



Central Statistics Office
An Phríomh-Oifig Staidrimh

Greenhouse Gas and Acid Rain Precursor Accounts for Ireland

1998-2006

November 2008

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Foreword

Background

The national accounts provide a comprehensive framework within which economic data can be presented in a coherent, consistent manner. They present information on the performance of the economy in a condensed manner, using internationally agreed standards.

However, such accounts can be incomplete depending on the focus and scope of particular analyses. In particular, the effects or the potential effects of pollution are not considered. Hence these satellite accounts are generated to organise information on the environment to supplement the broad orientation of the national accounts.

The Irish national accounts are basically compiled in accordance with the European System of Accounts 1995 (ESA 95) which is used in all member states of the European Community.

Greenhouse Gas and Acid Rain Satellite Accounts

The objective of the present accounts is to outline the potential environmental impact of economic and social activities and to list in quantifiable terms the amount of potential air pollutants produced by industry and households, which may in turn be compared to the employment and the value of output produced by these sectors. Due to the difficulties in dealing with aspects of environmental accounts in monetary terms, physical data is used instead which can be linked to the main accounts to describe the effects of pollution.

This publication represents the tenth set of environmental satellite accounts for Ireland. They set out a longitudinal series of air emissions in respect of the years 1998-2006. The work for years prior to 2001 was funded by Eurostat (the Statistical Office of the European Communities).

The CSO publishes these results as a potentially useful adjunct to the National Income & Expenditure (NIE) annual report.

The contributions of the Environmental Protection Agency, Sustainable Energy Ireland and An Bord Gáis in compiling this report is gratefully acknowledged.

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Chapter 1 Introduction

These satellite accounts breakdown, by economic sector, emissions of greenhouse gases and acid rain precursors into the environment, two phenomena that can impinge on our future well-being. **The allocations are based on the sector of the end-user as distinct from the sector of gas generation/production.** The accounts are not estimates of pollution levels. Emissions relate to the flow of pollutants into the environment whereas the level of pollution depends on the state of the receiving medium and its capacity to absorb and assimilate emissions without damage occurring now or in the future.

Under the Kyoto protocol to the United Nations Framework Convention on Climate Change (UNFCCC), EU Member States agreed to reduce greenhouse gas emissions in the EU as a whole to 8 per cent below 1990 levels in the period 2008-2012. Ireland's burden-sharing contribution is a target of 13 per cent increase above 1990 levels.

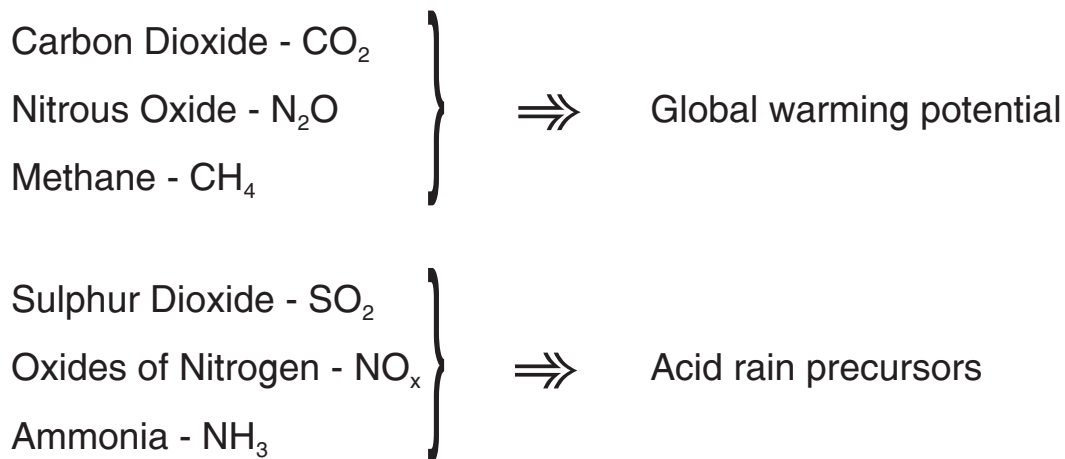
Ireland is also committed to reducing the emissions of four acid rain precursor air pollutants by 2010 under the 1999 Gothenburg Protocol. These pollutants contribute to regional acidification, eutrophication and local air pollution. The EU has put in place a Directive setting National Emissions Ceilings (NECs) for each Member State.

While official estimates of Irish air emissions are compiled and published by the Environmental Protection Agency (EPA)¹, the aim of this publication is to further attribute air emissions to economic sub-sectors rather than the physical processes that generate the emissions. When analysing these air emissions accounts it should be borne in mind that the figures are estimates and recalculations are periodically done as improved data and models become available, particularly in relation to the core work undertaken by the EPA and Sustainable Energy Ireland (SEI).

This year, significant changes have been incorporated into the underlying methodology for the calculation of greenhouse gas emissions from the Industry sector (see Chapter 3 for detailed explanation). These methodological changes resulted in greater concordance between the CSO calculated gas emissions

total and the EPA published total emissions (i.e. between 99% and 102% agreement for the years covered by the report). The data in the CSO tables has been adjusted to agree with EPA published totals, as in line with the approach taken in previous publications.

The six gases examined in these environmental accounts are classified into two separate themes based on their potential effects on the environment:



The data provided in this report incorporates revisions to the estimates previously published in respect of the years 1998-2005.

Technical Notes

- 1 Forestry sequestration: For the EPA methodology see the National Inventory Report 2008, page 94 or download from: <http://coe.epa.ie/ghg/nirdownloads.jsp>
- 2 Air Transport Greenhouse gases: Only gases resulting from domestic flights LTO's (landings and take-offs) and cruising from one Irish airport to another are accounted for under IPCC guidelines. No emissions from international flights are taken into account. See page 45 of National Inventory Report 2008, section entitled 'Memo Items' (or download from: <http://coe.epa.ie/ghg/nirdownloads.jsp>)
- 3 Air Transport Acid rain gases: (SO₂, NO_x and NH₃). These are treated differently than Greenhouse gases. The emissions from both domestic and international LTO's are accounted for, but nothing from cruising is taken into account, whether internally or internationally.

¹ http://coe.epa.ie/ghg/nirs/NIR_2008_IE.pdf
<http://www.epa.ie/OurEnvironment/ClimateChange/GreenhouseGasEmissions>

Chapter 2 Environmental Themes

Global warming potential

Carbon dioxide (CO₂) emissions are the result of burning fossil fuels such as coal, turf and petroleum. Carbon dioxide is also sequestered (absorbed) by vegetation growth, the most important in this context being by trees. **Nitrous oxide** (N₂O) emissions arise from some industrial processes and from nitrogen fertilisers. The digestive systems of ruminant animals and waste treatment systems lead to **methane** (CH₄) emissions.

There are other greenhouse gases (HFC, PFC and SF₆) which are not considered in this exercise - the emissions from these gases are estimated to comprise 0.7 per cent of the total greenhouse gas emissions for Ireland in 2006 (see details in Table 4.3, page 62 of National Inventory Report 2008 – EPA web-link <http://coe.epa.ie/ghg/nirdownloads.jsp>).

The relative contribution of each gas to the greenhouse effect can be expressed in terms of global warming potential. This is measured in tonnes of CO₂ equivalents. The relevant conversions used are as follows:

Emitted gas	Global warming potential over 100 years (CO ₂ equivalents per tonne of gas emitted)
Carbon dioxide (CO ₂)	1
Methane (CH ₄)	21
Nitrous oxide (N ₂ O)	310

It should be noted that these measures of global warming potential are those given by the Inter Governmental Panel on Climate Change (IPCC) and are used by the EPA. However, they may be subject to revision at some future date.

Acid rain precursors

Acid rain occurs when acidic gases and particles are transported in the air before falling as wet or dry deposition. High concentrations can be harmful to health, to water and soil quality, to buildings, and can reduce plant growth and damage forests. Emissions *per se* are not necessarily harmful but they have

acidification potential and are therefore aggregated into an acid rain precursor theme.

Burning of coal with high sulphur content is a significant source of **sulphur dioxide** (SO₂). **Oxides of nitrogen** (NO_x) arise when fossil fuels are burnt under certain conditions. **Ammonia** (NH₃) emissions arise primarily from animal manure and nitrogen based fertilisers. There are other acid rain precursors (VOC and CO) that are not considered in this exercise (see details on page 36 of National Inventory Report 2008 (EPA website <http://coe.epa.ie/ghg/nirdownloads.jsp>)).

Acid rain precursor emissions are expressed in sulphur dioxide (SO₂) equivalents using the following conversion factors:

Emitted gas	Acid rain precursors (SO ₂ equivalents per tonne of gas emitted)
Sulphur Dioxide (SO ₂)	1.0000
Oxides of Nitrogen (NO _x)	0.6957
Ammonia (NH ₃)	1.8824

Chapter 3 Sources of Data

Estimates of air emissions in both the Global Warming Potential and Acid Rain Precursors themes derive from the same data sources. Both involve emissions to air and are primarily due to the combustion of fossil fuels and agriculture. The EPA compiles the official air emissions estimates, which it submits annually to the United Nations Framework Convention on Climate Change (UNFCCC) and the European Environment Agency (EEA). This publication uses and complements EPA's work by estimating emissions by sector within the economy. Both the EPA's estimates and the data sources mentioned below are used to attribute emissions to the relevant economic sectors.

