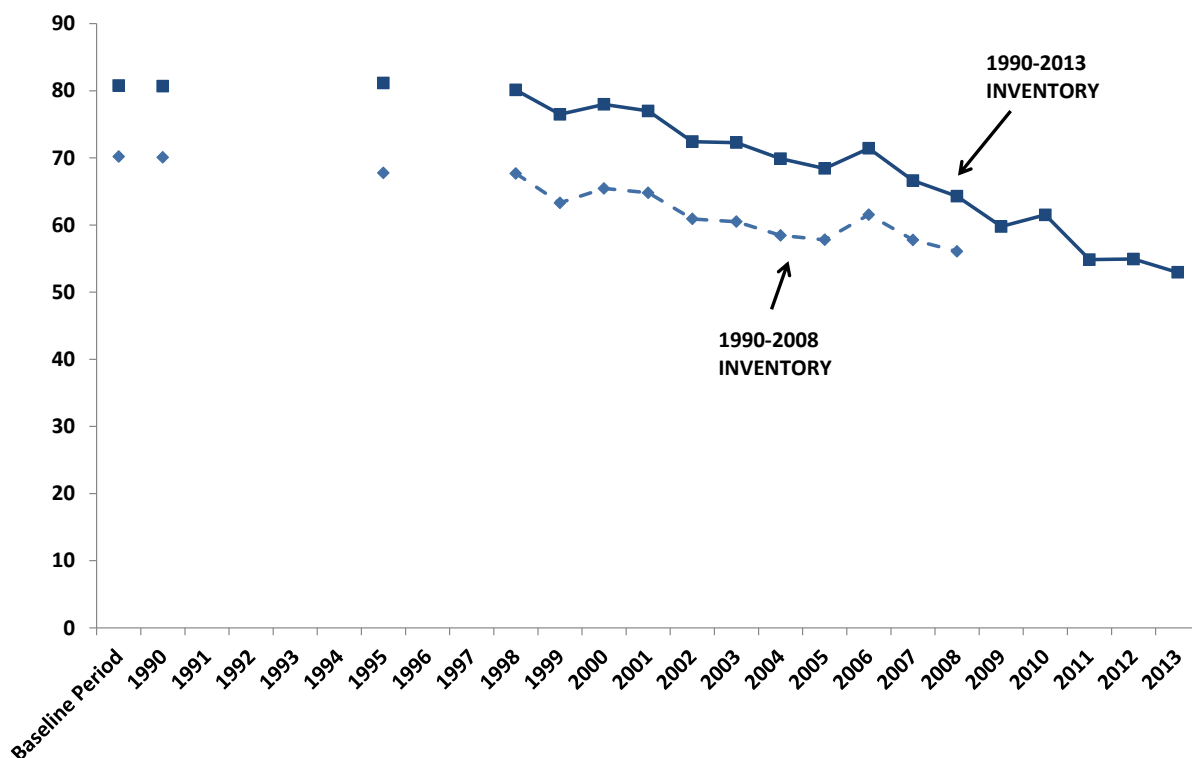


Scottish Greenhouse Gas Emissions 2013. Key Revisions since 2008

This paper provides a summary of the key revisions to the Scottish Greenhouse Gas Emissions Official Statistics publications over successive years from the 1990-2008 inventory to the latest (1990-2013) inventory and this builds on the paper Scottish Greenhouse Gas Emissions 2012 - Key Revisions Since 2008 which was published in October 2014.

The most recent publication provides estimates of greenhouse gas emissions in Scotland for the years 1990 to 2013 and is referred to as the 1990-2013 inventory. The overall estimate of emissions in each successive annual inventory is revised to incorporate methodological improvements; and new or updated data.

Scottish Greenhouse Gas Emissions, Comparison of 1990-2008 and 1990-2013 Inventories. Values in MtCO₂e



There has been a cumulative upwards revision between 1990-2008 and 1990-2013 across the entire time series.

The emissions in the Baseline have been revised upwards by 10.6 MtCO₂e (15.1%)

The emissions in 1990 have been revised upwards by 10.6 MtCO₂e (15.1%)

The emissions in 2008 have been revised upwards by 8.2 MtCO₂e (14.6%)

This paper discusses the main methodological changes which have occurred in the latest (between 1990-2012 and 1990-2013) inventories, and a summary of changes since the 1990-2008 inventory. This is with a view to understanding and improving the methodologies used in the compilation of the inventory and the rationale for these successive revisions. Detailed information on key revisions from the 1990-2008 to 1990-2012 inventory can be found in paper [Scottish Greenhouse Gas Emissions 2012 - Key Revisions Since 2008](#). Scottish Greenhouse Gas Emissions - Key Revisions Since 2008 which was published in October 2014.

[Section A](#) states how the greenhouse gases are compiled and categorised. The Scottish greenhouse gas inventory contains estimates of all greenhouse gas emissions and removals from 1990 to the latest available year of reporting, currently 2013. The latest statistics were published in June 2015 and were reported on in the Scottish Government Official Statistics publication "[Scottish Greenhouse Gas Emissions 2013](#)" and on the [National Atmospheric Emissions Inventory](#) website.

[Section B](#) provides a summary of the cumulative effect of upwards revisions to the greenhouse gas inventory from 1990-2008 to the latest inventory. The source sectors which has seen the greatest absolute increases between the inventories is Waste Management. This sector has seen a net increase to the Baseline of 4.1MtCO₂e (38.6% of all net upwards revisions). The other source sectors which have seen large upwards revisions over the last 6 inventories are the Agriculture and Related Land Use sector (2.29 MtCO₂e; 21.6% of all net upwards revisions), Business and Industrial Process emissions (1.96 MtCO₂e; 18.5% of all net upwards revisions) and Forestry (1.26 MtCO₂e; 11.9% of all net upwards revisions). Some other sectors, such as Energy Supply have seen much smaller revisions over successive inventories.

[Section C](#) provides information on the key revisions between the 1990-2012 inventory and the latest (1990-2013) inventory. [Section D](#) consists of charts showing the impact of successive revisions to the greenhouse gas inventory across the time series for each of the sectors. [Section E](#) consists of data tables from each successive inventory from 1990-2008 to 1990-2013, broken down by sector.

Summary of causes of main upwards revisions between 1990-2008 and 1990-2013 Inventories

WASTE MANAGEMENT. Methane emissions have increased. This is due to the implementation of Intergovernmental Panel on Climate Change (IPCC) (2006) reporting requirements which have resulted in the increase in potency of methane as a greenhouse gas ¹. Revisions and updates to the models used to estimate methane emissions from landfill sites, in particular to reflect recent Scotland-specific research on waste composition and disposal practices. New data on capturing and recovery of landfill gas have been incorporated and new assumptions on rate at which degradable waste decays have been made. These have increased emissions in the Baseline – and reduced emissions later in the series.

AGRICULTURE AND RELATED LAND USE. Incorporation of updated land use change data as a result of the use of Countryside Survey data for 2007, which is updated on an infrequent basis. This has had a particular impact on estimated emissions from land converted to cropland. More detailed data on the sources of nitrous oxide emissions from the use of fertilisers in agricultural soils has been used. The implementation of the IPCC (2006) guidelines has resulted in increases to methane emissions when measured in CO₂ equivalent terms. New data have been included in the latest inventory on the drainage of cropland and grassland on cattle weights in the latest inventory.

BUSINESS AND INDUSTRIAL PROCESSES. There have been upward revisions to underlying energy statistics (for both the UK and Scotland) following the incorporation of more detailed data on petroleum fuels in the business and industrial process sources, including the petrochemical industry. There have also been more improvements to the analysis of detailed point source data in the inventory in later years, for example to use newly available employment and census data. However, the bulk of the revisions are due to access to new data for the highest-emitting installations in Scotland, available through the operation of Phase II of the EU Emissions Trading System (EU ETS).

FORESTRY. Introduction of a new forestry accounting model, which allows for a greater representation of tree species, growth rates and forest management practices. This has increased emissions in the Baseline, but it has decreased values in later years.

INTERNATIONAL AVIATION AND SHIPPING. Within the transport sector, there has been a reallocation of some shipping emissions from domestic navigation to international shipping as a result of further research. There has been a corresponding fall in other transport emissions, which exclude international aviation and shipping.

¹ IPCC's 4th Assessment Report: <http://www.ipcc.ch/report/ar4/>

Contents

Section A. Introduction and Background	6
Section B. Summary of Revisions, from the 1990-2008 Inventory to the Latest Inventory	9
Section C. Revisions the between 1990-2012 and 1990-2013 Inventories. Key Revisions to baseline emissions	12
Section D. Impact of revisions to the time series, from the 1990-2008 Inventory to the Latest Inventory, by source sector.....	23
Section E. Data Tables.....	34
Acknowledgements	42

List of Charts

Scottish Greenhouse Gas Emissions, Comparison of 1990-2008 and 1990-2013 Inventories. Values in MtCO _{2e}	1
Chart B1. Revisions to the Baseline, from the 1990-2008 Inventory, to the Latest Inventory. Impact of Successive Revisions. Values in MtCO _{2e}	9
Chart B2. Revisions to the Baseline, from the 1990-2008 Inventory to the Latest Inventory (1990-2013), by source sector. Impact of Successive Revisions. Values in MtCO _{2e} , and <i>percentage changes</i>	10
Chart C1. Revisions to emissions in the Baseline, from the 1990-2012 inventory to the 1990-2013 inventory, by source sector. Values in MtCO _{2e} , and <i>percentage changes</i>	13
Chart C2. Revisions to emissions in 2012, from the 1990-2012 inventory to the 1990-2013 inventory, by source sector. Values in MtCO _{2e} , and <i>percentage changes</i>	14
Chart C3. Revisions to emissions in the Baseline Period, from the 1990-2012 inventory to the 1990-2013 inventory, by greenhouse gas. Values in MtCO _{2e} , and <i>percentage changes</i>	15
Chart C4. Revisions to 2012 emissions, from the 1990-2012 inventory to the 1990-2013 inventory, by greenhouse gas. Values in MtCO _{2e} , and <i>percentage changes</i>	15
Chart D1. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: ENERGY SUPPLY. Values in MtCO _{2e}	23
Chart D2. Net Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: AGRICULTURE AND RELATED LAND USE. Values in MtCO _{2e}	24
Chart D3. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: BUSINESS AND INDUSTRIAL PROCESS. Values in MtCO _{2e}	25

Chart D4. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: RESIDENTIAL. Values in MtCO ₂ e	26
Chart D5. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: WASTE MANAGEMENT. Values in MtCO ₂ e	27
Chart D6. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: TRANSPORT (INCLUDING INTERNATIONAL AVIATION AND SHIPPING). Values in MtCO ₂ e.....	28
Chart D7. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: TRANSPORT (EXCLUDING INTERNATIONAL AVIATION AND SHIPPING). Values in MtCO ₂ e.....	29
Chart D8. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: INTERNATIONAL AVIATION AND SHIPPING. Values in Mt CO ₂ e	30
Chart D9. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: DEVELOPMENT. Values in MtCO ₂ e.....	31
Chart D10. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: PUBLIC SECTOR BUILDINGS. Values in MtCO ₂ e.....	32
Chart D11. Net Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: FORESTRY. Values in MtCO ₂ e	33

List of Tables

Table B1. Revisions to the Baseline, from the 1990-2008 Inventory to the Latest Inventory (1990-2013), by source sector. Impact of Successive Revisions, percentage share, by source sector	11
Table C1. Changes in emissions by source sector. Comparison of 1990-2012 and 1990-2013 inventories. Values in MtCO ₂ e	16
Table C2. Comparison of global warming potentials (GWP) of greenhouse gases, 1990-2012 and 1990-2013 inventories.....	19
Table E1. Scottish Greenhouse Gas Emissions by Source Sector, Successive Inventories from 1990-2008 to 1990-2013. Values in MtCO ₂ e	34
Table E2. Percentage changes in emissions by source sector. Comparison of 1990- 2008 and 1990-2013 inventories. Values in MtCO ₂ e.....	38
Table E3. Year-on-year changes to the Baseline since the 1990-2008 inventory, by source sector. Values in MtCO ₂ e	41

Section A. Introduction and Background

Purpose of this paper

The “Scottish Greenhouse Gas Emissions” Official Statistics publication contains the results of the Scottish Greenhouse Gas Inventory. The overall estimate of greenhouse gas emissions within the latest year’s inventory are revised every year, due to new data sources, methodological improvements and scientific developments. Some of these changes occur as a result of changes in international reporting as stipulated by the United Nations Framework Convention on Climate Change (UNFCCC), or changes to the methodology guidelines by the Intergovernmental Panel on Climate Change (IPCC).

The Scottish greenhouse gas inventory contains estimates of all greenhouse gas emissions and removals from 1990 to the latest available year of reporting, currently 2013. The latest statistics were published in June 2015 and were reported on in the Scottish Government Official Statistics publication “Scottish Greenhouse Gas Emissions 2013” and on the National Atmospheric Emissions Inventory website. Data from the Scottish Greenhouse Gas Inventory have a number of uses. For instance, they are used for the reporting against and tracking of emissions reduction targets – both percentage targets and fixed targets. The inventory is also used for monitoring the effectiveness of policies for the abatement of greenhouse gas emissions. It is therefore important that key revisions to the inventory are understood to identify which sectors have seen revisions and which ones have remained stable over successive inventories. This paper examines revisions made in each inventory between the 1990-2012 inventory and the latest inventory (1990-2013), and summarises the revisions which have occurred since 1990-2008. The 1990-2008 inventory has been chosen as the first inventory in this paper as it was used as the basis for setting Scotland’s fixed Annual Climate Change Targets. This is with a view to understanding and improving the methodologies used in the compilation of the inventory.

