

## Scottish Greenhouse Gas Emissions 2010

This publication provides estimates of greenhouse gas emissions in Scotland for 2010. Except where stated, the emissions figures shown in this release include an estimate of emissions from international aviation and shipping. The release also provides information on the performance against emission reduction targets taking account of trading in carbon units.

### Key points

- In 2010, Scottish emissions of the basket of six greenhouse gases are estimated to be 55.7 million tonnes carbon dioxide equivalent (MtCO<sub>2</sub>e). This is 5.8 per cent higher than the 2009 figure of 52.7 MtCO<sub>2</sub>e, a 3.1 MtCO<sub>2</sub>e increase. Between 1990 and 2010, there was a 22.8 per cent reduction in emissions.
- When emissions are adjusted to take account of trading in the EU Emissions Trading System (EU ETS), emissions increased by 1.9 per cent between 2009 and 2010 (from 53.687 MtCO<sub>2</sub>e to 54.714 MtCO<sub>2</sub>e). Compared with the 1990 base year<sup>1</sup>, emissions in 2010 (after taking account of trading in the EU ETS) were 24.3 per cent lower.
- The annual target for 2010, as published in the Climate Change (Annual Targets) (Scotland) Order 2010, is 53.652 MtCO<sub>2</sub>e. The target is assessed using the adjusted emissions.

### Unadjusted emissions:

- Between 2009 and 2010, there were large increases in greenhouse gas emissions in the energy supply and residential sectors, of 2.2 and 1.1 MtCO<sub>2</sub>e respectively (increases of 12 and 15 per cent). This was primarily due to a rise in fossil fuel heating in the residential sector, combined with an increase in electricity generation from coal fired power stations. Emissions from the residential and public sectors are affected by changes in weather among other factors. 2010 was, on average, the 10<sup>th</sup> coldest in the period since 1910. In particular, the average temperature for the 6 months January-March and October-December was the coldest since 1919.
- Net removals from the forestry sector reduced in size from 10.0 MtCO<sub>2</sub>e to 9.6 MtCO<sub>2</sub>e (a 4 per cent reduction and 0.4 MtCO<sub>2</sub>e decrease) between 2009 and 2010. There were increases in emissions of 2 per cent from the business and industrial process sector (0.1 MtCO<sub>2</sub>e) while the public sector saw a 3 per cent rise (0.03 MtCO<sub>2</sub>e). International aviation and shipping showed the largest per cent reduction in emissions at 12 per cent (down 0.3 MtCO<sub>2</sub>e). Net emissions

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<sup>1</sup> The 1990 base year uses 1990 for carbon dioxide, methane and nitrous oxide and 1995 for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride

from agriculture and related land use and waste management both decreased by 3 per cent (0.3 MtCO<sub>2</sub>e and 0.1 MtCO<sub>2</sub>e respectively), while transport (excluding international aviation and shipping) and development emissions both reduced by 1 per cent (0.1 MtCO<sub>2</sub>e and 0.01 MtCO<sub>2</sub>e respectively).

- Since 1990, emissions from transport (excluding international aviation and shipping) have increased by 0.2 MtCO<sub>2</sub>e (2 per cent). Residential emissions also saw an increase of 0.2 MtCO<sub>2</sub>e, a 3 per cent increase since 1990. The largest absolute reduction was for the business and industrial process sector at 5.3 MtCO<sub>2</sub>e, a 40 per cent reduction. Other sectors with significant reductions are waste management down 4.4 MtCO<sub>2</sub>e (67 per cent reduction), agriculture and related land use down 3.8 MtCO<sub>2</sub>e (27 per cent), energy supply down 1.6 MtCO<sub>2</sub>e (7 per cent) and public down 0.4 MtCO<sub>2</sub>e (29 per cent). Development emissions decreased by 0.2 MtCO<sub>2</sub>e (9 per cent) and emissions from international aviation and shipping decreased by 0.02 MtCO<sub>2</sub>e (1 per cent). Net removals from forestry increased by 1.3 MtCO<sub>2</sub>e; 15 per cent more than removed in 1990.
- Carbon dioxide is the main greenhouse gas, accounting for around 79 per cent of Scottish greenhouse gas emissions in 2010 equating to 43.8 MtCO<sub>2</sub>. This was 7.6 per cent higher than the 2009 figure of 40.7 MtCO<sub>2</sub>. Since 1990, emissions of carbon dioxide have fallen by 18 per cent and emissions of the other greenhouse gases (methane, nitrous oxide and F-gases) have fallen by 37 per cent.
- All of the sectoral breakdowns included in this statistical release are based on the source of the emissions, as opposed to where the end-user activity occurred. Emissions related to electricity generation are therefore attributed to power stations, the source of the emissions, rather than to homes and businesses where the electricity is used. Similarly the figures include emissions related to goods produced in Scotland but exported abroad but do not include emissions related to the production of goods imported into Scotland.
- Scottish greenhouse gas emissions are reviewed every year, and the whole historical data series is revised to incorporate methodological improvements and new data. The 2009 figure has been revised up from 51.0 to 52.7 MtCO<sub>2</sub>e. Comparing the 2010 figures with the 2009 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.

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## Total Emissions

In 2010, Scottish emissions of the basket of six greenhouse gases are estimated to be 55.7 million tonnes carbon dioxide equivalent (MtCO<sub>2</sub>e). This is 5.8 per cent higher than the 2009 figure of 52.7 MtCO<sub>2</sub>e. Between 1990 and 2010, there was a 22.8 per cent reduction in emissions ([Table 1, Figure 1](#)).

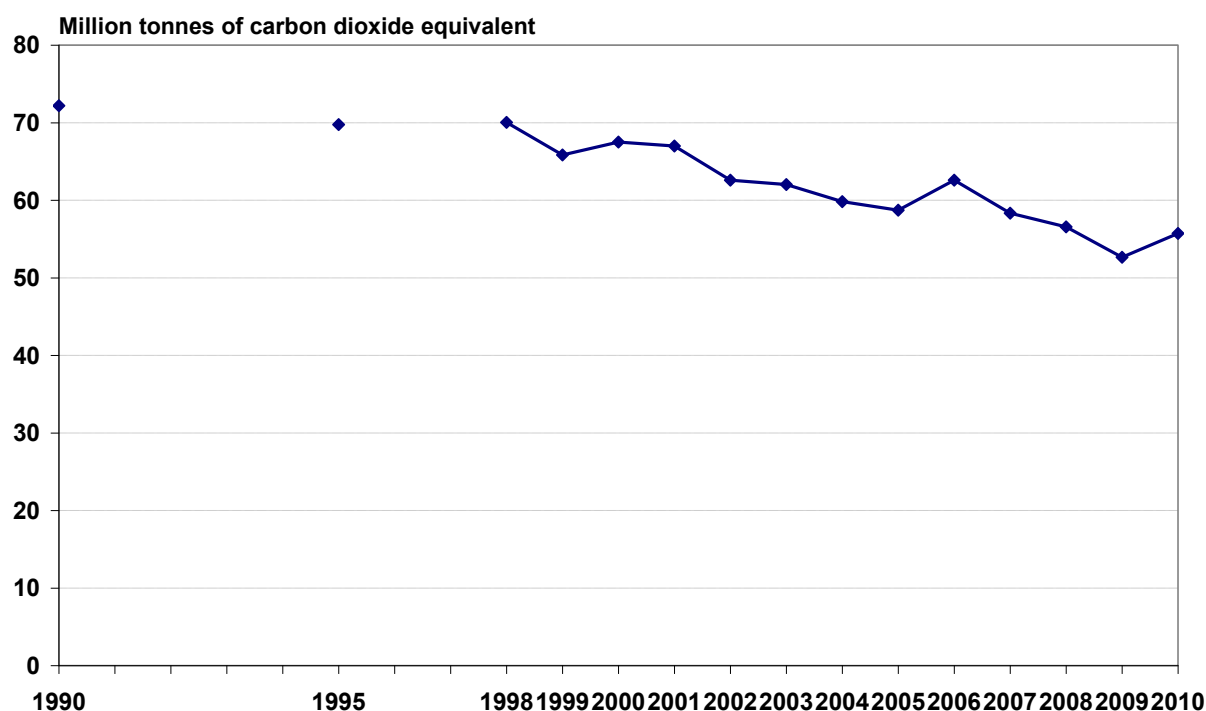
The available time series for 1990, 1995, 1998-2010 can be found in [Annex A](#) and [Annex B](#).

**Table 1: Emissions of greenhouse gases<sup>2</sup>**

(million tonnes carbon dioxide equivalent)

	1990	2009	2010	Change from 1990	Change from 2009
Greenhouse gas emissions <i>excluding</i> international aviation & shipping <sup>3</sup>	69.7	49.8	53.2	-23.6%	6.9%
International Aviation	0.5	1.1	1.0	118.5%	-6.1%
International Shipping	2.0	1.7	1.5	-28.5%	-15.9%
<b>Total greenhouse gas emissions <i>including</i> international aviation &amp; shipping</b>	<b>72.2</b>	<b>52.7</b>	<b>55.7</b>	<b>-22.8%</b>	<b>5.8%</b>

**Figure 1: Total greenhouse gas emissions, 1990, 1995, 1998 – 2010**



<sup>2</sup> 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 <sup>44</sup>/<sub>12</sub>.

<sup>3</sup> The figures include both emissions and removals (from activities such as afforestation).

## Coverage of emissions reporting

Greenhouse gas emissions estimates are provided by AEA under contract to the Department for Energy and Climate Change, the Scottish Government, the Welsh Government and the Northern Ireland Department of Environment. Reports are published on the [National Atmospheric Emissions Inventory \(NAEI\)](#) website and the latest figures are published in

[Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 - 2010](#)

The basket of greenhouse gases consists of carbon dioxide, methane, nitrous oxide, and the three F-gases (hydrofluorocarbons- HFCs, perfluorocarbons – PFCs and sulphur hexafluoride- SF<sub>6</sub>), 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. Greenhouse gas emissions are then presented in *carbon dioxide equivalent* units.

