



Central Statistics Office
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Environmental Accounts for Ireland 1997-2005

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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 in a condensed manner, using internationally agreed standards, information about the working of the economy.

However, such accounts can be incomplete depending on the analytical focus. In particular, the effects or the potential effects of pollution are not considered. Hence satellite accounts are generated to organise information to supplement the general-purpose 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.

Environmental Satellite Accounts

The aim of the present accounts is to outline the potential impact on the environment of economic and social activity. The idea is 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 eighth set of environmental satellite accounts for Ireland. They set out a longitudinal series of air emissions in respect of the years 1997-2005 and have been compiled by the Economic and Social Research Institute (ESRI) and the Central Statistics Office (CSO). The work for years prior to 2001 was funded by Eurostat (the Statistical Office of the European Communities).

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

The contributions from and assistance of the following bodies to the material in this report is gratefully acknowledged: Environmental Protection Agency, Department of Communications, Marine & Natural Resources, Sustainable Energy Ireland, Electricity Supply Board and Bord Gáis.

Central Statistics Office

July 2007

Chapter 1 Introduction

These satellite accounts breakdown, by economic sector, greenhouse gas emissions and acid rain precursor emissions, 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 figures in these accounts are estimates of emissions into the environment. They are not estimates of pollution levels. Emissions are the flow 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, 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), 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).

¹ http://coe.epa.ie/ghg/nirs/NIR_2007_IE.pdf
<http://www.epa.ie/OurEnvironment/ClimateChange/GreenhouseGasEmissions>

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

Carbon Dioxide - CO₂

Nitrous Oxide - N₂O ⇒⇒⇒ Global warming potential

Methane - CH₄

Sulphur Dioxide - SO₂

Oxides of Nitrogen - NO_x ⇒⇒⇒ Acid rain precursors

Ammonia - NH₃

Technical Notes

1. Forestry sequestration. For EPA Methodology

see <http://coe.epa.ie/ghg/nirdownloads.jsp>, page 80 and following.

2. Air Transport Greenhouse gases: Only the gases resulting from domestic flights LTO's (Landing and take-off's) and cruising from an Irish airport to another Irish airport are accounted for under IPCC guidelines. No emissions from international flights are accounted for.

See page 49 of <http://coe.epa.ie/ghg/nirdownloads.jsp>

Air Transport Acid rain gases: (SO₂, NO_x and NH₃). This is 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.

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 a few 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 be 1 per cent of the total greenhouse gas emissions for Ireland in 2005.

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 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 but may be subject to revision.

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. 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. 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 were used to attribute emissions to the relevant economic sectors. Much of the sectoral data available is company accounts data and the work undertaken in compiling these accounts involved inferring from this economic data the extent of emissions to air attributable to each economic sector (e.g. from fuel expenditure data).

Estimates of emissions to air by industry are primarily derived from the data collected in the CSO's annual *Census of Industrial Production (CIP)*. In the past, 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 in 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, is the best available in the absence of sectoral data on quantities of fuel consumption.

Figures for the services sectors, both market and non-market, were derived from the SEI's Energy Balance Sheets. These balance sheets disaggregate consumption by fuel type into five major sectors: Industry, Transport, Agriculture, Commercial and Public services, and the Residential sector. The balance sheets were also used to estimate sectoral air emissions for the agricultural and residential sectors.

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.

The data provided in this report incorporates revisions to the estimates previously published in respect of the years 1997-2004.

Chapter 4 Results Air Emissions Accounts 1997-2005

The large growth in the Irish economy during the past 8 years has 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 fixed 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 1997-2005

	Units	1997	2005	% change
Gross domestic product (GDP) at 2005 prices	€ Million	94,353	161,498	+71%
Gross domestic fixed capital formation at 2005 prices	€ Million	23,075	42,079	+82%
Numbers at work (Q2)	'000	1,328.5	1,929.2	+45%
Total Primary Energy Requirement	ktonne Oil equiv	11,711	15,613	+33%
Greenhouse Gas emissions	ktonne CO ₂ equiv	62,892	68,587	+9%
Acid Rain precursors	ktonne SO ₂ equiv	485	366	-25%
Household and commercial waste	ktonne	1,697	2,788	+64%

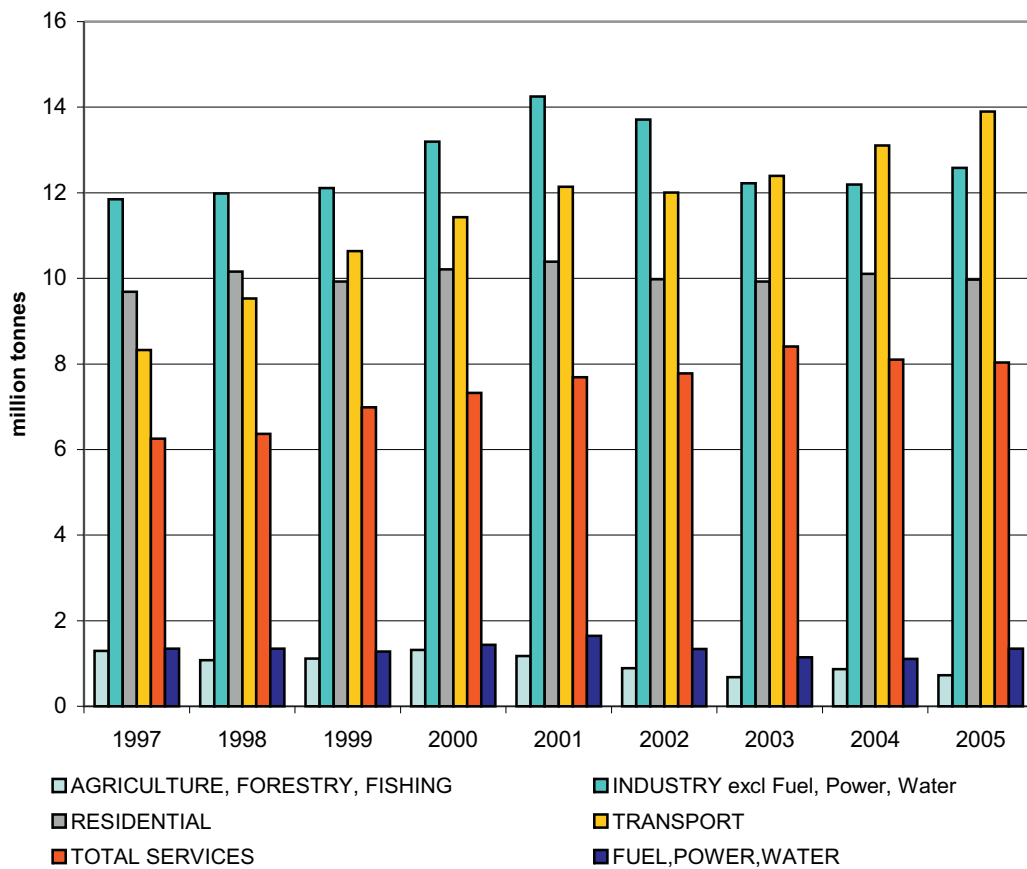
Trends in emissions of CO₂, which are lower than trends in energy consumption, can be explained by changes in the mix of energy sources such as increasing usage of natural gas in electricity generation and increasing imports of electricity. Emissions relating to such imports are not included in these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

Greenhouse Gases

CO₂ emissions

Emissions estimates for carbon dioxide (CO₂) are presented in Table 1. In the period 1997 to 2005 aggregate national emissions increased by 17% from approximately 38.9 to 46.6 million tonnes. The most marked increase in CO₂ emissions occurred in transport where emissions increased by 67% between 1997 and 2005. In the services sector there was a 29% increase, and a 6% increase in the industrial sector while emissions from the residential sector changed marginally. 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.

