

An Official Statistics Publication for Scotland

Scottish Greenhouse Gas Emissions 2007

This provides the first release of Scottish greenhouse gas emissions⁽¹⁾ data for 2007. Except where stated, the emissions figures shown in this release include an estimate of emissions from international aviation and shipping.

Key points

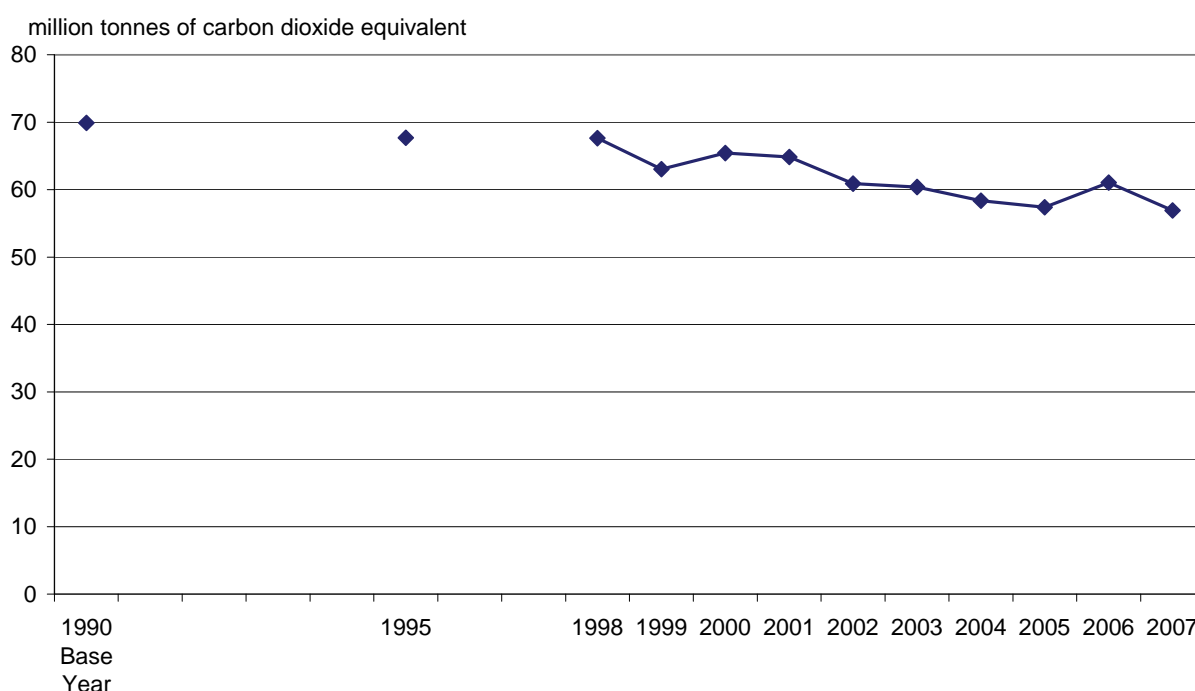
- In 2007, Scottish emissions of the basket of six greenhouse gases⁽²⁾ are estimated to be 56.9 million tonnes carbon dioxide equivalent⁽³⁾ (Mt CO₂e). This is 6.8 per cent lower than the 2006 figure of 61.0 Mt CO₂e. Emissions in the 1990 base year⁽⁴⁾ were 70.0 Mt CO₂e. Between the 1990 base year and 2007, there was an 18.7 per cent reduction in emissions.
- When trading in the EU Emissions Trading Scheme (EU ETS) is taken into account, emissions reduced by 1.2 per cent between 2006 and 2007 (from 57.3 Mt CO₂e to 56.6 Mt CO₂e). Compared with the 1990 base year, emissions in 2007 (after taking account of trading in the EU ETS) were 19.2 per cent lower.
- Excluding trading, between 2006 and 2007, there were decreases in emissions of 14 per cent (3.28 Mt CO₂e) from the energy supply sector, 9 per cent (0.08 Mt CO₂e) from the public sector, and 6 per cent (0.46 Mt CO₂e) from the business and industrial sector. There were, however, increases in emissions from some other sectors, including 1.4 per cent (0.03 Mt CO₂e) from the international shipping and aviation sector and 1.3 per cent (0.16 Mt CO₂e) from the rest of the transport sector. These sectors define the source of the emissions, as opposed to where the end-use occurred.
- Carbon dioxide is the main greenhouse gas, accounting for about 80 per cent of Scottish greenhouse gas emissions in 2007. In 2007, Scottish emissions of carbon dioxide were estimated to be 45.4 Mt CO₂. This was around 8 per cent lower than the 2006 figure of 49.2 Mt CO₂.