The emissions reported are the combination of emissions minus removals from the atmosphere by *carbon sinks*<sup>4</sup>. Carbon sinks are incorporated within the three sectors of agriculture and related land use, development, and forestry, which include emissions as well as removals resulting from afforestation, reforestation, deforestation and forest management together with changes between grassland, cropland and settlements.

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.

The total emissions reported here include emissions resulting from international aviation and shipping. The data presented for international shipping are regarded as preliminary estimates, as there is limited data availability for regional marine shipping fuel use. 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). Emissions from international aviation and shipping are recorded as “memo items” in the [UK inventory report to the UNFCCC](#).

All of the sectoral breakdowns included in this statistical release are based on the source of the emissions, as opposed to where the end-user activity occurred. Emissions related to electricity generation are therefore attributed to power stations, the source of the emissions, rather than to homes and businesses where the electricity is used. Similarly the figures include emissions related to goods produced in Scotland and then exported abroad but do not include emissions related to the production of goods that are imported into Scotland.

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<sup>4</sup> 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“.

The sector breakdowns used in this report are primarily based on the National Communication (NC) sectors. However, in order to associate emissions from conversion of grassland to and from cropland and liming of agricultural land with other agricultural activities we have generated three new sectors from the previous two sectors *Land Use, Land Use Change and Forestry* (LULUCF) and *Agriculture*. The first new sector *Agriculture and related land use* includes all emissions in the NC sector Agriculture together with those LULUCF emissions associated with agricultural practices. The remaining LULUCF emissions are grouped into *Forestry* (changes in emissions relating mainly to stock changes resulting from afforestation, deforestation and harvested wood products) and *Development* (changes in emissions resulting from land use change to settlements). These new sectors are the same as those that were reported in the Scottish Government publication “[Low Carbon Scotland - Meeting the Emissions Reduction Targets 2010-2022](#)”. A detailed mapping between the sectors used in this report and the NC sectors and Intergovernmental Panel on Climate Change (IPCC) sectors is given in [Annex E](#).

## 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<sup>5</sup>).

The revisions to the inventory have resulted in revisions to the 2009 figures and the entire time series. The total of all Scottish greenhouse gas emissions in 1990 (including international aviation and shipping) has been revised upwards from 71.6 to 72.2 MtCO<sub>2e</sub>. In 2009 the figure has been revised up from 51.0 to 52.7 MtCO<sub>2e</sub>. Comparing the 2010 figures with the 2009 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.

The main changes to the 2009 figures are:

- Business: (1.007 MtCO<sub>2e</sub> increase) predominantly due to a revision to industrial combustion allocation of other petroleum gas (OPG – mainly ethane) use in Scotland across the inventory time series and revisions to energy mapping grids in the industry and commercial sectors through use of new data on UK sector energy use and an updated Inter-Departmental Business Register. These changes have increased estimates for industrial combustion by around 0.500 MtCO<sub>2e</sub> in Scotland in 2009. In addition, revisions to the UK-wide model for emissions of HFCs from refrigeration and air conditioning equipment have increased the estimates for Scotland in 2009 by 0.256 MtCO<sub>2e</sub>.
- Energy Supply: (0.324 MtCO<sub>2e</sub> increase) primarily from the revision of OPG use in petroleum refining and revisions to gas oil allocations to the upstream

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<sup>5</sup> Emissions data was estimated in 1990 and 1995 and full Scottish data only exists from 1998 onwards.

oil and gas sector. This sector has also seen a reduction in estimates for 2009 of emissions from closed coal mines due to updated analysis from the update to closed coal mine emission estimates.

- Waste Management: (0.149 MtCO<sub>2</sub>e increase) from revisions to the UK waste model and also revisions to use more DA-specific input data to derive country-specific estimates

[Annex D](#) provides differences for each of the sectors for 1990 and 2009. More details are provided in Appendix 7 of [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2010](#).

## **Uncertainties**

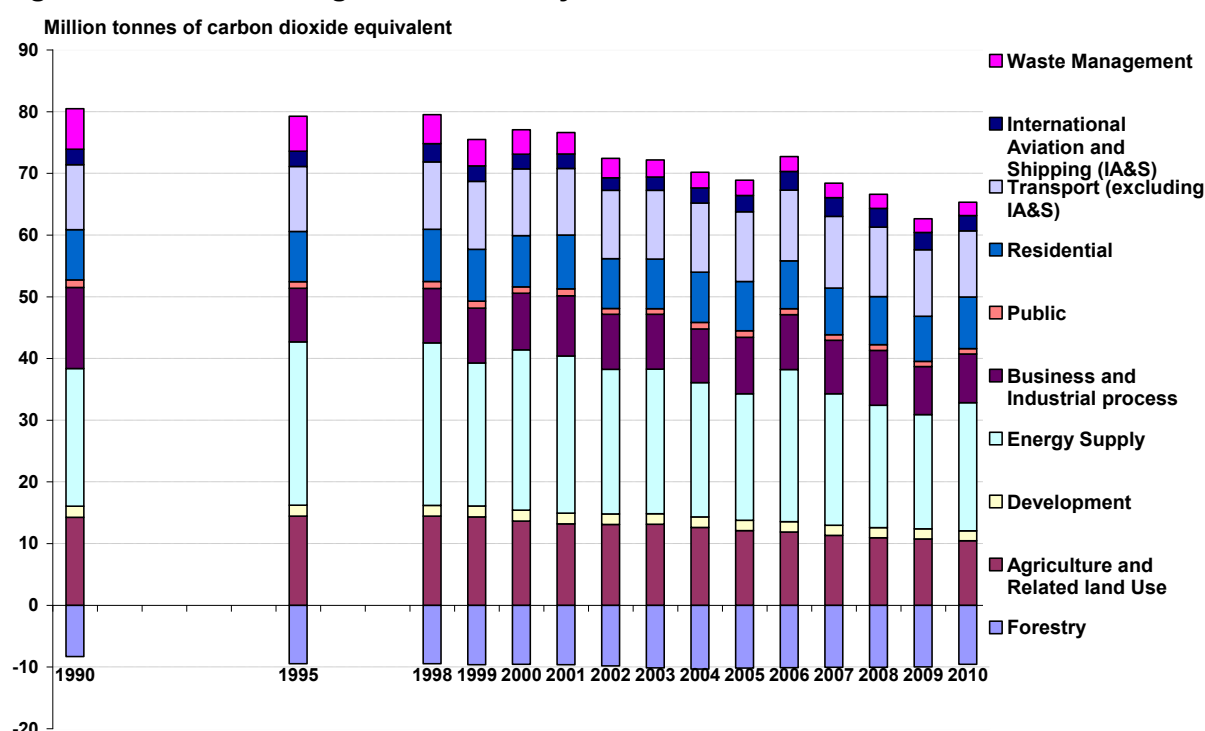
There are uncertainties associated with all estimates of greenhouse gas emissions. However, although for any given year considerable uncertainties may surround the emissions estimates for a pollutant, it is important to note that trends over time are likely to be much more reliable.

The approximate 95 per cent confidence interval for Scottish greenhouse gas emissions in 2010, excluding international aviation and shipping, is estimated to be  $\pm 27$  per cent of the mean (The estimates for international aviation have low uncertainty, while those for international shipping have high uncertainty). The approximate 95 per cent confidence interval for the trend in such greenhouse gas emissions between the 1990 base year and 2010 is between -32 per cent and -14 per cent around a central estimate of -24 per cent. More details are provided in Appendix 1 in [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2010](#)

## Sources of emissions

In 2010, 37 per cent of greenhouse gas emissions were from the energy supply sector<sup>6</sup>, 19 per cent from transport (excluding international aviation and shipping), 19 per cent from agriculture and related land use, 15 per cent from residential and 14 per cent from business<sup>7</sup>. Emissions from international aviation and shipping accounted for 4 per cent of emissions and waste management (mainly landfill) emissions also 4 per cent ([Figure 2a](#), [Table 2](#)). Development and public emissions accounted for 3 and 2 per cent respectively. These figures total more than 100 per cent due to the effect of net removals from the forestry sector (accounting for -17 per cent of overall emissions). More detail is given in [Annex A](#).