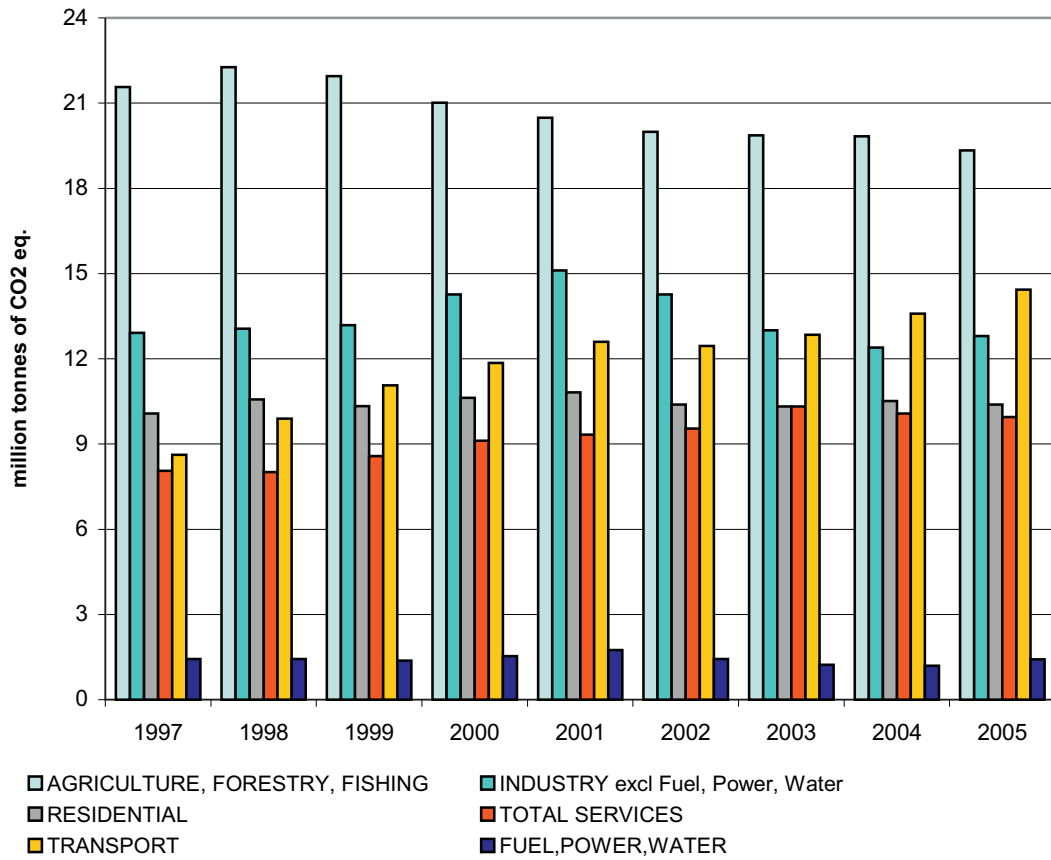
Aggregate N₂O emissions decreased by 11% over the eight-year period due primarily to the drop in production and subsequent closure of a specific plant in the Chemical sector. However the relatively large growth in emissions from the transport sector is notable where N₂O emissions increased by 90% between 1997 and 2005.

Ruminant animals are the primary source of CH₄ emissions while 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 the 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 1997-1999 greenhouse gas emissions in this sector were roughly stationary at an average of 22 million tonnes/annum but there was a 12% reduction in net emissions between 1999 and 2005 due primarily to a decrease in livestock numbers. Transport in particular changed from having the fourth highest level of emissions in 1997 to the second highest in 2005. The services sector recorded a 24% increase in emissions while the industrial sector's emissions decreased by 1% 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 in 1997 and were 23% above the 1990 baseline level in 2005.

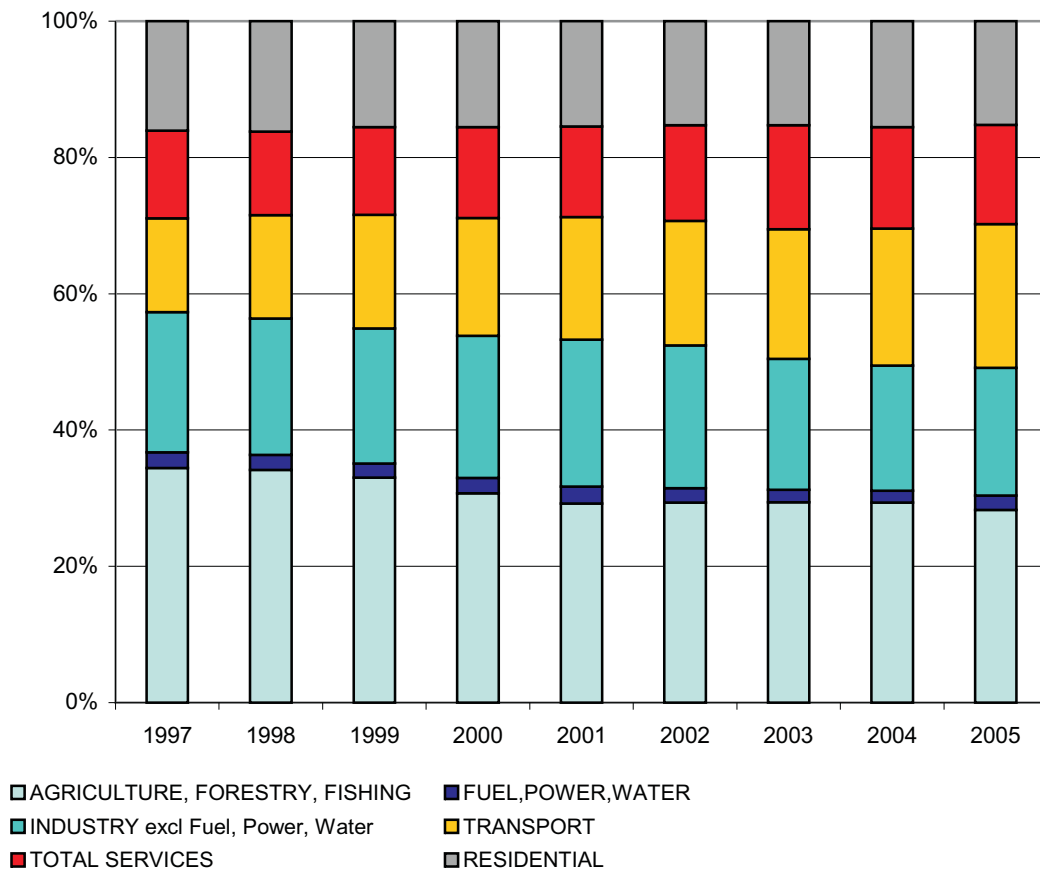
Greenhouse gas emissions as a percentage of 1990 Kyoto protocol baseline*

