<b>0.07</b>	<b>0.06</b>	<b>0.06</b>	<b>0.06</b>	<b>0.06</b>	<b>0.06</b>	<b>-20.64</b>
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	IE	IE	IE	IE	IE	IE	IE	IE	NA
C. Metal Production	0.08	0.08	0.07	0.06	0.06	0.06	0.06	0.06	-20.64
D. Other Production									
E. Production of Halocarbons and SF <sub>6</sub>									
F. Consumption of Halocarbons and SF <sub>6</sub>									
G. Other	IE	IE	IE	IE	IE	IE	IE	IE	NA
<b>3. Solvent and Other Product Use</b>									
<b>4. Agriculture</b>	<b>64.73</b>	<b>68.37</b>	<b>73.65</b>	<b>77.02</b>	<b>75.89</b>	<b>69.91</b>	<b>69.03</b>	<b>66.88</b>	<b>22.19</b>
A. Enteric Fermentation									
B. Manure Management	3.52	4.02	4.26	4.27	4.26	4.32	4.62	4.82	184.76
C. Rice Cultivation									
D. Agricultural Soils	51.89	53.40	56.23	57.05	56.55	54.33	53.46	53.41	15.16
E. Prescribed Burning of Savannas	8.89	10.54	12.75	15.26	14.70	10.88	10.61	8.30	30.92
F. Field Burning of Agricultural Residues	0.43	0.42	0.42	0.44	0.38	0.38	0.33	0.35	8.09
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>5. Land Use, Land-Use Change and Forestry</b>	<b>1.73</b>	<b>1.71</b>	<b>1.79</b>	<b>1.78</b>	<b>1.71</b>	<b>1.39</b>	<b>1.60</b>	<b>1.60</b>	<b>-46.39</b>
A. Afforestation and reforestation	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Land use change (deforestation)	1.73	1.71	1.79	1.78	1.71	1.39	1.60	1.60	-46.39
<b>6. Waste</b>	<b>1.70</b>	<b>1.72</b>	<b>1.74</b>	<b>1.76</b>	<b>1.78</b>	<b>1.80</b>	<b>1.82</b>	<b>1.85</b>	<b>19.43</b>
A. Solid Waste Disposal on Land									
B. Waste-water Handling	1.70	1.72	1.74	1.76	1.78	1.80	1.82	1.85	19.43
C. Waste Incineration	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>7. Other (as specified in Summary 1.A)</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Memo Items:</b>									
<b>International Bunkers</b>	<b>0.28</b>	<b>0.29</b>	<b>0.30</b>	<b>0.31</b>	<b>0.28</b>	<b>0.26</b>	<b>0.26</b>	<b>0.29</b>	<b>52.25</b>
Aviation	0.22	0.22	0.22	0.24	0.20	0.18	0.18	0.21	55.24
Marine	0.06	0.07	0.08	0.07	0.08	0.08	0.08	0.08	45.32
<b>Multilateral Operations</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
<b>CO<sub>2</sub> Emissions from Biomass</b>									

**TABLE 1 EMISSION TRENDS ( HFCs, PFCs and SF<sub>6</sub>)**  
(Sheet 4 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997
	(Gg)								
<b>Emissions of HFCs - (Gg CO<sub>2</sub> equivalent)</b>	<b>1126.27</b>	<b>1126.27</b>	<b>1126.27</b>	<b>1053.94</b>	<b>1446.59</b>	<b>814.36</b>	<b>1420.08</b>	<b>949.89</b>	<b>1225.69</b>
HFC-23	1126.27	1126.27	1126.27	1053.94	1446.59	811.70	718.85	NO	NO
HFC-32	NO	NO	NO	NO	NO	IE	IE	IE	IE
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-43-10mee	NO	NO	NO	NO	NO	IE	IE	IE	IE
HFC-125	NO	NO	NO	NO	NO	0.37	12.22	36.39	66.40
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-134a	NO	NO	NO	NO	NO	1.78	662.83	827.31	1003.46
HFC-152a	NO	NO	NO	NO	NO	IE	IE	IE	IE