Compilation of the Greenhouse Gas Inventory

The greenhouse gas inventory covers a wide variety of all anthropogenic (man-made) sources of greenhouse gas emissions and therefore a wide variety of emissions sources which require different approaches to their estimation. There are a large number of data sources used in its compilation, obtained from Government statistics, regulatory agencies, trade associations, individual companies, surveys and censuses. The methods used to compile the greenhouse gas inventory are consistent with international guidance on national inventory reporting from the Intergovernmental Panel on Climate Change.

Most emission estimates are compiled by combining activity data (such as fuel use) with a suitable emission factor (such as amount of CO₂ emitted per unit of fuel used). Estimates of emissions from the industrial sector are often compiled based on plant-specific emissions data. Emissions from some sectors are based on more complicated models - such as the model used to estimate emissions from landfill, and the model used to estimate the carbon dynamics in soils when trees are planted. Much of the data on net emissions from agriculture and related land use, land use change and forestry emissions are based on modelled data for Scotland, which are consistent with, but not constrained to, the UK totals and thus are known as “bottom up” estimates.

Many of the remaining emissions sources within the inventory have been collated on a “top down” approach where estimates of emissions have been apportioned to Scotland using proportions of energy use in the Department of Energy and Climate Change (DECC) Publication “Digest of UK Energy Statistics (DUKES)”. This approach is prompted by data availability on emissions being more limited at the sub-UK level.

Interpretation of revisions to the inventory

The latest published Scotland greenhouse gas inventory (currently 1990-2013) represents the best available data at the time of publication and these supersede any previous data, which should be disregarded. Very few revisions to the Greenhouse Gas Inventories arise as a result of 'errors' in the popular sense of the word. In fact, the compilation of the inventory is governed by a rigorous quality assurance process and is subject to a great deal of third party scrutiny, particularly by the UNFCCC at a UK level.

Interpretation of uncertainties in the inventory

All estimates, by definition, are subject to a degree of statistical 'error' but in this context it relates to the uncertainty inherent in any process or calculation that uses sampling, estimation or modelling.

Estimates of greenhouse gases are compiled by a consortium of contractors. The source emissions are based upon a range of data sources, ranging from model based estimates to point source emission data. As a result, the estimates are subject to a degree of uncertainty. Full analyses of these uncertainties are provided on the [National Atmospheric Emissions Inventory website](#).

The Scottish Government has commissioned research to overhaul and update the uncertainties model used for the Scottish greenhouse gas inventory. A detailed study has been carried out in parallel with the compilation of the Scottish greenhouse

gas inventory to review and improve the uncertainty calculations and can be found on the [Scottish Greenhouse Gas Inventory Project](#) page of the Scottish Government website.

Emission Source Sectors

For the purposes of reporting, greenhouse gas emissions are allocated into sectors. These are defined in Section A of the Official Statistics release [Scottish Greenhouse Gas Emissions 2013](#). Details of the detailed mapping of source sectors to IPCC categories can be in [Section E](#) of the same publication.

Reporting of emissions in the Baseline Period and 1990

A baseline period is used for reporting progress against Scotland's Climate Change Targets and this has been used in the context of this report. This is referred to as the "Baseline Period" when referring to changes over time in the charts, tables and text. The Baseline Period for reporting against Climate Change Targets is:

- 1990 for carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O)
- 1995 for Fluorinated gases (F gases): hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆). For the 1990-2013 inventory, a new F gas was included; nitrogen trifluoride (NF₃).

Within this paper, data are estimated for the Baseline Period; and for the years 1990, 1995 and all years from 1998 to 2013².

² The Climate Change (Additional Greenhouse Gas) (Scotland) Order 2015 legislates for the inclusion of nitrogen trifluoride to be added to the basket of gases in Scotland's greenhouse gas inventory, as prescribed in IPCC's 4th Assessment Report: <http://www.ipcc.ch/report/ar4/>. Details of the legislation can be found at: http://www.legislation.gov.uk/ssi/2015/197/pdfs/ssi_20150197_en.pdf

Section B. Summary of Revisions, from the 1990-2008 Inventory to the Latest Inventory

Cumulative revisions since the 1990-2008 inventory indicate the scale of total revisions since the establishment of fixed annual Climate Change targets. Chart B1 shows that the average annual increase in Baseline emissions between the 1990-2008 inventory and the latest inventory has been 2.1 MtCO₂e.

Chart B1. Revisions to the Baseline, from the 1990-2008 Inventory, to the Latest Inventory. Impact of Successive Revisions. Values in MtCO₂e

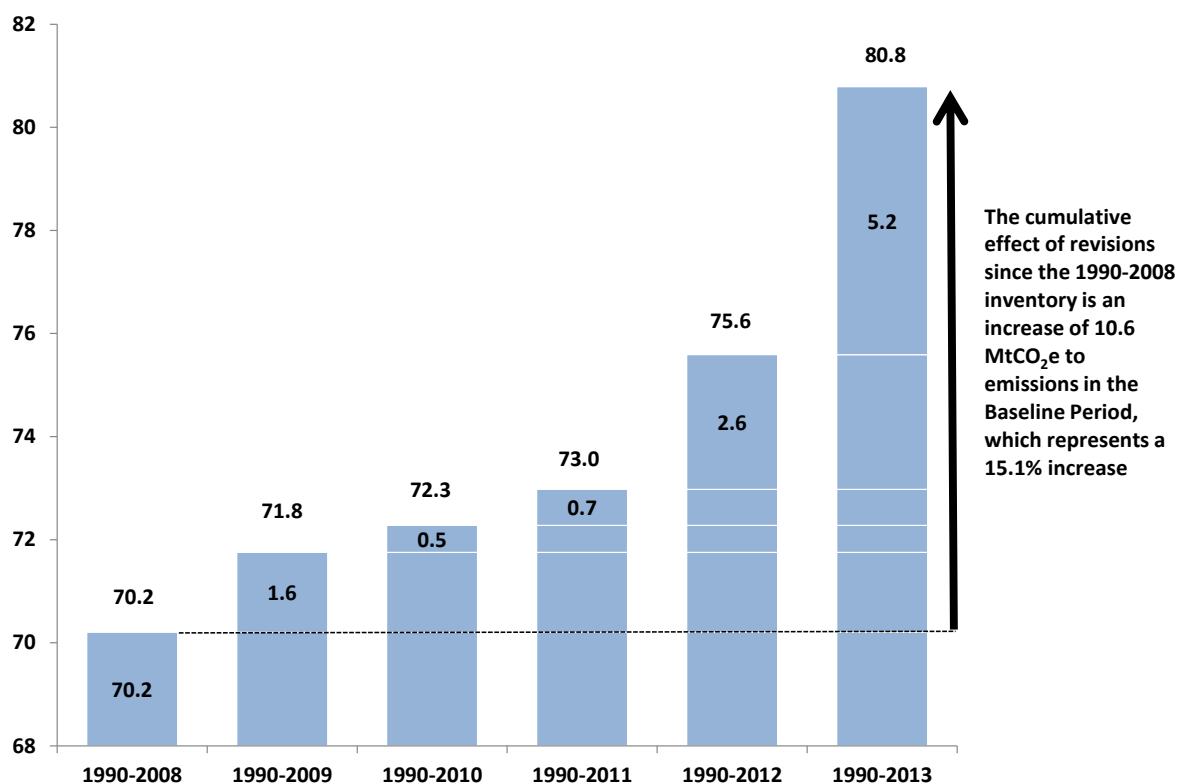
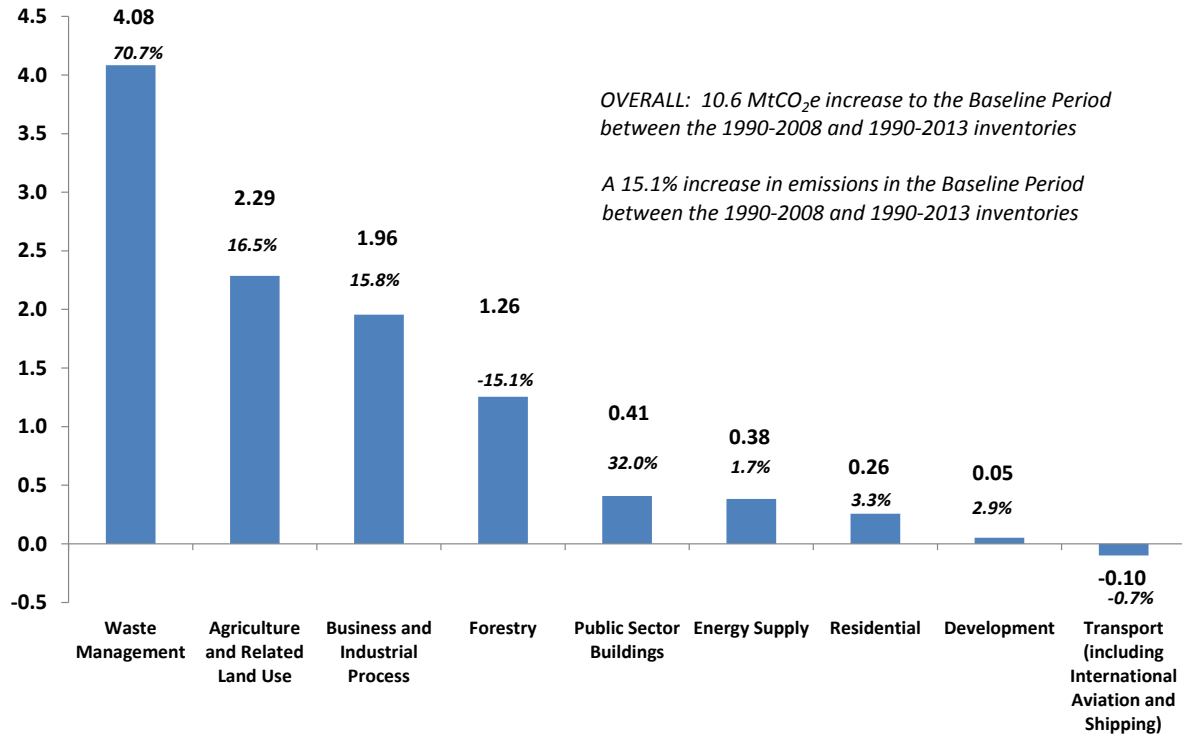


Chart B2 shows the breakdown by source sector in the cumulative upward revisions in emissions between the 1990-2008 inventory and the latest inventory. Table 1 lists the contribution of the each sector to the overall revisions to the Baseline over these inventories and provides information on key revisions in the each sector over this time period.

Chart B2. Revisions to the Baseline, from the 1990-2008 Inventory to the Latest Inventory (1990-2013), by source sector. Impact of Successive Revisions. Values in MtCO₂e, and percentage changes³



³ Unlike for other source sectors, upwards revisions to net emissions from forestry are presented as a negative percentage change. This is because forestry causes a net removal of emissions. This means that an upwards revision from forestry will cause a negative percentage change in the quantity of emissions removed.

Table B1. Revisions to the Baseline, from the 1990-2008 Inventory to the Latest Inventory (1990-2013), by source sector. Impact of Successive Revisions, percentage share, by source sector

Sector	% share by sector	Main drivers for change
Total	100.0%	
Waste Management	38.6%	Main revisions - (1) Development of new Landfill Waste Model – improvements took place over successive inventories; (2) Inclusion of Industrial Waste Water emissions (3) IPCC (2006) guidelines Increase in global warming potential of methane in 1990-2013 inventory and new sources of data, such as composting (4) new data in capturing and recovery of landfill gas (5) new assumptions on rate at which degradable waste decays
Agriculture and Related Land Use	21.6%	Main revisions –(1) Updates to Countryside Survey – land converted to Cropland; (2) Update to data on fertiliser in agricultural soils; (3) update to data on manure storage; (4)Implementation of IPCC guidelines for the Change in global warming potential of methane and nitrous oxide; (5) New data on drainage of cropland and grassland (6) new data on cattle weights
Business and Industrial Process	18.5%	Inclusion of additional emissions from petroleum fuels in industrial sectors and revisions to those fuels which are non-energy use in petrochemical manufacture. (2) Greater Use of EU Emissions Trading System (EU ETS) data within publication
Forestry	11.9%	1 Main Revision – to forestry accounting model in the 1990-2012 inventory
Public Sector Buildings	3.9%	Use of Scottish proxy data for Display Energy Certificates in public sector buildings and revisions to UK energy statistics for public sector gas use for the 1990-2012 inventory.
Energy Supply	3.6%	Greater use of EU Emissions Trading System data within inventory compilation.
Residential	2.4%	An increase in solid fuel emissions in the residential sector
Development	0.5%	
Transport (including International Aviation and Shipping)	-0.9%	(1) Within the Transport Sector, reallocation of some domestic shipping figures to international shipping figures due to better quality data on domestic navigation; (2) Improved representation of the road transport estimate of vehicle fleet in Scotland, through access to detailed vehicle licensing information, which has reduced emissions

Section C. Revisions the between 1990-2012 and 1990-2013 Inventories. Key Revisions to baseline emissions

This section outlines the key revisions between taking place between the 1990-2012 and 1990-2013 inventories.

Revisions between successive inventories between the 1990-2008 and 1990-2012 inventories are outlined in the Occasional Paper "[Scottish Greenhouse Gas Emissions 2012. Key Revisions since 2008](#)".

Impact of Revisions

Charts C1 to C4 and Table C1 illustrate the impacts of revisions between the 1990-2012 and 1990-2013 inventories, both by sector and by greenhouse gas. This is followed by a discussion of the reasons for the key revisions.