1997	1998	1999	2000	2001	2002	2003	2004	2005
114%	118%	120%	123%	126%	123%	122%	122%	123%

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

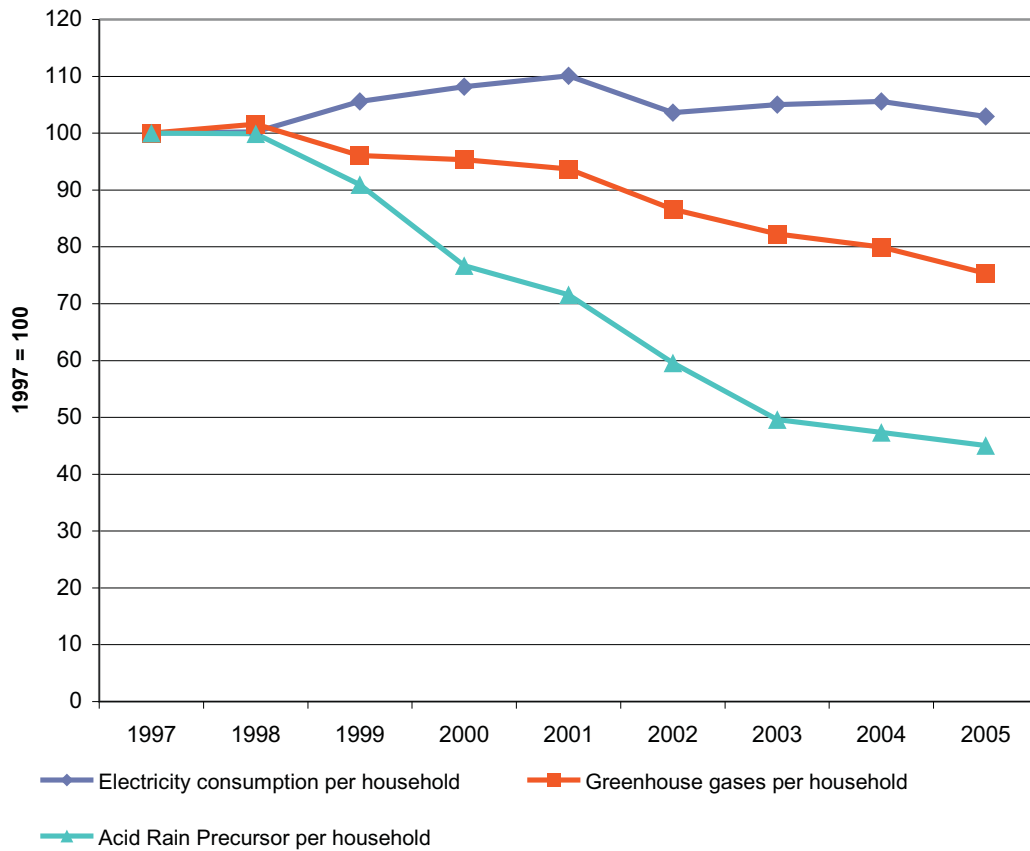
While aggregate emissions have been increasing between 1997 and 2005, the relative sectoral shares of greenhouse gas emissions have also changed, as shown in Figure 3. The share of emissions emanating from the residential and agricultural sectors have declined whereas share of emissions from the transport and services sectors increased.

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



Residential greenhouse gas emissions were stationary at approximately 10 million tonnes per annum between 1997 and 2005. Over the same period the housing stock increased by approximately 37% suggesting that emissions per household declined. However, this hides the fact that households actually increased their demand for energy. Figure 4 shows that residential electricity demand per household increased by 3% between 1997 and 2005 (source Energy Balances) while the greenhouse gas emissions per household declined by 22% in the same period. This increase in per household electricity demand in tandem with 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, less solid fuels used directly by the residential sector and changing patterns of occupancy.

