Overview

GHG Inventory summary Factsheet

Territorial coverage: UK including Crown Dependencies and Overseas Territories
Total emissions: Quoted with respect to emissions including net LULUCF
Sector Definition: National Communication

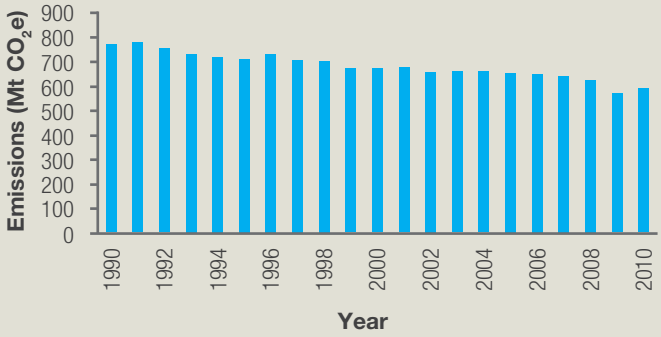
Summary – historic emissions

- Total net greenhouse gas (GHG) emissions in 2010 were 590 Mt CO_2e (excluding the impact of traded allowances).
- Emissions have decreased by 23% since 1990.
- CO_2 is the dominant GHG emitted, accounting for 85% of emissions in 2010.
- More than half of emissions in 2010 are from the Energy Supply and Transport sectors.
- Effects of the recession can be seen in some sectors, particularly in 2009.

Sources of emissions and data sets

- The UK emissions inventory aims to include estimates of emissions from all anthropogenic sources of GHGs.
- Key data sources used in the compilation of the UK inventory include:
  - DECC's Digest of UK Energy Statistics (DUKES)
  - The Pollution Inventory (Environment Agency), the Scottish Pollutant Release Inventory (SEPA) and the Inventory of Statutory Releases (Northern Ireland DoE)
  - EU Emissions Trading System (ETS) operator returns
  - Transport Statistics Great Britain (DfT)
  - Agriculture in the UK (Defra)
  - Data supplied directly by plant operators
  - Data supplied by Trade Associations
  - Waste management data (WasteDataFlow)
  - LULUCF data from the Countryside Survey

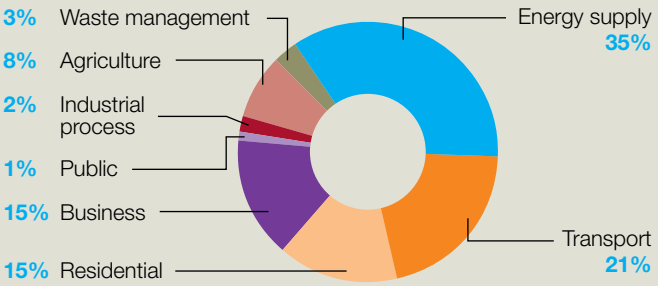
Total Net GHG Emissions, 1990-2010



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

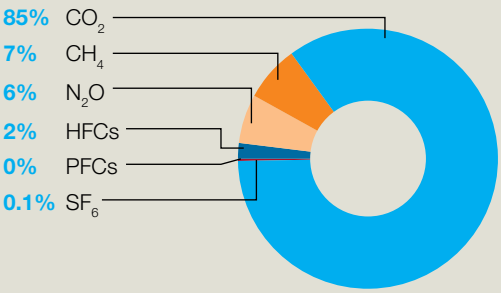
Note: Net emissions include all sources and sinks of GHGs but excludes impact of traded allowances.

Total Emissions by Sector (2010, excluding LULUCF)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Total Emissions by Gas (2010, excluding LULUCF)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Methodology

- The methods used to compile the inventory are based on the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 1996), the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000), and the Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC, 2003).
- Most emission estimates are compiled by combining activity data (e.g. fuel use) with a suitable emission factor (e.g. amount of CO_2 emitted per unit of fuel used).
- Emissions from some sectors are based on more complicated models (e.g. CH_4 from landfill sites).
- Industrial emission estimates are often compiled based on plant specific emissions data.

Uncertainties

- The estimated uncertainty in total net GHG emissions in 2010 was +/-16% as a 95% confidence interval.
- The uncertainty analysis indicates that the trend in GHG emissions from 1990 to 2010 is between -26 and -21% (excluding the impact of trading allowances).
- Uncertainties are estimated using a Monte Carlo simulation.
- The overall uncertainty is dominated by the uncertainty in emissions from agricultural soils.
- The uncertainty in the trend is much lower than the uncertainty in the emissions for a given year.

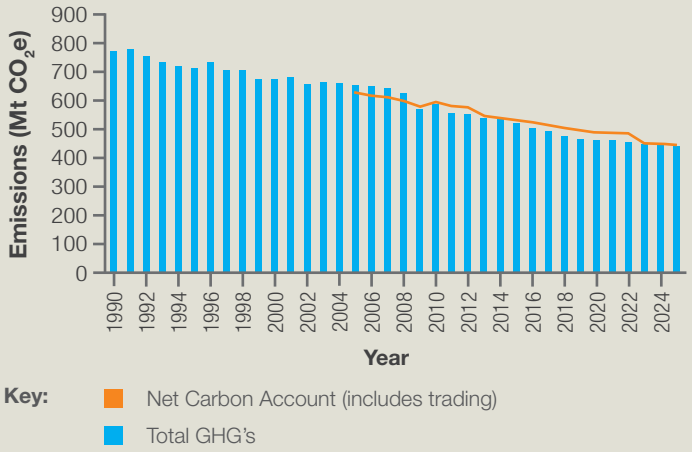
Improvements

- As part of the National Inventory System, there is a National Inventory Steering Committee (NISC) and an Improvements Programme to prioritise and approve improvements for the inventory.
- Improvements can be identified via annual reviews of the inventory by UNFCCC experts, by the inventory team or by sector leads on the NISC.