These results are shown in Table 1 and Figure 1. The available time series for 1990, 1995, 1998-2007 can be found in [Annex A](#) and [Annex B](#).

Table 1: Emissions of greenhouse gases (million tonnes carbon dioxide equivalent)

	2006	2007	Change
Greenhouse gas emissions excluding international aviation and shipping ⁽¹⁾	58.7	54.5	-7.1%
Greenhouse gas emissions from international aviation	1.1	1.1	0.5%
Greenhouse gas emissions from international shipping	1.2	1.2	2.2%
Total greenhouse gas emissions including international aviation and shipping	61.0	56.9	-6.8%

Figure 1: Total greenhouse gas emissions, 1990 Base Year, 1995, 1998 – 2007



Source: AEA

Coverage of emissions reporting

Reporting of emissions for Scotland excludes any allowance for those UK emissions not allocated to one of the four countries, Scotland, England, Wales or Northern Ireland. Such emissions are mainly emissions resulting from offshore activity.

Whereas in the past, total emissions reported for Scotland have not included an estimate of emissions resulting from international aviation and shipping, the total emissions reported here do include such emissions.

The data presented for international shipping are regarded as preliminary estimates, as there is limited data availability for regional marine shipping fuel use. There is research ongoing in the shipping sector, to derive improved emission estimates for the national and international shipping greenhouse gas emissions at UK level. Once this work is complete, the analysis of Scottish data will need to be re-visited. The data presented above for international aviation are regarded to be of low uncertainty. The aviation estimates are based on a database of UK flight movements and detailed

calculations of emissions from different phases of flights (take off, cruise and landing cycles).

The emissions reported are the combination of emissions minus removals from the atmosphere by *carbon sinks*⁽⁵⁾. Carbon sinks are incorporated within the Land Use, Land Use Change and Forestry (LULUCF) sector, which includes emissions as well as removals resulting from afforestation, reforestation, deforestation and forest management together with changes between grassland and cropland.

Revisions to the Inventory

Scottish greenhouse gas emissions are reviewed every year, and the whole historical data series is revised to incorporate methodological improvements and new data.

It is therefore not appropriate to compare the Inventory from one year with that from another – the latest Inventory represents a single consistent data series going back to 1990 (excluding 1992-1994 and 1996-1997).

In preparing the 2007 figures, the most notable revisions to the historical series since the 2006 figures were published have been linked to changes in the emissions factors used to estimate emissions attributable to specific activities. For the carbon dioxide series, the most significant changes have resulted from new data being incorporated in the inventory series for 2005 and 2006 in respect of fossil fuels use by power stations, autogenerators and refineries, and also from revisions to the Department of Energy and Climate Change (DECC) Regional Energy Statistics from new research into industrial energy use patterns. For the methane series, the most significant changes have been in respect of livestock manure management, again related to the emissions factors, and landfill methane, for which new data has been incorporated from 1998 onwards. For the nitrous oxide series, the only significant changes have resulted from updates to the emissions factors for road transport.

All the revisions to the inventory have resulted in revisions to the 2006 figures. The total of all Scottish greenhouse gas emissions (including international aviation and shipping) has been revised downwards from 61.4 to 61.0 Mt CO₂e. Comparing the 2007 figures with the 2006 figures published a year ago will therefore give a different year-on-year percentage change, but one which is incorrect and should not be used.

Scottish emissions reduction targets

Scotland has a number of targets for reducing greenhouse gas emissions.