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143a	NO	NO	NO	NO	NO	0.51	17.00	50.63	92.40
HFC-227ea	NO	NO	NO	NO	NO	IE	IE	IE	IE
HFC-236fa	NO	NO	NO	NO	NO	IE	IE	IE	IE
HFC-245ca	NO	NO	NO	NO	NO	IE	IE	IE	IE
Unspecified mix of listed HFCs - (Gg CO <sub>2</sub> equivalent)	NO	NO	NO	NO	NO	NO	9.19	35.56	63.44
<b>Emissions of PFCs - (Gg CO<sub>2</sub> equivalent)</b>	<b>3938.28</b>	<b>3938.28</b>	<b>3941.47</b>	<b>3935.10</b>	<b>2833.50</b>	<b>1848.06</b>	<b>1308.71</b>	<b>1206.10</b>	<b>1060.69</b>
CF <sub>4</sub>	3326.77	3326.77	3329.46	3324.08	2393.53	1561.10	1105.50	1018.82	895.99
C <sub>2</sub> F <sub>6</sub>	611.51	611.51	612.01	611.02	439.97	286.96	203.21	187.28	164.70
C <sub>3</sub> F <sub>8</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO
C <sub>4</sub> F <sub>10</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO
c-C <sub>4</sub> F <sub>8</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO
C <sub>5</sub> F <sub>12</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO
C <sub>6</sub> F <sub>14</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of listed PFCs - (Gg CO <sub>2</sub> equivalent)	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Emissions of SF<sub>6</sub> - (Gg CO<sub>2</sub> equivalent)</b>	<b>521.02</b>	<b>521.02</b>	<b>521.02</b>	<b>521.02</b>	<b>521.02</b>	<b>521.02</b>	<b>521.02</b>	<b>529.62</b>	<b>527.00</b>
SF <sub>6</sub>	521.02	521.02	521.02	521.02	521.02	521.02	521.02	529.62	527.00

**TABLE 1 EMISSION TRENDS ( HFCs, PFCs and SF<sub>6</sub>)**  
(Sheet 4 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1998	1999	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	(Gg)								%
<b>Emissions of HFCs - (Gg CO<sub>2</sub> equivalent)</b>	<b>1521.16</b>	<b>1845.44</b>	<b>2240.86</b>	<b>2659.84</b>	<b>3083.35</b>	<b>3532.34</b>	<b>3884.42</b>	<b>4251.74</b>	<b>277.51</b>
HFC-23	NO	NO	NO	NO	NO	NO	NO	NO	NA
HFC-32	IE	IE	IE	IE	IE	IE	IE	IE	NA
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NA
HFC-43-10mee	IE	IE	IE	IE	IE	IE	IE	IE	NA
HFC-125	102.03	143.71	214.44	292.14	376.37	471.73	552.82	645.53	NA
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NA
HFC-134a	1185.28	1380.91	1577.62	1784.30	1990.71	2194.74	2343.79	2480.28	NA
HFC-152a	IE	IE	IE	IE	IE	IE	IE	IE	NA
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NA
HFC-143a	141.98	199.96	298.39	406.51	523.71	656.41	769.23	898.23	NA
HFC-227ea	IE	IE	IE	IE	IE	IE	IE	IE	NA
HFC-236fa	IE	IE	IE	IE	IE	IE	IE	IE	NA
HFC-245ca	IE	IE	IE	IE	IE	IE	IE	IE	NA
Unspecified mix of listed HFCs - (Gg CO <sub>2</sub> equivalent)	91.87	120.86	150.41	176.88	192.56	209.46	218.58	227.69	NA
									NA
<b>Emissions of PFCs - (Gg CO<sub>2</sub> equivalent)</b>	<b>1535.90</b>	<b>987.83</b>	<b>1109.74</b>	<b>1553.62</b>	<b>1507.17</b>	<b>1467.80</b>	<b>1485.91</b>	<b>1566.73</b>	<b>-60.22</b>
CF <sub>4</sub>	1297.41	834.44	937.43	1312.39	1273.14	1239.89	1255.19	1323.46	-60.22