**Figure 2a: Greenhouse gas emissions by source: 1990, 1995, 1998 – 2010**

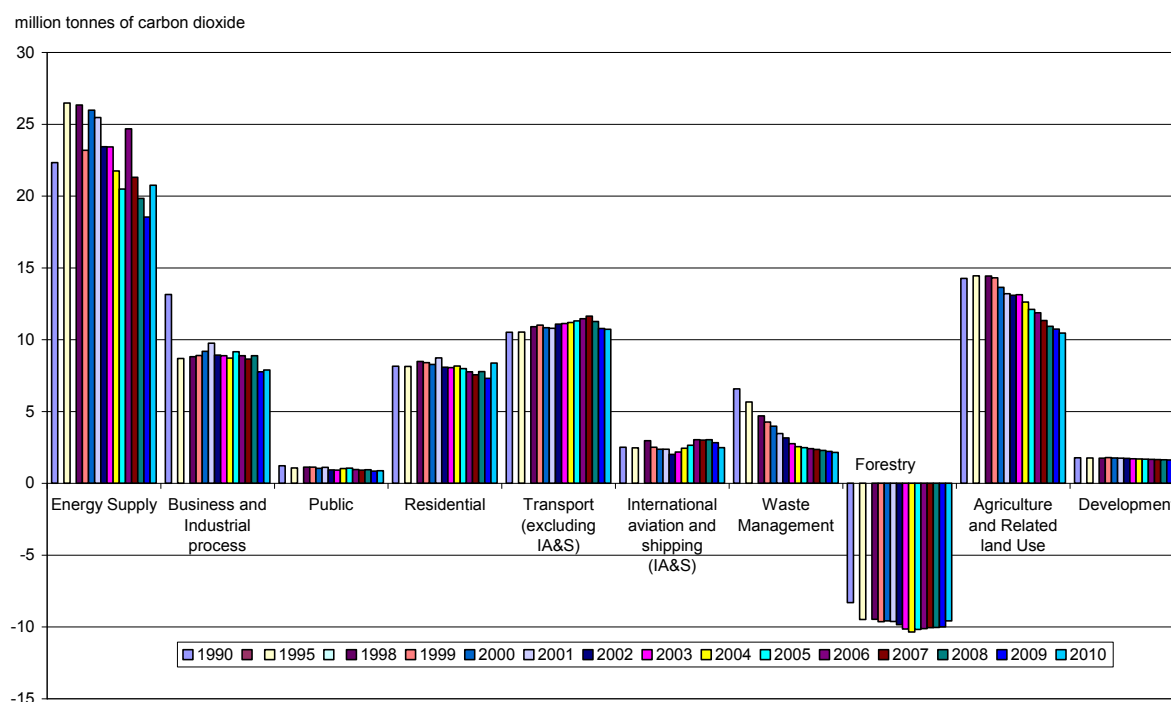


Since 1990, emissions from transport (excluding international aviation and shipping) have increased by 0.2 MtCO<sub>2</sub>e (2 per cent). Residential emissions also saw an increase of 0.2 MtCO<sub>2</sub>e, a 3 per cent increase since 1990. The largest absolute reduction was for the business and industrial process sector at 5.3 MtCO<sub>2</sub>e, a 40 per cent reduction, mainly as a result of the closure, in 1992, of Ravenscraig iron and steel plant and the relocation, in 1995, of a site manufacturing nitric acid from Leith to Ireland. Other sectors with significant reductions are waste management down 4.4 MtCO<sub>2</sub>e (67 per cent reduction), agriculture and related land use down 3.8 MtCO<sub>2</sub>e (27 per cent) and energy supply down 1.6 MtCO<sub>2</sub>e (7 per cent). Development emissions decreased by 0.2 MtCO<sub>2</sub>e (9 per cent) and emissions from international aviation and shipping decreased by 0.02 MtCO<sub>2</sub>e (1 per cent). Net removals from forestry increased by 1.3 MtCO<sub>2</sub>e; 15 per cent more than removed in 1990. ([Figure 2b](#)).

<sup>6</sup> The data presented uses Scottish Government sectors, for more information see [Annex D](#).

<sup>7</sup> Business includes „Industrial process“.



**Figure 2b: Greenhouse Gas Emissions by source 1990, 1995, 1998 - 2010**

Between 2009 and 2010, there were large increases in greenhouse gas emissions in the energy supply and residential sectors, of 2.2 and 1.1 MtCO<sub>2</sub>e (12 and 15 per cent respectively). This was primarily due to a rise in fossil fuel heating in the residential sector, combined with an increase in electricity generation from coal fired power stations. Emissions from the residential and public sectors are affected by changes in weather among other factors. 2010 was, on average, the 10<sup>th</sup> coldest in the period since 1910. In particular, the average temperature for the six months January-March and October-December was the coldest since 1919. 2010 was also the driest year since 2003 resulting in a drop of hydro-generation in Scotland of 33% between 2009 and 2010 and as a result renewable energy generation overall decreased. In addition there were reductions in output from gas and nuclear, likely attributable to a rise in gas prices (making gas generation relatively less economic) and planned maintenance outages respectively. Electricity generated by coal increased by 23% from 2009 to 2010.

Net removals from the forestry sector reduced in size from 10.0 MtCO<sub>2</sub>e to 9.6 MtCO<sub>2</sub>e (a 4 per cent reduction and 0.4 MtCO<sub>2</sub>e decrease) between 2009 and 2010. There were increases in emissions of 2 per cent from the business and industrial process sector (0.1 MtCO<sub>2</sub>e) while the public sector saw a 3 per cent rise (0.03 MtCO<sub>2</sub>e). International aviation and shipping showed the largest per cent reduction in emissions at 12 per cent (down 0.3 MtCO<sub>2</sub>e). Net emissions from agriculture and related land use and waste management both decreased by 3 per cent (0.3 MtCO<sub>2</sub>e and 0.1 MtCO<sub>2</sub>e respectively), while transport (excluding international aviation and shipping) and development emissions both reduced by 1 per cent (0.1 MtCO<sub>2</sub>e and 0.01 MtCO<sub>2</sub>e respectively).

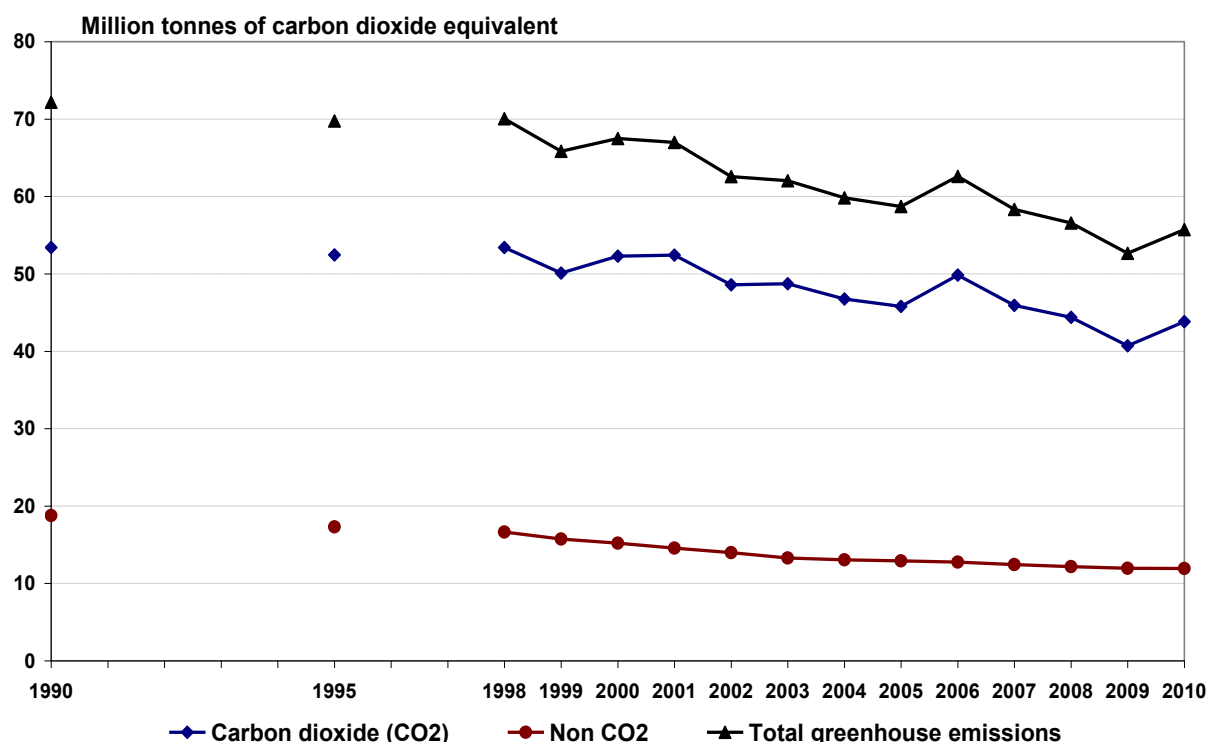
**Table 2: Scottish greenhouse gas emissions by source: 2010 share, 2010 comparisons with 1990 and 2009**

<b>National Communication Sectors</b>	<b>% share of 2010</b>	<b>%change from 1990</b>	<b>%change from 2009</b>
Energy Supply	37%	-7%	12%
Transport (excluding IA&S)	19%	2%	-1%
International Aviation and Shipping (IA&S)	4%	-1%	-12%
<i>International Aviation</i>	2%	118%	-6%
<i>International Shipping</i>	3%	-29%	-16%
Business and Industrial Process	14%	-40%	2%
<i>Business</i>	13%	-33%	2%
<i>Industrial Process</i>	1%	-79%	-4%
Residential	15%	3%	15%
Public	2%	-29%	3%
Waste Management	4%	-67%	-3%
Development	3%	-9%	-1%
Agriculture and Related Land Use	19%	-27%	-3%
Forestry	-17%	15%	-4%
<b>Total greenhouse gas emissions</b>	<b>100%</b>	<b>-23%</b>	<b>6%</b>

## Emissions by gas

Carbon dioxide is the main greenhouse gas, accounting for around 79 per cent of Scottish greenhouse gas emissions in 2010 when Scottish emissions of carbon dioxide were estimated to be 43.8 MtCO<sub>2</sub>. This was 7.6 per cent higher than the 2009 figure of 40.7 MtCO<sub>2</sub> ([Figure 3](#)).

Carbon dioxide emissions have fallen by 17.9 per cent since 1990 and non-CO<sub>2</sub> emissions (methane, nitrous oxide and F-gases) have fallen by 36.6 per cent since 1990 (Table 3). More detail is given in [Annex B](#).