Figure 4: Residential Sector Electricity Demand and Emissions

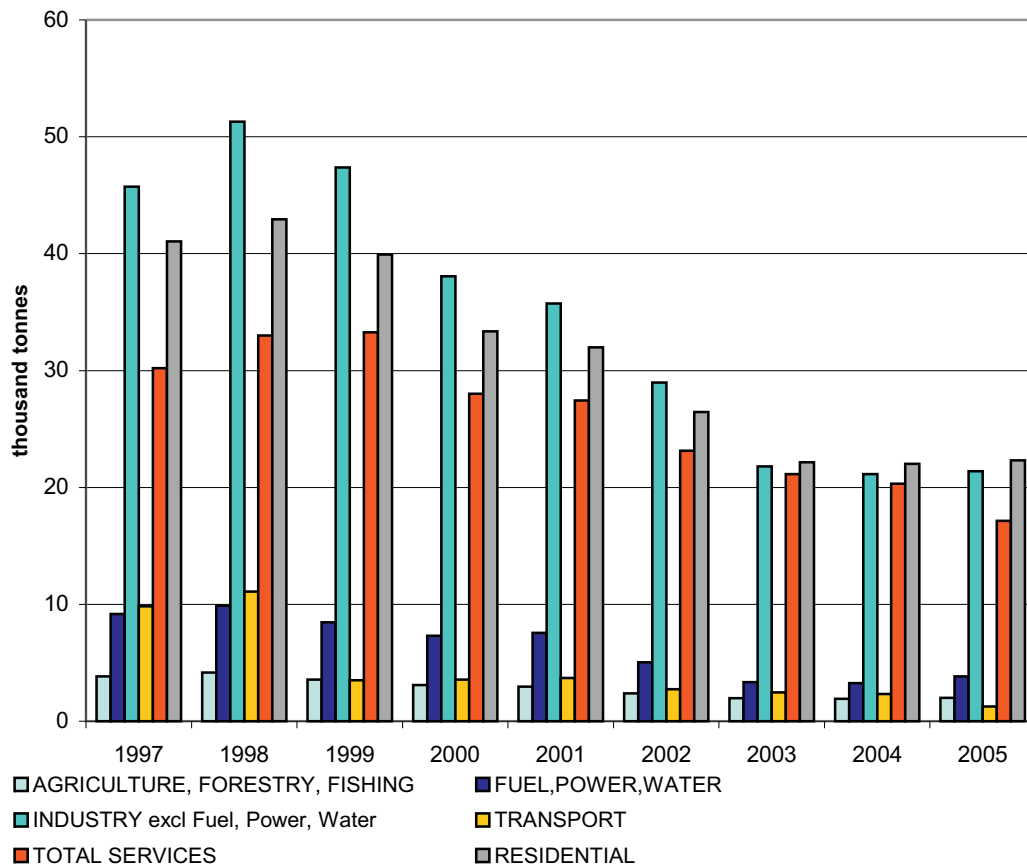


Acid rain precursors

SO₂ emissions

Sulphur dioxide (SO₂) emissions are presented in Table 5, which shows that emissions declined by 57% between 1997 and 2005. 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 86% of all SO₂ emissions in contrast to 70% in 1997.

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 1997 and 2005 was 5% overall while the residential sector showed a significant downward movement (-9%) over the period due primarily to less intensive emissions in electricity generation. Ammonia (NH₃) emissions which predominantly derive from agricultural sources were 3% higher in 1999 compared to 1997 levels but subsequently declined by 11% in the period 1999 to 2005 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). The emissions declined by 25% over the period reaching 366,000 tonnes in 2005. The agricultural sector which accounts for 60% of total emissions at present, fell by 10% in the period. Elsewhere in the economy there have been only relatively small fluctuations in the magnitude of emissions up to 2001, as illustrated in Figure 7.

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

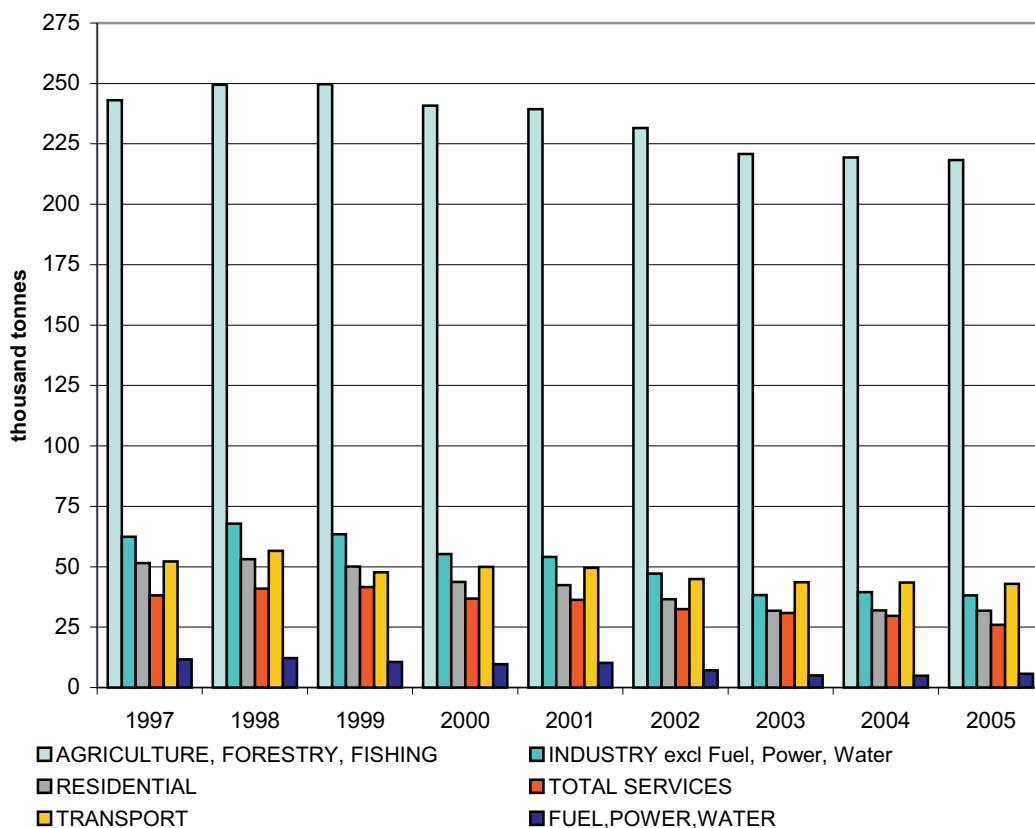
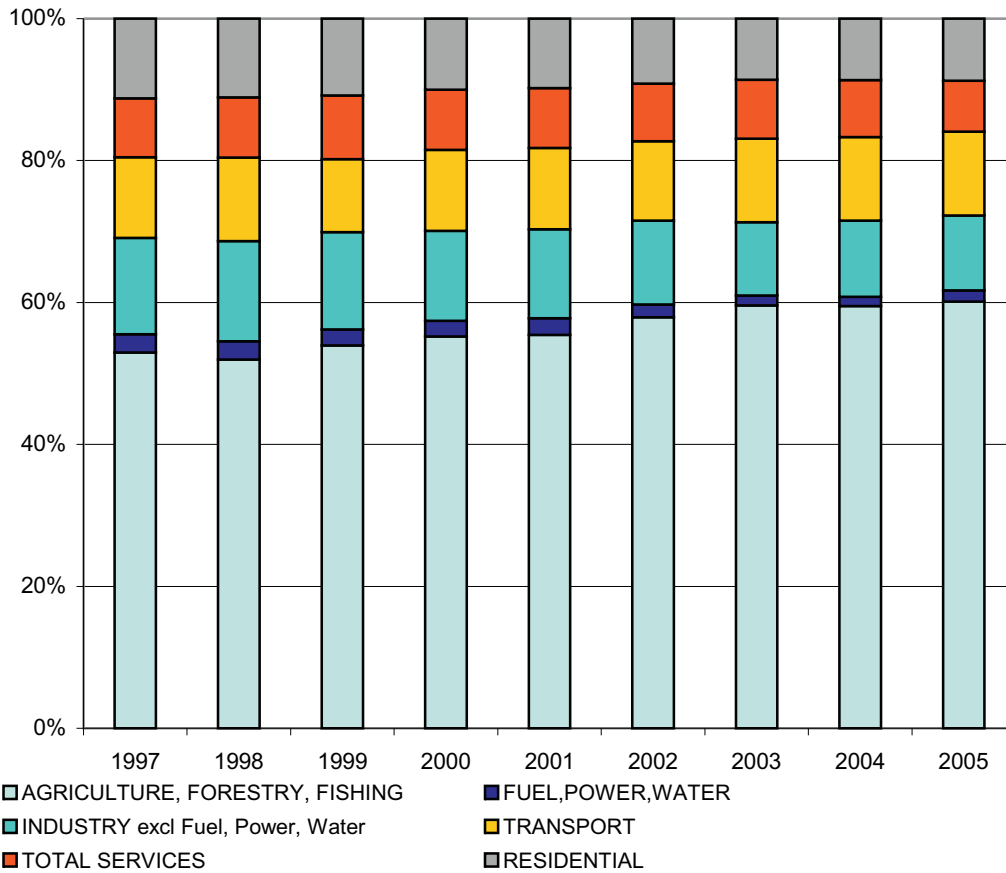