C <sub>2</sub> F <sub>6</sub>	238.49	153.38	172.31	241.24	234.02	227.91	230.72	243.27	-60.22
C <sub>3</sub> F <sub>8</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NA
C <sub>4</sub> F <sub>10</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NA
c-C <sub>4</sub> F <sub>8</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NA
C <sub>5</sub> F <sub>12</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NA
C <sub>6</sub> F <sub>14</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NA
Unspecified mix of listed PFCs - (Gg CO <sub>2</sub> equivalent)	NA	NA	NA	NA	NA	NA	NA	NA	NA
									NA
<b>Emissions of SF<sub>6</sub> - (Gg CO<sub>2</sub> equivalent)</b>	<b>524.68</b>	<b>524.61</b>	<b>523.41</b>	<b>521.02</b>	<b>521.02</b>	<b>521.02</b>	<b>521.02</b>	<b>521.02</b>	<b>0.00</b>
SF <sub>6</sub>	524.68	524.61	523.41	521.02	521.02	521.02	521.02	521.02	0.00



**TABLE 1 EMISSION TRENDS (SUMMARY)**  
(Sheet 5 of 6)

GREENHOUSE GAS EMISSIONS	Base year	1990	1991	1992	1993	1994	1995	1996	1997
	CO2 equivalent (Gg)								
CO <sub>2</sub> emissions including net CO <sub>2</sub> from LULUCF <sup>(1)</sup>	404306.00	404306.00	383265.91	372274.54	363734.46	367656.71	367167.95	372939.38	376785.43
CO <sub>2</sub> emissions excluding net CO <sub>2</sub> from LULUCF <sup>(1)</sup>	279763.73	279763.73	281467.72	286419.16	291150.96	296000.46	306856.39	314419.75	322280.80
CH <sub>4</sub>	117457.49	117457.49	116572.19	116264.18	115734.74	114436.06	115772.46	113347.91	116600.36
N <sub>2</sub> O	19777.51	19777.51	19521.77	19342.78	19702.43	20389.58	21278.29	21759.77	22352.66
HFCs	1126.27	1126.27	1126.27	1053.94	1446.59	814.36	1420.08	949.89	1225.69
PFCs	3938.28	3938.28	3941.47	3935.10	2833.50	1848.06	1308.71	1206.10	1060.69
SF <sub>6</sub>	521.02	521.02	521.02	521.02	521.02	521.02	521.02	529.62	527.00
<b>Total (including net CO<sub>2</sub> from LULUCF)</b>	<b>547126.57</b>	<b>547126.57</b>	<b>524948.63</b>	<b>513391.56</b>	<b>503972.74</b>	<b>505665.78</b>	<b>507468.51</b>	<b>510732.67</b>	<b>518551.83</b>
<b>Total (excluding net CO<sub>2</sub> from LULUCF)</b>	<b>422584.30</b>	<b>422584.30</b>	<b>423150.45</b>	<b>427536.17</b>	<b>431389.24</b>	<b>434009.54</b>	<b>447156.95</b>	<b>452213.04</b>	<b>464047.20</b>
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997
	CO2 equivalent (Gg)								
1. Energy	286969.05	286969.05	288681.34	294737.05	299339.74	301398.92	313428.33	319385.13	330129.15
2. Industrial Processes	25282.16	25282.16	24642.69	25237.46	25257.35	25613.91	25828.19	25742.99	25728.51
3. Solvent and Other Product Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Agriculture	87715.51	87715.51	87569.72	85980.68	85451.21	85925.29	87105.73	87343.00	88480.50
5. Land Use, Land-Use Change and Forestry	128852.03	128852.03	105622.31	89066.34	75488.55	74607.26	62812.99	60993.52	56956.77
6. Waste	18307.83	18307.83	18432.57	18370.04	18435.89	18120.40	18293.27	17268.03	17256.90