These can be summarised as follows:

Climate Change (Scotland) Act 2009

The Act creates a statutory framework for greenhouse gas emissions reductions in Scotland by setting an interim 42 per cent reduction target for 2020, with a power for this to be varied based on expert advice, and an 80 per cent reduction target for 2050. These reductions are based on a 1990 baseline (1995 for the F-Gases⁽²⁾). It also requires the Scottish Ministers to set annual targets, in secondary legislation, for Scottish emissions from 2010-

2050. The first set of targets, covering the period 2010-22, must be set by 1st June 2010.

National performance framework sustainability purpose targets

The long term target (2050) now equates to the target in the Climate Change (Scotland) Act 2009.

The Scottish Government has also set a short term target to reduce emissions by 2011 compared with a 2006 baseline.

Emissions Trading

In reporting emissions reductions against these targets, Scotland is able to take account of emissions trading through the European Union Emissions Trading Scheme (EU ETS). The Scheme has now entered Phase II, covering the five year period 2008-2012. Final results are now available for each year of Phase I, which covered the three year period 2005-2007.

The EU ETS operates as a *cap and trade* scheme, which means that any installation within the Scheme in the EU is given an allocation of emissions allowances (a 'cap') each year. If the installation's actual emissions are above this initial allocation for the year in question, then the installation must either purchase allowances through the Scheme, or bring forward some allowances from the following year's allocation, so as to cover the deficit. Conversely, installations with a surplus of emissions compared with their cap are allowed to either sell allowances or carry them over into the following year's allocation, thus providing a financial incentive to reduce emissions. As there is a finite limit of allowances in the Scheme, any allowances purchased should come from installations which have reduced emissions.

Overall, in the second and third years of Phase I, Scotland was a net acquirer of allowances. This effectively means that installations in Scotland either purchased or brought forward more emissions allowances than they sold or carried over. Taking this into account within the context of Scotland's reported emissions will affect the results by reducing the level of emissions by the amount of EU ETS allowances acquired in those two years. Conversely in the first year of Phase I, Scottish installations sold or carried over more emission allowances than they purchased or brought forward and taking this into account will affect the results by increasing the level of emissions.

It should be noted that at the end of Phase I, the UK Government sold a small number of unallocated allowances on the open market. Scotland's percentage share of these allowances was estimated as being equal to the number of allowances allocated to sites in Scotland in Phase I as a percentage of the number of allowances allocated to UK sites in Phase I. Since it would not have been appropriate to incorporate these sales in the 2007 results alone, they were spread equally over each of the three years in Phase I. Further details of the Scheme can also be found at the [EU ETS section of the Defra website](#).

Scottish performance against emissions reduction targets

Performance measured against targets, incorporating the net EU ETS trading position, can, where appropriate, be summarised as follows:

- Scottish emissions (including international aviation and shipping) of the basket of six greenhouse gases were 19.2 per cent lower in 2007 than in the 1990 base year, down from 70.0 to 56.6 Mt CO₂e.
- Scottish emissions of the basket of six greenhouse gases were 1.2 per cent lower in 2007 than in 2006, down from 57.3 to 56.6 Mt CO₂e.

These results are shown in the context of the headline results in Table 2 and Figure 2 below. A more detailed summary of the results can also be found in [Annex C](#).