Industry Sector

Much of the data for the industry sector is derived from the CSO's annual Census of Industrial Production (CIP). The work undertaken in compiling these accounts involves inferring from this economic data the extent of emissions to air attributable to each economic sector (e.g. fuel expenditure data). Prior to 2004 the CIP collected detailed information on the breakdown of fuel expenditure on an infrequent basis and this detailed data was then also used to infer expenditure by fuel type for the intervening years. The data is now collected on an annual basis. Quantities of fuels consumed were estimated by dividing fuel expenditure by average fuel prices using fuel price time series maintained by SEI. Standard conversion factors were then used to convert the fuel quantities consumed into estimates of air emissions. The methodology employed, where fuel consumption is inferred from fuel expenditure, was the best available in the absence of sectoral data on quantities of fuel consumption.

Figures for the services sectors, both market and non-market and the Residential sector, were derived from the SEI's Energy Balance Sheets. These balance sheets disaggregate consumption by fuel type into five major sectors: Service industry, Transport, Agriculture, Commercial and Public services, and the Residential sector.

Electricity-related emissions were attributed to the individual economic sectors in proportion to their final demand for electricity. Emissions associated with

natural gas consumption were similarly attributed to individual economic sectors in proportion to their consumption except where natural gas is used as a production feedstock, in which case the associated emissions are estimated separately.

The estimates presented here are best interpreted as indicative in nature but it is hoped that they give further insights into the interaction which the different economic sectors have with the environment and, in particular, air.

New Methodology for Industry

Firstly, in the industry sector, the accounts include gas emissions from the Emissions Trading Scheme (ETS) group of companies. For 2005 and later years CO₂ emissions to air from this group are audited directly by the EPA and therefore, are not imputed or derived from underlying cost and emissions factor data. For years prior to 2005, estimates for the ETS industry sectors are based directly upon the numbers employed in the constituent companies. It is therefore assumed that gas emissions are proportional to the numbers employed by the ETS companies in the various sectors.

Secondly, imputation calculations are now based upon the assumption that the gas emissions are directly proportional to the energy requirement of the various sectors. This energy demand index uses expenditure on energy at 1998 prices as a base year with subsequent years calculated using a combination of the actual reported total expenditure on energy and the CSO's Wholesale Price Indices (WPI) in respect of energy products. Where a particular fuel is not specifically covered by the WPI, it is assumed that its price moves in accordance with the broad WPI category entitled 'Energy Products used in Manufacturing Industry'. An intermediate check in this process examines the energy use per employee, at an aggregate 2-digit Nace level, and makes corrections for outlying data in the main data source. As such there is a secondary assumption that, at a 2-digit Nace level, energy demand use is proportional to the numbers employed in the sector. The corrected aggregate total data is then used to correct its constituent components, where they are known.

Thirdly, where no raw data is available for dis-aggregated energy spending (1999, 2000, 2002, and 2003) estimates are made for it by linear interpolation of data from the years 1998, 2001, and 2004 at a 2-digit Nace level.

Chapter 4 Results Air Emissions Accounts 1998-2006

The growth in the Irish economy during the years 1998 – 2006 required a large increase in the consumption of raw materials and energy inputs, with consequential knock-on effects on the environment. The increase in economic activity is evidenced, for example, in the increase in the size of the labour force and in the level of physical capital formation over the period. The increase in the use of natural resources can be gauged by the expansion in the area of land used for construction and the increase in both energy consumption and raw materials inputs. The ensuing increases in emissions of greenhouse gases further increases the pressure on the environment.

Aspects of Economic Activity 1998-2006

	Units	1998	2006	% change
Gross domestic product (GDP) at 2006 prices	€ Million	105,840	177,286	+67.5%
Gross domestic fixed capital formation at 2006 prices	€ Million	25,200	48,092	+90.8%
Numbers at work (Q2)	'000	1,494	2,017	+35.0%
Total Primary Energy Requirement	ktonne Oil equiv	13,197	16,200	+22.8%
Greenhouse Gas emissions	ktonne CO ₂ equiv	65,393	68,550	+4.8%
Acid Rain precursors	ktonne SO ₂ equiv	509	352	-30.8%
Household and commercial waste generated	ktonne	1,976	3,306	+67.3%

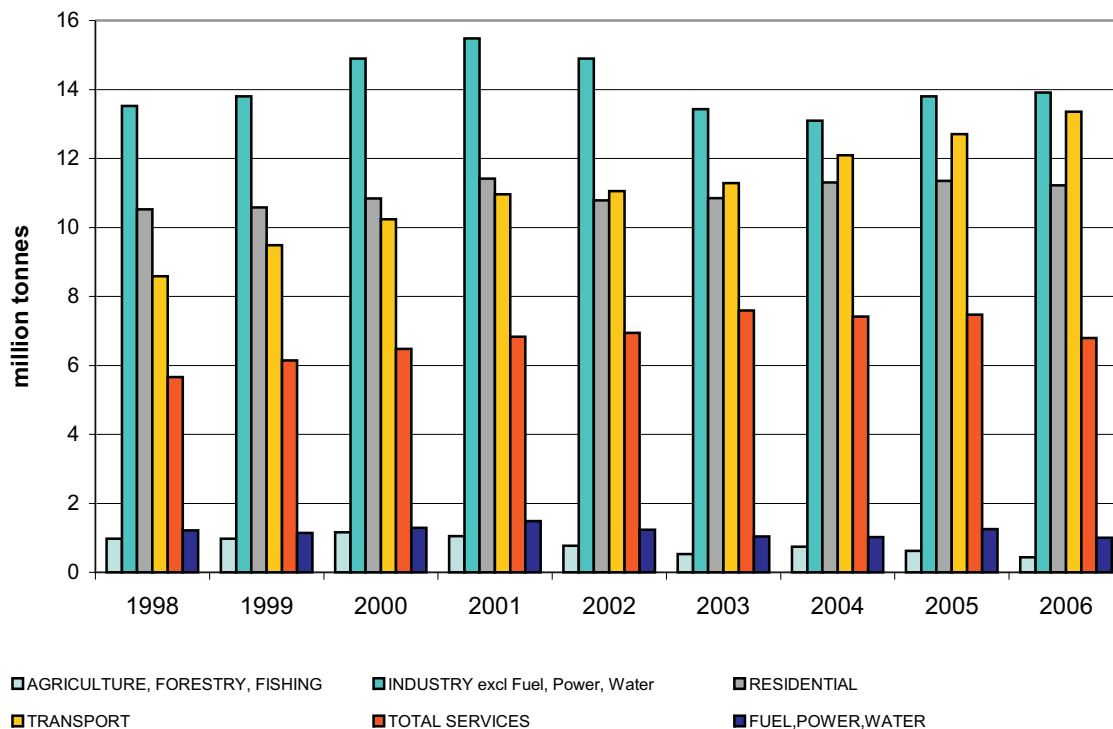
Trends in emissions of CO₂, which are lower than trends in energy consumption, can be explained by changes in the mix of energy sources such as the increasing usage of natural gas in electricity generation and increasing imports of electricity. Emissions relating to such imports are not included in these accounts.

Greenhouse Gases

CO₂ emissions

Emissions estimates for carbon dioxide (CO₂) are presented in Table 1. In the period 1998 to 2006 aggregate national emissions increased by 15.3% from 40.6 to 46.8 million tonnes. The most marked increase in CO₂ emissions occurred in transport² where emissions increased by 56% between 1998 and 2006. Other increases for the period include the services sector (+20%), the residential sector (+7%) and the industrial sector (+3%). Emissions trends are presented graphically in Figure 1.

Figure 1: Carbon Dioxide Emissions



² Included here are both the Transport Sector and transport activities carried out in all other sectors (both private and business).