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (including LULUCF)</b>	<b>547126.57</b>	<b>547126.57</b>	<b>524948.63</b>	<b>513391.56</b>	<b>503972.74</b>	<b>505665.78</b>	<b>507468.51</b>	<b>510732.67</b>	<b>518551.83</b>

1. includes confidential emissions from Soda Ash Production and Use (2.A.4), Magnesia Production (2.A.7), Ammonia Production (2.B.1), Nitric Acid Production (2.B.2), Acetylene Use (2.B.5), Titanium Dioxide Production (2.B.5), and Nitrous Oxide Use (3.D)

**TABLE 1 EMISSION TRENDS (SUMMARY)**  
(Sheet 5 of 6)

GREENHOUSE GAS EMISSIONS	1998	1999	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	CO2 equivalent (Gg)								(%)
CO <sub>2</sub> emissions including net CO <sub>2</sub> from LULUCF <sup>(1)</sup>	400160.99	396807.15	403721.37	405613.81	415323.50	400700.77	414632.74	415517.51	2.77
CO <sub>2</sub> emissions excluding net CO <sub>2</sub> from LULUCF <sup>(1)</sup>	335850.79	344686.93	352415.00	358433.58	362468.54	372119.42	381445.69	384161.01	37.32
CH <sub>4</sub>	115772.02	115514.09	117819.00	121294.41	119242.51	113823.65	113547.50	112922.21	-3.86
N <sub>2</sub> O	23110.08	24299.12	26089.02	27188.08	26906.17	25058.94	25015.92	24295.29	22.84
HFCs	1521.16	1845.44	2240.86	2659.84	3083.35	3532.34	3884.42	4251.74	277.51
PFCs	1535.90	987.83	1109.74	1553.62	1507.17	1467.80	1485.91	1566.73	-60.22
SF <sub>6</sub>	524.68	524.61	523.41	521.02	521.02	521.02	521.02	521.02	0.00
<b>Total (including net CO<sub>2</sub> from LULUCF)</b>	<b>542624.81</b>	<b>539978.22</b>	<b>551503.41</b>	<b>558830.78</b>	<b>566583.73</b>	<b>545104.52</b>	<b>559087.52</b>	<b>559074.49</b>	<b>2.18</b>
<b>Total (excluding net CO<sub>2</sub> from LULUCF)</b>	<b>478314.62</b>	<b>487858.01</b>	<b>500197.03</b>	<b>511650.55</b>	<b>513728.76</b>	<b>516523.17</b>	<b>525900.47</b>	<b>527717.99</b>	<b>24.88</b>
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1998	1999	2000	2001	2002	2003	2004	2005	Change from 1990 to latest reported year
	CO2 equivalent (Gg)								(%)
1. Energy	342888.87	348980.70	357555.89	364587.50	368379.18	376703.18	386075.83	391019.43	36.26
2. Industrial Processes	27129.62	27334.47	27370.84	28299.71	28780.35	29615.22	30571.28	29462.70	16.54
3. Solvent and Other Product Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA
4. Agriculture	88984.89	91956.04	95516.22	98757.93	96383.97	90911.01	89794.10	87888.87	0.20
5. Land Use, Land-Use Change and Forestry	66803.29	54591.90	53892.35	49744.66	55331.16	30589.93	35497.43	33666.88	-73.87
6. Waste	16818.15	17115.12	17168.10	17440.98	17709.07	17285.18	17148.88	17036.60	-6.94
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (including LULUCF)</b>	<b>542624.81</b>	<b>539978.22</b>	<b>551503.41</b>	<b>558830.78</b>	<b>566583.73</b>	<b>545104.52</b>	<b>559087.52</b>	<b>559074.49</b>	<b>2.18</b>