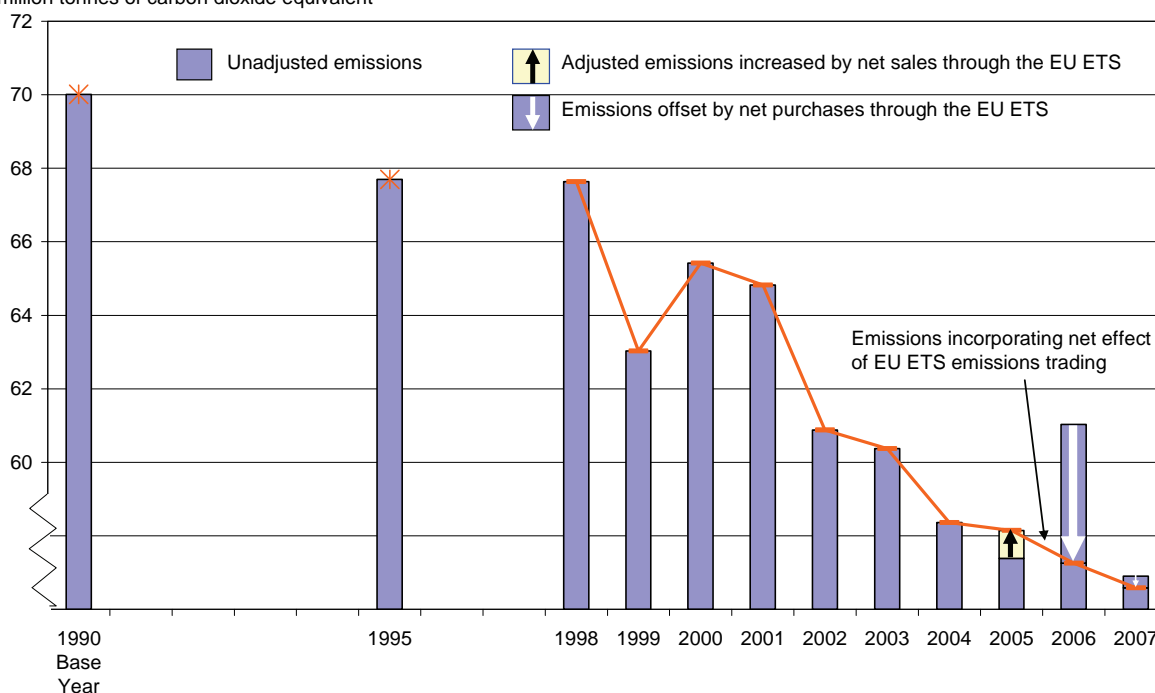
Table 2: Performance against emissions reduction targets (million tonnes carbon dioxide equivalent)

All greenhouse gases	Base year	Base year emissions	2007	
			Emissions	Change from base year
No allowance for trading	1990	70.0	56.9	-18.7%
With allowance for trading	1990	70.0	56.6	-19.2%
No allowance for trading	2006	61.0	56.9	-6.8%
With allowance for trading	2006	57.3	56.6	-1.2%

The 1990 base year uses 1990 for carbon dioxide, methane and nitrous oxide and 1995 for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride

Figure 2: Greenhouse gas emissions incorporating net effect of EU ETS emissions trading: 1990 Base Year, 1995, 1998 – 2007

million tonnes of carbon dioxide equivalent



Source: AEA, DECC, EA, SEPA
Note: Scale does not start at 0

Sources of emissions

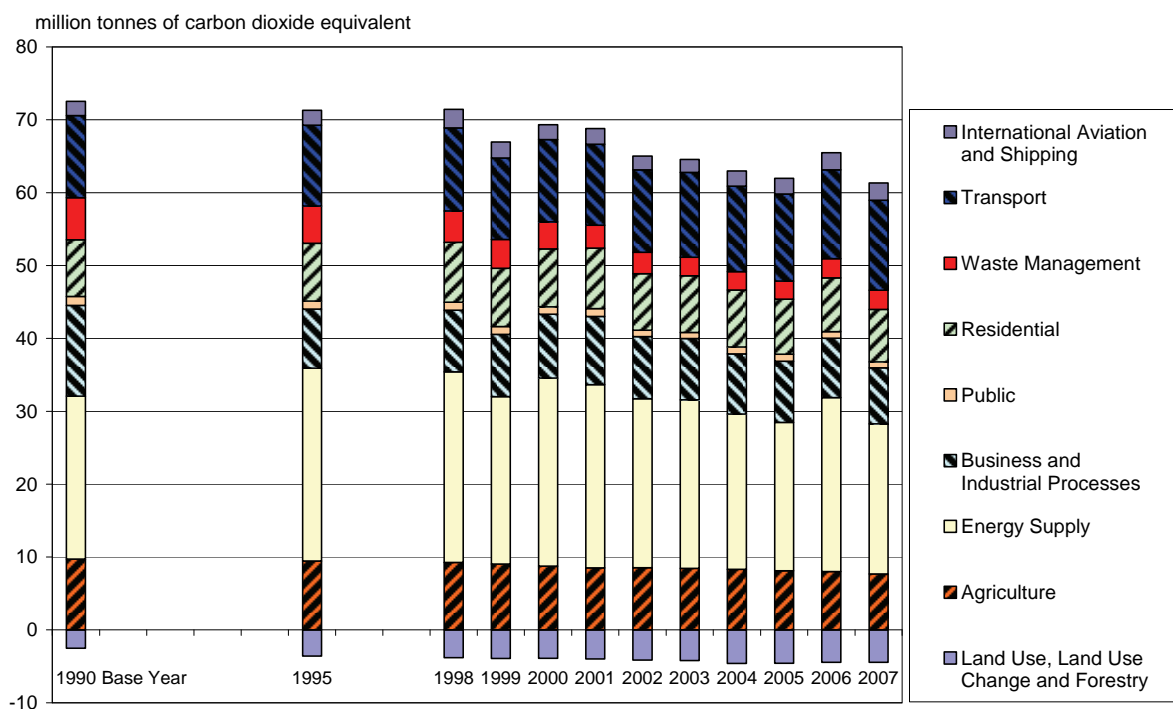
In Scotland in 2007, net removals of carbon dioxide from the land use, land use change and forestry sector were 4.5 Mt CO₂. These removals reduced emissions of carbon dioxide from other sources by 9 per cent from 49.9 Mt CO₂ to 45.4 Mt CO₂. In total carbon dioxide emissions (taking account of removals) accounted for about 80 per cent of Scotland's greenhouse gas emissions in 2007.