N₂O and CH₄ emissions

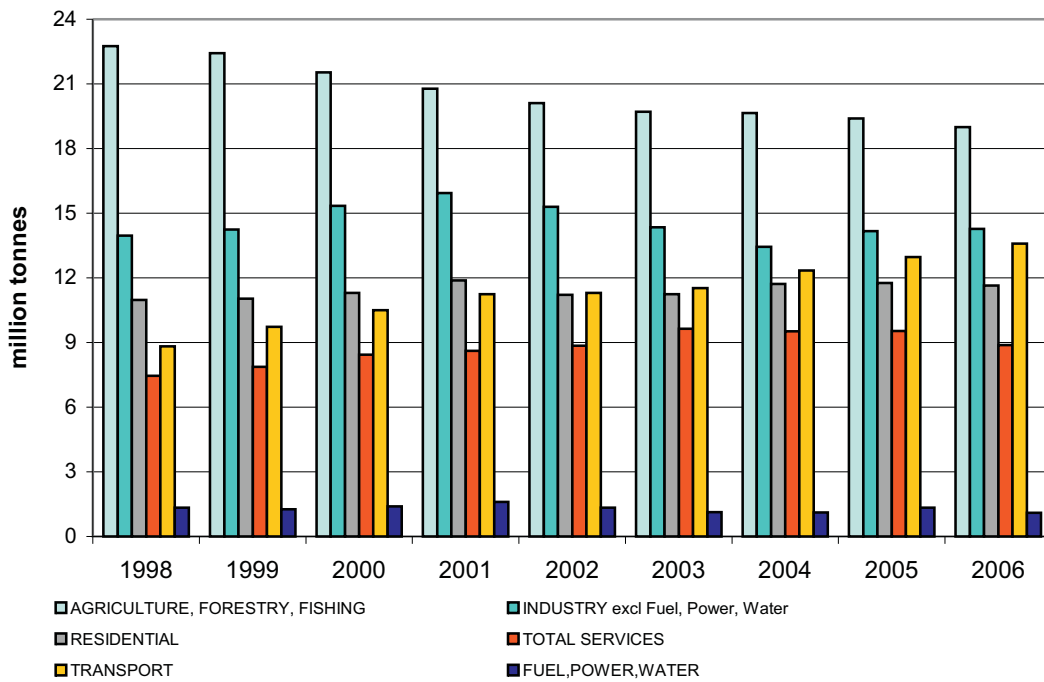
Emissions of nitrous oxide (N₂O) and methane (CH₄) are presented in Tables 2 and 3 respectively. Although the aggregate magnitude of emissions of these gases are significantly lower than those for CO₂ emissions, N₂O and CH₄ are relatively more potent in terms of global warming potential. Aggregate N₂O emissions decreased by 19% over the eight-year period under review, but the transport sector recorded increases of 8%.

Ruminant animals are the primary source of CH₄ emissions while natural gas distribution losses is another significant source. A unique production incident in 2003 was responsible for a large increase in emissions of CH₄ in the mining sector in that year.

Greenhouse Gases combined

Table 4 (and Figure 2) shows the three greenhouse gases as a single emissions estimate in terms of carbon dioxide equivalents. Although forestry acts as a large sink for CO₂ emissions, the high level of emissions of N₂O and CH₄ (when expressed as CO₂ equivalents) from farming contributes to agriculture, forestry and fishing being the sector with the highest level of greenhouse gas emissions. For the period 1998-1999 greenhouse gas emissions in this sector were remained largely unchanged at an average of 22 million tonnes/annum but there was a 15% reduction in net emissions between 1999 and 2006 due primarily to a decrease in livestock numbers. Transport changed from having the fourth highest level of emissions in 1998 to the third highest in 2006 with the level of emissions increasing by 54%. The services sector recorded a 19% increase in emissions while the industrial sector's emissions increased by 2% over the period.

Figure 2: Greenhouse Gas (CO₂, N₂O, CH₄) Emissions



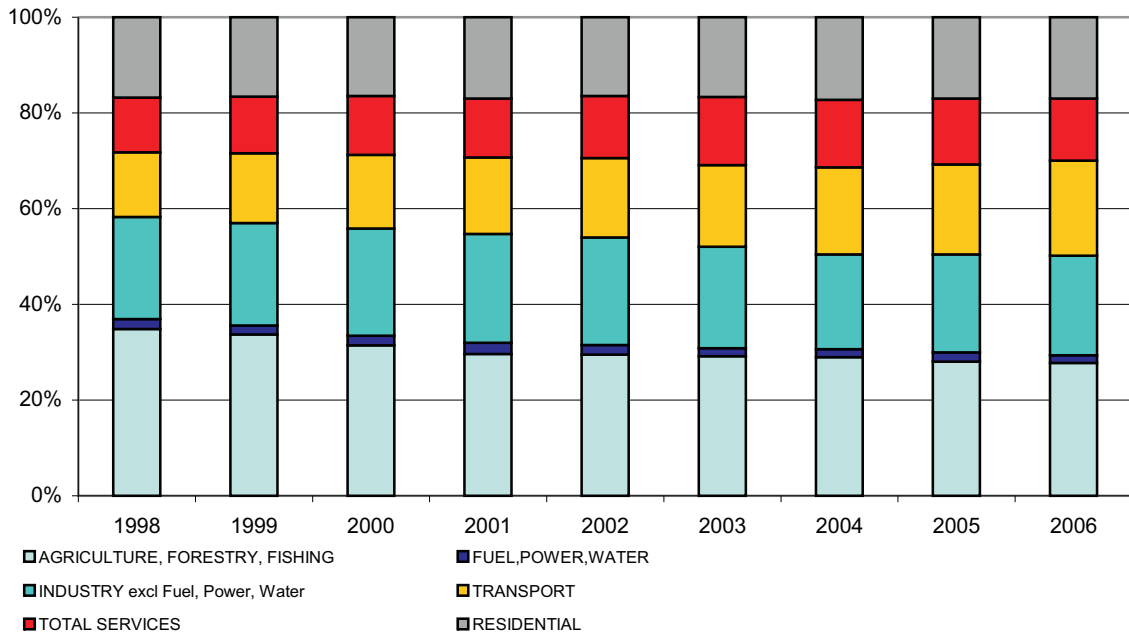
Under the Kyoto protocol of the United Nations Framework Convention on Climate Change, Ireland is committed to limit its increase in emissions of six greenhouse gases to 13% above 1990 levels between the years 2008 to 2012. Based on the EPA’s official estimates, national greenhouse gas emissions exceeded the Kyoto target for the first time in 1997 and were 25% above the 1990 baseline level in 2006.

Greenhouse gas emissions as a percentage of 1990 Kyoto protocol baseline*									
1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
114%	118%	120%	124%	127%	123%	123%	123%	125%	125%

* Calculations based on official aggregate emissions estimates compiled by the EPA and Kyoto definitions.

While aggregate emissions have been increasing between 1998 and 2006, the relative sectoral shares of greenhouse gas emissions have also changed, as shown in Figure 3. The share of emissions emanating from the residential and agricultural sectors have declined whereas share of emissions from the transport and services sectors increased.

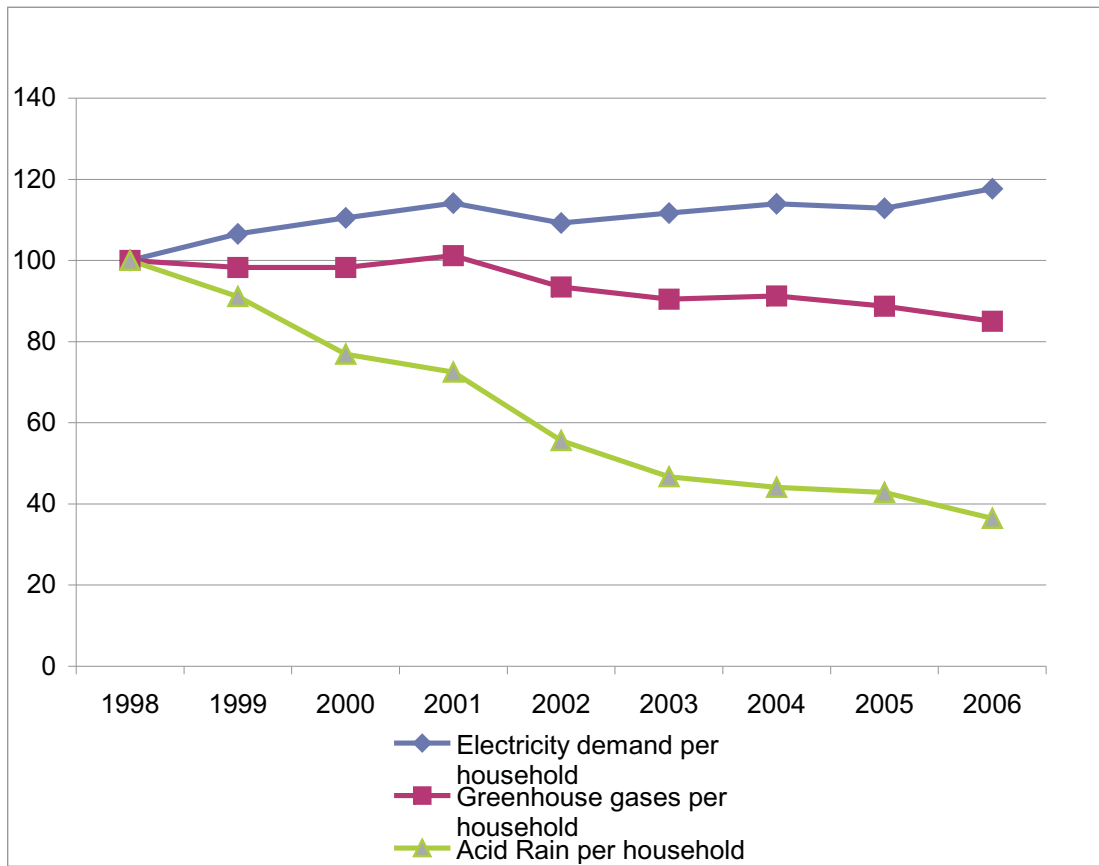
Figure 3: Sector Shares - Greenhouse Gas (CO₂, N₂O, CH₄) Emissions



Residential greenhouse gas emissions were broadly in the region of 11 million tonnes per annum between 1998 and 2006. Over the same period the number of households increased by approximately 25% (Censuses of Population) suggesting that emissions per household declined. However, this hides the fact that households actually increased their demand for energy. Figure 4 (taking 1998 as the base year) shows that residential electricity demand per household increased by 17% between 1998 and 2006* while the greenhouse gas emissions per household declined by 15% in the same period. This increase in per household electricity demand, alongside a large decline in per household emissions, is influenced by factors such as electricity generation becoming cleaner in recent years in terms of intensity of greenhouse gas emissions and less solid fuels used directly by households.