1. includes confidential emissions from Soda Ash Production and Use (2.A.4), Magnesia Production (2.A.7), Ammonia Production (2.B.1), Nitric Acid Production (2.B.2), Acetylene Use (2.B.5), Titanium Dioxide Production (2.B.5), and Nitrous Oxide Use (3.D)

**TABLE 1 EMISSIONS TRENDS (CO<sub>2</sub>-e)**  
(Sheet 6 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997
					(Gg)				
<b>Total CO<sub>2</sub>-e emissions</b>	<b>547126.57</b>	<b>547126.57</b>	<b>524948.63</b>	<b>513391.56</b>	<b>503972.74</b>	<b>505665.78</b>	<b>507468.51</b>	<b>510732.67</b>	<b>518551.83</b>
<b>1. Energy</b>	<b>286969.05</b>	<b>286969.05</b>	<b>288681.34</b>	<b>294737.05</b>	<b>299339.74</b>	<b>301398.92</b>	<b>313428.33</b>	<b>319385.13</b>	<b>330129.15</b>
A. Fuel Combustion (Sectoral Approach)	257877.02	257877.02	260556.46	264771.91	268899.23	272046.04	282620.48	290218.47	298364.98
1. Energy Industries	143093.90	143093.90	146360.59	149712.01	151487.38	152420.94	158291.77	162979.87	169611.39
2. Manufacturing Industries and Construction	37103.58	37103.58	36624.14	36244.54	36835.31	37487.13	38722.24	38749.98	38722.40
3. Transport	61892.40	61892.40	61663.61	62441.68	63714.59	65316.56	68004.24	70408.82	71666.35
4. Other Sectors	14742.01	14742.01	14881.65	15297.75	15760.41	15666.62	16315.83	16678.07	16928.81
5. Other	1045.13	1045.13	1026.46	1075.93	1101.54	1154.80	1286.40	1401.73	1436.04
B. Fugitive Emissions from Fuels	29092.03	29092.03	28124.88	29965.13	30440.51	29352.88	30807.85	29166.67	31764.16
1. Solid Fuels	16114.44	16114.44	16091.10	17358.70	18705.22	17757.23	17859.68	17218.29	19739.87
2. Oil and Natural Gas	12977.59	12977.59	12033.79	12606.43	11735.29	11595.65	12948.17	11948.37	12024.29
<b>2. Industrial Processes</b>	<b>25282.16</b>	<b>25282.16</b>	<b>24642.69</b>	<b>25237.46</b>	<b>25257.35</b>	<b>25613.91</b>	<b>25828.19</b>	<b>25742.99</b>	<b>25728.51</b>
A. Mineral Products	5122.80	5122.80	4809.83	4605.89	4815.46	5566.78	5371.34	5437.02	5375.55
B. Chemical Industry	416.01	416.01	385.65	445.46	524.26	485.18	575.42	594.52	601.06
C. Metal Production	16210.87	16210.87	15940.84	16550.59	15308.94	15432.96	15174.62	15267.68	15056.68
D. Other Production	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF <sub>6</sub>	1126.27	1126.27	1126.27	1053.94	1446.59	811.70	718.85	NO	NO
F. Consumption of Halocarbons and SF <sub>6</sub>	521.02	521.02	521.02	521.02	523.68	523.68	1222.26	1470.91	1746.71
G. Other <sup>(1)</sup>	1885.19	1885.19	1859.08	2060.56	2641.09	2793.61	2765.71	2972.87	2948.51
<b>3. Solvent and Other Product Use</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>4. Agriculture</b>	<b>87715.51</b>	<b>87715.51</b>	<b>87569.72</b>	<b>85980.68</b>	<b>85451.21</b>	<b>85925.29</b>	<b>87105.73</b>	<b>87343.00</b>	<b>88480.50</b>
A. Enteric Fermentation	63880.86	63880.86	64018.49	62738.70	61354.98	59893.78	59423.26	59135.23	59568.17
B. Manure Management	2065.31	2065.31	2123.51	2239.73	2394.99	2531.66	2659.10	2647.68	2824.27