Of the remaining basket of greenhouse gases, when weighted by global warming potential, in 2007 methane accounted for 11 per cent, nitrous oxide 8 per cent and the F-gases (hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride) 2 per cent.

In 2007, 36 per cent of greenhouse gas emissions were from the energy supply sector, 22 per cent from transport (excluding international aviation and shipping), 14 per cent from agriculture and 13 per cent from both business⁽⁶⁾ and from residential fossil fuel use. Emissions from waste management (mainly landfill) accounted for 5 per cent of emissions and emissions from international aviation and shipping 4 per cent. These figures total more than 100 per cent due to the effect of net removals from the land use, land use change and forestry (accounting for -8 per cent of overall emissions).

Since the 1990 base year, emissions from transport (excluding international aviation and shipping) have increased by 10 per cent with emissions from international aviation and shipping increasing by 21 per cent. The largest absolute reduction was for business⁽⁶⁾ at -4.8 Mt CO₂e, a 38 per cent reduction. Others categories with significant reductions are waste management down 3.1 Mt CO₂e (54 per cent reduction), agriculture down 2.0 Mt CO₂e (21 per cent) and energy supply down 1.8 Mt CO₂e (8 per cent). Land use, land use change and forestry net removals increased by 1.9 Mt CO₂e; 76 per cent more than removed in the base year.

Figure 3: Greenhouse gas emissions by source: 1990 Base Year, 1995, 1998 – 2007



Source: AEA

Since 2006, emissions from transport (excluding international aviation and shipping) have risen by 1 per cent as have emissions from international aviation and shipping and emissions from waste management. Emissions from energy supply, public sector fossil fuel use and business⁽⁶⁾ have fallen by 14, 9 and 6 per cent respectively. The fall in emissions from the energy supply sector equates to 3.3 Mt CO₂e. This follows a rise of 3.5 Mt CO₂e the previous year which was mainly the result of increased use of coal fired power stations due to the relatively high price of gas.

Uncertainties

There are uncertainties associated with all estimates of greenhouse gas emissions. However, although for any given year considerable uncertainties may surround the emissions estimates for a pollutant, it is important to note that trends over time are likely to be much more reliable.

AEA have provided estimates of the uncertainties for Scottish greenhouse gas emissions excluding international aviation and shipping. For the 1990 base year the 95% confidence interval is +/- 27% around an estimate of 68.0 Mt CO₂e. For 2007, the 95% confidence interval is +/- 26% around an estimate of 54.5 Mt CO₂e. The 95% confidence interval for the percentage change between the 1990 base year and 2007 is between -29% and -9% with a best estimate of -20%.