* Sustainable Energy Ireland's Annual Energy Balances

Figure 4: Residential Sector Electricity Demand and Emissions

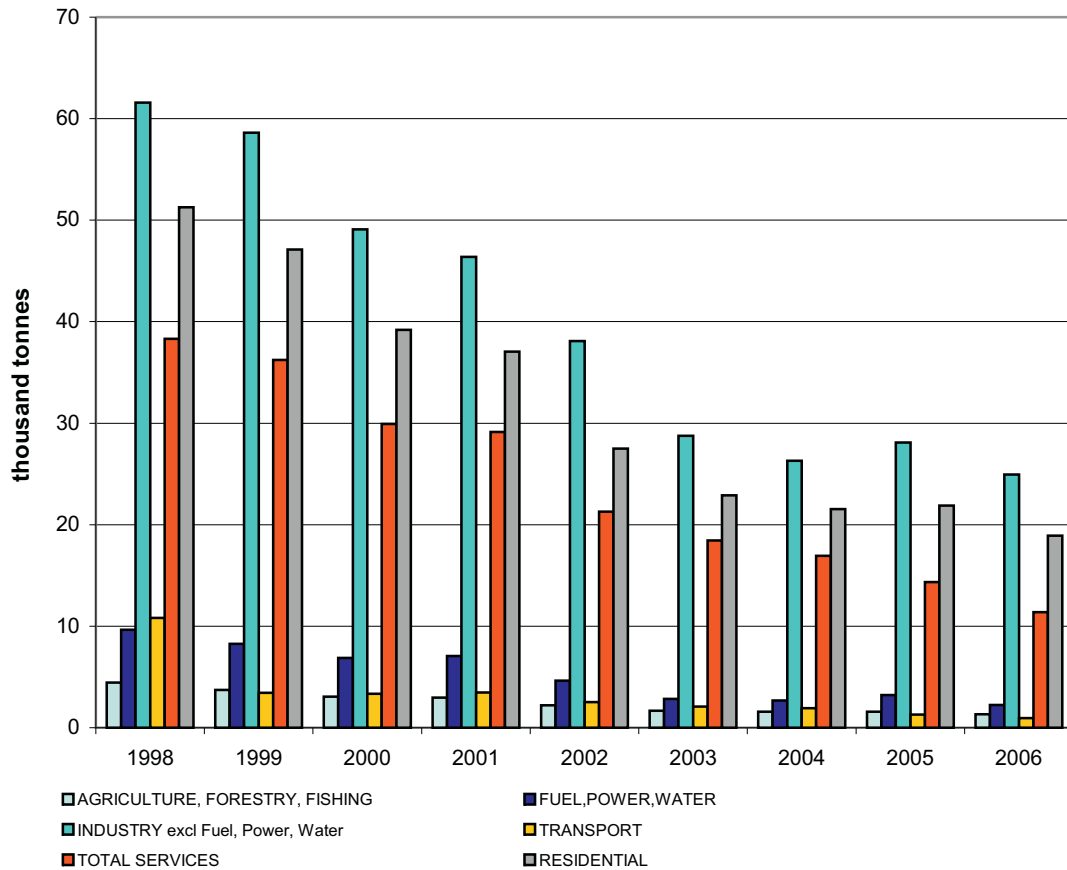


Acid rain precursors

SO₂ emissions

Sulphur dioxide (SO₂) emissions are presented in Table 5, which shows that emissions declined by 66% between 1998 and 2006. The decline occurred in all sectors of the economy, which is due principally to a decline in the volume of sulphur emissions from electricity generation and the introduction in 1999 of low sulphur transport fuel. The industrial, residential and services sectors now emit 92% of all SO₂ emissions in contrast to 86% in 1998.

Figure 5: Sulphur Dioxide Emissions



NO_x and NH₃ emissions

Tables 6 and 7 give emissions estimates for oxides of nitrogen (NO_x) and ammonia (NH₃). The decline in NO_x emissions between 1998 and 2006 was 11% overall while the residential sector showed a significant downward movement (-13%) over the period due primarily to less intensive emissions in electricity generation. Ammonia (NH₃) emissions which predominantly derive from agricultural declined by 13% in the period 1998 to 2006 reflecting the significant drop in both cattle and sheep numbers.

Acid Rain Precursors combined

Estimates of emissions of total acid rain precursors, expressed in SO₂ equivalents, are presented in Table 8 (and Figure 6). From 1998 to 2006 the overall level of emissions decreased by 31%. While decreases were recorded in all main sectors of the economy, the agriculture sector, which accounted for 60% of emissions in 2006, fell by 15% in the period under review (see Figure 7).

Figure 6: Acid Rain Precursor (SO₂, NO_x, NH₃) Emissions

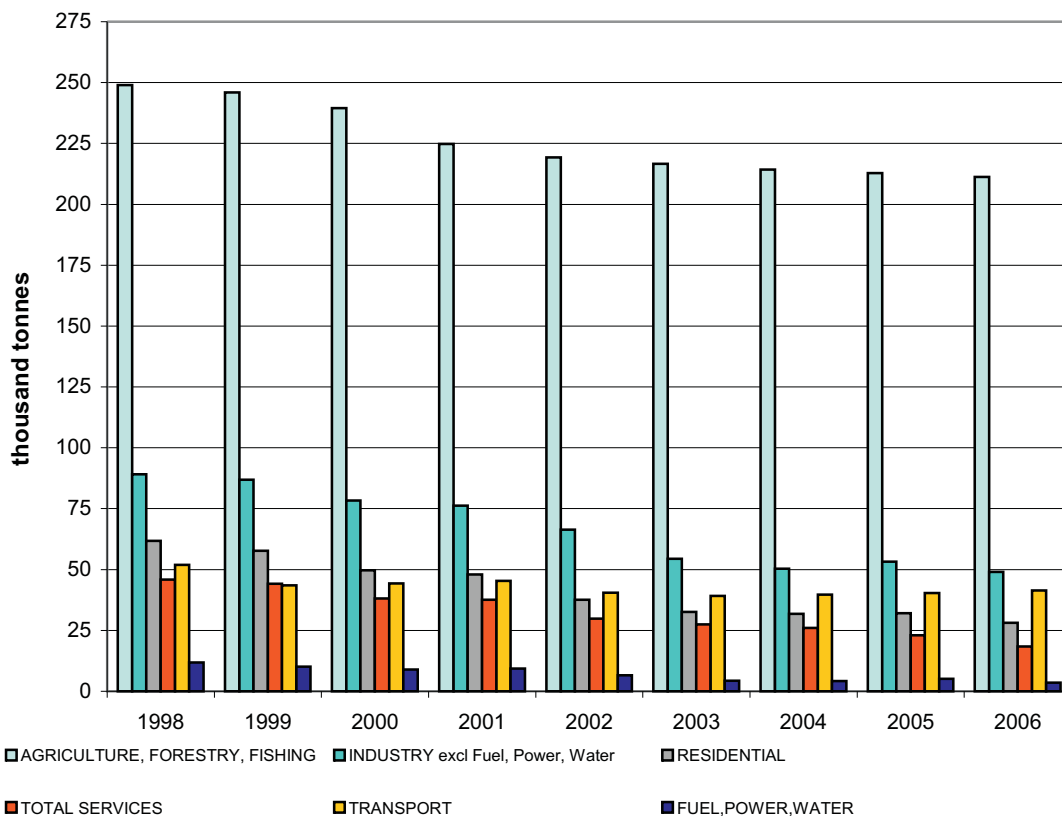
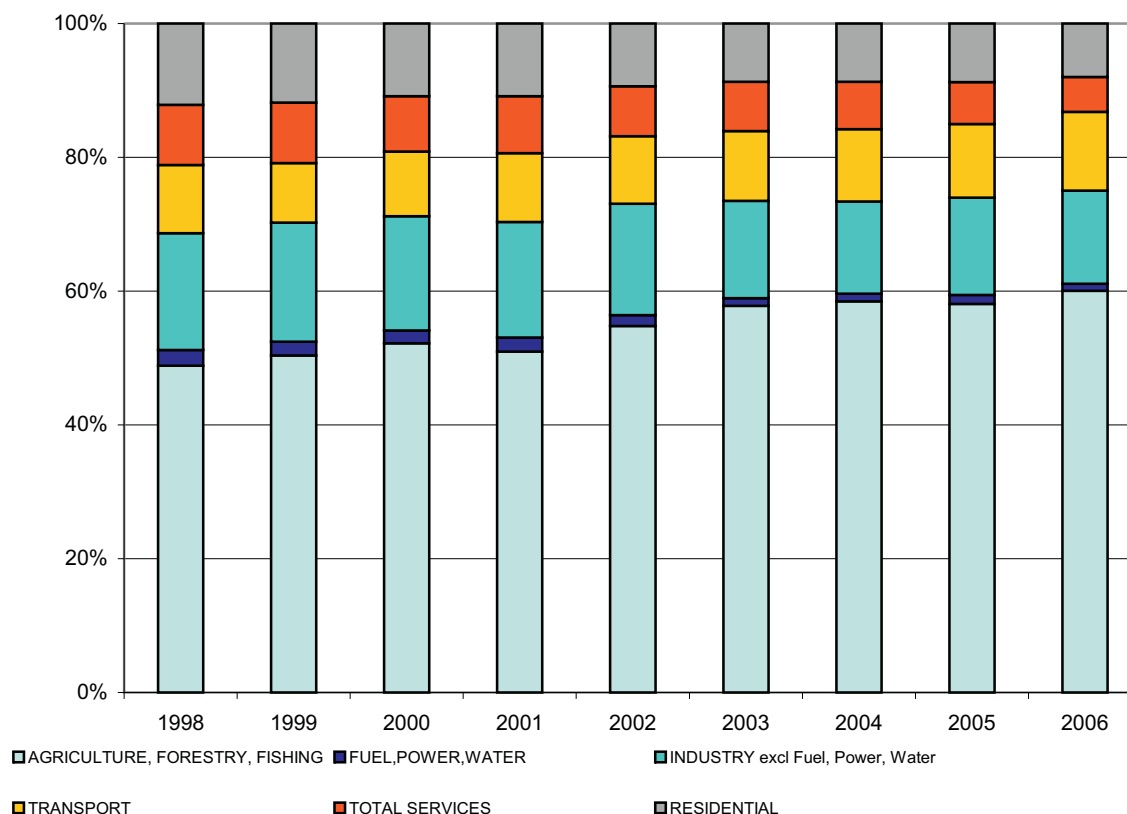