Chart C1 shows that the Waste Management sector contributed by far the greatest upwards revisions to emissions in the Baseline Period, at 3.2 MtCO_{2e} (contributing to 60.9 per cent of the upward revision). Other sectors which saw considerable upwards revisions to emissions in the Baseline Period were Agriculture and Related Land Use (0.9 MtCO_{2e}), Business and Industrial Processes (0.8 MtCO_{2e}) and Energy Supply (0.3 MtCO_{2e}). There was a small downward revision for Residential emissions.

Chart C1. Revisions to emissions in the Baseline, from the 1990-2012 inventory to the 1990-2013 inventory, by source sector. Values in MtCO₂e, and percentage changes

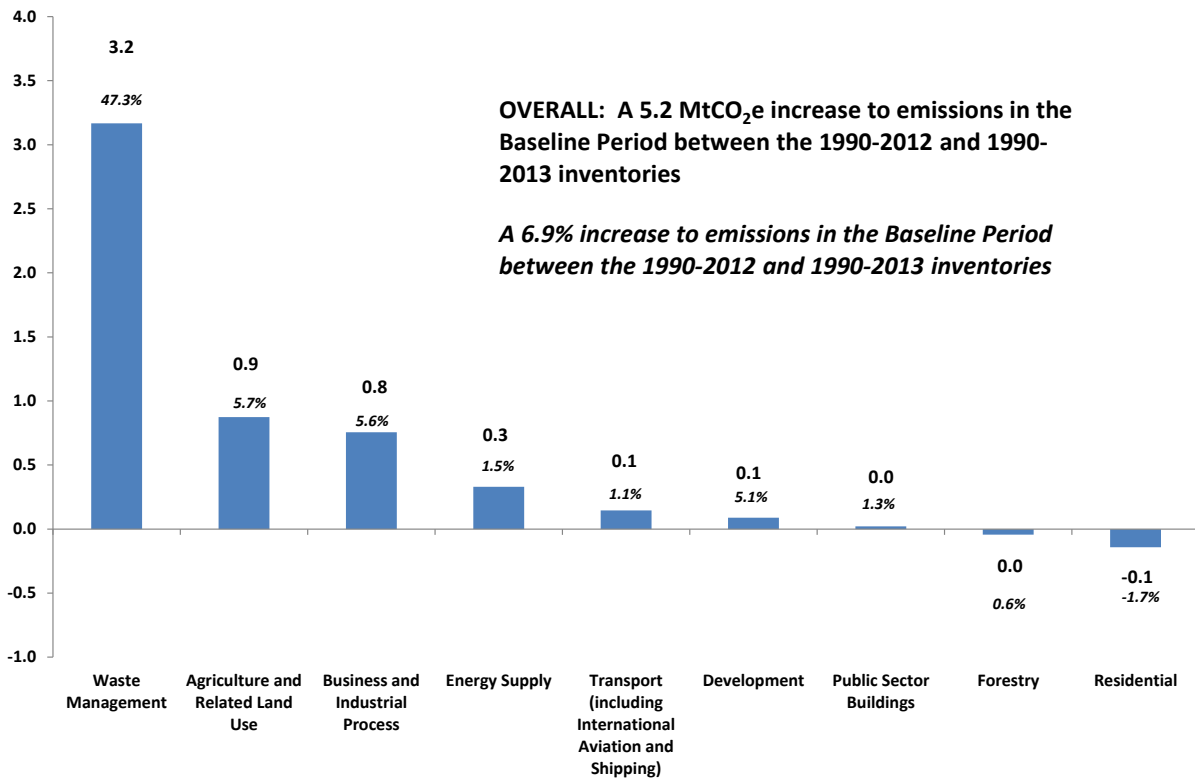


Chart C2 shows that the greatest upwards revisions in 2012 have occurred in the Agriculture and Related Land Use sector (1.4 MtCO₂e; contributing to 67.2 per cent of revisions). The Waste Management emissions and Energy Supply emissions have both been revised upwards by 0.4 MtCO₂e in 2012. Emissions in the Business and Industrial Process sector have been revised upwards by 0.3 MtCO₂e.

Chart C2. Revisions to emissions in 2012, from the 1990-2012 inventory to the 1990-2013 inventory, by source sector. Values in MtCO₂e, and percentage changes

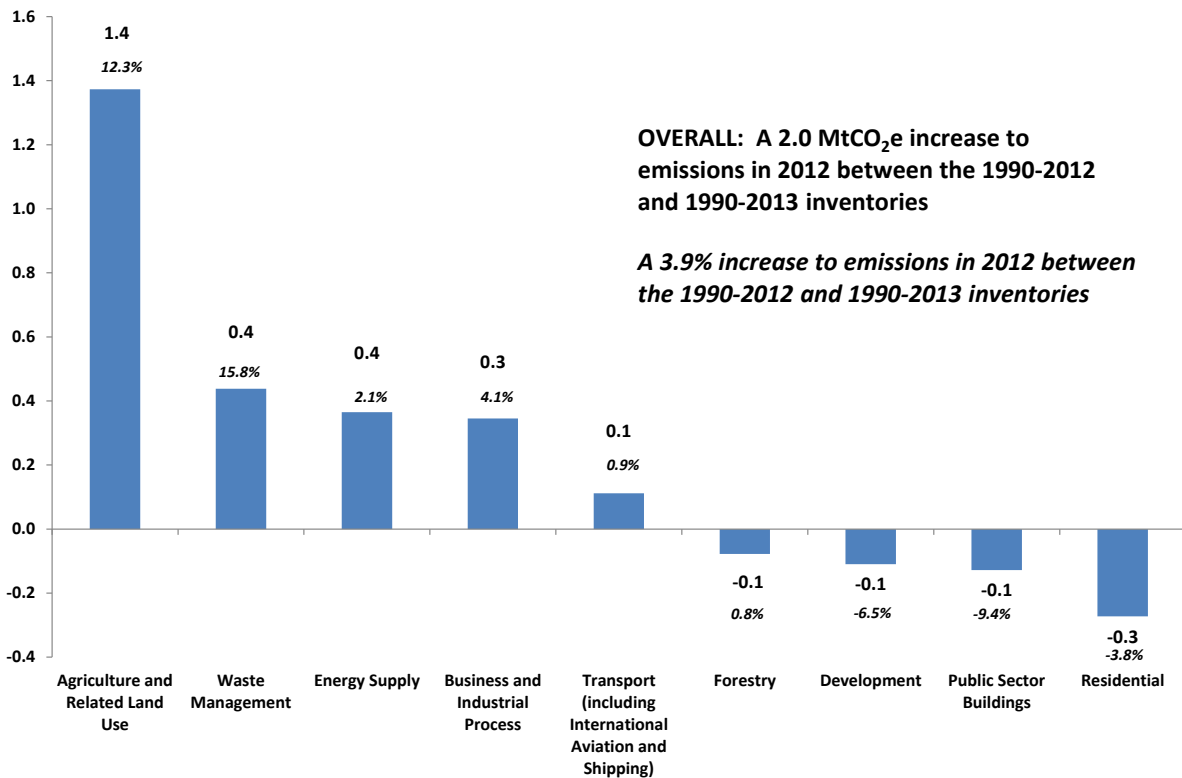


Chart C3 shows the impact of revisions to emissions in the Baseline Period for each greenhouse gas separately, with Chart C4 showing the impact of revisions in 2012. In both cases, methane emissions have seen the greatest upwards revisions, followed by carbon dioxide - with nitrous oxide emissions being revised downwards across the time series.

It is worth noting that the introduction of nitrogen trifluoride (NF₃) has a negligible effect on the 1990-2013 greenhouse gas inventory. It was included for the first time in the 1990-2013 inventory.

Chart C3. Revisions to emissions in the Baseline Period, from the 1990-2012 inventory to the 1990-2013 inventory, by greenhouse gas. Values in MtCO₂e, and percentage changes

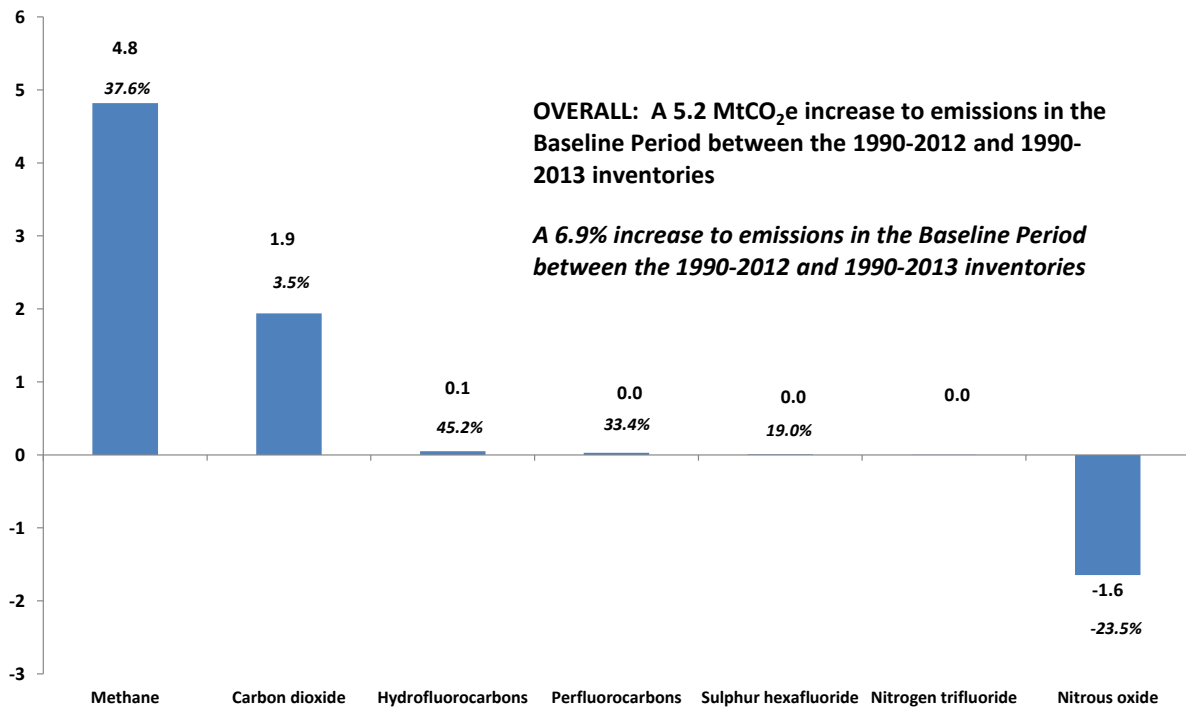


Chart C4. Revisions to 2012 emissions, from the 1990-2012 inventory to the 1990-2013 inventory, by greenhouse gas. Values in MtCO₂e, and percentage changes

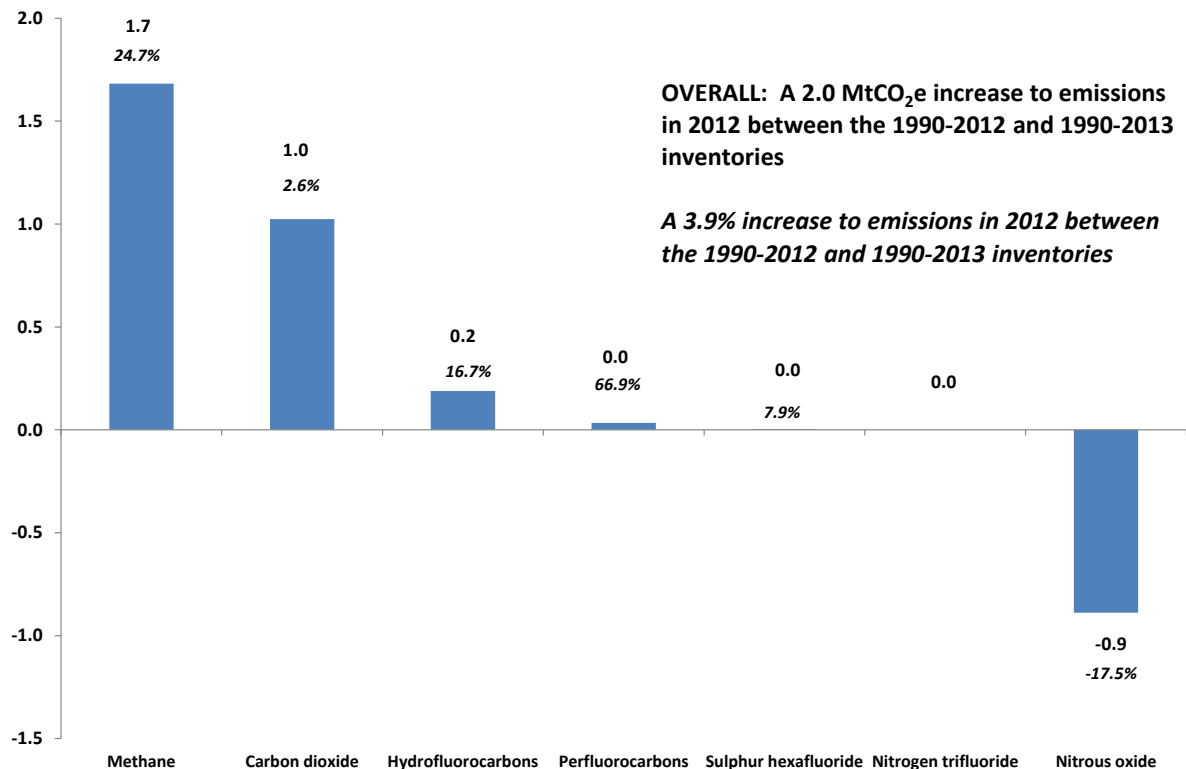


Table C1. Changes in emissions by source sector. Comparison of 1990-2012 and 1990-2013 inventories. Values in MtCO₂e