**Figure 3: Greenhouse emissions by gas, 1990, 1995, 1998-2010****Table 3 Scottish greenhouse gas emissions by gas<sup>8</sup>: 2010 comparison with 1990 and 2009**

Basket of Greenhouse Gases	Change from 1990	Change from 2009
Carbon dioxide (CO <sub>2</sub> )	-17.9%	7.6%
Non-CO <sub>2</sub>	-36.6%	-0.3%
<b>Total Scottish greenhouse gas emissions</b>	<b>-22.8%</b>	<b>5.8%</b>

<sup>8</sup> 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 <sup>44</sup>/<sub>12</sub>

## 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 target of at least a 42 per cent reduction for 2020, and at least 80 per cent reduction target for 2050. These reductions are based on a 1990 baseline (1995 for the F-Gases). It also requires the Scottish Ministers to set annual targets for emissions at least 12 years in advance. In October 2010 the Scottish Parliament passed legislation setting the first batch of annual targets, for the years up to 2022<sup>9</sup>. Targets for 2023-2027 were set in October 2011<sup>10</sup>, and will continue to be set at 5-year intervals.

The 2010 target is 53.652 MtCO<sub>2</sub>e.

Achievement of Scotland's targets is measured against the level of the Net Scottish Emissions Account (NSEA). There is a limit on the net amount of carbon units that may be credited to the NSEA in addition to those from the EU Emissions Trading System. The Climate Change (Limit on Carbon Units) (Scotland) Order 2010<sup>11</sup> specifies that the net amount of carbon units that may be credited to the Net Scottish Emissions Account for the period 2010-2012 is zero. The Climate Change (Limit on Carbon Units) (Scotland) Order 2011<sup>12</sup> sets limits for the period 2013-2017.

### National performance framework sustainability purpose targets

There are two 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 System (EU ETS). The System has now entered Phase II, covering the five year period 2008-2012. Results are available for each year of Phase I, which covered the three year period 2005-2007 and for 2008-2011 in Phase II.

<sup>9</sup> The Climate Change (Annual Targets) (Scotland) Order 2010, SSI 2010 no. 359: <http://www.legislation.gov.uk/ssi/2010/359/contents/made>

<sup>10</sup> The Climate Change (Annual Targets) (Scotland) Order 2011, SSI 2011 no. 353: <http://www.legislation.gov.uk/ssi/2011/353/contents/made>

<sup>11</sup> The Climate Change (Limit on Carbon Units) (Scotland) Order 2010, SSI 2010 no. 217: <http://www.legislation.gov.uk/ssi/2010/217/contents/made>

<sup>12</sup> The Climate Change (Limit on Carbon Units) (Scotland) Order 2011, SSI 2011 no. 440: <http://www.legislation.gov.uk/ssi/2011/440/contents/made>

Emissions from electricity generation and other large emitters of carbon dioxide are covered by the EU ETS and are known as the "traded sector".

The EU ETS operates through the trade of greenhouse gas emissions allowances throughout the EU, where one allowance represents one tonne of carbon dioxide equivalent (CO<sub>2</sub>e). A fixed ("capped") number of allowances is allocated or auctioned to participants, who can then trade them with other participants so that their allowances match their emissions year by year.

Participants in the EU ETS are required to "surrender" carbon units to cover their emissions for each calendar 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 System, or bring forward some allowances from the following year's allocation, so as to cover the deficit. Conversely, installations with a surplus of allocation compared with their emissions are allowed to either sell allowances or carry them over into the following year's allocation, thus providing a financial incentive to reduce 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 allocated pro rata to those in the wider UK 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.

Scottish Ministers are required to determine the quantity of carbon units surrendered by EU ETS participants in Scotland for each year from 2010 onwards. This quantity is then compared to Scotland's share of the total EU ETS emissions cap – the "specified amount" – to determine whether participants have exceeded or emitted less than Scotland's share of the EU ETS cap for that year. For the period 2008-2020, estimates of Scotland's share of the EU ETS cap were published by the Climate Change Committee in Table 1.4 of the Technical Appendix accompanying their report "Scotland's path to a low-carbon economy". The "specified amount" for the period 2010-2012 is determined under section 8 of "The Carbon Accounting Scheme (Scotland) Regulations 2010" and for 2010 is 23.025 MtCO<sub>2</sub>e.

Sites are required to surrender units to equate to their emissions in a given year. In some cases units surrendered may not match emissions – for example, due to operator error more units than necessary may be surrendered – in such cases the shortfall/excess is offset the following year. For such sites, rather than simply use the number of units surrendered, the figure used is the number of units necessary to be surrendered to satisfy EU ETS compliance for the reporting year which equates to the amount emitted. Since for other sites the number of units surrendered already equates to emissions, the effect is to compare actual emissions from EU ETS sites with the specified amount.

In summary, the NSEA is calculated as follows:

NSEA = net greenhouse gas emissions including international aviation and shipping  
           + Scotland's share of the EU ETS cap ("specified amount")  
           - EU ETS emissions

In 2010 (the third year of Phase II), Scotland's "specified amount" was less than the amount of emissions from Scottish EU ETS sites. Taking this into account within the context of Scotland's reported emissions reduces 2010 emissions by the difference between the amount of emissions from Scottish EU ETS sites and the "specified amount".

As required by Section 33 of the Climate Change (Scotland) Act 2009, a *Report on Annual Targets* will be laid before the Scottish Parliament by 31 October. The report must state:

- Whether the annual target for the target year has been met. If the annual target has not been met, the report must explain why.
- Whether the domestic effort target<sup>13</sup> has been met in the target year to which the report relates. If the domestic effort target has not been met, the report must explain why.
- The report must also contain information mentioned in section 34 of the Act, including Scottish electricity consumption and generation.

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<sup>13</sup> Section 8 of the Climate Change (Scotland) Act places a duty on the Scottish Ministers to ensure that reductions in net Scottish emissions of greenhouse gases account for at least 80% of the reduction in the net Scottish emissions account in any target year. This is known as the domestic effort target.

## Scottish performance against emissions reduction targets

Performance measured against targets, adjusted to take account of trading in the EU ETS, can be summarised as follows:

- Scottish emissions (including international aviation and shipping) of the basket of six greenhouse gases were 54.714 MtCO<sub>2</sub>e in 2010, 24.3 per cent lower than in the 1990 base year<sup>14</sup>.
- Scottish emissions of the basket of six greenhouse gases were 1.9 per cent higher in 2010 than in 2009, up from 53.687 to 54.714 MtCO<sub>2</sub>e.
- Compared with 2006, Scottish emissions of the basket of six greenhouse gases showed a 4.111 MtCO<sub>2</sub>e reduction, a 7.0 per cent decrease.

These results are shown in the context of the headline results in Table 4 and Figure 4. A more detailed summary of the results can also be found in [Annex C](#).

**Table 4: Performance against emissions reduction targets**

*(million tonnes carbon dioxide equivalent)*

All greenhouse gases	1990 Base Year	2006	2009	2010	% change from 1990 Base Year	% change from 2006	% change from 2009
Unadjusted emissions	72.3	62.6	52.7	55.7	-22.9%	-11.0%	5.8%
Adjusted for trading in the EU ETS	72.3	58.8	53.7	54.7	-24.3%	-7.0%	1.9%

<sup>14</sup> The 1990 base year uses 1990 for carbon dioxide, methane and nitrous oxide and 1995 for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride

**Figure 4: Greenhouse gas emissions adjusted to take account of trading in the EU ETS: 1990 Base Year, 1995, 1998 – 2010<sup>15</sup>**