Figure 7: Sector Shares - Acid Rain Precursor (SO₂, NO_x, NH₃) Emissions



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 2005 Emissions (kt)	Ceiling by 2010 (kt)	Reduction required to meet 2010 target (kt)	Percentage reduction required
Sulphur Dioxide (SO ₂)	71	42	29	41%
Nitrogen Oxides (NO _x)	119	65	54	45%
Ammonia (NH ₃)	113	116	0	0%

Source: Department of the Environment and Local Government & 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 – 2004

Table 1: Carbon Dioxide (CO₂) Emissions

		Thousand tonnes									
NACE		1997	1998	1999	2000	2001	2002	2003	2004	2005	
REV 1											
	Emissions by Agriculture, Forestry, Fishing	1,644.9	1,581.1	1,703.1	1,791.0	1,802.6	1,625.3	1,739.6	1,530.1	1,535.6	
	Sequestration by forestry	-349.4	-505.2	-591.9	-474.2	-624.9	-738.4	-1,060.0	-665.8	-811.4	
	AGRICULTURE, FORESTRY, FISHING	1,295.4	1,076.0	1,111.2	1,316.8	1,177.7	886.9	679.6	864.4	724.2	
	FUEL, POWER, WATER	1,347.7	1,347.5	1,282.2	1,436.4	1,642.6	1,339.7	1,142.3	1,108.4	1,345.2	
	Coal, peat, petroleum, metal ores, quarrying	904.2	961.4	994.4	1,037.3	1,129.7	1,162.1	1,148.7	1,126.3	1,141.7	
	Food, beverage, tobacco	2,411.7	2,467.7	2,482.8	2,658.7	2,823.4	2,915.7	2,486.9	2,548.9	2,463.4	
	Textiles Clothing Leather & Footwear	238.8	234.1	235.7	237.6	262.8	231.3	198.4	178.2	181.9	
	Wood & wood products	280.6	269.4	277.1	277.3	284.3	260.2	227.5	216.5	225.6	
	Pulp, paper & print production	249.5	252.2	259.0	258.5	268.0	244.8	212.8	232.0	217.5	
	Chemical production	2,668.6	2,674.1	2,580.0	2,643.1	2,695.7	2,338.7	1,263.8	1,138.0	1,252.1	
	Rubber & plastic production	134.9	137.5	139.0	135.3	94.8	86.8	77.6	74.3	81.1	
	Non-metallic mineral production	2,524.3	2,394.9	2,432.7	3,256.4	3,933.3	3,856.3	4,109.3	4,481.8	4,794.9	
	Metal prod. excl. machinery & transport equip.	969.0	1,030.1	1,010.1	1,001.8	841.0	737.7	751.4	730.8	713.3	
	Agriculture & industrial machinery	839.4	869.6	892.8	903.7	1,105.1	1,087.7	950.0	885.2	920.0	
	Office and data process machines	57.7	67.2	75.9	78.1	105.1	107.3	96.2	79.1	63.8	
	Electrical goods	268.6	260.6	273.0	268.7	298.2	272.8	262.7	259.3	298.2	
	Transport equipment	99.0	102.0	103.8	102.3	100.0	91.2	79.3	82.4	84.8	
	Other manufacturing	161.9	216.9	309.6	291.2	256.0	258.3	307.1	115.2	99.0	
	Construction	42.5	44.8	45.7	46.6	48.7	60.0	48.4	47.0	44.3	
	INDUSTRY excl. Fuel, Power, Water	11,850.8	11,982.7	12,111.5	13,196.6	14,246.2	13,710.9	12,220.2	12,195.0	12,581.6	
	TRANSPORT*	8,326.6	9,530.0	10,636.8	11,426.4	12,137.5	12,004.1	12,393.6	13,107.3	13,899.2	
	SERVICES excl Transport	6,253.8	6,368.5	6,986.3	7,322.7	7,687.7	7,782.6	8,410.5	8,099.2	8,036.9	
	RESIDENTIAL	9,690.2	10,158.6	9,924.2	10,213.2	10,390.7	9,975.4	9,925.6	10,103.6	9,972.4	
	Sub-TOTAL	38,764.5	40,463.3	42,052.2	44,912.0	47,282.4	45,699.6	44,771.8	45,477.8	46,559.6	
	Not attributed to any sector	87.3	88.3	85.0	80.3	79.5	77.2	75.7	74.5	75.4	
	TOTAL	38,851.8	40,551.6	42,137.2	44,992.3	47,361.9	45,776.8	44,847.5	45,552.3	46,635.0	

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

Table 2: Nitrous Oxide (N₂O) Emissions

		Thousand tonnes									
NACE		1997	1998	1999	2000	2001	2002	2003	2004	2005	
REV 1											
AGRICULTURE, FORESTRY, FISHING	1,2,5	25.67	27.31	27.24	25.80	24.59	24.25	24.84	24.29	23.66	
FUEL,POWER,WATER	40-41	0.15	0.16	0.15	0.16	0.19	0.15	0.12	0.12	0.15	
Coal, peat, petroleum, metal ores, quarrying	10-14	0.07	0.07	0.07	0.08	0.08	0.08	0.07	0.07	0.07	
Food, beverage, tobacco	15-16	0.15	0.17	0.17	0.16	0.17	0.15	0.12	0.11	0.12	
Textiles Clothing Leather & Footwear	17-19	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	
Wood & wood products	20	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	
Pulp, paper & print production	21-22	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	
Chemical production	24	2.68	2.71	2.70	2.71	1.99	1.05	0.09	0.08	0.09	
Rubber & plastic production	25	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Non-metallic mineral production	26	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.03	0.04	
Metal prod. excl. machinery & transport equip.	27-28	0.07	0.07	0.07	0.07	0.05	0.04	0.03	0.03	0.03	
Agriculture & industrial machinery	29	0.09	0.10	0.10	0.10	0.12	0.12	0.09	0.09	0.10	
Office and data process machines	30	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	
Electrical goods	31-33	0.02	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	
Transport equipment	34-35	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Other manufacturing	36-37,23	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	
Construction	45	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	
INDUSTRY excl. Fuel, Power, Water		3.25	3.32	3.32	3.31	2.62	1.61	0.55	0.50	0.55	
TRANSPORT*		0.82	1.01	1.23	1.19	1.31	1.26	1.30	1.40	1.56	
SERVICES excl Transport		0.71	0.76	0.82	0.85	0.88	0.87	0.90	0.87	0.86	
RESIDENTIAL		1.02	1.09	1.14	1.14	1.21	1.17	1.11	1.16	1.20	
Sub-TOTAL		31.62	33.65	33.89	32.45	30.80	29.31	28.82	28.34	27.98	
Not attributed to any sector		0.44	0.42	0.45	0.50	0.50	0.50	0.49	0.49	0.56	
TOTAL		32.06	34.06	34.35	32.95	31.30	29.81	29.30	28.83	28.55	