	Baseline Period	1990	2012	2013	% change between Baseline Period and 2012	% change between 1990 and 2012	% change between Baseline Period and 2013	% change between 1990 and 2013
Total								
1990-2012	75.6	75.5	52.9		-30.0%	-29.9%		
1990-2013	80.8	80.7	54.9	53.0	-32.0%	-31.9%	-34.4%	-34.3%
Difference between 1990-2012 and 1990-2013	5.2	5.2	2.0					
Energy Supply								
1990-2012	22.4	22.4	17.1		-23.5%	-23.5%		
1990-2013	22.7	22.7	17.5	16.0	-23.0%	-23.0%	-29.5%	-29.5%
Difference between 1990-2012 and 1990-2013	0.3	0.3	0.4					
Transport (including International Aviation and Shipping)								
1990-2012	13.1	13.1	12.9		-1.2%	-1.2%		
1990-2013	13.2	13.2	13.0	12.9	-1.4%	-1.4%	-2.1%	-2.1%
Difference between 1990-2012 and 1990-2013	0.1	0.1	0.1					
Transport (excluding IA&S)								
1990-2012	10.5	10.5	10.5		0.1%	0.1%		
1990-2013	10.6	10.6	10.6	10.5	-0.2%	-0.2%	-1.0%	-1.0%
Difference between 1990-2012 and 1990-2013	0.1	0.1	0.1					
International Aviation and Shipping (IA&S)								
1990-2012	2.5	2.5	2.4		-6.4%	-6.4%		
1990-2013	2.6	2.6	2.4	2.4	-6.6%	-6.6%	-6.4%	-6.4%
Difference between 1990-2012 and 1990-2013	0.0	0.0	0.0					
Agriculture and Related Land Use								
1990-2012	15.2	15.2	11.2		-26.7%	-26.7%		
1990-2013	16.1	16.1	12.5	12.4	-22.2%	-22.2%	-23.1%	-23.1%
Difference between 1990-2012 and 1990-2013	0.9	0.9	1.4					

	Baseline Period	1990	2012	2013	% change between Baseline Period and 2012	% change between 1990 and 2012	% change between Baseline Period and 2013	% change between 1990 and 2013
Business and Industrial Process								
1990-2012	13.6	13.5	8.5		-37.3%	-37.0%		
1990-2013	14.4	14.3	8.9	9.1	-38.2%	-37.9%	-36.6%	-36.3%
Difference between 1990-2012 and 1990-2013	0.8	0.8	0.3					
Residential								
1990-2012	8.2	8.2	7.3		-11.1%	-10.8%		
1990-2013	8.0	8.0	7.0	7.0	-13.0%	-12.3%	-13.0%	-12.4%
Difference between 1990-2012 and 1990-2013	-0.1	-0.2	-0.3					
Waste Management								
1990-2012	6.7	6.7	2.8		-58.6%	-58.6%		
1990-2013	9.9	9.9	3.2	2.7	-67.5%	-67.5%	-72.6%	-72.6%
Difference between 1990-2012 and 1990-2013	3.2	3.2	0.4					
Development								
1990-2012	1.7	1.7	1.7		-3.4%	-3.4%		
1990-2013	1.8	1.8	1.6	1.6	-14.1%	-14.1%	-14.7%	-14.7%
Difference between 1990-2012 and 1990-2013	0.1	0.1	-0.1					
Public Sector Buildings								
1990-2012	1.7	1.7	1.4		-17.8%	-17.8%		
1990-2013	1.7	1.7	1.2	1.2	-26.4%	-26.4%	-26.2%	-26.2%
Difference between 1990-2012 and 1990-2013	0.0	0.0	-0.1					
Forestry								
1990-2012	-7.0	-7.0	-9.9		41.9%	41.9%		
1990-2013	-7.0	-7.0	-10.0	-10.0	42.1%	42.1%	42.0%	42.0%
Difference between 1990-2012 and 1990-2013	0.0	0.0	-0.1					

Details of Main Revisions

A complete list of the revisions between the previous and latest inventories can be found in the National Atmospheric Emissions Inventory report Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 - 2013 ⁴.

Details of the most notable revisions are listed below:

1. Implementation of IPCC (2006) Guidelines

The UK and the Scottish greenhouse gas inventory are required to comply with reporting guidelines as prescribed by the IPCC. These guidelines have been updated for this year's release to reflect the details published in the IPCC's 4th Assessment Report ⁵. The latest set of guidelines are known as the IPCC (2006) guidelines. These have been agreed internationally and replace the previous guidelines, which were referred to as the IPCC (1996) guidelines. The adoption of the IPCC (2006) guidelines has led to a number of revisions, as detailed below:

Revised Global Warming Potentials of greenhouse gases

The global warming potentials (GWPs) used for each gas have been updated to those published in the IPCC's 4th Assessment Report. Table 3 shows the revised GWPs as used in this year's publication, compared with those used in last year's publication. The impact of the GWP changes has been greatest on the agriculture and related land use and on the waste management sectors.

⁴ http://naei.defra.gov.uk/reports/reports?report_id=810

⁵ IPCC's 4th Assessment Report: <http://www.ipcc.ch/report/ar4/>

Table C2. Comparison of global warming potentials (GWP) of greenhouse gases, 1990-2012 and 1990-2013 inventories

Name of Greenhouse Gas	Chemical Formula	1990-2012	1990-2013
Carbon dioxide	CO ₂	1	1
Methane	CH ₄	21	25
Nitrous oxide	N ₂ O	310	298
F-gases			
- Hydrofluorocarbons	HFC	140 - 11,700	12 - 14,800
- Perfluorocarbons	PFC	6,500 - 9,200	7,390 - 17,340
- Sulphur hexafluoride	SF ₆	23,900	22,800
- Nitrogen trifluoride	NF ₃	Not included	17,200

New data sources and methodologies

New sources include the use of nitrous oxide in anaesthesia and emissions from composting. Some existing sources have also been updated with new methodologies, such as in the emissions of F gases in the Business and Industrial Process sector.

New greenhouse gas

A new F-gas, nitrogen trifluoride (NF₃) has been included in the 1990-2013 inventory for the first time. This gas is only emitted in tiny amounts in Scotland and is emitted in the semiconductor industry.

2. Waste Management

Impact of IPCC (2006) guidelines

The majority of greenhouse gas emissions in the Waste Management sector are of methane. Changing the global warming potential of methane from 21 to 25 has resulted in emissions in the Baseline Period for this sector being revised upwards by around 1.2 MtCO₂e and 2012 emissions being revised upwards by around 0.5 MtCO₂e in 2012. There have also been new requirements under the IPCC (2006) guidelines to report on new sources for this first time – such as emissions from composting.

Landfill gas data

New information has been used for this publication from the Scottish Environment Protection Agency on the volumes of landfill gas flared and recovered at landfill sites; previously these volumes had been estimated. This has led to a downwards revision to emissions in recent years.

Waste decay data

New research from Defra has shown that the rate at which degradable waste is estimated to decay over time in landfill is slightly higher than previously thought. This increases methane emissions in the early part of the time series and decreases them after 2009.

Other changes

There have been further, more minor updates to emissions in this sector. These include:

- Changes to assumptions of gas combustion engine efficiency
- New data on waste composition.
- Revisions to estimates of industrial and domestic waste water treatment methods (to be consistent with IPCC (2006) guidelines)
- New emissions from private sewage treatment works

3. Agriculture and Related Land Use

Impact of IPCC (2006) guidelines

A considerable proportion of net greenhouse gas emissions in the Agriculture and Related Land Use sector are of methane and nitrous oxide. Changing the global warming potential of methane from 21 to 25 and changing that of nitrous oxide from 310 to 298 has resulted in emissions in the Baseline Period for this sector being revised upwards by around 0.6 MtCO₂e and the 2012 emissions being revised upwards by around 0.5 MtCO₂e.

Adopting the IPCC (2006) guidelines has also meant that there have been changes to the assumptions for the emissions from animal digestion (enteric fermentation), which have increased emissions across the series.

Implementing the IPCC (2006) guidelines has also meant that emissions for agricultural soils have been revised downwards, but not to the same extent as the upwards revisions in other parts of the Agricultural and Related Land Use source sector. This downward revision has been due to changes in emissions factors for agricultural soils. There have also been changes to assumptions regarding the

greenhouse gas emissions from manure management practices in farms, which results in a small drop in emissions across the time series.

Drainage of Cropland and Grassland

DEFRA have published revised UK land areas of cropland and improved grassland on organic soils which have been drained for agricultural purposes. UNFCCC reviewers have requested for this information to be included in the inventory and they only relate to the drainage of these land use types. This has resulted in an increase in around 1.17 MtCO₂e across the time series and they particularly affect the size of carbon sink from grasslands.

Cattle Weights

New research from DEFRA has resulted in updated estimates of the average weights of dairy cattle and beef cattle. This has led to further upwards revisions to enteric fermentation emissions by cattle across the time series

4. Business and Industrial Process

Chemical Industry

There has been a revision to emissions from petroleum fuels which are regarded as non-energy use due to their use in petrochemical manufacture. This has led to an increase in emissions in all years. There has also been incorporation of Phase III EU ETS data which has resulted in improvements in the completeness and allocation of the inventory for chemical sites.

5. Energy Supply

Changes to Allocations of Fuel Use

Some allocations of fuel use have been changed in DECC's Digest of UK Energy Statistics (DUKES). This has increased emissions as more fuel use has been allocated to activities which combust the fuel, and therefore release emissions. There has been a slight reallocation of emissions across the UK's power stations, to be consistent with the DUKES fuel use data. This has led to a slight increase in energy supply emissions in Scotland.

Revisions to Emission Factors For Some Fuels

Emission factors for coal, anthracite and coke have been updated to the IPCC default values as a result of questions received during the international review process. This has increased emissions by a small amount.

Fugitive Emissions

Emissions from fugitive emissions from gas and oil extraction in the UK have been revised to account for venting from the gas distribution network and there are now better estimates of emissions from small coal mines.

Section D. Impact of revisions to the time series, from the 1990-2008 Inventory to the Latest Inventory, by source sector

Energy Supply

For the Energy Supply sector, the Baseline emissions are equal to those for 1990, as there are no F gas emissions in this sector.

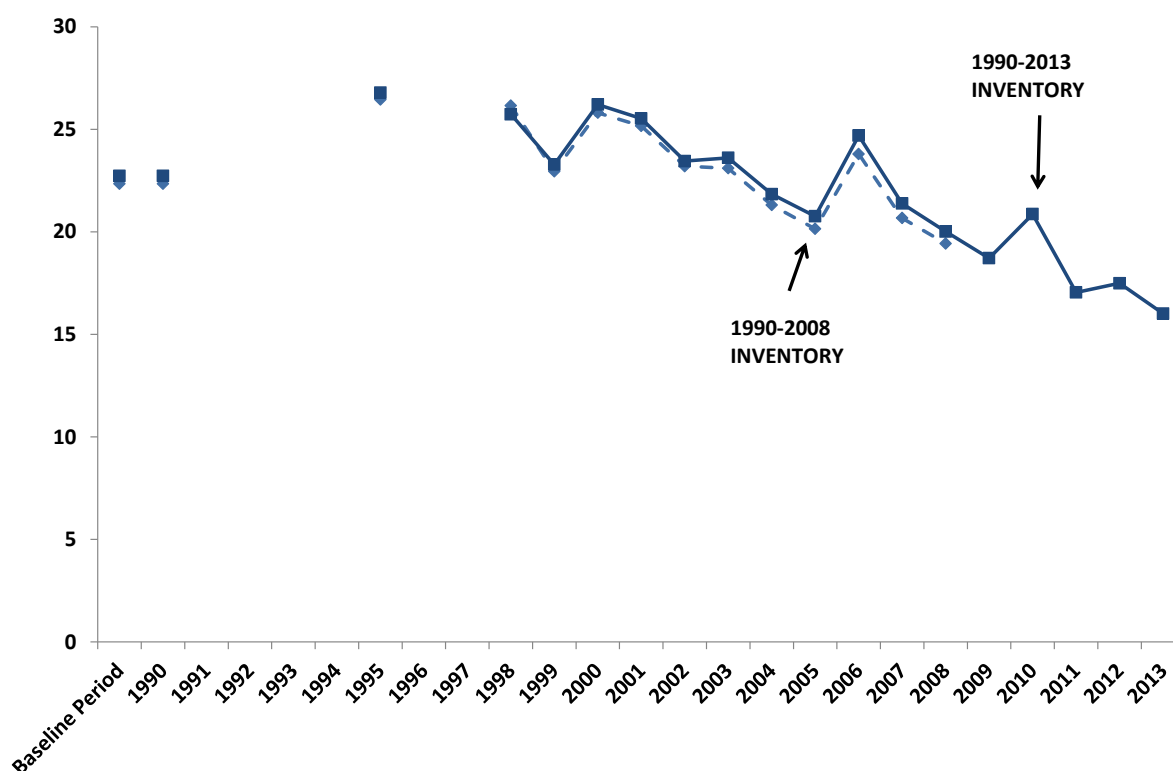
There has been a cumulative upwards revision between 1990-2008 and 1990-2013 across the entire time series.

Between the 1990-2008 and 1990-2013 inventories:

- The emissions in the Baseline have been revised upwards by 0.4 MtCO₂e (1.7%)
- The emissions in 1990 have been revised upwards by 0.4 MtCO₂e (1.7%)
- The emissions in 2008 have been revised upwards by 0.6 MtCO₂e (3.0%)

Chart D1 shows the impact of these revisions on the Energy Supply emissions time series.

Chart D1. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: ENERGY SUPPLY. Values in MtCO₂e



Agriculture and Related Land Use

For the Agriculture and Related Land Use sector, the Baseline emissions are equal to those for 1990, as there are no F gas emissions in this sector.