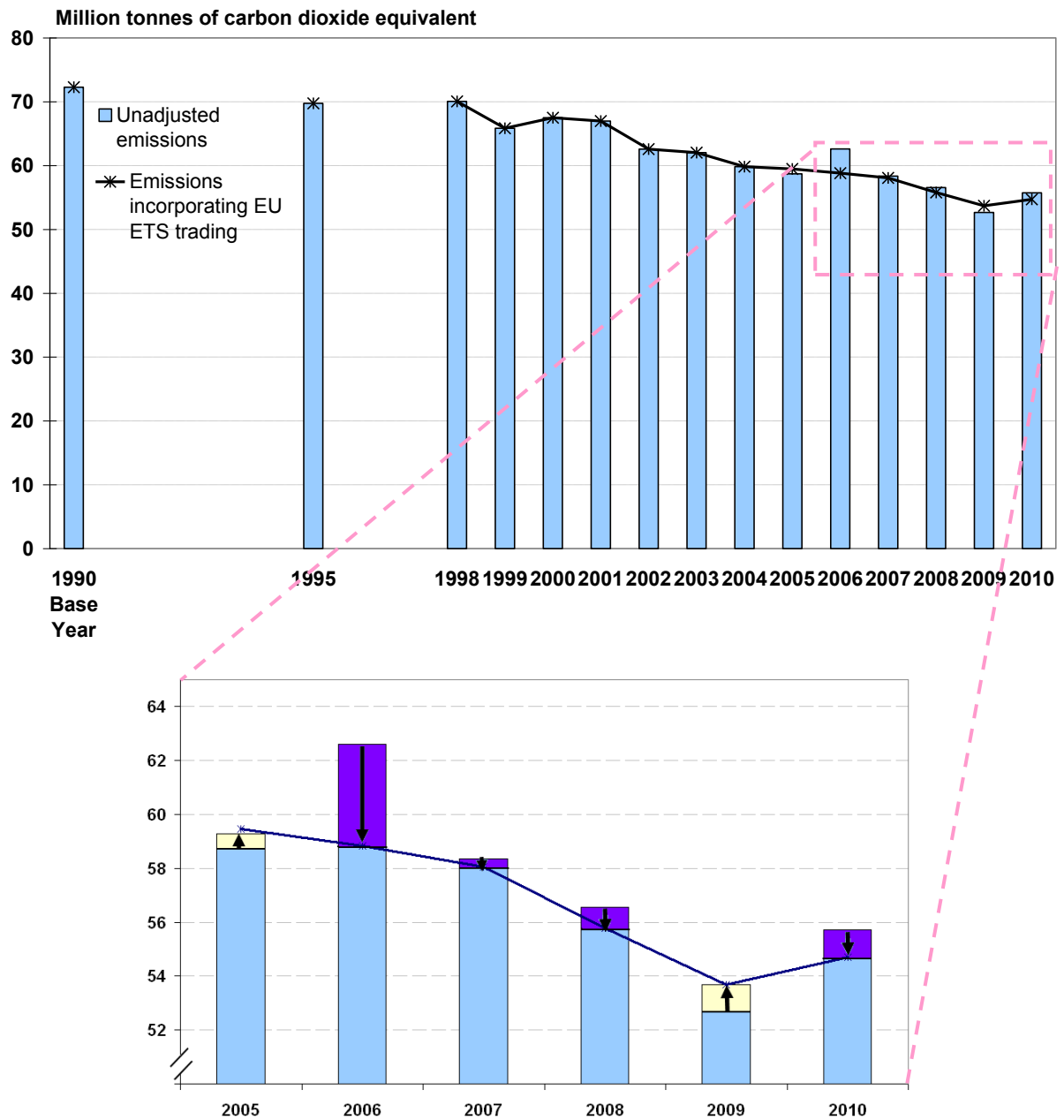


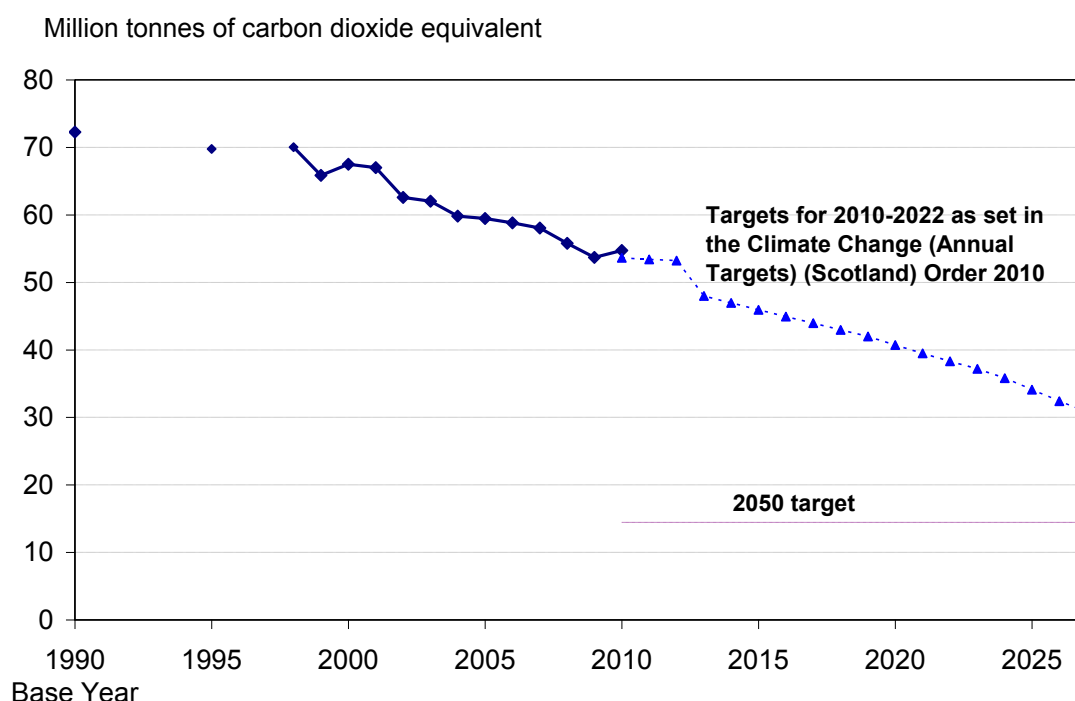
Figure 5 shows adjusted emissions since the 1990 base year, it also shows the emissions reduction targets for 2010-2022 and for 2050.

For more information on Scotland's targets see [Scotland Performs](#).

<sup>15</sup> An upward arrow (2005 and 2009) indicates that emissions have been increased by net sales through the EU ETS. A downward arrow (2006, 2007, 2008 and 2010) indicates that emissions have been offset by net purchases through the EU ETS.



**Figure 5: Greenhouse gas emissions adjusted to take account of trading in the EU ETS – progression towards 2050 target<sup>16</sup>.**



## End User emissions

Emissions of greenhouse gases reported above are on a “by source” basis. This means that the emissions are allocated to the source sector at the point of their release. When figures are reported on an “end user” basis, emissions resulting from energy production (e.g. power stations, fossil fuel extraction and refining) are allocated to the final users of the energy.

Comparisons of Scottish emissions on a 'by source' and 'end user' basis are provided in chapter 3 of [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2010](#).

End user emission trends are subject to higher uncertainty than source based emissions. Across all sectors, the sector-specific electricity related emission estimates are uncertain, especially in the 1990 data where very limited sector-specific information on electricity consumption is available. This must be taken into consideration when using the data to inspect the reported emission trends.

<sup>16</sup> 2050 target presented is 80 per cent of 1990 base year emissions as taken from the 2009 greenhouse gas inventory.

## Further Information

- This publication together with Excel downloads of the tables are available at: <http://www.scotland.gov.uk/ghg10>
- Full details of the methodology used to estimate Scottish greenhouse gas emissions together with further breakdowns are provided on the [National Atmospheric Emissions Inventory](#) website in the publication [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2010](#).
- [Scottish Greenhouse Gas Emissions on a Consumption Basis](#). The figures are currently classed as „data being developed“ which means that they may be subject to a greater degree of revision as the methodologies and data-sources continue to be developed.
- Climate Change (Scotland) Act 2009: <http://www.legislation.gov.uk/asp/2009/12/contents>
- Climate Change (Annual Targets) (Scotland) Order 2010: <http://www.legislation.gov.uk/ssi/2010/359/contents/made>
- National Performance Framework Sustainability Purpose Targets: <http://www.scotland.gov.uk/About/scotPerforms/purposes/sustainability>
- Department of Energy and Climate Change: [http://www.decc.gov.uk/en/content/cms/statistics/climate\\_change/climate\\_change.aspx](http://www.decc.gov.uk/en/content/cms/statistics/climate_change/climate_change.aspx)
- UK greenhouse gas inventory national system: <http://www.ghgi.org.uk>
- Committee on Climate Change: <http://www.theccc.org.uk>
- For further information on the United Nations Framework Convention on Climate Change: <http://unfccc.int/>
- EU Emissions Trading System (ETS): [EU ETS section of the Department for Energy and Climate Change website](#)
- Overview of trends from energy generation statistics in Scotland: [Scotland Energy Statistics Summary](#)

## **ANNEXES**

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## ANNEX A

**A.1 Scottish greenhouse gas emissions by source: 1990 Base Year, 1990, 1995, 1998-2010** (*million tonnes of carbon dioxide equivalent*)

Source Sector	1990 Base Year	1990	1995	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy supply	22.3	22.3	26.5	26.3	23.2	26.0	25.5	23.4	23.4	21.7	20.5	24.7	21.3	19.8	18.5	20.7
Transport	10.5	10.5	10.5	10.9	11.1	10.8	10.8	11.1	11.1	11.2	11.3	11.5	11.6	11.3	10.8	10.7
International Aviation and Shipping	2.5	2.5	2.5	3.0	2.5	2.4	2.4	2.0	2.2	2.4	2.6	3.0	3.0	3.0	2.8	2.5
<i>International Aviation</i>	0.5	0.5	0.6	0.7	0.8	0.8	0.8	0.8	0.9	1.0	1.2	1.3	1.3	1.2	1.1	1.0
<i>International Shipping</i>	2.0	2.0	1.9	2.3	1.7	1.6	1.5	1.2	1.3	1.4	1.5	1.8	1.7	1.9	1.7	1.5
Business and Industrial Process	13.2	13.1	8.7	8.8	8.9	9.2	9.7	8.9	8.9	8.7	9.2	8.9	8.6	8.9	7.8	7.9
Business	11.4	11.3	8.1	8.2	8.3	8.6	9.2	8.3	8.3	8.1	8.6	8.3	8.1	8.4	7.4	7.5
Industrial Process	1.8	1.9	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4
Residential	8.2	8.1	8.1	8.5	8.4	8.3	8.7	8.1	8.1	8.2	8.0	7.8	7.6	7.8	7.3	8.4
Public	1.2	1.2	1.1	1.1	1.1	1.0	1.1	0.9	0.9	1.0	1.1	1.0	0.9	0.9	0.8	0.9
Waste Management	6.6	6.6	5.7	4.7	4.3	4.0	3.5	3.2	2.8	2.6	2.5	2.4	2.4	2.3	2.2	2.2
Development	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6
Agriculture and Related Land Use	14.3	14.3	14.4	14.4	14.3	13.6	13.2	13.1	13.1	12.6	12.1	11.9	11.3	10.9	10.7	10.5
Forestry	-8.3	-8.3	-9.5	-9.5	-9.6	-9.6	-9.6	-9.8	-10.1	-10.4	-10.2	-10.1	-10.0	-10.0	-10.0	-9.6
<b>Total greenhouse gas emissions</b>	<b>72.3</b>	<b>72.2</b>	<b>69.8</b>	<b>70.0</b>	<b>65.8</b>	<b>67.5</b>	<b>67.0</b>	<b>62.6</b>	<b>62.0</b>	<b>59.8</b>	<b>58.7</b>	<b>62.6</b>	<b>58.3</b>	<b>56.6</b>	<b>52.7</b>	<b>55.7</b>

Source: AEA

**Notes:**

1. Base Year consists of emissions of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O in 1990 and of HFCs, PFCs and SF<sub>6</sub> in 1995.
2. Emissions for each gas are weighted by global warming potential.
3. The agriculture and related land use and forestry sectors includes removals as well as emissions.
4. The entire time series is revised each year to take into 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 equivalent to carbon, divide figures by <sup>44</sup>/<sub>12</sub>.
6. Figures shown do not include any adjustment for the effect of the EU Emissions Trading System (EU ETS), which was introduced in 2005.