C. Rice Cultivation	490.50	490.50	523.78	540.22	602.42	606.24	648.74	704.74	723.17
D. Agricultural Soils	14378.73	14378.73	14158.55	14094.54	14193.70	14168.94	14669.28	14973.90	15459.75
E. Prescribed Burning of Savannas	6608.26	6608.26	6459.65	6074.90	6590.07	8414.06	9381.82	9533.97	9515.60
F. Field Burning of Agricultural Residues	291.85	291.85	285.74	292.60	315.04	310.60	323.54	347.46	389.54
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>5. Land Use, Land-Use Change and Forestry</b>	<b>128852.03</b>	<b>128852.03</b>	<b>105622.31</b>	<b>89066.34</b>	<b>75488.55</b>	<b>74607.26</b>	<b>62812.99</b>	<b>60993.52</b>	<b>56956.77</b>
A. Afforestation and reforestation <sup>(2)</sup>	0.00	0.00	-485.20	-994.33	-1501.45	-1876.27	-2459.23	-3157.15	-4486.75
B. Land use change (deforestation)	128852.03	128852.03	106107.51	90060.67	76990.00	76483.53	65272.22	64150.67	61443.52
<b>6. Waste</b>	<b>18307.83</b>	<b>18307.83</b>	<b>18432.57</b>	<b>18370.04</b>	<b>18435.89</b>	<b>18120.40</b>	<b>18293.27</b>	<b>17268.03</b>	<b>17256.90</b>
A. Solid Waste Disposal on Land	15249.65	15249.65	15400.96	15390.13	15520.36	15253.88	15518.26	14645.80	14709.05
B. Waste-water Handling	3036.91	3036.91	3010.20	2958.35	2893.84	2844.68	2747.48	2598.03	2519.90
C. Waste Incineration	21.27	21.27	21.41	21.56	21.70	21.84	27.53	24.20	27.95
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>7. Other (as specified in Summary I.A)</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total CO<sub>2</sub> emissions including net CO<sub>2</sub> from LUCF</b>	<b>547126.57</b>	<b>547126.57</b>	<b>524948.63</b>	<b>513391.56</b>	<b>503972.74</b>	<b>505665.78</b>	<b>507468.51</b>	<b>510732.67</b>	<b>518551.83</b>
<b>Total CO<sub>2</sub> emissions excluding net CO<sub>2</sub> from LUCF</b>	<b>418274.54</b>	<b>418274.54</b>	<b>419326.33</b>	<b>424325.22</b>	<b>428484.19</b>	<b>431058.53</b>	<b>444655.52</b>	<b>449739.15</b>	<b>461595.06</b>
<b>Memo Items:</b>									
<b>International Bunkers</b>	<b>6456.88</b>	<b>6456.88</b>	<b>6432.55</b>	<b>6641.84</b>	<b>7039.04</b>	<b>7427.39</b>	<b>8608.94</b>	<b>9108.59</b>	<b>9104.60</b>
Aviation	4380.02	4380.02	4556.00	4834.23	5241.14	5393.46	5904.71	6362.39	6591.93
Marine	2076.85	2076.85	1876.55	1807.61	1797.91	2033.92	2704.24	2746.20	2512.68
<b>Multilateral Operations</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
<b>CO<sub>2</sub> Emissions from Biomass</b>	<b>14760.10</b>	<b>14760.10</b>	<b>14652.58</b>	<b>13414.64</b>	<b>15002.18</b>	<b>15923.34</b>	<b>16676.92</b>	<b>17656.86</b>	<b>18486.20</b>

1. Speciated emissions from Ammonia Production, Nitric Acid Production, Magnesia Production, Soda Ash Production and Use, Acetylene Use, Titanium Dioxide Production, and the Use of N<sub>2</sub>O in Aerosols and Anaesthesia are confidential and reported as CO<sub>2</sub>-e