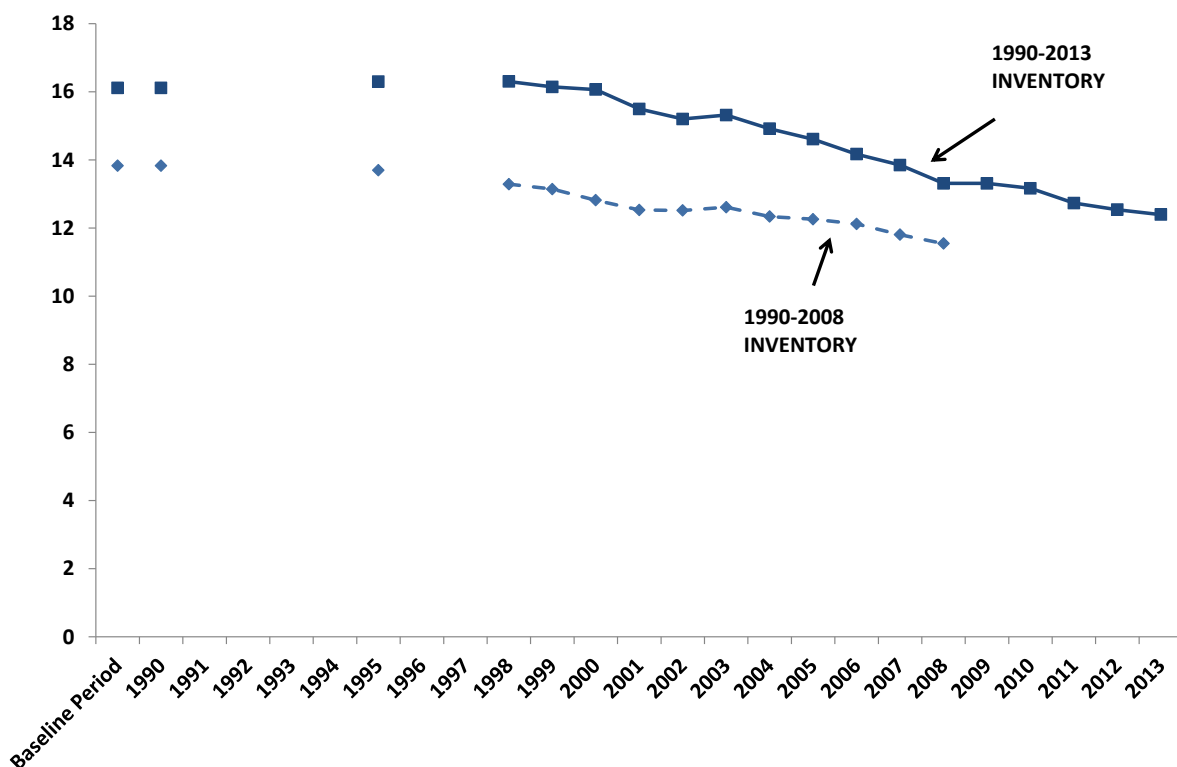
There has been a cumulative upwards revision between 1990-2008 and 1990-2013 across the entire time series.

Between the 1990-2008 and 1990-2013 inventories:

- The emissions in the Baseline have been revised upwards by 2.3 MtCO₂e (16.5%)
- The emissions in 1990 have been revised upwards by 2.3 MtCO₂e (16.5%)
- The emissions in 2008 have been revised upwards by 1.8 MtCO₂e (15.3%)

Chart D2 shows the impact of these revisions on the Agriculture and Related Land Use emissions time series.

Chart D2. Net Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: AGRICULTURE AND RELATED LAND USE. Values in MtCO₂e



Business and Industrial Process

For the Business and Industrial Process sector, there are some emissions of F gases. The Baseline Period for F gases is 1995 rather than 1990, as for the other greenhouse gases⁶. This means that the Baseline emissions for the Business and Industrial Process sector are different from the 1990 emissions

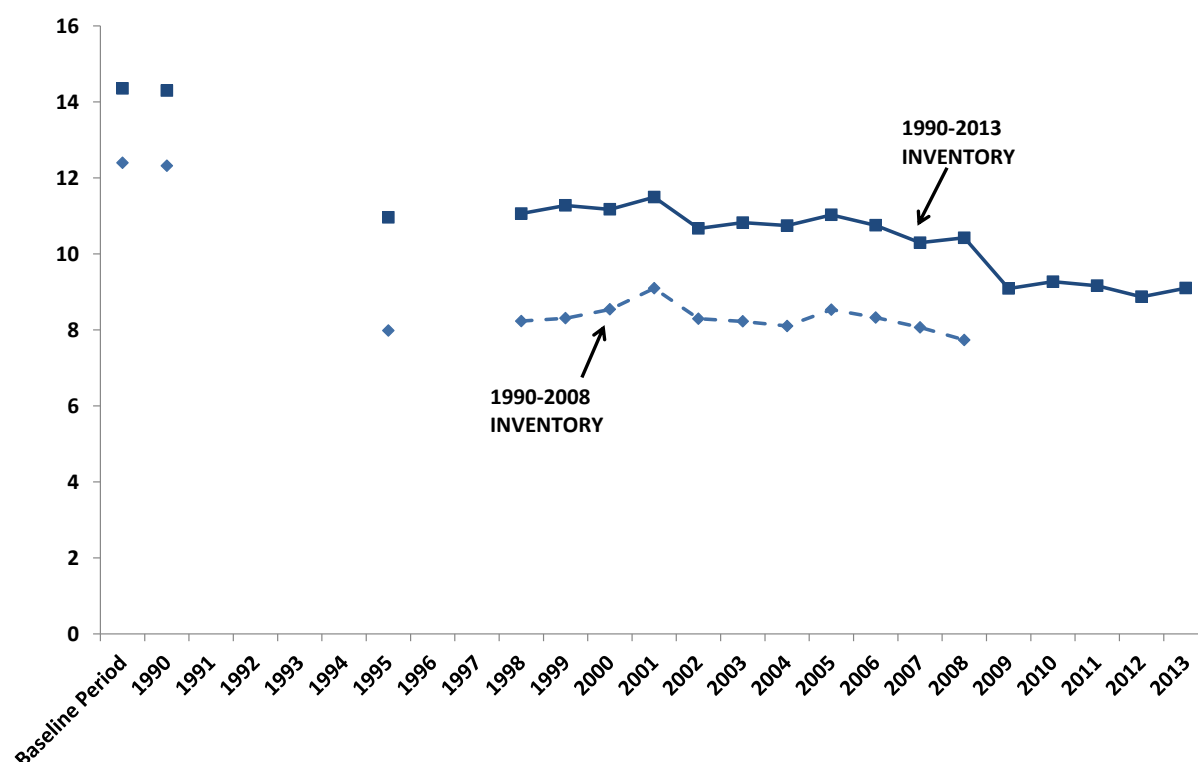
Between the 1990-2008 and 1990-2013 inventories:

There has been a cumulative upwards revision between 1990-2008 and 1990-2013 across the entire time series.

- The emissions in the Baseline have been revised upwards by 2.0 MtCO₂e (15.8%)
- The emissions in 1990 have been revised upwards by 2.0 MtCO₂e (16.0%)
- The emissions in 2008 have been revised upwards by 2.7 MtCO₂e (34.8%)

Chart D3 shows the impact of these revisions on the Business and Industrial Process emissions time series.

Chart D3. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: BUSINESS AND INDUSTRIAL PROCESS. Values in MtCO₂e



⁶ The Baseline Period for reporting against Climate Change Targets is:

- 1990 for carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O)
- 1995 for Fluorinated gases (F gases): hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆) and nitrogen trifluoride (NF₃)

Residential

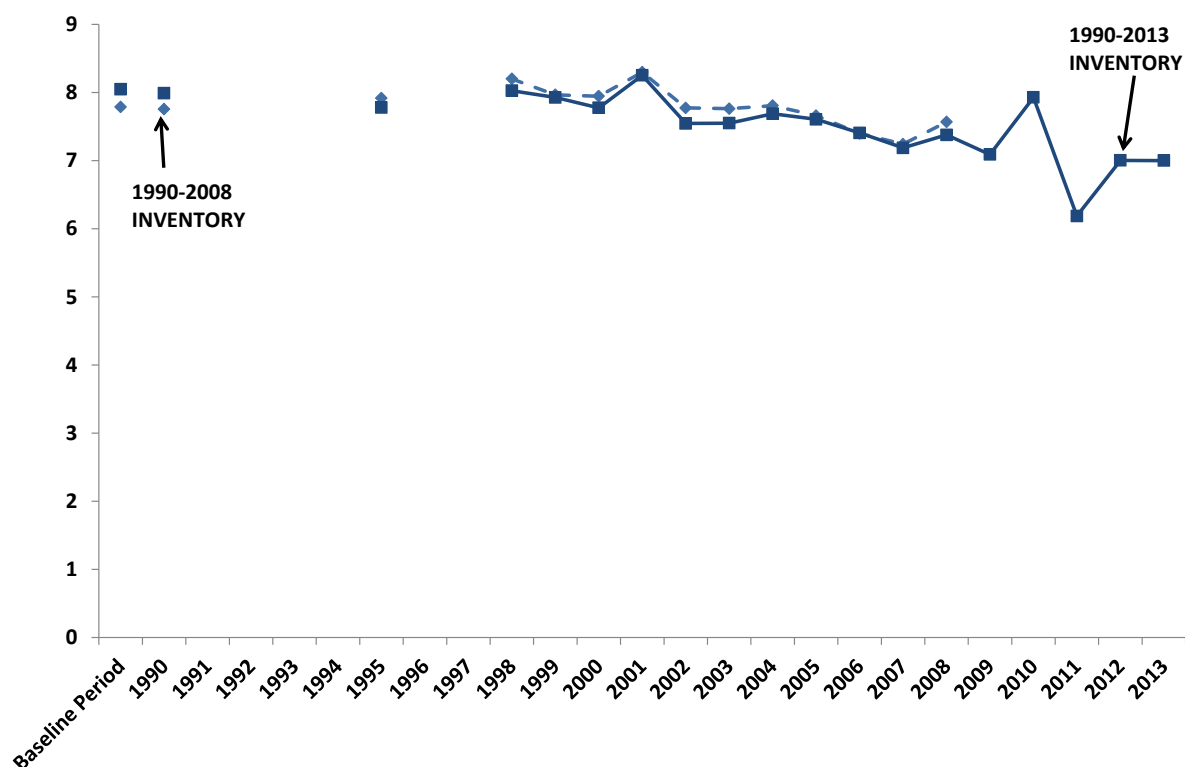
For the Residential sector, there are some emissions of F gases. The Baseline Period for F gases is 1995 rather than 1990, as for the other greenhouse gases⁷. This means that the Baseline emissions for the Business and Industrial Process sector are different from the 1990 emissions

Between the 1990-2008 and 1990-2013 inventories:

- The emissions in the Baseline have been revised upwards by 0.3 MtCO₂e (3.3%)
- The emissions in 1990 have been revised upwards by 0.2 MtCO₂e (3.0%)
- The emissions in 2008 have been revised downwards by 0.2MtCO₂e (2.5%)

Chart D4 shows the impact of these revisions on the Residential emissions time series.

Chart D4. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: RESIDENTIAL. Values in MtCO₂e



⁷ The Baseline Period for reporting against Climate Change Targets is:

- 1990 for carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O)
- 1995 for Fluorinated gases (F gases): hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆) and nitrogen trifluoride (NF₃)

Waste Management

For the Waste Management sector, the Baseline emissions are equal to those for 1990, as there are no F gas emissions in this sector.

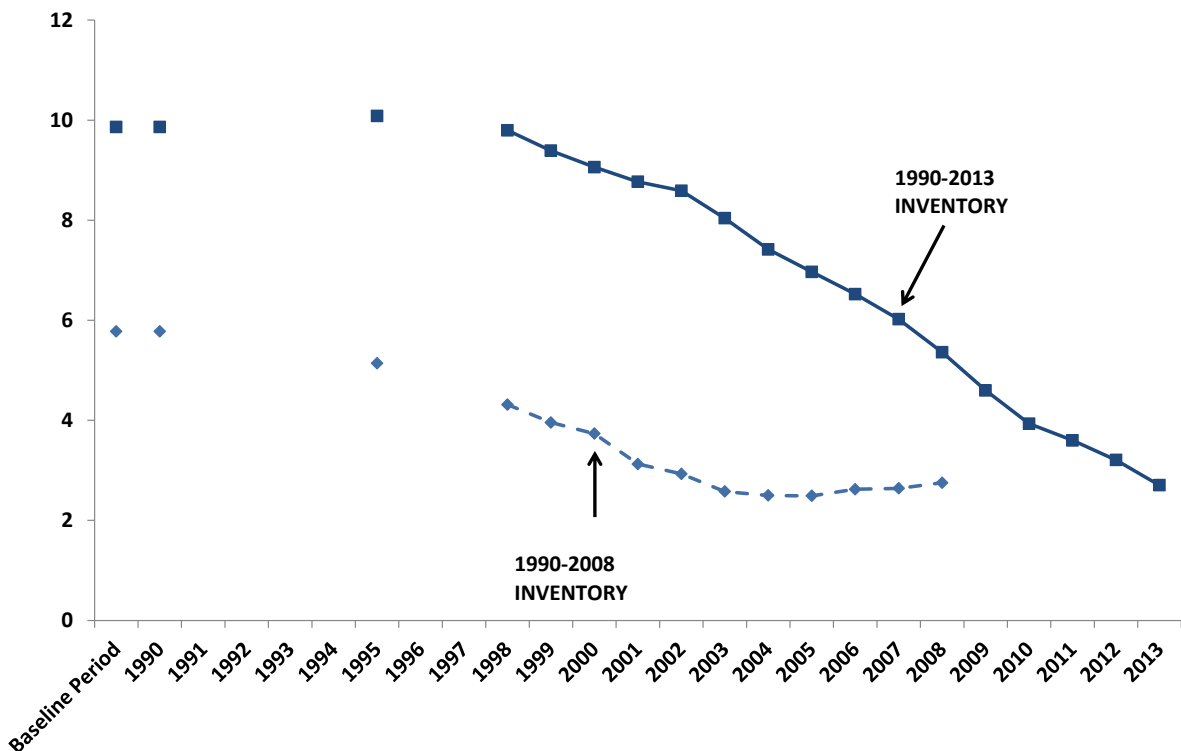
There has been a cumulative upwards revision between 1990-2008 and 1990-2013 across the entire time series.