Further Information

Further information on climate change, including Excel downloads of the tables in this statistical release, is available at:

<http://www.scotland.gov.uk/envstats>

Explanatory notes

- (1) The figures include both emissions and removals (from activities such as afforestation).
- (2) The basket of greenhouse gases consists of carbon dioxide, methane, nitrous oxide, and the three F-gases (hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride), all of which are weighted by global warming potential (GWP). The GWP for each gas is defined as its warming influence relative to that of carbon dioxide.
- (3) Emissions are presented as carbon dioxide equivalent, in line with international reporting and carbon trading protocols. To convert carbon dioxide into carbon equivalents, divide figures by 44/12.
- (4) The base year is 1990 for carbon dioxide, methane and nitrous oxide and 1995 for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.
- (5) Carbon sinks are defined by the UNFCCC as “any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere”.
- (6) Business includes “industrial processes”.

ANNEXES

ANNEX A:

Scottish Greenhouse Gas Emissions by Source:
1990 Base Year, 1990, 1995, 1998-2007

ANNEX B

Scottish Greenhouse Gas Emissions by Gas:
1990 Base Year, 1990, 1995, 1998-2007

ANNEX C

Scottish Greenhouse Gas Emissions Showing Adjustment for Trading in the
EU Emissions Trading Scheme (EU ETS): 1990 Base Year, 1990, 1995, 1998-2007.

Scottish Greenhouse Gas Emissions by Source: 1990 Base Year, 1990, 1995, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007.

National Communication Categories	Million tonnes carbon dioxide equivalent												
	1990 Base Year	1990	1995	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Energy Supply	22.3	22.3	26.5	26.2	22.9	25.8	25.2	23.2	23.1	21.3	20.3	23.9	20.6
Business and Industrial processes	12.5	12.4	8.1	8.5	8.5	8.8	9.4	8.5	8.4	8.3	8.4	8.1	7.7
Public	1.2	1.2	1.1	1.1	1.1	1.0	1.1	0.9	0.9	0.9	0.9	0.9	0.8
Transport	11.3	11.3	11.1	11.4	11.2	11.3	11.1	11.3	11.6	11.7	11.9	12.2	12.4
International Aviation	0.4	0.4	0.5	0.6	0.7	0.7	0.7	0.7	0.8	0.9	1.1	1.1	1.1
International Shipping	1.6	1.6	1.6	2.0	1.5	1.3	1.4	1.2	1.0	1.1	1.1	1.2	1.2
Residential	7.8	7.8	7.9	8.2	8.0	8.0	8.3	7.8	7.8	7.8	7.6	7.4	7.2
Waste Management	5.8	5.8	5.1	4.3	3.9	3.7	3.1	2.9	2.6	2.5	2.5	2.6	2.6
Agriculture	9.7	9.7	9.5	9.3	9.1	8.7	8.5	8.5	8.4	8.3	8.1	8.0	7.7
Land Use, Land Use Change & Forestry	-2.5	-2.5	-3.6	-3.8	-3.9	-3.9	-4.0	-4.1	-4.2	-4.6	-4.6	-4.5	-4.4
Total greenhouse gas emissions	70.0	69.9	67.7	67.6	63.0	65.4	64.8	60.9	60.4	58.4	57.4	61.0	56.9

Source: AEA

Notes:

1. Base year consists of emissions of CO₂, CH₄ and N₂O in 1990, and of HFCs, PFCs and SF₆ in 1995.
2. Emissions for each gas are weighted by global warming potential.
3. The land use, land use change and forestry sector includes removals as well as emissions.
4. The entire time series is revised each year to take account of methodological improvements in the UK emissions inventory.
5. Emissions are presented as carbon dioxide equivalent in line with international reporting and carbon trading. To convert carbon dioxide into carbon equivalents, divide figures by 44/12.
6. Figures shown do not include any adjustment for the effect of the EU Emissions Trading Scheme (EU ETS), which was introduced in 2005.

Scottish Greenhouse Gas Emissions by Gas: 1990 Base Year, 1990, 1995, 1998-2007.