2. Greenhouse sinks credits are accounted for in 2008-12 only. The values provided are only an indicative estimate of sequestration in reforestation activities

**TABLE 1 EMISSIONS TRENDS (CO<sub>2</sub>-e)**  
(Sheet 6 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1998	1999	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	(Gg)								%
<b>Total CO<sub>2</sub>-e emissions</b>	<b>542624.81</b>	<b>539978.22</b>	<b>551503.41</b>	<b>558830.78</b>	<b>566583.73</b>	<b>545104.52</b>	<b>559087.52</b>	<b>559074.49</b>	<b>2.18</b>
<b>1. Energy</b>									
A. Fuel Combustion (Sectoral Approach)	342888.87	348980.70	357555.89	364587.50	368379.18	376703.18	386075.83	391019.43	36.26
1. Energy Industries	311123.87	319062.61	326592.82	332073.69	336339.85	346433.54	355533.17	359791.67	39.52
2. Manufacturing Industries and Construction	182424.26	188665.48	192870.34	199720.06	200733.77	207610.59	212302.47	214327.94	49.78
3. Transport	38570.25	39415.93	40233.17	39419.64	40882.67	41637.62	42914.12	43721.26	17.84
4. Other Sectors	71725.82	72536.93	74559.73	73185.71	74875.07	75441.59	79453.71	80389.42	29.89
5. Other	17075.10	17204.89	17648.71	18451.09	18584.46	20480.02	19538.43	20146.66	36.66
B. Fugitive Emissions from Fuels	1328.43	1239.38	1280.88	1297.19	1263.88	1263.71	1324.44	1206.39	15.43
1. Solid Fuels	31765.00	29918.09	30963.07	32513.81	32039.33	30269.64	30542.66	31227.77	7.34
2. Oil and Natural Gas	19695.95	18506.87	18353.79	19328.61	19679.78	19939.58	20575.74	21611.25	34.11
3. Other	12069.05	11411.22	12609.28	13185.20	12359.55	10330.07	9966.92	9616.52	-25.90
<b>2. Industrial Processes</b>	<b>27129.62</b>	<b>27334.47</b>	<b>27370.84</b>	<b>28299.71</b>	<b>28780.35</b>	<b>29615.22</b>	<b>30571.28</b>	<b>29462.70</b>	<b>16.54</b>
A. Mineral Products	5808.73	5706.04	5526.15	5471.73	5490.06	5640.73	5593.26	5640.58	10.11
B. Chemical Industry	676.44	688.11	800.35	928.40	846.63	864.40	856.62	937.70	125.40
C. Metal Production	15419.75	15505.25	14973.79	14576.19	14317.07	14054.33	14653.64	12790.96	-21.10
D. Other Production	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF <sub>6</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NA
F. Consumption of Halocarbons and SF <sub>6</sub>	2042.18	2366.46	2761.88	3180.86	3604.37	4053.36	4405.44	4772.76	816.04
G. Other	3182.52	3068.61	3308.67	4142.54	4522.23	5002.40	5062.33	5320.71	182.24
<b>3. Solvent and Other Product Use</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>NA</b>
<b>4. Agriculture</b>	<b>88984.89</b>	<b>91956.04</b>	<b>95516.22</b>	<b>98757.93</b>	<b>96383.97</b>	<b>90911.01</b>	<b>89794.10</b>	<b>87888.87</b>	<b>0.20</b>
A. Enteric Fermentation	59502.34	60159.65	60435.41	60785.59	59371.08	58691.88	58248.22	58678.42	-8.14
B. Manure Management	2985.85	3192.73	3297.81	3352.62	3367.79	3347.90	3384.51	3434.36	66.29
C. Rice Cultivation	724.59	670.74	741.36	737.83	589.29	399.28	236.87	216.01	-55.96