* 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												
		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	
AGRICULTURE, FORESTRY, FISHING	1,2,5	567.10	567.50	579.89	586.52	605.82	590.24	557.43	556.68	551.44	547.09	544.79	536.77	
FUEL, POWER, WATER	40-41	1.62	1.78	1.96	1.90	1.81	1.91	1.94	1.90	1.97	2.38	2.27	1.61	
Coal, peat, petroleum, metal ores, quarrying	10-14	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.08	0.07	27.13	0.08	0.09	
Food, beverage, tobacco	15-16	0.76	0.83	0.74	0.66	0.53	0.47	0.49	0.49	0.51	0.50	0.62	0.54	
Textiles Clothing Leather & Footwear	17-19	0.05	0.05	0.05	0.06	0.06	0.05	0.06	0.08	0.07	0.06	0.05	0.05	
Wood & wood products	20	0.03	0.06	0.04	0.02	0.00	0.00	0.00	-	-	-	0.00	0.00	
Pulp, paper & print production	21-22	0.01	0.01	0.01	0.00	0.00	0.00	0.00	-	-	-	0.02	0.01	
Chemical production	24	1.83	1.56	1.29	1.31	1.13	0.95	0.81	0.79	0.48	0.11	0.10	0.11	
Rubber & plastic production	25	0.01	0.01	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-	
Non-metallic mineral production	26	0.43	0.54	0.51	0.50	0.46	0.40	0.53	1.03	1.06	1.02	1.20	1.50	
Metal prod. excl. machinery & transport equip.	27-28	0.06	0.05	0.05	0.04	0.03	0.04	0.00	0.00	0.00	0.00	0.00	0.00	
Agriculture & industrial machinery	29	0.03	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
Office and data process machines	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.01	0.01	0.01	
Electrical goods	31-33	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.03	0.03	0.04	
Transport equipment	34-35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-	0.00	0.00	
Other manufacturing	36-37,23	0.17	0.14	0.11	0.08	0.11	0.17	0.13	0.11	0.10	0.10	0.03	0.02	
Construction	45	-	-	-	-	-	-	-	-	-	-	-	-	
INDUSTRY excl. Fuel, Power, Water		3.43	3.33	2.88	2.75	2.39	2.16	2.10	2.66	2.36	29.00	2.18	2.40	
TRANSPORT*		1.87	1.89	2.01	2.06	2.27	2.38	2.59	2.58	2.48	2.33	2.23	2.16	
SERVICES excl Transport**		73.05	75.66	77.89	75.35	66.91	63.35	73.05	64.92	71.05	77.83	81.22	78.68	
RESIDENTIAL		3.75	3.28	3.54	2.97	3.27	2.80	2.80	2.72	2.54	2.39	2.47	2.29	
Sub-TOTAL		650.82	653.46	668.17	671.56	682.47	662.84	639.91	631.46	631.83	661.01	635.16	623.92	
Not attributed to any sector		-	-	-	-	-	-	-	-	-	-	-	-	
TOTAL		650.82	653.46	668.17	671.56	682.47	662.84	639.91	631.46	631.83	661.01	635.16	623.92	

* 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)

NACE		Thousand tonnes CO ₂ equivalents									
REV 1		1997	1998	1999	2000	2001	2002	2003	2004	2005	
1,2,5	AGRICULTURE, FORESTRY, FISHING	21,570.4	22,264.2	21,949.9	21,019.6	20,489.7	19,984.6	19,869.3	19,834.3	19,332.6	
40-41	FUEL, POWER, WATER	1,435.6	1,435.4	1,369.1	1,527.1	1,741.2	1,428.1	1,229.1	1,192.0	1,424.6	
10-14	Coal, peat, petroleum, metal ores, quarrying	926.0	984.7	1,018.4	1,061.9	1,156.7	1,188.9	1,740.8	1,149.4	1,166.7	
15-16	Food, beverage, tobacco	2,472.6	2,530.1	2,544.7	2,719.0	2,887.2	2,973.8	2,535.2	2,596.6	2,512.9	
17-19	Textiles Clothing Leather & Footwear	245.3	241.0	242.7	244.4	269.7	237.4	203.3	182.6	186.7	
20	Wood & wood products	289.8	278.9	286.8	286.6	294.0	268.8	234.3	222.8	232.5	
21-22	Pulp, paper & print production	257.8	261.2	268.0	267.2	277.1	252.9	219.3	238.3	224.1	
24	Chemical production	3,527.8	3,536.8	3,436.3	3,499.8	3,329.8	2,673.0	1,293.9	1,165.6	1,282.4	
25	Rubber & plastic production	138.8	141.7	143.2	139.3	97.8	89.4	79.7	76.2	83.4	
26	Non-metallic mineral production	2,550.1	2,421.1	2,457.9	3,283.8	3,971.6	3,893.2	4,142.3	4,517.7	4,838.2	
27-28	Metal prod. excl. machinery & transport equip.	990.9	1,053.7	1,034.1	1,024.1	857.0	748.7	759.9	738.7	721.9	
29	Agriculture & industrial machinery	868.5	901.2	924.7	934.6	1,143.7	1,125.1	980.0	912.9	950.4	
30	Office and data process machines	59.2	68.9	77.6	79.7	108.4	110.1	98.5	81.0	65.4	
31-33	Electrical goods	276.4	269.0	281.5	276.9	306.9	280.2	268.9	265.3	305.6	
34-35	Transport equipment	102.1	105.4	107.2	105.6	103.4	94.2	81.7	84.6	87.3	
36-37,23	Other manufacturing	165.5	221.4	315.2	296.0	260.1	261.8	310.5	116.8	100.4	
45	Construction	44.1	46.5	47.4	48.2	50.5	62.1	50.0	48.5	45.8	
	INDUSTRY excl. Fuel, Power, Water	12,914.8	13,061.4	13,185.7	14,267.1	15,113.9	14,259.3	12,998.4	12,397.1	12,803.7	
	TRANSPORT*	8,624.2	9,891.4	11,068.0	11,849.0	12,599.3	12,446.0	12,846.3	13,587.9	14,428.6	
	SERVICES excl Transport	8,056.3	8,009.3	8,571.3	9,119.7	9,324.4	9,544.6	10,323.8	10,074.0	9,954.6	
	RESIDENTIAL	10,068.1	10,563.9	10,335.3	10,626.4	10,822.5	10,391.7	10,318.8	10,515.4	10,393.2	
	Sub-TOTAL	62,669.5	65,225.6	66,479.3	68,408.9	70,091.0	68,054.4	67,585.7	67,600.7	68,337.3	
	Not attributed to any sector	222.1	217.6	225.7	235.6	233.6	231.3	226.4	226.1	250.1	
	TOTAL	62,891.6	65,443.2	66,705.0	68,644.6	70,324.6	68,285.7	67,812.0	67,826.8	68,587.3	