Between the 1990-2008 and 1990-2013 inventories:

- The emissions in the Baseline have been revised upwards by 4.1 MtCO₂e (70.7%)
- The emissions in 1990 have been revised upwards by 4.1MtCO₂e (70.7%)
- The emissions in 2008 have been revised upwards by 2.6 MtCO₂e (94.7%)

Chart D5 shows the impact of these revisions on the Waste Management emissions time series.

Chart D5. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: WASTE MANAGEMENT. Values in MtCO₂e



Transport (Including International Aviation and Shipping)

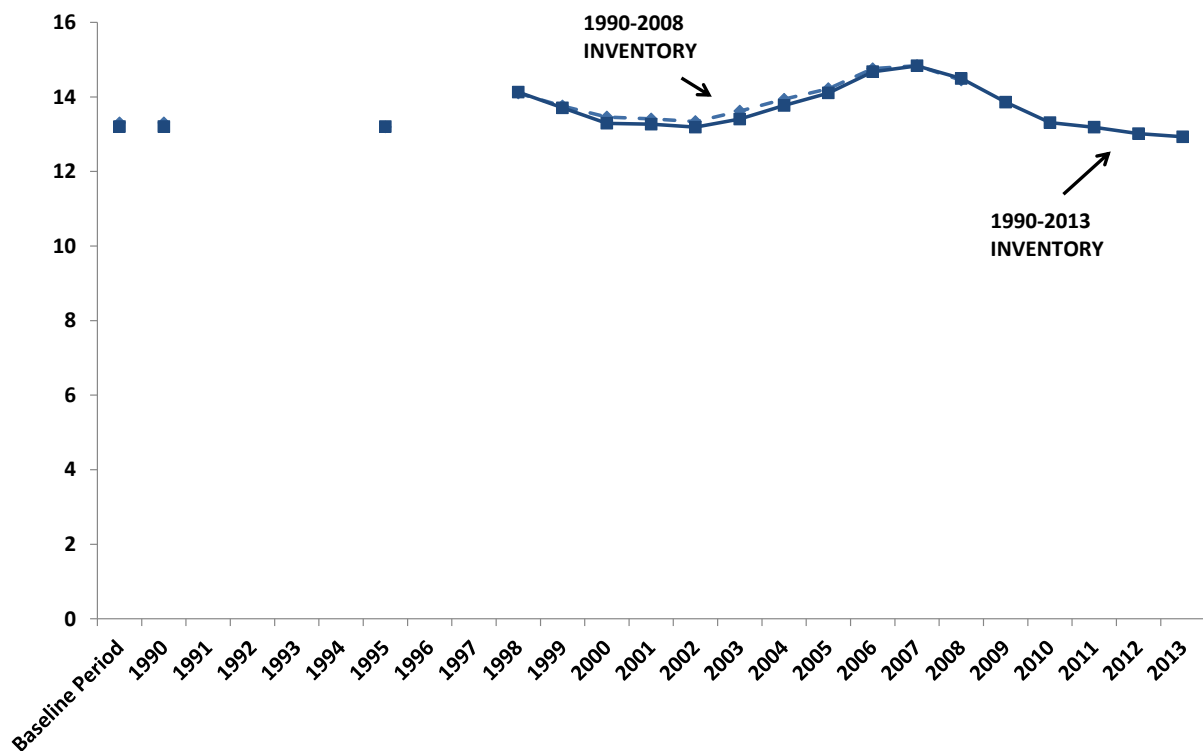
For the Transport sector (including International Aviation and Shipping), the Baseline emissions are equal to those for 1990, as there are no F gas emissions in this sector.

Between the 1990-2008 and 1990-2013 inventories

- The emissions in the Baseline have been revised downwards by 0.1 MtCO₂e (0.7%)
- The emissions in 1990 have been revised downwards by 0.1 MtCO₂e (0.7%)
- The emissions in 2008 have been revised upwards by 0.0 MtCO₂e (0.3%)

Chart D6 shows the impact of these revisions on the transport time series.

Chart D6. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: TRANSPORT (INCLUDING INTERNATIONAL AVIATION AND SHIPPING). Values in MtCO₂e



Transport (Excluding International Aviation and Shipping)

For the Transport sector (excluding International Aviation and Shipping), the Baseline emissions are equal to those for 1990, as there are no F gas emissions in this sector.

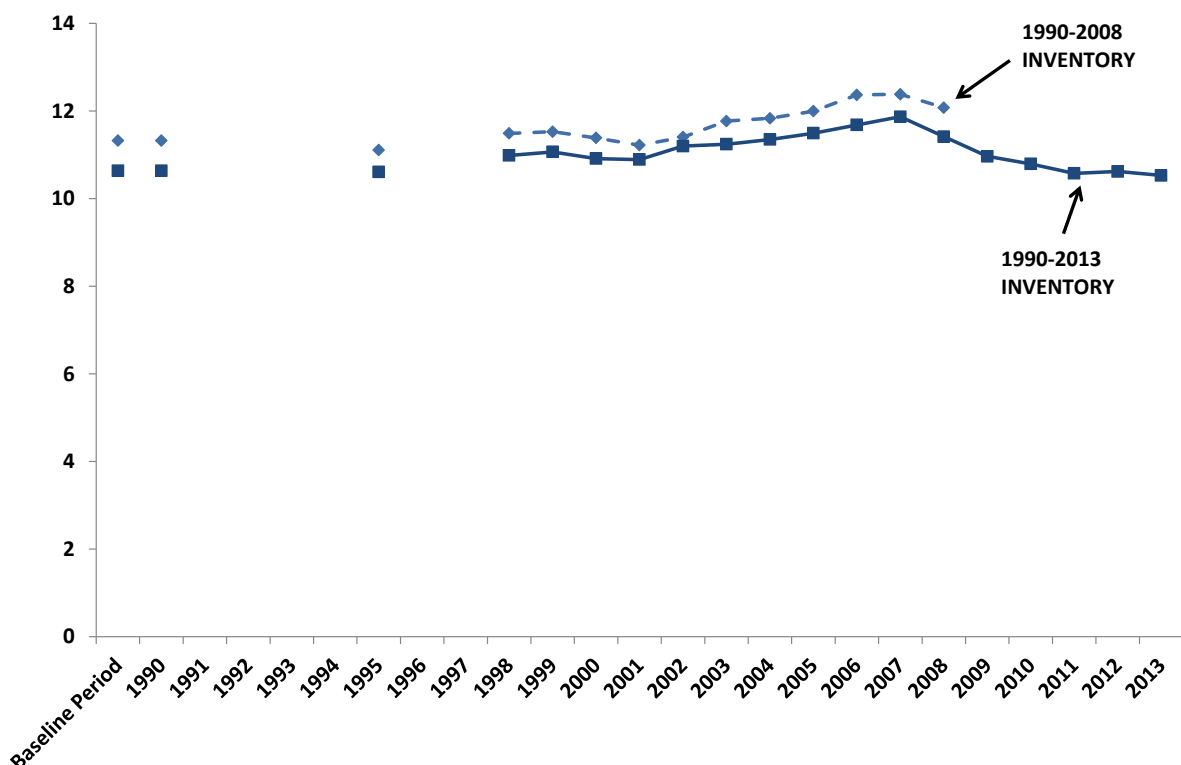
There has been a cumulative downwards revision between 1990-2008 and 1990-2013 across the entire time series.

Between the 1990-2008 and 1990-2013 inventories:

- The emissions in the Baseline have been revised downwards by 0.7 MtCO₂e (6.1%)
- The emissions in 1990 have been revised downwards by 0.7 MtCO₂e (6.1%)
- The emissions in 2008 have been revised downwards by 0.7 MtCO₂e (5.5%)

Chart D7 shows the impact of these revisions on this time series.

Chart D7. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: TRANSPORT (EXCLUDING INTERNATIONAL AVIATION AND SHIPPING). Values in MtCO₂e



International Aviation and Shipping

For International Aviation and Shipping, the Baseline emissions are equal to those for 1990, as there are no F gas emissions in this sector.

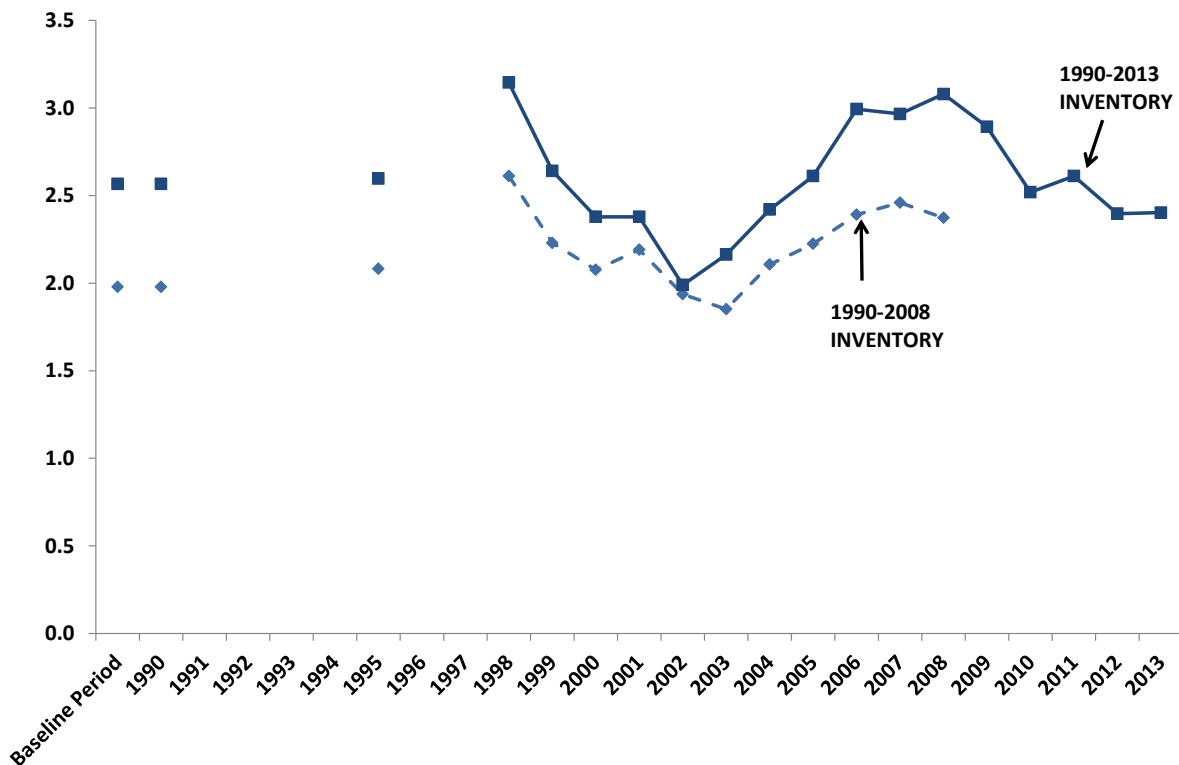
There has been a cumulative upwards revision between 1990-2008 and 1990-2013 across the entire time series.

Between the 1990-2008 and 1990-2013 inventories:

- The emissions in the Baseline have been revised upwards by 0.6 MtCO₂e (29.7%)
- The emissions in 1990 have been revised upwards by 0.6 MtCO₂e (29.7%)
- The emissions in 2008 have been revised upwards by 0.7MtCO₂e (29.8%)

Chart D8 shows the impact of these revisions on this time series.

Chart D8. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: INTERNATIONAL AVIATION AND SHIPPING. Values in Mt CO₂e



Development

For the Development sector, the Baseline emissions are equal to those for 1990, as there are no F gas emissions in this sector.