Figure 7: Sector Shares - Acid Rain Precursor (SO₂, NO_x, NH₃) Emissions



Ireland's targets under the Gothenburg Protocol

Under the Gothenburg Protocol (UNECE 1999) Ireland is committed to reducing the three acid rain precursor emissions. The subsequent National Emissions Ceilings Directive (EU 2001) set national emissions ceilings for EU member states which in Ireland's case are the same as the Gothenburg Protocol targets as outlined below. With the exception of ammonia, significant further reductions in Ireland's emissions are required if these targets are to be met.

National Emissions Ceilings for Ireland

Pollutant	Year 2006 Emissions (kt)	Ceiling by 2010 (kt)	Reduction required to meet 2010 target (kt)	Percentage reduction required
Sulphur Dioxide (SO ₂)	60	42	18	30%
Nitrogen Oxides (NO _x)	122	65	57	47%
Ammonia (NH ₃)	110	116	0	0%

Source: Department of the Environment and Local Government and EPA

Tables

Because of the uncertainties regarding the sectoral allocations of electricity and gas in recent years, the year-on-year changes must be regarded as indicative rather than absolute.

This report incorporates revisions to the estimates previously published in respect of the years 1997 – 2005

Table 1: Carbon Dioxide (CO₂) Emissions**Thousand tonnes**

	NACE REV 1	1998	1999	2000	2001	2002	2003	2004	2005	2006
Emissions by Agriculture, Forestry, Fishing		1,473.5	1,552.9	1,634.6	1,669.0	1,496.1	1,583.6	1,411.8	1,426.1	1,393.6
Sequestration by forestry		-496.4	-580.9	-475.3	-621.9	-730.3	-1,055.8	-670.0	-807.2	-955.8
AGRICULTURE, FORESTRY, FISHING	1,2,5	977.1	972.0	1,159.3	1,047.0	765.8	527.9	741.8	618.9	437.8
FUEL,POWER,WATER	40-41	1,213.7	1,143.1	1,286.4	1,482.9	1,233.2	1,039.8	1,022.7	1,249.3	1,000.6
Coal, peat, petroleum, metal ores, quarrying	10-14	883.7	1,016.3	1,043.8	1,108.0	1,114.4	1,088.4	1,096.6	1,161.8	1,333.4
Food, beverage, tobacco	15-16	2,449.2	2,488.9	2,588.9	2,711.5	2,526.8	2,314.5	2,087.8	2,175.7	2,245.9
Textiles, clothing, leather & footwear	17-19	191.9	201.5	211.9	205.7	183.5	155.9	138.5	157.1	84.6
Wood & wood products	20	257.6	264.9	271.0	276.5	259.8	233.0	225.7	235.6	240.6
Pulp, paper & print production	21-22	261.1	272.5	285.1	300.3	279.2	247.2	233.8	227.0	247.6
Chemical production	24	1,231.9	1,285.1	1,335.9	1,418.1	1,359.6	1,227.9	1,173.3	1,269.1	1,034.0
Rubber & plastic production	25	126.3	130.0	133.0	98.9	97.0	97.6	88.3	108.9	97.1
Non-metallic mineral production	26	4,854.8	4,891.8	5,614.5	5,810.9	5,585.2	4,829.1	4,969.4	4,982.9	4,724.1
Metal prod. excl. machinery & transport equip.	27-28	1,687.7	1,603.4	1,689.4	1,593.8	1,587.3	1,555.0	1,550.2	1,443.2	1,709.5
Agriculture & industrial machinery	29	805.7	825.0	843.5	1,027.8	1,024.1	879.3	813.2	857.5	952.3
Office and data process machines	30	63.1	70.7	74.4	103.9	93.6	85.5	62.8	63.2	56.4
Electrical goods	31-33	290.6	317.5	355.0	368.6	340.5	325.2	290.4	339.8	418.5
Transport equipment	34-35	94.0	100.7	107.4	113.5	104.6	91.6	85.4	91.7	91.6
Other manufacturing	36-37,23	284.8	294.0	303.0	302.6	284.2	255.8	235.7	642.4	634.3
Construction	45	40.4	40.8	41.7	44.0	55.2	44.1	43.4	41.1	37.6
INDUSTRY excl. Fuel, Power, Water		13,522.7	13,803.0	14,898.7	15,484.2	14,895.1	13,430.0	13,094.4	13,796.9	13,907.5
TRANSPORT*		8,584.0	9,483.0	10,233.7	10,957.8	11,050.2	11,282.4	12,093.6	12,706.2	13,353.8
SERVICES excl Transport		5,663.3	6,140.1	6,477.2	6,834.6	6,945.3	7,595.2	7,418.8	7,474.7	6,793.3
RESIDENTIAL		10,525.6	10,576.5	10,838.9	11,414.1	10,787.9	10,853.2	11,307.6	11,346.4	11,223.1
Sub-TOTAL		40,486.5	42,117.7	44,894.3	47,220.7	45,677.5	44,728.6	45,678.9	47,192.5	46,716.1
Not attributed to any sector		86.8	83.4	80.5	79.2	76.4	75.4	74.9	75.0	79.9
TOTAL		40,573.3	42,201.1	44,974.8	47,299.8	45,753.9	44,804.0	45,753.9	47,267.5	46,795.9

* Includes both the Transport sector and road transport activities carried out in all other sectors.