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

Table 5: Sulphur Dioxide (SO₂) Emissions

		Thousand tonnes									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	
NACE											
REV 1											
1,2,5	AGRICULTURE, FORESTRY, FISHING	3.84	4.16	3.56	3.08	2.97	2.40	1.97	1.91	1.88	
40-41	FUEL,POWER,WATER	9.19	9.88	8.46	7.30	7.56	5.05	3.34	3.26	3.80	
10-14	Coal, peat, petroleum, metal ores, quarrying	4.17	4.77	4.52	3.64	2.81	2.71	1.94	2.14	2.32	
15-16	Food, beverage, tobacco	10.84	12.17	11.26	8.93	8.78	7.09	5.23	5.01	4.89	
17-19	Textiles Clothing Leather & Footwear	1.15	1.24	1.14	0.90	0.85	0.65	0.46	0.41	0.40	
20	Wood & wood products	1.74	1.95	1.81	1.41	1.33	1.02	0.72	0.67	0.67	
21-22	Pulp, paper & print production	1.61	1.80	1.66	1.30	1.21	0.91	0.62	0.58	0.57	
24	Chemical production	7.26	8.12	7.56	5.94	5.68	4.42	3.10	2.95	2.98	
25	Rubber & plastic production	0.84	0.94	0.86	0.67	0.41	0.30	0.21	0.20	0.22	
26	Non-metallic mineral production	3.24	3.65	3.33	2.70	2.68	2.15	1.60	1.62	1.71	
27-28	Metal prod. excl. machinery & transport equip.	6.01	6.83	6.13	5.46	4.55	3.79	3.81	3.73	3.61	
29	Agriculture & industrial machinery	5.48	6.16	5.69	4.43	4.93	4.00	2.71	2.52	2.52	
30	Office and data process machines	0.31	0.35	0.33	0.27	0.39	0.29	0.20	0.16	0.12	
31-33	Electrical goods	1.68	1.79	1.68	1.32	1.17	0.87	0.65	0.64	0.71	
34-35	Transport equipment	0.65	0.72	0.67	0.52	0.45	0.34	0.23	0.22	0.22	
36-37,23	Other manufacturing	0.43	0.47	0.43	0.34	0.27	0.21	0.17	0.15	0.12	
45	Construction	0.29	0.33	0.30	0.24	0.22	0.23	0.14	0.14	0.12	
	INDUSTRY excl. Fuel, Power, Water	45.72	51.29	47.39	38.06	35.74	28.97	21.79	21.13	21.17	
	TRANSPORT*	9.82	11.09	3.50	3.57	3.70	2.74	2.46	2.33	1.53	
	SERVICES excl Transport	30.21	33.01	33.28	28.01	27.43	23.15	21.14	20.31	16.99	
	RESIDENTIAL	41.06	42.93	39.93	33.37	31.99	26.46	22.16	22.03	22.09	
	Sub-TOTAL	139.83	152.36	136.12	113.39	109.38	88.78	72.86	70.97	67.46	
	Not attributed to any sector	26.28	23.70	21.25	18.09	16.67	7.47	3.82	-0.05	2.94	
	TOTAL	166.11	176.06	157.37	131.49	126.05	96.25	76.69	70.92	70.40	

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

Table 6: Oxides of Nitrogen (NO_x) Emissions

	NACE REV 1	Thousand tonnes									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	
AGRICULTURE, FORESTRY, FISHING	1,2,5	12.23	13.05	13.99	15.19	13.38	13.35	13.47	13.03	13.19	
FUEL,POWER,WATER	40-41	3.58	3.41	3.05	3.45	3.71	3.08	2.48	2.39	2.83	
Coal, peat, petroleum, metal ores, quarrying	10-14	2.02	2.06	2.10	2.45	2.55	2.62	2.26	2.54	2.69	
Food, beverage, tobacco	15-16	6.17	6.09	5.92	6.31	6.32	6.63	5.60	5.69	5.54	
Textiles Clothing Leather & Footwear	17-19	0.69	0.67	0.64	0.66	0.73	0.66	0.55	0.48	0.49	
Wood & wood products	20	0.77	0.68	0.66	0.66	0.64	0.60	0.50	0.47	0.48	
Pulp, paper & print production	21-22	0.66	0.63	0.61	0.61	0.60	0.56	0.46	0.48	0.45	
Chemical production	24	3.97	3.81	3.71	3.95	3.69	3.39	2.64	2.39	2.57	
Rubber & plastic production	25	0.35	0.34	0.32	0.32	0.21	0.19	0.16	0.15	0.16	
Non-metallic mineral production	26	3.16	3.06	2.79	3.41	5.33	5.54	5.28	6.06	7.30	
Metal prod. excl. machinery & transport equip.	27-28	2.45	2.54	2.39	2.42	1.96	1.79	1.81	1.77	1.71	
Agriculture & industrial machinery	29	2.26	2.24	2.16	2.21	2.55	2.55	2.12	1.97	2.00	
Office and data process machines	30	0.13	0.14	0.15	0.15	0.26	0.25	0.22	0.19	0.15	
Electrical goods	31-33	0.69	0.64	0.63	0.63	0.67	0.63	0.58	0.58	0.67	
Transport equipment	34-35	0.26	0.25	0.24	0.24	0.22	0.21	0.17	0.17	0.17	
Other manufacturing	36-37,23	0.34	0.43	0.58	0.55	0.46	0.48	0.56	0.22	0.19	
Construction	45	0.11	0.11	0.11	0.11	0.11	0.14	0.11	0.10	0.09	
INDUSTRY excl. Fuel, Power, Water		24.02	23.68	23.01	24.69	26.30	26.23	23.02	23.28	24.66	
TRANSPORT*		58.66	62.44	59.80	61.77	60.58	54.67	53.05	52.63	51.50	
SERVICES excl Transport		11.35	11.32	11.92	12.70	12.78	13.34	13.97	13.44	12.97	
RESIDENTIAL		15.07	14.73	14.61	14.92	14.86	14.59	13.92	14.18	13.94	
Sub-TOTAL		124.91	128.64	126.37	132.71	131.61	125.26	119.92	118.95	119.09	
Not attributed to any sector		-	-	-	-	-	-	-	-	-	
TOTAL		124.91	128.64	126.37	132.71	131.61	125.26	119.92	118.95	119.09	