## ANNEX B

**B.1 Scottish greenhouse gas emissions by gas: 1990 Base Year, 1990, 1995, 1998-2010** (*million tonnes of carbon dioxide equivalent*)*Greenhouse gas emissions weighted by global warming potential*

Basket of Greenhouse Gases	1990 Base Year	1990	1995	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Carbon dioxide (CO <sub>2</sub> )	53.4	53.4	52.4	53.4	50.1	52.3	52.4	48.6	48.7	46.8	45.8	49.8	45.9	44.4	40.7	43.8
Methane (CH <sub>4</sub> )	11.9	11.9	10.7	9.5	8.7	8.3	7.7	7.1	6.4	6.3	6.3	6.1	6.0	5.8	5.6	5.6
Nitrous Oxide (N <sub>2</sub> O)	6.8	6.8	6.3	6.5	6.4	6.2	6.1	6.1	5.9	5.8	5.6	5.5	5.3	5.1	5.1	5.0
F-gases	0.2	0.1	0.2	0.5	0.6	0.7	0.8	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.3
Hydrofluorocarbons (HFCs)	0.1	0.0	0.1	0.4	0.4	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.1	1.1	1.2	1.2
Perfluorocarbons (PFCs)	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	0.1	0.1	0.0
Sulphur hexafluoride (SF <sub>6</sub> )	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	0.1	0.0	0.0
<b>Total greenhouse gas emissions</b>	<b>72.3</b>	<b>72.2</b>	<b>69.8</b>	<b>70.0</b>	<b>65.8</b>	<b>67.5</b>	<b>67.0</b>	<b>62.6</b>	<b>62.0</b>	<b>59.8</b>	<b>58.7</b>	<b>62.6</b>	<b>58.3</b>	<b>56.6</b>	<b>52.7</b>	<b>55.7</b>

Source: AEA

**Notes:**

- Figures for each individual gas include the Agriculture and Related Land Use and Forestry sectors. In particular for CO<sub>2</sub> it includes removals as well as emissions.
- Base Year consists of emissions of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O in 1990 and of HFCs, PFCs and SF<sub>6</sub> in 1995.
- Includes emissions from international aviation and shipping.
- The entire time series is revised each year to take account of methodological improvements in the UK emissions inventory.
- Emissions are presented as carbon dioxide equivalent in line with international reporting and carbon trading. To convert carbon dioxide equivalent to carbon divide figures by <sup>44</sup>/<sub>12</sub>.
- Figures shown do not include any adjustment for the effect of the EU Emissions Trading System (EU ETS), which was introduced in 2005.

**B.2 Scottish greenhouse gas emissions by gas and sector, 1990, 1995, 1998-2010** (*million tonnes of carbon dioxide equivalent*)

Scottish carbon dioxide emissions by source	1990 base year	1990	1995	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy Supply	20.6	20.6	14.7	24.8	22.0	24.8	24.2	22.5	22.7	21.1	19.8	24.0	20.6	19.2	17.9	20.1
Transport and International Aviation/Shipping	12.8	12.8	12.8	13.7	13.3	13.0	13.0	12.9	13.1	13.5	13.8	14.3	14.5	14.1	13.5	13.1
Business & Industrial Processes	12.4	12.4	8.3	8.3	8.3	8.5	9.1	8.1	8.0	7.8	8.2	7.9	7.6	7.8	6.6	6.7
Residential	7.9	7.9	8.0	8.2	8.1	8.0	8.4	7.8	7.8	7.9	7.7	7.4	7.2	7.5	7.0	8.1
Public	1.2	1.2	1.1	1.1	1.1	1.0	1.1	0.9	0.9	1.0	1.1	1.0	0.9	0.9	0.8	0.9
Waste Management	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Development	1.8	1.8	1.8	1.7	1.8	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6
Agriculture and Related Land Use	5.0	5.0	5.3	5.0	5.1	4.7	4.6	4.4	4.6	4.2	3.8	3.7	3.5	3.3	3.2	2.9
Forestry	-8.3	-8.3	-9.5	-9.5	-9.6	-9.6	-9.6	-9.8	-10.1	-10.4	-10.2	-10.1	-10.1	-10.0	-10.0	-9.6
<b>Total carbon dioxide emissions</b>	<b>53.4</b>	<b>53.4</b>	<b>52.4</b>	<b>53.4</b>	<b>50.1</b>	<b>52.3</b>	<b>52.4</b>	<b>48.6</b>	<b>48.7</b>	<b>46.8</b>	<b>45.8</b>	<b>49.8</b>	<b>45.9</b>	<b>44.4</b>	<b>40.7</b>	<b>43.8</b>
<b>Scottish non-carbon dioxide emissions by source</b>																
Energy Supply	1.8	1.8	1.7	1.5	1.2	1.2	1.3	1.0	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6
Transport and International Aviation/Shipping	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
Business & Industrial Processes	0.8	0.7	0.3	0.5	0.6	0.7	0.7	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.1	1.2
Residential	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Public	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Waste Management	6.5	6.5	5.6	4.7	4.2	4.0	3.4	3.1	2.7	2.5	2.5	2.4	2.3	2.3	2.2	2.1
Development	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agriculture and Related Land Use	9.3	9.3	9.2	9.4	9.2	8.9	8.6	8.6	8.5	8.4	8.3	8.2	7.9	7.7	7.5	7.7
Forestry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Total non - carbon dioxide emissions</b>	<b>18.9</b>	<b>18.8</b>	<b>17.3</b>	<b>16.6</b>	<b>15.7</b>	<b>15.2</b>	<b>14.6</b>	<b>14.0</b>	<b>13.3</b>	<b>13.1</b>	<b>12.9</b>	<b>12.8</b>	<b>12.4</b>	<b>12.2</b>	<b>11.9</b>	<b>11.9</b>
<b>Total Scottish emissions</b>	<b>72.3</b>	<b>72.2</b>	<b>69.8</b>	<b>70.0</b>	<b>65.8</b>	<b>67.5</b>	<b>67.0</b>	<b>62.6</b>	<b>62.0</b>	<b>59.8</b>	<b>58.7</b>	<b>62.6</b>	<b>58.3</b>	<b>26.6</b>	<b>52.7</b>	<b>55.7</b>

Source: AEA

**Notes:**

- Figures for non carbon dioxide emissions are emissions of CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs and SF<sub>6</sub>.
- Base Year consists of emissions of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O in 1990 and of HFCs, PFCs and SF<sub>6</sub> in 1995.
- Emissions are presented as carbon dioxide equivalent in line with international reporting and carbon trading. To convert carbon dioxide equivalent to carbon dioxide figures by <sup>44</sup>/12.
- Figures shown do not include any adjustment for the effect of the EU Emissions Trading System (EU ETS), which was introduced in 2005.

## ANNEX C

**C.1 Scottish greenhouse gas emissions adjusted to take account of trading in the EU Emissions Trading System: 1990 Base Year, 1990, 1995, 1998-2010**  
*(million tonnes carbon dioxide equivalent)*

1990-2010		1990 Base Year	1990	1995	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
No allowance for EU ETS	Emissions (excluding international aviation and shipping)	69.77	69.67	67.28	67.07	63.33	65.13	64.62	60.57	59.85	57.37	56.06	59.96	55.33	53.53	49.83	53.24
	Emissions from international aviation and shipping	2.51	2.51	2.47	2.97	2.51	2.37	2.37	2.01	2.17	2.45	2.64	3.04	3.01	3.04	2.83	2.49
	<b>Total Scottish greenhouse gas emissions</b>	<b>72.28</b>	<b>72.18</b>	<b>69.75</b>	<b>70.04</b>	<b>65.84</b>	<b>67.49</b>	<b>66.98</b>	<b>62.57</b>	<b>62.02</b>	<b>59.82</b>	<b>58.71</b>	<b>62.59</b>	<b>58.34</b>	<b>56.57</b>	<b>52.66</b>	<b>55.73</b>
	<b>Percentage change from baseline</b>			-3.5%	-3.1%	-8.9%	-6.6%	-7.3%	-13.4%	-14.2%	-17.2%	-18.8%	-13.4%	-19.3%	-21.7%	-27.1%	-22.9%
EU ETS	Net purchases/sales by Scottish installations											0.57	-3.95	-0.46	-0.77	1.03	-1.02
	Scottish share of net purchases/sales by UK Government											0.18	0.18	0.18			
	Net purchases/sales											0.75	-3.77	-0.28	-0.77	1.03	-1.02
allowance for EU	<b>Total Scottish greenhouse gas emissions</b>	<b>72.28</b>	<b>72.18</b>	<b>69.75</b>	<b>70.04</b>	<b>65.84</b>	<b>67.49</b>	<b>66.98</b>	<b>62.57</b>	<b>62.02</b>	<b>59.82</b>	<b>59.46</b>	<b>58.82</b>	<b>58.06</b>	<b>55.79</b>	<b>53.69</b>	<b>54.71</b>
	<b>Percentage change from baseline</b>			-3.5%	-3.1%	-8.9%	-6.6%	-7.3%	-13.4%	-14.2%	-17.2%	-17.7%	-18.6%	-19.7%	-22.8%	-25.7%	-24.3%

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

**Notes:**

1. Base year consists of emissions of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O in 1990, and of HFCs, PFCs and SF<sub>6</sub> in 1995.
2. Emissions are presented as carbon dioxide equivalent in line with international reporting and carbon trading. To convert carbon dioxide equivalent to carbon divide figures by <sup>44</sup>/<sub>12</sub>.
3. Net purchase/sales is the difference between units surrendered by EU ETS sites necessary to achieve compliance and units allocated (for 2008 onwards this is the "specified amount" – see page 13).