Table 2: Nitrous Oxide (N₂O) Emissions
Thousand tonnes

	NACE REV 1	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGRICULTURE, FORESTRY, FISHING	1,2,5	29.25	29.23	27.65	25.86	24.73	24.57	23.97	23.64	23.08
FUEL,POWER,WATER	40-41	0.18	0.17	0.17	0.20	0.15	0.11	0.12	0.15	0.12
Coal, peat, petroleum, metal ores, quarrying	10-14	0.09	0.10	0.10	0.11	0.09	0.07	0.06	0.06	0.07
Food, beverage, tobacco	15-16	0.31	0.32	0.32	0.33	0.27	0.21	0.19	0.20	0.20
Textiles, clothing, leather & footwear	17-19	0.04	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01
Wood & wood products	20	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03
Pulp, paper & print production	21-22	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03
Chemical production	24	0.17	0.18	0.17	0.18	0.15	0.12	0.12	0.13	0.11
Rubber & plastic production	25	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Non-metallic mineral production	26	0.10	0.10	0.11	0.10	0.12	0.14	0.18	0.19	0.18
Metal prod. excl. machinery & transport equip.	27-28	0.22	0.24	0.24	0.22	0.20	0.20	0.21	0.21	0.20
Agriculture & industrial machinery	29	0.13	0.13	0.13	0.17	0.15	0.11	0.09	0.10	0.11
Office and data process machines	30	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Electrical goods	31-33	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.06
Transport equipment	34-35	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Other manufacturing	36-37,23	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.04
Construction	45	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
INDUSTRY excl. Fuel, Power, Water		1.29	1.33	1.34	1.35	1.21	1.03	1.02	1.09	1.06
TRANSPORT*		0.62	0.65	0.70	0.72	0.67	0.64	0.66	0.68	0.67
SERVICES excl Transport		1.25	1.33	1.35	1.36	1.32	1.30	1.29	1.29	1.21
RESIDENTIAL		1.25	1.31	1.28	1.33	1.20	1.09	1.16	1.20	1.16
Sub-TOTAL		33.83	34.01	32.50	30.82	29.28	28.75	28.23	28.04	27.31
TOTAL		33.83	34.01	32.50	30.82	29.28	28.75	28.23	28.04	27.31

* Includes both the Transport sector and road transport activities carried out in all other sectors.

Table 3: Methane (CH₄) Emissions

	NACE REV 1	Thousand tonnes								
		1998	1999	2000	2001	2002	2003	2004	2005	2006
AGRICULTURE, FORESTRY, FISHING	1,2,5	605.49	590.34	561.76	557.92	556.32	550.89	546.30	545.09	542.71
FUEL,POWER,WATER	40-41	3.07	3.07	2.97	3.03	2.55	2.23	2.30	1.63	3.03
Coal, peat, petroleum, metal ores, quarrying	10-14	0.12	0.11	0.11	0.10	0.08	27.12	0.07	0.10	0.10
Food, beverage, tobacco	15-16	0.46	0.42	0.47	0.41	0.32	0.27	0.33	0.28	0.33
Textiles, clothing, leather & footwear	17-19	0.04	0.04	0.05	0.04	0.04	0.04	0.03	0.04	0.03
Wood & wood products	20	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
Pulp, paper & print production	21-22	0.07	0.06	0.06	0.05	0.04	0.03	0.03	0.03	0.03
Chemical production	24	0.22	0.20	0.19	0.21	0.16	0.13	0.18	0.14	0.19
Rubber & plastic production	25	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
Non-metallic mineral production	26	0.31	0.27	0.40	0.49	0.49	0.54	0.67	0.70	0.61
Metal prod. excl. machinery & transport equip.	27-28	0.11	0.11	0.11	0.09	0.09	0.10	0.11	0.11	0.29
Agriculture & industrial machinery	29	0.03	0.03	0.04	0.04	0.03	0.02	0.02	0.02	0.02
Office and data process machines	30	-	-	-	-	-	-	-	-	-
Electrical goods	31-33	0.10	0.09	0.10	0.10	0.08	0.05	0.05	0.05	0.06
Transport equipment	34-35	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Other manufacturing	36-37,23	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Construction	45	-	-	-	-	-	-	-	-	-
INDUSTRY excl. Fuel, Power, Water		1.51	1.38	1.58	1.59	1.36	28.33	1.54	1.49	1.70
TRANSPORT*		2.26	2.36	2.59	2.58	2.48	2.33	2.23	2.15	1.32
SERVICES excl Transport**		66.84	62.87	73.09	65.02	71.10	77.94	81.29	78.75	81.38
RESIDENTIAL		3.29	2.82	2.81	2.79	2.55	2.41	2.48	2.44	2.66
Sub-TOTAL		682.47	662.84	644.80	632.92	636.37	664.13	636.14	631.55	632.79
Not attributed to any sector										
TOTAL		682.47	662.84	644.80	632.92	636.37	664.13	636.14	631.55	632.79

* Includes both the Transport sector and road transport activities carried out in all other sectors.

** Due mainly to Solid Waste disposal on land

Table 4: Greenhouse Gas Emissions (CO₂, N₂O, CH₄)

 Thousand tonnes CO₂ equivalents

	NACE REV 1	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGRICULTURE, FORESTRY, FISHING	1,2,5	22,759.5	22,429.2	21,527.9	20,779.9	20,115.1	19,713.9	19,646.1	19,392.6	18,989.6
FUEL,POWER,WATER	40-41	1,333.1	1,259.2	1,401.3	1,607.6	1,334.5	1,122.2	1,106.8	1,329.5	1,099.9
Coal, peat, petroleum, metal ores, quarrying	10-14	915.4	1,048.5	1,076.9	1,143.2	1,143.4	1,679.1	1,115.5	1,182.3	1,357.4
Food, beverage, tobacco	15-16	2,554.6	2,596.7	2,699.5	2,823.4	2,618.4	2,386.0	2,153.6	2,244.8	2,315.0
Textiles, clothing, leather & footwear	17-19	203.6	213.4	224.2	217.5	192.9	163.0	144.2	163.4	88.8
Wood & wood products	20	269.1	276.7	281.9	287.6	269.8	241.1	234.0	244.6	249.6
Pulp, paper & print production	21-22	274.6	286.1	298.1	313.4	290.2	255.9	242.4	236.1	257.6
Chemical production	24	1,290.1	1,344.3	1,392.5	1,476.9	1,410.3	1,268.5	1,214.2	1,312.1	1,072.5
Rubber & plastic production	25	133.0	137.0	139.9	103.9	101.5	101.5	91.8	112.9	100.7
Non-metallic mineral production	26	4,892.8	4,929.4	5,658.0	5,851.3	5,631.9	4,883.7	5,038.0	5,055.6	4,792.7
Metal prod. excl. machinery & transport equip.	27-28	1,758.5	1,679.1	1,767.2	1,662.8	1,652.6	1,618.0	1,616.7	1,510.5	1,777.5
Agriculture & industrial machinery	29	845.9	866.1	884.5	1,081.1	1,070.3	912.9	842.1	889.7	986.1
Office and data process machines	30	65.2	73.1	76.9	107.6	96.8	88.1	64.6	65.1	58.1
Electrical goods	31-33	310.6	338.0	375.5	386.8	357.9	341.4	306.4	357.8	437.3
Transport equipment	34-35	99.1	105.9	112.3	118.4	108.7	94.9	88.6	95.0	94.7
Other manufacturing	36-37,23	298.5	307.9	316.1	315.3	295.9	265.5	245.2	652.5	645.5
Construction	45	42.2	42.6	43.4	45.8	57.4	45.6	44.9	42.7	38.9
INDUSTRY excl. Fuel, Power, Water		13,953.3	14,244.8	15,346.8	15,935.1	15,297.9	14,344.9	13,442.2	14,164.9	14,272.5
TRANSPORT*		8,822.8	9,733.8	10,506.1	11,235.9	11,309.2	11,530.9	12,346.1	12,963.2	13,590.5
SERVICES excl Transport		7,454.6	7,872.8	8,431.6	8,621.0	8,846.3	9,634.2	9,526.5	9,529.6	8,878.2
RESIDENTIAL		10,982.6	11,040.5	11,294.8	11,885.4	11,215.0	11,242.7	11,720.6	11,769.1	11,639.3
Sub-TOTAL		65,305.9	66,580.3	68,508.6	70,065.0	68,118.0	67,588.8	67,788.3	69,148.9	68,470.1
Not attributed to any sector		86.8	83.4	80.5	79.2	76.4	75.4	74.9	75.0	79.9
TOTAL		65,392.7	66,663.7	68,589.1	70,144.1	68,194.4	67,664.2	67,863.3	69,223.9	68,550.0

* Includes both the Transport sector and road transport activities carried out in all other sectors.