D. Agricultural Soils	16086.16	16552.72	17430.03	17684.04	17530.80	16843.33	16572.86	16557.96	15.16
E. Prescribed Burning of Savannas	9280.82	10977.10	13201.86	15772.38	15165.12	11261.87	11017.79	8650.18	30.90
F. Field Burning of Agricultural Residues	405.13	403.11	409.74	425.46	359.90	366.75	333.85	351.94	20.59
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>5. Land Use, Land-Use Change and Forestry</b>	<b>66803.29</b>	<b>54591.90</b>	<b>53892.35</b>	<b>49744.66</b>	<b>55331.16</b>	<b>30589.93</b>	<b>35497.43</b>	<b>33666.88</b>	<b>-73.87</b>
A. Afforestation and reforestation	-5984.36	-7613.28	-10896.94	-11915.30	-13896.91	-15844.85	-17778.26	-19608.81	NA
B. Land use change (deforestation)	72787.65	62205.18	64789.29	61659.95	69228.07	46434.78	53275.69	53275.69	-58.65
									NA
									NA
									NA
<b>6. Waste</b>	<b>16818.15</b>	<b>17115.12</b>	<b>17168.10</b>	<b>17440.98</b>	<b>17709.07</b>	<b>17285.18</b>	<b>17148.88</b>	<b>17036.60</b>	<b>-6.94</b>
A. Solid Waste Disposal on Land	14373.08	14701.64	14771.80	14958.99	15265.48	14894.14	14775.09	14742.03	-3.33
B. Waste-water Handling	2416.79	2384.71	2368.64	2454.19	2415.63	2362.92	2345.51	2266.14	-25.38
C. Waste Incineration	28.28	28.77	27.66	27.80	27.96	28.12	28.28	28.43	33.66
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>7. Other (as specified in Summary 1.A)</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total CO<sub>2</sub> emissions including net CO<sub>2</sub> from LUCF</b>	<b>542624.81</b>	<b>539978.22</b>	<b>551503.41</b>	<b>558830.78</b>	<b>566583.73</b>	<b>545104.52</b>	<b>559087.52</b>	<b>559074.49</b>	<b>2.18</b>
<b>Total CO<sub>2</sub> emissions excluding net CO<sub>2</sub> from LUCF</b>	<b>475821.52</b>	<b>485386.32</b>	<b>497611.05</b>	<b>509086.12</b>	<b>511252.57</b>	<b>514514.59</b>	<b>523590.09</b>	<b>525407.61</b>	<b>25.61</b>
<b>Memo Items:</b>									<b>NA</b>
<b>International Bunkers</b>	<b>9529.63</b>	<b>9800.98</b>	<b>10186.63</b>	<b>10483.44</b>	<b>9614.71</b>	<b>8765.95</b>	<b>8851.89</b>	<b>9856.02</b>	<b>52.64</b>
Aviation	7290.97	7326.44	7389.74	7856.42	6747.72	5971.09	6034.08	6832.67	56.00
Marine	2238.66	2474.53	2796.89	2627.01	2866.99	2794.86	2817.81	3023.36	45.57
<b>Multilateral Operations</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
<b>CO<sub>2</sub> Emissions from Biomass</b>	<b>18773.67</b>	<b>18527.73</b>	<b>18747.84</b>	<b>17968.81</b>	<b>16120.37</b>	<b>17236.14</b>	<b>17218.26</b>	<b>16568.50</b>	<b>12.25</b>

1. Speciated emissions from Ammonia Production, Nitric Acid Production, Magnesia Production, Soda Ash Production and Use, Acetylene Use, Titanium Dioxide Production, and the Use of N<sub>2</sub>O in Aerosols and Anaesthesia are confidential and reported as CO<sub>2</sub>-e

2. Greenhouse sinks credits are accounted for in 2008-12 only. The values provided are only an indicative estimate of sequestration in reforestation activities