## ANNEX D

**D.1 Scottish greenhouse gas emissions by source: revised figure comparison** (*million tonnes of carbon dioxide equivalent*)

Source Sector	1990 Base Year				2009			
	(1990-2009 Inventory)	(1990-2010 Inventory)	Absolute Difference	% Difference	(1990-2009 Inventory)	(1990-2010 Inventory)	Absolute Difference	% Difference
Energy supply	22.239	22.323	0.084	0.38%	18.211	18.535	0.324	1.78%
Transport	10.563	10.521	-0.042	-0.40%	10.742	10.772	0.031	0.28%
International Aviation and Shipping	2.528	2.510	-0.018	-0.71%	2.835	2.829	-0.006	-0.20%
<i>International Aviation</i>	0.422	0.471	0.049	11.63%	1.028	1.095	0.067	6.49%
<i>International Shipping</i>	2.106	2.039	-0.067	-3.18%	1.806	1.734	-0.073	-4.02%
Business and Industrial Process	12.418	13.207	0.789	6.35%	6.756	7.770	1.013	15.00%
Business	10.594	11.383	0.789	7.44%	6.359	7.366	1.008	15.85%
Industrial Process	1.824	1.824	0.000	0.00%	0.398	0.403	0.006	1.43%
Residential	8.180	8.180	0.000	0.01%	7.341	7.304	-0.037	-0.50%
Public	1.330	1.226	-0.104	-7.83%	0.790	0.849	0.059	7.47%
Waste Management	6.476	6.572	0.096	1.48%	2.074	2.223	0.149	7.18%
Development	1.787	1.780	-0.007	-0.37%	1.548	1.627	0.079	5.08%
Agriculture and Related Land Use	14.505	14.261	-0.244	-1.68%	10.629	10.743	0.113	1.07%
Forestry	-8.272	-8.305	0.033	0.40%	-9.975	-9.993	-0.019	0.19%
<b>Total greenhouse gas emissions</b>	<b>71.755</b>	<b>72.276</b>	<b>0.521</b>	<b>0.73%</b>	<b>50.951</b>	<b>52.657</b>	<b>1.706</b>	<b>3.35%</b>

1. Figures for each individual gas include the Agriculture and Related Land Use and Forestry sectors. In particular for CO<sub>2</sub> it includes removals as well as emissions.

2. Includes emissions from international aviation and shipping.

3. Emissions are presented as carbon dioxide equivalent in line with international reporting and carbon trading. To convert carbon dioxide equivalent to carbon divide figures by <sup>44</sup>/<sub>12</sub>.

4. Figures shown do not include any adjustment for the effect of the EU Emissions Trading System (EU ETS), which was introduced in 2005.



# **ANNEX E: E.1 Mapping between Scottish Government sectors, National Communication sectors, International Panel for Climate Change sectors and source**

SG Sector	National Communication Sector	IPCC Sector	Source Name
Energy Supply	Energy Supply	1A1a Public Electricity & Heat Production	Miscellaneous industrial/commercial combustion
			Power stations
			Public sector combustion
		1A1b Petroleum Refining	Refineries - combustion
		1A1ci Manufacture of Solid Fuels-coke	Coke production
			Solid smokeless fuel production
		1A1cii Other Energy Industries	Collieries - combustion
			Gas production
			Gas Production - combustion at gas separation plant
			Gas Production - gas combustion
			Nuclear fuel production
			Oil Production - gas combustion
			Town gas manufacture
		1B1ai Post-Mining Activities	Coal storage and transport
		1B1ai Underground Mines	Closed Coal Mines
			Deep-mined coal
		1B1aii Surface Mines	Open-cast coal
		1B1b Solid Fuel Transformation	Coke production
			Iron and steel - flaring
			Solid smokeless fuel production
		1B2ai Oil Exploration	Oil Production - Offshore Well Testing
		1B2aii Oil Production	Oil Production - process emissions
		1B2aiii Oil Transport	Oil Production - Offshore Oil Loading
			Oil Production - Onshore Oil Loading
		1B2aiv Refining/Storage	Oil Production - Oil terminal storage
			Petroleum processes
		1B2bi Gas Production	Gas Production - Gas terminal storage
			Gas Production - Offshore Well Testing
			Gas Production - process emissions
		1B2bii Transmission/Distribution	Gas leakage
		1B2ci Flaring Oil	Oil Production - gas flaring
		1B2ci Venting Oil	Oil Production - gas venting
		1B2cii Flaring Gas	Gas Production - gas flaring
		1B2cii Venting Gas	Gas Production - gas venting
		2A3 Limestone & Dolomite Use	Power stations - FGD

SG Sector	National Communication Sector	IPCC Sector	Source Name
Business and Industrial process	Business	1A2a Manufacturing Industry & Construction: Iron & Steel	Blast furnaces
			Iron and steel - combustion plant
		1A2b Non-Ferrous Metals	Non-Ferrous Metal (combustion)
		1A2c Chemicals	Ammonia production - combustion
			Chemicals (combustion)
		1A2d Pulp Paper Print	Pulp, Paper and Print (combustion)
		1A2e Food drink tobacco	Food & drink, tobacco (combustion)
		1A2f Manufacturing Industry & Construction: Other	Autogeneration - exported to grid
			Autogenerators
			Cement production - combustion
			Lime production - non decarbonising
			Other industrial combustion
		1A2fii Manufacturing Industry & Construction: Off-road	Industrial engines
			Industrial off-road mobile machinery
		1A4a Commercial/Institutional	Miscellaneous industrial/commercial combustion
		2B5 Carbon from NEU of products	Other industrial combustion
		2F1 Refrigeration and Air Conditioning Equipment	Commercial Refrigeration
			Domestic Refrigeration
			Industrial Refrigeration
			Mobile Air Conditioning
			Refrigerated Transport
			Stationary Air Conditioning
		2F2 Foam Blowing	Foams
		2F3 Fire Extinguishers	Firefighting
		2F5 Solvents	Other PFC use
			Precision cleaning - HFC
		2F9 Other (One Component Foams)	One Component Foams
		2F9 Other (semiconductors electrical sporting goods)	Electrical insulation
			Electronics - PFC
			Electronics - SF6
			Sporting goods
	Industrial Process	1A2a Manufacturing Industry & Construction: Iron & Steel	Sinter production
		2A1 Cement Production	Cement - decarbonising
		2A2 Lime Production	Lime Production - decarbonising
		2A3 Limestone & Dolomite Use	Basic oxygen furnaces
			Sinter production
		2A7 (Fletton Bricks)	Brick manufacture - Fletton
		2A7 Glass Production	Glass - general
		2B1 Ammonia Production	Ammonia Production - feedstock use of gas
		2B2 Nitric Acid Production	Nitric Acid Production
		2B3 Adipic Acid Production	Adipic Acid Production
		2B5 Chemical Industry Other	Chemical industry - ethylene
			Chemical industry - general
			Chemical industry - methanol
		2C1 Iron & Steel	Electric arc furnaces
			Iron and steel - flaring
			Ladle arc furnaces
		2C3 Aluminium Production	Primary aluminium production - general

			Primary aluminium production - PFC emissions
		2C4 Cover gas used in Al and Mg foundries	Magnesium cover gas
		2E1 Production of Halocarbons and Sulphur Hexafluoride	Halocarbons production - by-product
		2E2 Production of Halocarbons and Sulphur Hexafluoride	Halocarbons production - fugitive
		3 Solvent and Other Product Use	Solvent use

SG Sector	National Communication Sector	IPCC Sector	Source Name
Transport (excluding international aviation and shipping)	Transport	1A3aii Civil Aviation Domestic	Aircraft - domestic cruise
			Aircraft - domestic take off and landing
		1A3b Road Transportation	Road transport - all vehicles LPG use
			Road transport - buses and coaches - motorway driving
			Road transport - buses and coaches - rural driving
			Road transport - buses and coaches - urban driving
			Road transport - cars - cold start
			Road transport - cars - motorway driving
			Road transport - cars - rural driving
			Road transport - cars - urban driving
			Road transport - HGV articulated - motorway driving
			Road transport - HGV articulated - rural driving
			Road transport - HGV articulated - urban driving
			Road transport - HGV rigid - motorway driving
			Road transport - HGV rigid - rural driving
			Road transport - HGV rigid - urban driving
			Road transport - LGVs - cold start
			Road transport - LGVs - motorway driving
			Road transport - LGVs - rural driving
			Road transport - LGVs - urban driving
			Road transport - mopeds (<50cc 2st) - urban driving
			Road transport - motorcycle (>50cc 2st) - rural driving
			Road transport - motorcycle (>50cc 2st) - urban driving
			Road transport - motorcycle (>50cc 4st) - motorway driving
			Road transport - motorcycle (>50cc 4st) - rural driving
			Road transport - motorcycle (>50cc 4st) - urban driving
			Road vehicle engines
		1A3c Railways	Rail - coal
			Railways - freight
			Railways - intercity
			Railways - regional
		1A3dii National Navigation	Inland goods-carrying vessels
			Marine engines
			Motorboats / workboats (e.g. canal boats, dredgers, service boats, tourist boats, river boats)
			Personal watercraft e.g. jet ski
			Sailing boats with auxiliary engines
			Shipping - coastal
		1A3e Other Transportation	Aircraft - support vehicles

		1A4a Commercial/Institutional	Railways - stationary combustion
		1A4ciii Fishing	Fishing vessels
		1A5b Other: Mobile	Aircraft - military
			Shipping - naval