Table 5: Sulphur Dioxide (SO₂) Emissions

Thousand tonnes

	NACE REV 1	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGRICULTURE, FORESTRY, FISHING	1,2,5	4.45	3.73	3.06	2.97	2.20	1.67	1.57	1.59	1.34
FUEL,POWER,WATER	40-41	9.63	8.28	6.87	7.06	4.64	2.84	2.69	3.20	2.24
Coal, peat, petroleum, metal ores, quarrying	10-14	3.15	3.22	2.51	2.24	1.79	1.28	1.22	1.25	1.57
Food, beverage, tobacco	15-16	11.69	11.03	8.79	8.48	6.44	4.50	3.92	3.97	4.04
Textiles, clothing, leather & footwear	17-19	1.16	1.11	0.88	0.76	0.55	0.35	0.30	0.30	0.15
Wood & wood products	20	1.95	1.83	1.41	1.30	0.96	0.64	0.58	0.60	0.52
Pulp, paper & print production	21-22	1.74	1.62	1.22	1.13	0.83	0.53	0.48	0.49	0.50
Chemical production	24	7.59	7.12	5.45	5.20	3.87	2.52	2.27	2.19	1.76
Rubber & plastic production	25	0.87	0.82	0.62	0.39	0.29	0.21	0.17	0.18	0.16
Non-metallic mineral production	26	12.79	12.61	11.97	11.13	10.13	8.38	7.83	7.30	6.91
Metal prod. excl. machinery & transport equip.	27-28	9.36	8.68	8.22	7.58	6.84	6.17	5.87	7.04	5.03
Agriculture & industrial machinery	29	6.00	5.58	4.19	4.61	3.67	2.30	2.06	2.12	2.01
Office and data process machines	30	0.34	0.32	0.25	0.36	0.26	0.19	0.13	0.10	0.09
Electrical goods	31-33	1.79	1.73	1.37	1.21	0.92	0.68	0.56	0.76	0.80
Transport equipment	34-35	0.67	0.62	0.47	0.42	0.31	0.19	0.17	0.18	0.15
Other manufacturing	36-37,23	2.16	2.01	1.52	1.35	1.01	0.68	0.62	1.48	1.16
Construction	45	0.32	0.30	0.22	0.21	0.21	0.12	0.11	0.11	0.08
INDUSTRY excl. Fuel, Power, Water		61.59	58.61	49.10	46.37	38.09	28.75	26.28	28.10	24.93
TRANSPORT*		10.82	3.43	3.36	3.46	2.52	2.09	1.92	1.29	0.96
SERVICES excl Transport		38.30	36.22	29.92	29.13	21.28	18.43	16.92	14.34	11.39
RESIDENTIAL		51.27	47.11	39.19	37.06	27.51	22.91	21.52	21.89	18.91
Sub-TOTAL		176.06	157.37	131.49	126.05	96.25	76.69	70.92	70.40	59.77
Not attributed to any sector		-	-	-	-	-	-	-	-	-
TOTAL		176.06	157.37	131.49	126.05	96.25	76.69	70.92	70.40	59.77

* Includes both the Transport sector and road transport activities carried out in all other sectors.

Table 6: Oxides of Nitrogen (NO_x) Emissions
Thousand tonnes

	NACE REV 1	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGRICULTURE, FORESTRY, FISHING	1,2,5	11.92	12.67	13.31	12.13	11.92	12.14	12.10	12.53	11.57
FUEL,POWER,WATER	40-41	3.08	2.74	3.00	3.34	2.75	2.23	2.21	2.69	1.94
Coal, peat, petroleum, metal ores, quarrying	10-14	2.96	2.86	2.53	2.21	2.13	2.02	2.01	2.55	3.44
Food, beverage, tobacco	15-16	10.71	11.07	11.46	12.03	10.98	9.88	8.70	9.27	9.78
Textiles, clothing, leather & footwear	17-19	0.72	0.91	1.10	1.25	1.03	0.79	0.57	0.56	0.29
Wood & wood products	20	0.71	0.73	0.75	0.78	0.74	0.67	0.67	0.60	0.54
Pulp, paper & print production	21-22	0.71	0.73	0.75	0.78	0.77	0.73	0.75	0.69	0.67
Chemical production	24	4.44	4.73	5.00	5.36	5.10	4.61	4.39	3.81	2.82
Rubber & plastic production	25	0.66	0.55	0.44	0.26	0.25	0.25	0.23	0.27	0.27
Non-metallic mineral production	26	7.86	8.32	8.76	8.70	8.63	7.82	7.64	7.75	6.16
Metal prod. excl. machinery & transport equip.	27-28	6.24	6.14	6.38	6.26	5.92	5.50	5.19	4.98	5.22
Agriculture & industrial machinery	29	2.08	2.10	2.16	2.59	2.54	2.13	1.98	2.06	1.89
Office and data process machines	30	0.11	0.14	0.16	0.24	0.24	0.24	0.22	0.22	0.15
Electrical goods	31-33	0.98	1.05	1.15	1.20	1.06	0.93	0.80	2.15	2.04
Transport equipment	34-35	0.38	0.36	0.34	0.32	0.29	0.24	0.22	0.28	0.23
Other manufacturing	36-37,23	0.84	0.84	0.86	0.86	0.97	1.06	1.21	0.89	1.02
Construction	45	0.10	0.10	0.10	0.10	0.12	0.09	0.09	0.09	0.07
INDUSTRY excl. Fuel, Power, Water		39.50	40.62	41.96	42.94	40.75	36.97	34.68	36.17	34.61
TRANSPORT*		56.46	53.81	53.86	54.50	48.82	47.79	48.86	48.92	51.08
SERVICES excl Transport		10.87	11.38	11.79	12.10	12.35	13.08	13.01	12.43	10.01
RESIDENTIAL		15.20	15.16	15.18	15.65	14.45	14.02	14.87	14.55	13.22
Sub-TOTAL		137.04	136.37	139.10	140.66	131.05	126.23	125.73	127.28	122.44
Not attributed to any sector		-	-	-	-	-	-	-	-	-
TOTAL		137.04	136.37	139.10	140.66	131.05	126.23	125.73	127.28	122.44

* Includes both the Transport sector and road transport activities carried out in all other sectors.

Table 7: Ammonia (NH₃) Emissions**Thousand tonnes**

	NACE REV 1	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGRICULTURE, FORESTRY, FISHING	1,2,5	125.50	124.00	120.66	113.33	110.90	109.70	108.55	107.59	107.23
FUEL,POWER,WATER	40-41	-	-	-	-	-	-	-	-	-
Coal, peat, petroleum, metal ores, quarrying	10-14	-	-	-	-	-	-	-	-	-
Food, beverage, tobacco	15-16	-	-	-	-	-	-	-	-	-
Textiles, clothing, leather & footwear	17-19	-	-	-	-	-	-	-	-	-
Wood & wood products	20	-	-	-	-	-	-	-	-	-
Pulp, paper & print production	21-22	-	-	-	-	-	-	-	-	-
Chemical production	24	-	-	-	-	-	-	-	-	-
Rubber & plastic production	25	-	-	-	-	-	-	-	-	-
Non-metallic mineral production	26	-	-	-	-	-	-	-	-	-
Metal prod. excl. machinery & transport equip.	27-28	-	-	-	-	-	-	-	-	-
Agriculture & industrial machinery	29	-	-	-	-	-	-	-	-	-
Office and data process machines	30	-	-	-	-	-	-	-	-	-
Electrical goods	31-33	-	-	-	-	-	-	-	-	-
Transport equipment	34-35	-	-	-	-	-	-	-	-	-
Other manufacturing	36-37,23	-	-	-	-	-	-	-	-	-
Construction	45	-	-	-	-	-	-	-	-	-
INDUSTRY excl. Fuel, Power, Water		-	-	-	-	-	-	-	-	-
TRANSPORT*		0.98	1.40	1.85	2.08	2.10	2.03	2.02	2.69	2.59
SERVICES excl Transport		-	-	-	-	-	-	-	-	-
RESIDENTIAL		-	-	-	-	-	-	-	-	-
Sub-TOTAL		126.48	125.40	122.51	115.41	113.00	111.72	110.57	110.29	109.82
Not attributed to any sector										
TOTAL		126.48	125.40	122.51	115.41	113.00	111.72	110.57	110.29	109.82

* Includes both the Transport sector and road transport activities carried out in all other sectors.

Table 8: Acid Rain Precursor Emissions (SO₂, NO_x, NH₃)
Thousand tonnes SO₂ equivalents

	NACE REV 1	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGRICULTURE, FORESTRY, FISHING	1,2,5	248.99	245.96	239.46	224.74	219.25	216.61	214.32	212.84	211.24
FUEL,POWER,WATER	40-41	11.78	10.18	8.96	9.39	6.56	4.39	4.23	5.07	3.59
Coal, peat, petroleum, metal ores, quarrying	10-14	5.21	5.21	4.27	3.78	3.27	2.69	2.61	3.03	3.96
Food, beverage, tobacco	15-16	19.14	18.73	16.76	16.85	14.08	11.38	9.97	10.42	10.84
Textiles, clothing, leather & footwear	17-19	1.66	1.74	1.64	1.63	1.27	0.90	0.69	0.69	0.35
Wood & wood products	20	2.44	2.34	1.93	1.84	1.48	1.10	1.05	1.02	0.89
Pulp, paper & print production	21-22	2.24	2.13	1.74	1.68	1.37	1.04	1.01	0.98	0.97
Chemical production	24	10.68	10.41	8.93	8.93	7.41	5.73	5.32	4.85	3.73
Rubber & plastic production	25	1.33	1.20	0.93	0.57	0.46	0.38	0.33	0.37	0.35
Non-metallic mineral production	26	18.26	18.40	18.07	17.18	16.14	13.82	13.15	12.69	11.20
Metal prod. excl. machinery & transport equip.	27-28	13.70	12.95	12.66	11.94	10.96	10.00	9.47	10.51	8.67
Agriculture & industrial machinery	29	7.45	7.04	5.69	6.41	5.43	3.78	3.44	3.55	3.33
Office and data process machines	30	0.42	0.42	0.36	0.52	0.43	0.35	0.28	0.25	0.19
Electrical goods	31-33	2.47	2.46	2.18	2.05	1.66	1.33	1.12	2.26	2.21
Transport equipment	34-35	0.94	0.87	0.70	0.64	0.51	0.36	0.33	0.38	0.31
Other manufacturing	36-37,23	2.74	2.60	2.12	1.94	1.69	1.42	1.46	2.10	1.87
Construction	45	0.39	0.36	0.29	0.28	0.29	0.19	0.18	0.17	0.13
INDUSTRY excl. Fuel, Power, Water		89.07	86.87	78.29	76.24	66.45	54.47	50.41	53.26	49.01
TRANSPORT*		51.95	43.50	44.30	45.30	40.44	39.15	39.73	40.39	41.36
SERVICES excl Transport		45.86	44.13	38.11	37.55	29.87	27.53	25.97	22.99	18.36
RESIDENTIAL		61.84	57.65	49.75	47.94	37.56	32.66	31.87	32.01	28.11
Sub-TOTAL		509.49	488.30	458.87	441.16	400.12	374.81	366.53	366.56	351.68
Not attributed to any sector										
TOTAL		509.49	488.30	458.87	441.16	400.12	374.81	366.53	366.56	351.68