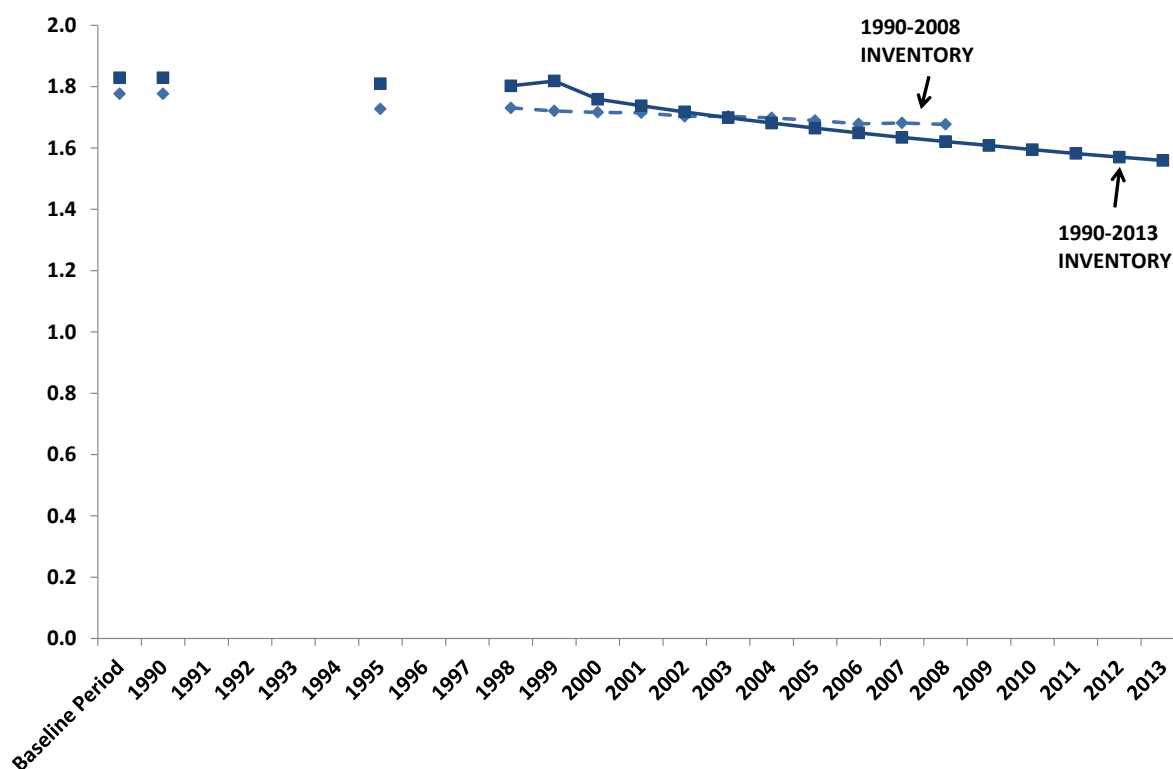
Between the 1990-2008 and 1990-2013 inventories:

The emissions in the Baseline have been revised upwards by 0.1 MtCO₂e (2.9%)

- The emissions in 1990 have been revised upwards by 0.1 MtCO₂e (2.9%)
- The emissions in 2008 have been revised downwards by 0.1MtCO₂e (3.3%)

Chart D9 shows the impact of these revisions on the Development emissions time series

Chart D9. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: DEVELOPMENT. Values in MtCO₂e



Public Sector Buildings

For Public sector Buildings, the Baseline emissions are equal to those for 1990, as there are no F gas emissions in this sector.

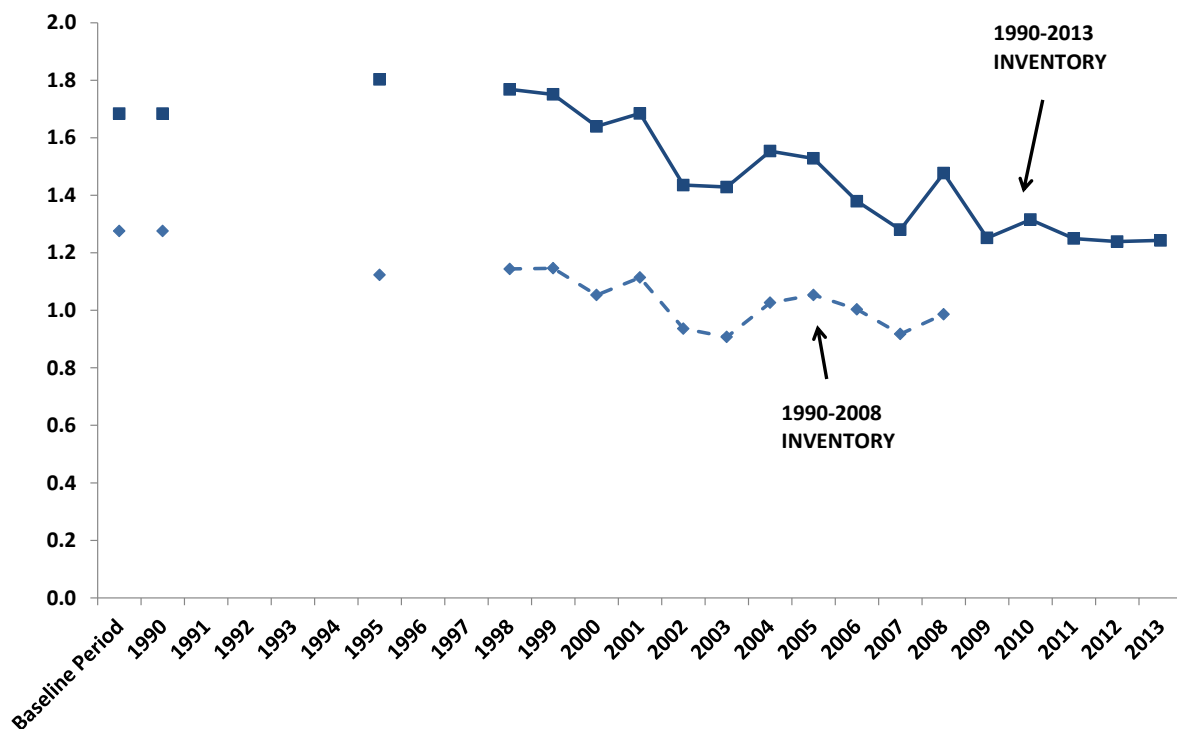
There has been a cumulative upwards revision between 1990-2008 and 1990-2013 across the entire time series.

Between the 1990-2008 and 1990-2013 inventories,

- The emissions in the Baseline have been revised upwards by 0.4 MtCO₂e (32.0%)
- The emissions in 1990 have been revised upwards by 0.4 MtCO₂e (32.0%)
- The emissions in 2008 have been revised upwards by 0.5 MtCO₂e (49.7%)

Chart D10 shows the impact of these revisions on this time series.

Chart D10. Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: PUBLIC SECTOR BUILDINGS. Values in MtCO₂e



Forestry

For the Forestry sector, the Baseline value is equal to the 1990 value, as there are no F gas emissions in this sector.

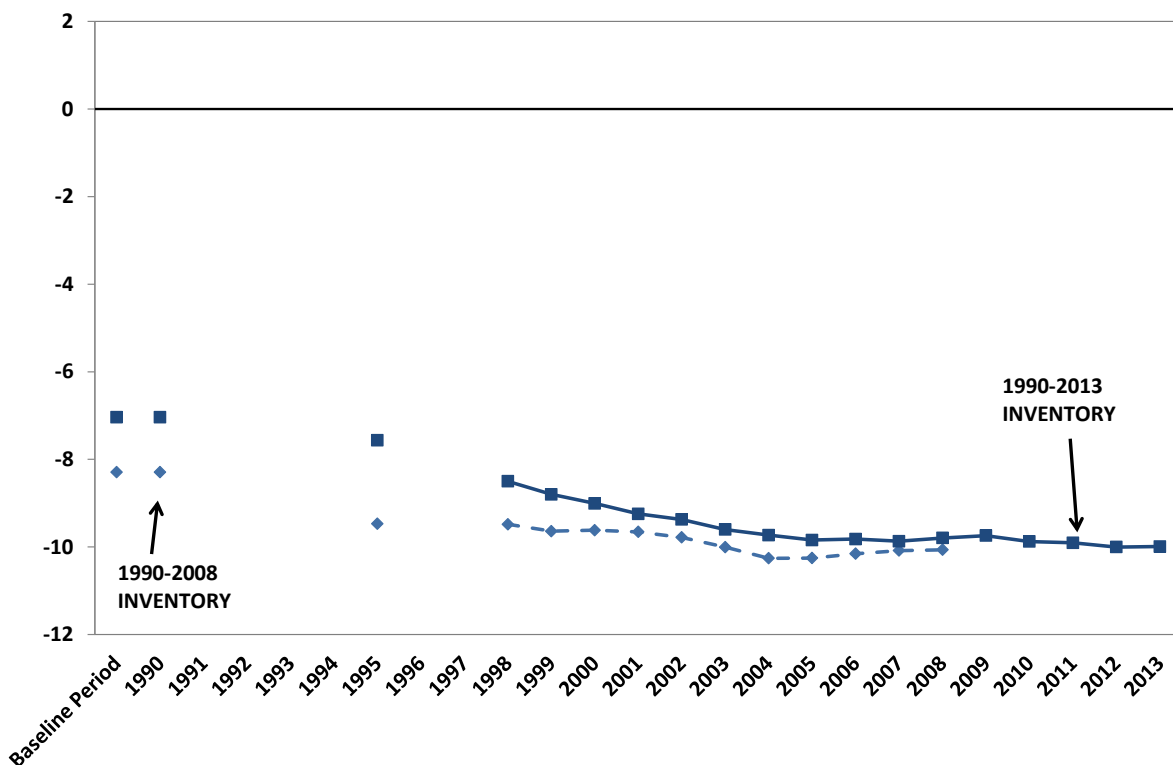
There has been a cumulative upwards revision between 1990-2008 and 1990-2013 across the entire time series.

Between the 1990-2008 and 1990-2013 inventories,

- The emissions in the Baseline have been revised upwards by 1.3 MtCO₂e (-15.1%)
- The emissions in 1990 have been revised upwards by 1.3 MtCO₂e (-15.1%)
- The emissions in 2008 have been revised upwards by 0.3MtCO₂e (-2.7%)

Chart D11 shows the impact of these revisions on the time series

Chart D11. Net Greenhouse Gas Emissions: 1990-2008 and 1990-2013 Inventories: FORESTRY. Values in MtCO₂e



Section E. Data Tables

Table E1. Scottish Greenhouse Gas Emissions by Source Sector, Successive Inventories from 1990-2008 to 1990-2013. Values in MtCO₂e

	Baseline Period	1990	1995	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total																			
1990-2008	70.2	70.1	67.8	67.7	63.3	65.5	64.8	60.9	60.5	58.5	57.8	61.5	57.8	56.1					
1990-2009	71.8	71.6	68.6	68.5	64.3	66.0	65.4	61.2	60.7	58.5	57.5	61.2	56.9	54.8	51.0				
1990-2010	72.3	72.2	69.8	70.0	65.8	67.5	67.0	62.6	62.0	59.8	58.7	62.6	58.3	56.6	52.7	55.7			
1990-2011	73.0	72.9	70.9	70.3	66.8	69.0	68.2	63.8	63.3	61.1	60.3	63.9	59.4	58.1	54.2	56.9	51.3		
1990-2012	75.6	75.5	75.4	74.2	70.3	72.0	71.3	67.0	66.7	64.4	63.1	66.8	62.2	60.2	56.3	58.3	52.5	52.9	
1990-2013	80.8	80.7	81.2	80.1	76.5	78.0	77.0	72.4	72.3	69.9	68.4	71.4	66.6	64.3	59.8	61.5	54.8	54.9	53.0
Energy Supply																			
1990-2008	22.3	22.3	26.5	26.2	23.0	25.8	25.2	23.2	23.1	21.3	20.1	23.8	20.7	19.4					
1990-2009	22.2	22.2	26.4	26.2	23.1	25.9	25.3	23.3	23.4	21.6	20.5	24.4	21.1	19.6	18.2				
1990-2010	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			
1990-2011	22.4	22.4	26.5	25.5	23.1	26.0	25.3	23.3	23.4	21.8	20.4	24.4	21.1	19.9	18.6	20.7	16.9		
1990-2012	22.4	22.4	26.5	25.5	23.1	26.0	25.3	23.3	23.4	21.8	20.5	24.7	21.3	20.0	18.6	20.7	16.9	17.1	
1990-2013	22.7	22.7	26.8	25.7	23.3	26.2	25.5	23.5	23.6	21.8	20.8	24.7	21.4	20.0	18.7	20.9	17.0	17.5	16.0
Agriculture and Related Land Use																			
1990-2008	13.8	13.8	13.7	13.3	13.1	12.8	12.5	12.5	12.6	12.3	12.3	12.1	11.8	11.5					
1990-2009	14.5	14.5	14.4	14.1	14.0	13.4	12.9	12.7	12.6	12.1	11.9	11.6	11.1	10.7	10.6				
1990-2010	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			
1990-2011	14.3	14.3	14.4	14.5	14.3	13.7	13.2	13.0	13.0	12.6	12.2	11.8	11.3	10.9	10.7	10.4	10.1		
1990-2012	15.2	15.2	15.4	15.5	15.3	15.1	14.5	14.3	14.3	13.9	13.6	13.1	12.7	12.2	12.0	11.8	11.5	11.2	
1990-2013	16.1	16.1	16.3	16.3	16.1	16.1	15.5	15.2	15.3	14.9	14.6	14.2	13.8	13.3	13.3	13.2	12.7	12.5	12.4