SG Sector	National Communicati on Sector	IPCC Sector	Source Name
Residential	Residential	1A4b Residential	Domestic combustion
		1A4bii Residential: Off-road	House and garden machinery
		2B5 Chemical Industry Other	Non-aerosol products - household products
		2F4 Aerosols	Aerosols - halocarbons
			Metered dose inhalers
		6C Waste Incineration	Accidental fires - vehicles
Development	Land Use Change	5E Settlements (Biomass Burning - controlled)	Settlements - Biomass Burning
		5E1 Settlements remaining Settlements	Settlements remaining Settlements
		5E2 Land converted to Settlements	Land converted to Settlements
Public	Public	1A4a Commercial/Institutional	Public sector combustion
International Aviation and Shipping	International Aviation and Shipping	7A International Shipping	International Shipping
		7B International Aviation	International Aviation
Waste Management	Waste Management	6A1 Managed Waste Disposal on Land	Landfill
		6B2 Wastewater Handling	Sewage sludge decomposition
		6C Waste Incineration	Incineration
			Incineration - chemical waste
			Incineration - clinical waste
			Incineration - sewage sludge
Forestry	Land Use Change	5A Forest Land (Biomass Burning - wildfires)	Forest Land - Biomass Burning
		5A1 Forest Land Remaining Forest Land	Forest Land Remaining Forest Land
		5A2 Forest Land (N fertilisation)	Direct N <sub>2</sub> O emission from N fertilisation of forest land
		5A2 Land Converted to Forest Land	Land Converted to Forest Land
		5G Other (Harvested wood)	Harvested Wood Products

SG Sector	National Communication Sector	IPCC Sector	Source Name
Agriculture and related land use	Agriculture	1A4ci Agriculture/Forestry/Fishing: Stationary	Agriculture - stationary combustion
			Miscellaneous industrial/commercial combustion
		1A4cii Agriculture/Forestry/Fishing: Off-road	Agricultural engines
			Agriculture - mobile machinery
		2B5 Chemical Industry Other	Agriculture - agrochemicals use
		4A10 Enteric Fermentation Deer	Agriculture livestock - deer enteric
		4A1a Enteric Fermentation Dairy	Agriculture livestock - dairy cattle enteric
		4A1b Enteric Fermentation Non-Dairy	Agriculture livestock - other cattle enteric
		4A3 Enteric Fermentation Sheep	Agriculture livestock - sheep enteric
		4A4 Enteric Fermentation Goats	Agriculture livestock - goats enteric
		4A6 Enteric Fermentation Horses	Agriculture livestock - horses enteric
		4A8 Enteric Fermentation Swine	Agriculture livestock - pigs enteric
		4B10 Manure Management Deer	Agriculture livestock - deer wastes
		4B12 Liquid Systems	Agriculture livestock - manure liquid systems
		4B13 Solid Storage and Drylot	Agriculture livestock - manure solid storage and dry lot
		4B14 Other	Agriculture livestock - manure other
		4B1a Manure Management Dairy	Agriculture livestock - dairy cattle wastes
		4B1b Manure Management Non-Dairy	Agriculture livestock - other cattle wastes
		4B3 Manure Management Sheep	Agriculture livestock - sheep goats and deer wastes
		4B4 Manure Management Goats	Agriculture livestock - goats wastes
		4B6 Manure Management Horses	Agriculture livestock - horses wastes
		4B8 Manure Management Swine	Agriculture livestock - pigs wastes
		4B9 Manure Management Poultry	Agriculture livestock - broilers wastes
			Agriculture livestock - laying hens wastes
			Agriculture livestock - other poultry wastes
		4D Agricultural Soils	Agricultural Soils
		4F1 Field Burning of Agricultural Residues	Field Burning
		4F5 Field Burning of Agricultural Residues	Field Burning
	Land Use Change	5B Cropland (Biomass Burning - controlled)	Cropland - Biomass Burning
		5B Liming	Cropland - Liming
		5B1 Cropland Remaining Cropland	Cropland Remaining Cropland
		5B2 Land Converted to Cropland	Land Converted to Cropland

		5B2 N2O emissions from disturbance associated with land-use conversion to cropland	N2O emissions from disturbance associated with land-use conversion to cropland
		5C Grassland (Biomass burning - controlled)	Grassland - Biomass Burning
		5C Liming	Grassland - Liming
		5C1 Grassland Remaining Grassland	Grassland Remaining Grassland
		5C2 Land converted to grassland	Land converted to Grassland
		5D1 Wetlands remaining wetlands	Wetlands Remaining Wetland
		5D2 Non-CO2 emissions from drainage of soils and wetlands	Non-CO2 emissions from drainage of soils and wetlands



## Glossary

### Adjusted emissions

Greenhouse gas emissions that have taken into account purchases/sales through the EU ETS. Adjusted emissions may be higher or lower than actual emitted emissions depending on the quantity of purchases or sales. Further details are given on pages [12 and 13](#). Scottish Government emission reduction targets are assessed using adjusted emissions.

### Afforestation

The act or process of establishing a forest on land that has not been forested in recent history.

### Base year

Emissions reduction is based on a base year. For the greenhouse gases CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, 1990 was specified as base year. 1995 is the base year for emissions of the F-gases.

### Carbon dioxide (CO<sub>2</sub>)

Carbon dioxide is one of the main gases responsible for climate change. It is mostly emitted through the oxidation of carbon in fossil fuels (e.g. burning coal).

### Climate change

Climate change is a long-term change in the earth's climate. This can be accelerated by human activity, e.g. releasing CO<sub>2</sub> into the atmosphere.

### Deforestation

The removal of forest stands by cutting and burning to provide land for agricultural purposes, residential or industrial building sites, roads, etc., or the harvesting of trees for building materials or fuel.

### EU ETS

The European Union Greenhouse Gas Emissions Trading Scheme (EU ETS) is the largest multi-national emissions trading scheme in the world. Operating across Europe the scheme is mandatory for large energy-intensive industrial installations. The EU ETS aims to deliver a 21 per cent reduction in emissions by 2020.

Over 10,000 installations throughout the EU are covered by the scheme, accounting for nearly 50 per cent of the EU's total CO<sub>2</sub> emissions. Around 100 installations participate in the scheme in Scotland.

The EU ETS began in 2005. Phase II commenced in January 2008 and runs to December 2012.

### F-gases

F-gases are the generic name given to HFCs, PFCs and SF<sub>6</sub>. These have been used as replacements for CFCs, which are ozone depleting substances that have banned under the Montreal Protocol. They have very high GWPs.

**Greenhouse effect**

The greenhouse effect is the process by which heat from the sun is trapped within the earth's atmosphere by greenhouse gases. This process is also known as *radiative forcing*.

**Greenhouse gas**

A greenhouse gas is a gas which absorbs infrared radiation emitted from the surface of the earth, helping to retain a portion of that energy in the atmosphere as heat.

**Global warming potential (GWP)**

GWP is a measure of how much a greenhouse gas is estimated to contribute to global warming. It is a relative scale which compares a gas to CO<sub>2</sub>.

**Hydrofluorocarbons (HFCs)**

HFCs are produced commercially as a substitute for chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). HFCs are largely used in refrigeration and insulating foam. Their GWPs range from 140 to 11,700 times that of CO<sub>2</sub>, depending on the gas type.

**Inventory**

The [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 - 2010](#) contains greenhouse gas emissions estimates for Scotland and the UK. The Inventory is a disaggregation of the UK Inventory, which is based on six major sectors: energy, industrial processes, solvents and other product use, agriculture, land-use change and forestry, and waste.

**LULUCF**

Estimates of emissions and removals from land use, land use change and forestry (LULUCF) depend critically on assumptions made on the rate of loss or gain of carbon in Scotland's carbon rich soils. In Scotland, LULUCF activities, taken as a whole, acts as a sink, absorbing more greenhouse gas emissions than it releases.

**Methane (CH<sub>4</sub>)**

Methane is a greenhouse gas that is around 21 times more potent in the atmosphere than CO<sub>2</sub> over a 100-year time horizon. Main sources include agriculture and landfill.

**National Communication (NC) Sectors**

The NC sectors are agreed groupings of the more detailed sectors reported to the United Nations Framework Convention on Climate Change. This report uses Scottish Government sectors. Mapping of these to NC sectors and IPCC sectors can be seen in [Annex D](#).

**Nitrous oxide (N<sub>2</sub>O)**

Nitrous oxide is a greenhouse gas that is around 310 times more potent in the atmosphere than CO<sub>2</sub> over a 100-year time horizon. The main source is agricultural soils.

**Other Petroleum Gas (OPG)**

This consists mainly of ethane plus some other hydrocarbons, excluding butane and propane

**Perfluorocarbons (PFCs)**

PFCs are a by-product of aluminium smelting. They also are the replacement for CFCs in manufacturing semiconductors. The GWP of PFCs ranges from 6,500 - 9,200 over a 100-year time horizon.

**Radiative forcing**

An externally imposed perturbation in the radiative energy budget of the Earth's atmosphere. Such a perturbation can be brought about by changes in the concentrations of radiatively active species (e.g. greenhouse gases), changes in the solar irradiance incident upon the planet, or other changes that affect the radiative energy absorbed by the surface (e.g. changes in surface reflection properties).

**Source (UNFCCC definition)**

Any process or activity which releases a greenhouse gas or a precursor GHG to the atmosphere.

**Sulphur hexafluoride (SF<sub>6</sub>)**

It is largely used in heavy industry to insulate high-voltage equipment and to assist in the manufacturing of cable-cooling systems. Its GWP is some 23,900 times that of CO<sub>2</sub> over a 100-year time horizon.

**UNFCCC**

In 1992, the [United Nations Framework Convention on Climate Change \(UNFCCC\)](#) was adopted as the basis for a global response to climate change. The ultimate objective of the Convention is to stabilise greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous human interference with the climate system.

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