* Includes both the Transport sector and road transport activities carried out in all other sectors.

Table 9: Gross Value Added (GVA) at current prices and Numbers Employed by Sector

GVA shown in €million

	NACE Rev 1	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGRICULTURE, FORESTRY, FISHING - Numbers employed	1,2,5	120,875	124,725	117,075	112,575	111,275	105,825	105,450	103,900	104,240
AGRICULTURE, FORESTRY, FISHING* - GVA	1,2,5	3,495	3,259	3,504	3,596	3,428	3,437	3,552	4,017	3,812
Coal, peat, petroleum,metal ores, quarrying - Numbers employed	10-14	5,752	4,861	5,292	5,558	5,517	5,578	5,837	5,875	6,246
Coal, peat, petroleum,metal ores, quarrying - GVA	10-14	334	328	439	464	410	463	513	664	1,279
Food, beverage, tobacco - Numbers employed	15-16	47,113	48,270	48,925	50,806	50,865	50,176	45,555	43,870	43,326
Food, beverage, tobacco - GVA	15-16	4,467	5,191	5,944	6,902	7,099	7,684	6,834	6,974	7,270
Textiles, clothing, leather & footwear - Numbers employed	17-19	15,564	12,459	10,922	9,763	8,570	7,259	5,946	5,176	4,504
Textiles, clothing, leather & footwear - GVA	17-19	427	371	360	341	284	249	238	262	177
Wood & wood products - Numbers employed	20	5,016	5,583	6,189	6,043	6,298	6,495	6,396	6,657	7,300
Wood & wood products - GVA	20	174	226	246	246	311	314	388	387	409
Pulp, paper & print production - Numbers employed	21-22	23,260	24,094	23,555	23,634	23,164	22,351	20,191	18,764	18,835
Pulp, paper & print production - GVA	21-22	1,973	3,000	3,398	3,250	3,270	3,918	4,960	4,440	4,651
Chemical production - Numbers employed	24	21,415	22,958	23,126	24,210	25,317	23,641	24,136	24,566	24,583
Chemical production - GVA	24	8,222	10,054	9,940	12,370	16,755	13,737	13,010	12,000	13,231
Rubber & plastic production - Numbers employed	25	10,476	10,530	10,811	9,565	9,371	9,723	9,766	9,779	10,468
Rubber & plastic production - GVA	25	448	449	487	469	432	470	545	542	569
Non-metallic mineral production - Numbers employed	26	9,977	10,325	11,037	10,654	11,033	10,631	10,784	10,849	11,583
Non-metallic mineral production - GVA	26	565	688	771	699	705	794	784	935	1,092
Metal prod. excl. machinery & transport equip. - Numbers employed	27-28	14,960	15,669	16,322	15,366	15,420	14,955	15,174	15,276	15,536
Metal prod. excl. machinery & transport equip. - GVA	27-28	564	597	737	686	653	686	790	770	825
Agriculture & industrial machinery - Numbers employed	29	14,668	14,450	14,382	14,048	12,741	12,100	11,751	11,345	11,491
Agriculture & industrial machinery - GVA	29	636	645	705	639	661	655	731	775	817
Office and data process machines - Numbers employed	30	16,249	20,130	20,620	19,207	14,230	13,106	14,389	12,733	12,859
Office and data process machines - GVA	30	953	1,503	2,576	1,593	1,851	1,854	1,512	1,990	2,011
Electrical goods - Numbers employed	31-33	43,878	45,019	48,308	45,899	41,994	40,026	38,376	40,719	38,565
Electrical goods - GVA	31-33	3,039	4,792	5,833	5,700	4,604	4,412	4,808	5,107	6,746
Transport equipment - Numbers employed	34-35	7,464	7,883	7,886	8,222	7,971	7,927	7,359	7,218	7,988
Transport equipment - GVA	34-35	334	363	436	392	369	420	420	476	453
Other manufacturing - Numbers employed	36-37,23	12,164	10,980	11,421	11,197	11,379	10,637	10,076	9,135	10,437
Other manufacturing - GVA	36-37,23	543	528	731	556	809	784	732	835	612
Construction - Numbers employed	45	124,450	140,250	162,125	174,050	176,775	184,475	203,600	233,850	256,880
Construction* - GVA	45	4,270	5,356	6,981	8,146	8,966	10,030	11,813	14,112	15,924
INDUSTRY**										
incl Construction but excl Fuel, Power, Water - Numbers employed		372,406	393,461	420,921	428,222	420,645	419,080	429,336	455,812	480,601
INDUSTRY**										
incl Construction but excl Fuel, Power, Water - GVA		26,949	34,091	39,584	42,453	47,179	46,470	48,078	50,269	56,066

* GVA source for Agriculture, Forestry, Fishing and Construction: National Income and Expenditure

**GVA source for Industry: Census of Industrial Production (CIP)

References

National Inventory Report 2008, M McGettigan, P Duffy, N Connolly, and B Hyde,
<http://coe.epa.ie/ghg/nirdownloads.jsp>

Emissions to Air 1990-1998, Estimation Methods, Trends and Challenges,
M McGettigan and P. Duffy, 2000, Environmental Protection Agency,
Co. Wexford, Ireland.

Sustainable Energy Ireland Expanded Energy Balances 2006
<http://www.sei.ie/index.asp?locID=75&docID=-1>

Ambient Air Quality in Ireland, 2006, B O'Leary, Environmental Protection
Agency, Co. Wexford, Ireland.
http://www.epa.ie/downloads/pubs/air/quality/epa_air_quality_report_2006.pdf

Bulletin of Vehicle and Driver Statistics, (Department of Environment and
Local Government) Stationery Office, Dublin.

International Panel on Climate Change (IPCC). <various publications>
<http://www.ipcc.ch/>

*Strategy to Reduce Emissions of Transboundary Pollution by 2010 to comply
with National Emission ceilings*, Department of Environment and Local
Government.

IRL-2008-2006-v1.3.xls Environmental Protection Agency,
County Wexford, Ireland.

Appendix

Air Emission Conversion Factors

	TOE per tonne	TOE per 1000 litres	Tonnes CO ₂ /TJ	Tonnes SO ₂ /TJ	Tonnes NO _x /TJ	Tonnes CH ₄ /TJ
1 TOE (Tonne of Oil Equivalent) = 41.868 x 10 ⁻³ TJ and TJ (Tera Joule) = 10 ¹² Joules						
Briquettes	0.443		98.860	0.280	0.100	0.050
Milled Peat	0.186		113.262	0.270	0.160	0.050
Sod Peat	0.313		104.000	0.300	0.100	0.050
Coal	0.665		94.600	0.323	0.050	0.100
Gas/Diesel Oil	1.034	0.869	73.247	0.074	0.100	
Kerosene	1.056	0.845	71.342	0.034	0.100	0.005
Residual Fuel Oil	0.985		75.959	0.485	0.200	
LPG	1.126	0.579	63.647	0.000	0.100	
Natural Gas			54.890	0.000	0.100	0.005

Sources: Environmental Protection Agency, Sustainable Energy Ireland

Global Warming Potential

Emitted Gas	Global warming potential over 100 years (CO ₂ equivalents per tonne of gas emitted)		
	Carbon dioxide (CO ₂)	1	
Methane (CH ₄)	21		
Nitrous Oxide (N ₂ O)	310		
Emitted Gas	Acid rain precursors (SO ₂ equivalents per tonne of gas emitted)		
	Sulphur dioxide (SO ₂)	1	
	Oxides of Nitrogen (NO _x)	0.6957	
	Ammonia (NH ₃)	1.8824	