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

Table 7: Ammonia (NH₃) Emissions

NACE REV 1	Thousand tonnes									
	1997	1998	1999	2000	2001	2002	2003	2004	2005	
AGRICULTURE, FORESTRY, FISHING	122.60	125.50	125.61	120.66	120.65	116.81	111.31	110.73	110.11	
FUEL,POWER,WATER	-	-	-	-	-	-	-	-	-	-
Coal, peat, petroleum, metal ores, quarrying	-	-	-	0.00	0.00	-	0.29	1.14	-	-
Food, beverage, tobacco	-	-	-	-	-	-	-	-	-	-
Textiles Clothing Leather & Footwear	-	-	-	-	-	-	-	-	-	-
Wood & wood products	-	-	-	-	-	-	-	-	-	-
Pulp, paper & print production	-	-	-	-	-	-	-	-	-	-
Chemical production	-	-	-	-	-	-	-	-	-	-
Rubber & plastic production	-	-	-	-	-	-	-	-	-	-
Non-metallic mineral production	-	-	-	-	-	-	-	-	-	-
Metal prod. excl. machinery & transport equip.	-	-	-	-	-	-	-	-	-	-
Agriculture & industrial machinery	-	-	-	-	-	-	-	-	-	-
Office and data process machines	-	-	-	-	-	-	-	-	-	-
Electrical goods	-	-	-	-	-	-	-	-	-	-
Transport equipment	-	-	-	-	-	-	-	-	-	-
Other manufacturing	-	-	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-	-	-	-
INDUSTRY excl. Fuel, Power, Water	-	-	-	0.00	0.00	-	0.29	1.14	-	-
TRANSPORT*	0.80	1.05	1.38	1.78	1.95	2.17	2.25	2.41	2.58	
SERVICES excl Transport	-	-	-	-	-	-	-	-	-	-
RESIDENTIAL	-	-	-	-	-	-	-	-	-	-
Sub-TOTAL	123.40	126.55	126.99	122.44	122.60	118.97	113.84	114.27	112.70	
Not attributed to any sector	-	-	-	-	-	-	-	-	-	-
TOTAL	123.40	126.55	126.99	122.44	122.60	118.97	113.84	114.27	112.70	

* 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)

NACE REV 1	Thousand tonnes SO ₂ equivalents									
	1997	1998	1999	2000	2001	2002	2003	2004	2005	
1,2,5	243.1	249.5	249.7	240.8	239.4	231.6	220.9	219.4	218.3	
40-41	11.7	12.2	10.6	9.7	10.1	7.2	5.1	4.9	5.8	
10-14	5.6	6.2	6.0	5.3	4.6	4.5	4.1	6.1	4.2	
15-16	15.1	16.4	15.4	13.3	13.2	11.7	9.1	9.0	8.7	
17-19	1.6	1.7	1.6	1.4	1.4	1.1	0.8	0.7	0.7	
20	2.3	2.4	2.3	1.9	1.8	1.4	1.1	1.0	1.0	
21-22	2.1	2.2	2.1	1.7	1.6	1.3	0.9	0.9	0.9	
24	10.0	10.8	10.1	8.7	8.2	6.8	4.9	4.6	4.8	
25	1.1	1.2	1.1	0.9	0.6	0.4	0.3	0.3	0.3	
26	5.4	5.8	5.3	5.1	6.4	6.0	5.3	5.8	6.8	
27-28	7.7	8.6	7.8	7.1	5.9	5.0	5.1	5.0	4.8	
29	7.1	7.7	7.2	6.0	6.7	5.8	4.2	3.9	3.9	
30	0.4	0.5	0.4	0.4	0.6	0.5	0.4	0.3	0.2	
31-33	2.2	2.2	2.1	1.8	1.6	1.3	1.1	1.0	1.2	
34-35	0.8	0.9	0.8	0.7	0.6	0.5	0.3	0.3	0.3	
36-37,23	0.7	0.8	0.8	0.7	0.6	0.5	0.6	0.3	0.3	
45	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	
INDUSTRY excl. Fuel, Power, Water	62.4	67.8	63.4	55.2	54.0	47.2	38.3	39.5	38.3	
TRANSPORT*	52.1	56.5	47.7	49.9	49.5	44.9	43.6	43.5	42.2	
SERVICES excl Transport	38.1	40.9	41.6	36.8	36.3	32.4	30.9	29.7	26.0	
RESIDENTIAL	51.5	53.2	50.1	43.7	42.3	36.6	31.8	31.9	31.8	
Sub-TOTAL	459.0	480.1	463.1	436.2	431.7	399.9	370.6	368.8	362.5	
Not attributed to any sector	26.3	23.7	21.2	18.1	16.7	7.5	3.8	-0.0	2.9	
TOTAL	485.3	503.8	484.3	454.3	448.4	407.3	374.4	368.8	365.4	

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

Table 9: GVA by Sector (Current Prices)

	NACE REV 1	1997	1998	1999	2000	2001	2002	2003	2004	2005
Agriculture, Forestry and Fishing	1,2,5	3,435	3,495	3,259	3,504	3,596	3,462	3,499	3,569	4,097
Coal, peat, petroleum, metal ores, quarrying	10-14	410	362	328	435	481	429	450	503	607
Food, beverage, tobacco	15-16	4,289	4,845	5,185	5,885	7,161	7,769	8,670	7,950	8,400
Textiles Clothing Leather & Footwear	17-19	382	463	371	356	354	297	242	235	215
Wood & wood products	20	172	189	226	244	255	326	305	380	383
Pulp, paper & print production	21-22	1,902	2,140	2,996	3,364	3,372	3,789	3,895	4,520	5,104
Chemical production	24	5,882	8,918	10,042	9,842	12,834	17,026	13,545	12,273	10,805
Rubber & plastic production	25	399	486	448	482	487	452	457	534	579
Non-metallic mineral production	26	517	613	687	763	725	738	772	768	945
Metal prod. excl. machinery & transport equip.	27-28	475	612	596	730	712	684	667	774	803
Agriculture & industrial machinery	29	584	690	644	698	663	671	618	677	685
Electrical and Optical Equipment	30-33	4,014	4,330	6,288	8,326	7,567	6,480	6,777	6,756	7,342
Transport equipment	34-35	278	362	363	432	407	386	409	411	414
Other manufacturing	36-37,23	525	589	527	724	577	638	763	717	679
Construction	45	3,374	4,261	5,334	6,981	8,145	8,944	10,192	11,700	13,504

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*Strategy to Reduce Emissions of Transboundary Pollution by 2010 to comply
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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	