	Baseline Period	1990	1995	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Business and Industrial Process																			
1990-2008	12.4	12.3	8.0	8.2	8.3	8.5	9.1	8.3	8.2	8.1	8.5	8.3	8.1	7.7					
1990-2009	12.4	12.3	8.0	8.2	8.3	8.6	9.1	8.3	8.3	8.1	8.4	8.2	7.9	7.7	6.8				
1990-2010	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			
1990-2011	13.6	13.6	9.5	9.7	9.8	10.4	11.0	10.2	10.1	9.9	10.6	10.2	9.7	10.2	9.1	9.1	9.2		
1990-2012	13.6	13.5	9.3	9.5	9.6	9.9	10.4	9.4	9.5	9.4	9.8	9.5	9.1	9.1	8.1	8.2	8.5	8.5	
1990-2013	14.4	14.3	11.0	11.1	11.3	11.2	11.5	10.7	10.8	10.7	11.0	10.8	10.3	10.4	9.1	9.3	9.2	8.9	9.1
Residential																			
1990-2008	7.8	7.8	7.9	8.2	8.0	7.9	8.3	7.8	7.8	7.8	7.7	7.4	7.2	7.6					
1990-2009	8.2	8.1	8.1	8.5	8.4	8.3	8.7	8.1	8.1	8.2	8.0	7.8	7.5	7.8	7.3				
1990-2010	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			
1990-2011	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	6.6		
1990-2012	8.2	8.2	8.1	8.5	8.4	8.2	8.7	8.0	8.0	8.1	7.9	7.7	7.5	7.7	7.3	8.3	6.6	7.3	
1990-2013	8.0	8.0	7.8	8.0	7.9	7.8	8.3	7.5	7.5	7.7	7.6	7.4	7.2	7.4	7.1	7.9	6.2	7.0	7.0
Waste Management																			
1990-2008	5.8	5.8	5.1	4.3	4.0	3.7	3.1	2.9	2.6	2.5	2.5	2.6	2.6	2.8					
1990-2009	6.5	6.5	5.1	4.1	3.7	3.5	2.9	2.7	2.3	2.2	2.2	2.2	2.2	2.2	2.1				
1990-2010	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			
1990-2011	6.7	6.7	5.8	4.8	4.4	4.1	3.6	3.3	2.9	2.7	2.6	2.5	2.5	2.4	2.3	2.2	2.2		
1990-2012	6.7	6.7	6.7	6.2	5.7	5.2	5.1	5.1	4.6	4.0	3.9	3.8	3.6	3.6	3.4	3.0	2.9	2.8	
1990-2013	9.9	9.9	10.1	9.8	9.4	9.1	8.8	8.6	8.0	7.4	7.0	6.5	6.0	5.4	4.6	3.9	3.6	3.2	2.7

	Baseline Period	1990	1995	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Transport (including International Aviation and Shipping)																			
1990-2008	13.3	13.3	13.2	14.1	13.8	13.5	13.4	13.3	13.6	13.9	14.2	14.8	14.8	14.4					
1990-2009	13.1	13.1	13.1	13.9	13.6	13.3	13.2	13.1	13.3	13.7	14.0	14.5	14.6	14.3	13.6				
1990-2010	13.0	13.0	13.0	13.9	13.5	13.2	13.2	13.1	13.3	13.6	13.9	14.5	14.6	14.3	13.6	13.2			
1990-2011	12.9	12.9	12.9	13.8	13.4	13.1	13.1	13.0	13.3	13.6	13.9	14.5	14.7	14.3	13.6	13.1	13.0		
1990-2012	13.1	13.1	13.1	14.0	13.6	13.2	13.1	13.1	13.3	13.6	14.0	14.5	14.8	14.4	13.8	13.2	13.1	12.9	
1990-2013	13.2	13.2	13.2	14.1	13.7	13.3	13.3	13.2	13.4	13.8	14.1	14.7	14.8	14.5	13.9	13.3	13.2	13.0	12.9
Transport (excluding IA&S)																			
1990-2008	11.3	11.3	11.1	11.5	11.5	11.4	11.2	11.4	11.8	11.8	12.0	12.4	12.4	12.1					
1990-2009	10.6	10.6	10.6	10.9	11.1	10.9	10.8	11.1	11.2	11.2	11.3	11.5	11.6	11.2	10.7				
1990-2010	10.5	10.5	10.5	10.9	11.0	10.8	10.8	11.1	11.1	11.2	11.3	11.5	11.6	11.3	10.8	10.7			
1990-2011	10.5	10.5	10.5	10.9	11.0	10.8	10.8	11.1	11.1	11.2	11.4	11.6	11.8	11.3	10.9	10.7	10.5		
1990-2012	10.5	10.5	10.5	10.9	11.0	10.9	10.8	11.1	11.2	11.3	11.4	11.6	11.9	11.3	10.9	10.7	10.5	10.5	
1990-2013	10.6	10.6	10.6	11.0	11.1	10.9	10.9	11.2	11.2	11.3	11.5	11.7	11.9	11.4	11.0	10.8	10.6	10.6	10.5
International Aviation and Shipping (IA&S)																			
1990-2008	2.0	2.0	2.1	2.6	2.2	2.1	2.2	1.9	1.9	2.1	2.2	2.4	2.5	2.4					
1990-2009	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				
1990-2010	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			
1990-2011	2.4	2.4	2.4	2.9	2.5	2.3	2.3	1.9	2.1	2.4	2.6	3.0	2.9	3.0	2.8	2.4	2.5		
1990-2012	2.5	2.5	2.5	3.1	2.6	2.3	2.3	1.9	2.1	2.4	2.6	3.0	2.9	3.1	2.9	2.5	2.6	2.4	
1990-2013	2.6	2.6	2.6	3.1	2.6	2.4	2.4	2.0	2.2	2.4	2.6	3.0	3.0	3.1	2.9	2.5	2.6	2.4	2.4

	Baseline Period	1990	1995	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Development																			
1990-2008	1.8	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7					
1990-2009	1.8	1.8	1.7	1.8	1.8	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.5				
1990-2010	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			
1990-2011	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.7		
1990-2012	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.7	
1990-2013	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Public Sector Buildings																			
1990-2008	1.3	1.3	1.1	1.1	1.1	1.1	1.1	0.9	0.9	1.0	1.1	1.0	0.9	1.0					
1990-2009	1.3	1.3	1.2	1.1	1.2	1.1	1.1	0.9	0.9	1.0	1.1	1.0	0.9	0.9	0.8				
1990-2010	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			
1990-2011	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	1.0	0.8	0.9	0.7		
1990-2012	1.7	1.7	1.8	1.7	1.7	1.6	1.7	1.4	1.4	1.5	1.5	1.4	1.3	1.4	1.3	1.4	1.3	1.4	
1990-2013	1.7	1.7	1.8	1.8	1.8	1.6	1.7	1.4	1.4	1.6	1.5	1.4	1.3	1.5	1.3	1.3	1.2	1.2	1.2
Forestry																			
1990-2008	-8.3	-8.3	-9.5	-9.5	-9.6	-9.6	-9.7	-9.8	-10.0	-10.3	-10.3	-10.2	-10.1	-10.1					
1990-2009	-8.3	-8.3	-9.4	-9.4	-9.6	-9.6	-9.6	-9.7	-10.0	-10.2	-10.2	-10.1	-10.0	-10.0	-10.0				
1990-2010	-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			
1990-2011	-8.2	-8.2	-9.1	-9.3	-9.6	-9.5	-9.5	-9.7	-10.0	-10.3	-10.1	-9.9	-9.9	-9.9	-9.8	-9.6	-9.1		
1990-2012	-7.0	-7.0	-7.3	-8.4	-8.8	-8.9	-9.1	-9.3	-9.5	-9.7	-9.7	-9.7	-9.7	-9.7	-9.6	-9.9	-9.9	-9.9	
1990-2013	-7.0	-7.0	-7.6	-8.5	-8.8	-9.0	-9.2	-9.4	-9.6	-9.7	-9.8	-9.8	-9.9	-9.8	-9.7	-9.9	-9.9	-10.0	-10.0

Table E2. Percentage changes in emissions by source sector. Comparison of 1990-2008 and 1990-2013 inventories. Values in MtCO_{2e}

	Baseline Period	1990	2008	2013	% change between Baseline Period and 2008	% change between 1990 and 2008	% change between Baseline Period and 2013	% change between 1990 and 2013
Total								
1990-2008	70.2	70.1	56.1		-20.1%	-20.0%		
1990-2013	80.8	80.7	64.3	53.0	-20.4%	-20.3%	-34.4%	-34.3%
Difference between 1990-2008 and 1990-2013	10.6	10.6	8.2					
% change between 1990-2008 and 1990-2013	15.1%	15.1%	14.6%					
Energy Supply								
1990-2008	22.3	22.3	19.4		-13.0%	-13.0%		
1990-2013	22.7	22.7	20.0	16.0	-11.9%	-11.9%	-29.5%	-29.5%
Difference between 1990-2008 and 1990-2013	0.4	0.4	0.6					
% change between 1990-2008 and 1990-2013	1.7%	1.7%	3.0%					
Agriculture and Related Land Use								
1990-2008	13.8	13.8	11.5		-16.5%	-16.5%		
1990-2013	16.1	16.1	13.3	12.4	-17.4%	-17.4%	-23.1%	-23.1%
Difference between 1990-2008 and 1990-2013	2.3	2.3	1.8					
% change between 1990-2008 and 1990-2013	16.5%	16.5%	15.3%					
Business and Industrial Process								
1990-2008	12.4	12.3	7.7		-37.6%	-37.2%		
1990-2013	14.4	14.3	10.4	9.1	-27.4%	-27.1%	-36.6%	-36.3%
Difference between 1990-2008 and 1990-2013	2.0	2.0	2.7					
% change between 1990-2008 and 1990-2013	15.8%	16.0%	34.8%					
Residential								
1990-2008	7.8	7.8	7.6		-2.8%	-2.4%		
1990-2013	8.0	8.0	7.4	7.0	-8.3%	-7.6%	-13.0%	-12.4%
Difference between 1990-2008 and 1990-2013	0.3	0.2	-0.2					
% change between 1990-2008 and 1990-2013	3.3%	3.0%	-2.5%					

	Baseline Period	1990	2008	2013	% change between Baseline Period and 2008	% change between 1990 and 2008	% change between Baseline Period and 2013	% change between 1990 and 2013
Waste Management								
1990-2008	5.8	5.8	2.8		-52.3%	-52.3%		
1990-2013	9.9	9.9	5.4	2.7	-45.6%	-45.6%	-72.6%	-72.6%
Difference between 1990-2008 and 1990-2013	4.1	4.1	2.6					
% change between 1990-2008 and 1990-2013	70.7%	70.7%	94.7%					
Transport (including International Aviation and Shipping)								
1990-2008	13.3	13.3	14.4		8.6%	8.6%		
1990-2013	13.2	13.2	14.5	12.9	9.8%	9.8%	-2.1%	-2.1%
Difference between 1990-2008 and 1990-2013	-0.1	-0.1	0.0					
% change between 1990-2008 and 1990-2013	-0.7%	-0.7%	0.3%					
Transport (excluding IA&S)								
1990-2008	11.3	11.3	12.1		6.6%	6.6%		
1990-2013	10.6	10.6	11.4	10.5	7.3%	7.3%	-1.0%	-1.0%
Difference between 1990-2008 and 1990-2013	-0.7	-0.7	-0.7					
% change between 1990-2008 and 1990-2013	-6.1%	-6.1%	-5.5%					
International Aviation and Shipping (IA&S)								
1990-2008	2.0	2.0	2.4		19.9%	19.9%		
1990-2013	2.6	2.6	3.1	2.4	20.0%	20.0%	-6.4%	-6.4%
Difference between 1990-2008 and 1990-2013	0.6	0.6	0.7					
% change between 1990-2008 and 1990-2013	29.7%	29.7%	29.8%					
Development								
1990-2008	1.8	1.8	1.7		-5.6%	-5.6%		
1990-2013	1.8	1.8	1.6	1.6	-11.4%	-11.4%	-14.7%	-14.7%
Difference between 1990-2008 and 1990-2013	0.1	0.1	-0.1					
% change between 1990-2008 and 1990-2013	2.9%	2.9%	-3.3%					

	Baseline Period	1990	2008	2013	<i>% change between Baseline Period and 2008</i>	<i>% change between 1990 and 2008</i>	<i>% change between Baseline Period and 2013</i>	<i>% change between 1990 and 2013</i>
Public Sector Buildings								
1990-2008	1.3	1.3	1.0		-22.7%	-22.7%		
1990-2013	1.7	1.7	1.5	1.2	-12.3%	-12.3%	-26.2%	-26.2%
Difference between 1990-2008 and 1990-2013	0.4	0.4	0.5					
% change between 1990-2008 and 1990-2013	32.0%	32.0%	49.7%					
Forestry								
1990-2008	-8.3	-8.3	-10.1		21.4%	21.4%		
1990-2013	-7.0	-7.0	-9.8	-10.0	39.2%	39.2%	42.0%	42.0%
Difference between 1990-2008 and 1990-2013	1.3	1.3	0.3					
% change between 1990-2008 and 1990-2013	-15.1%	-15.1%	-2.7%					

Table E3. Year-on-year changes to the Baseline since the 1990-2008 inventory, by source sector. Values in MtCO_{2e}

	Change from 1990-2008 to 1990-2013	1990- 2009	1990- 2010	1990- 2011	1990- 2012	1990- 2013	Change from 1990-2008 to 1990-2013
Total	10.58	1.55	0.52	0.70	2.62	5.20	15.1%
Waste Management	4.08	0.70	0.10	0.14	-0.02	3.17	70.7%
Agriculture and Related Land Use	2.29	0.68	-0.24	0.08	0.90	0.87	16.5%
Business and Industrial Process	1.96	0.02	0.79	0.43	-0.04	0.76	15.8%
Forestry	1.26	0.02	-0.03	0.08	1.23	-0.04	-15.1%
Public Sector Buildings	0.41	0.05	-0.10	0.00	0.44	0.02	32.0%
Energy Supply	0.38	-0.11	0.08	0.08	-0.01	0.33	1.7%
Residential	0.26	0.39	0.00	0.00	0.01	-0.14	3.3%
Development	0.05	0.01	-0.01	-0.03	-0.01	0.09	2.9%
Transport (including International Aviation and Shipping)	-0.10	-0.21	-0.06	-0.08	0.11	0.15	-0.7%

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http://naei.defra.gov.uk/reports/reports?report_id=810

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<http://www.gov.scot/Topics/Statistics/Browse/Environment/Publications>

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How to access background or source data

The data collected for this publication:

- are available in more detail through Scottish Neighbourhood Statistics
- are available from National Atmospheric Emissions Inventory website and from a separate Excel workbook accompanying this publication
- may be made available on request, subject to consideration of legal and ethical factors. Please contact <email address> for further information.
- cannot be made available by Scottish Government for further analysis as Scottish Government is not the data controller.

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