Basket of Greenhouse Gases	Greenhouse gas emissions weighted by global warming potential (million tonnes carbon dioxide equivalent)												
	1990 Base Year	1990	1995	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Carbon dioxide (CO ₂)	52.4	52.4	51.5	52.4	48.6	51.4	51.6	48.0	48.2	46.4	45.5	49.2	45.4
Methane (CH ₄)	11.0	11.0	10.2	9.2	8.4	8.1	7.4	6.9	6.2	6.2	6.2	6.3	6.2
Nitrous Oxide (N ₂ O)	6.3	6.3	5.7	5.5	5.3	5.1	5.1	5.1	5.0	4.8	4.7	4.7	4.4
Hydrofluorocarbons (HFC)	0.1	0.0	0.1	0.5	0.5	0.6	0.7	0.7	0.8	0.8	0.8	0.8	0.8
Perfluorocarbons (PFC)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Sulphur hexafluoride (SF ₆)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Total greenhouse gas emissions	70.0	69.9	67.7	67.6	63.0	65.4	64.8	60.9	60.4	58.4	57.4	61.0	56.9

Source: AEA

Notes:

1. Figures for each individual gas include the Land Use, Land-Use Change and Forestry sector. In particular for CO₂ it includes removals as well as emissions.
2. The 1990 base year is 1990 for CO₂, CH₄ and N₂O and 1995 for HFCs, PFCs and SF₆.
3. Includes emissions from international aviation and shipping.
4. The entire time series is revised each year to take account of methodological improvements in the UK emissions inventory.
5. Emissions are presented as carbon dioxide equivalent in line with international reporting and carbon trading. To convert carbon dioxide into carbon equivalents, divide figures by 44/12.
6. Figures shown do not include any adjustment for the effect of the EU Emissions Trading Scheme (EU ETS), which was introduced in 2005.

**Scottish Greenhouse Gas Emissions Showing Adjustment for Trading in the EU Emissions Trading Scheme (EU ETS)
1990 Base Year, 1990, 1995, 1998-2007.**

		Million tonnes carbon dioxide equivalent												
		1990 Base Year	1990	1995	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
No allowance for EU ETS	Emissions (including net emissions/removals from LULUCF but excluding emissions from international aviation and shipping)	68.06	67.93	65.65	65.06	60.84	63.39	62.68	58.99	58.58	56.29	55.22	58.70	54.53
	Emissions from international aviation and shipping	1.96	1.96	2.05	2.58	2.19	2.03	2.15	1.89	1.79	2.07	2.16	2.34	2.37
EU ETS	Emissions (including net emissions/removals from LULUCF and including emissions from international aviation and shipping)	70.01	69.89	67.70	67.64	63.03	65.42	64.82	60.88	60.37	58.36	57.39	61.03	56.90
	Percentage change from baseline		-3.3%		-3.4%	-10.0%	-6.6%	-7.4%	-13.0%	-13.8%	-16.6%	-18.0%	-12.8%	-18.7%
With allowance for EU ETS	Net purchases/(sales) by Scottish installations											(0.58)	3.96	0.50
	Scottish share of net purchases/(sales) by UK Government											(0.18)	(0.18)	(0.18)
	Net UK purchases/(sales)											(0.76)	3.78	0.32
EU ETS	Emissions (including net emissions/removals from LULUCF and including emissions from international aviation and shipping)	70.01	69.89	67.70	67.64	63.03	65.42	64.82	60.88	60.37	58.36	58.15	57.25	56.59
	Percentage change from baseline		-3.3%		-3.4%	-10.0%	-6.6%	-7.4%	-13.0%	-13.8%	-16.6%	-16.9%	-18.2%	-19.2%

Source: AEA, Department of Energy and Climate Change, Environment Agency, Scottish Environment Protection Agency

Notes:

1. Base year consists of emissions of CO₂, CH₄ and N₂O in 1990, and of HFCs, PFCs and SF₆ in 1995.
2. Emissions are presented as carbon dioxide equivalent in line with international reporting and carbon trading. To convert carbon dioxide into carbon equivalent, divide figures by 44/12.
3. Net purchase/sales is the difference between units surrendered and units allocated.

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Correspondence and enquiries

Enquiries on this publication should be addressed to:

Environment Statistics
Rural and Environment Analytical Services
Rural and Environment Research and Analysis Directorate
1F-South, Victoria Quay
Edinburgh, EH6 6QQ
Telephone: 0131 244 0445;
e-mail: envstats@scotland.gsi.gov.uk

General enquiries on Scottish Government statistics can be addressed to:

Office of the Chief Statistician
Scottish Government
1N.04, St Andrews House
EDINBURGH EH1 3DG
Telephone: (0131) 244 0442
e-mail: statistics.enquiries@scotland.gsi.gov.uk

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