Projections

- Emissions are expected to continue to be dominated by CO_2.
- The most significant decrease in CO_2 emissions from 2010 to 2025 occurs in the Energy Supply sector.
- Emissions in 2025 are projected to be around 25.3% lower than in 2010, or 25.5% lower including the impact of trading (based on Updated Energy and Emissions Projections: October 2011 (DECC) using historic data from the 2012 inventory).

Historic and Projected Total GHG Emissions



Source: Updated Energy and Emissions Projections: October 2011 (DECC).

Links

- UUK GHG Inventory: http://ghgi.decc.gov.uk/
- UK GHG National Statistics: http://www.statistics.gov.uk/hub/agriculture-environment/environment/climate-change/index.html
- UK Updated Energy Projections: http://www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/en_emis_projs/en_emis_projs.aspx
- IPCC Guidelines http://www.ipcc-nggip.iges.or.jp/public/index.html

Agriculture

GHG Inventory summary Factsheet

Territorial coverage: UK including Crown Dependencies and Overseas Territories
Total emissions: Quoted with respect to emissions including net LULUCF
Sector Definition: National Communication

Sector summary – historic emissions

- Overall contribution of agricultural emissions to UK total in 2010 was 8.6%.
- Emissions from the agriculture sector have decreased by 20% since 1990, driven mostly by a decrease in emissions from agricultural soils.
- N_2O is the dominant GHG emitted, accounting for 56% of emissions from this sector.
- Emissions from agricultural soils dominate the agricultural sector emissions in the UK.

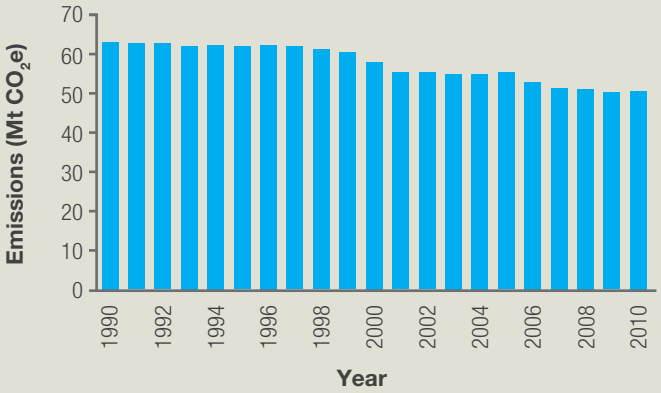
Sources of emissions and data sets

- Stationary combustion includes all emissions from the direct combustion of fuel for heating or other uses. The main data set used is the Digest of UK Energy Statistics (DUKES).
- Emissions from enteric fermentation relate to CH_4 emissions associated with the digestion of food. The main data set for this is the June Survey of Agriculture and Horticulture, published by Defra.
- Animal wastes and manure management give rise to emissions of CH_4 and N_2O due to anaerobic decay and denitrification. Estimates are also based on the Defra June Survey.
- Mobile machinery relates to emissions from equipment such as tractors.
- A small amount of CO_2 is released from the breakdown of agrochemicals. Data for this is taken from the Crop Protection Association handbook.
- Agricultural soil emissions arise from: the use of fertilisers (synthetic and animal manures); biological fixation of nitrogen by crops; ploughing in of crop residues; cultivation of organic soils; indirect emissions from atmospheric deposition of NO_x and NH_3; and leaching and runoff of nitrate. Key data sources include the British Survey of Fertiliser Practice (Defra), and the June Survey.

Methodology

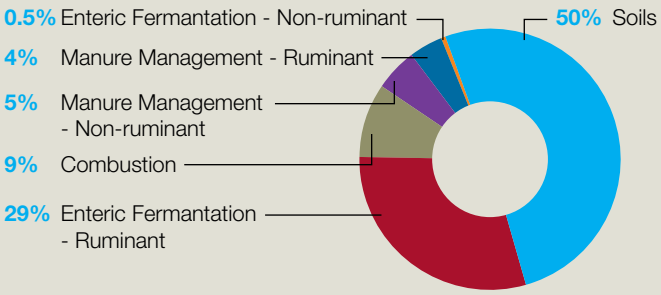
- Inventory compilers for the agriculture sector are Rothamsted Research.
- Stationary fuel combustion emissions are estimated by multiplying the fuel use estimates in DUKES by an emission factor (taken from IPCC and UNECE).

Agriculture Emissions 1990-2010



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Agriculture Emissions by Source (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Agriculture Emissions by Gas (2010)

Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

- Emissions from mobile machinery are modelled based on the population of the various machinery types, the age profile, the lifetime of the equipment, and average annual usage.
- For the breakdown of pesticides, an estimate of the carbon content of these products is combined with an estimate of how much carbon is stored, and how much is released. These estimates are based on data from the US EPA.
- Emissions from enteric fermentation are estimated by combining livestock numbers with appropriate emission factors (either default or UK specific).
- CH_4 emissions from animal wastes are estimated using livestock statistics and emission factors (default or UK specific).
- N_2O emissions from manure management are based on livestock numbers, nitrogen excretion rates and animal waste management systems used.
- Emissions from agricultural soils are modelled using various statistical inputs, such as crop areas and fertiliser use, and the methods set out in the IPCC guidelines.

Uncertainties

- The GHG Inventory quantifies uncertainties on emission factors and activity data, which in turn allow for the production of uncertainty estimates on the: emissions; overall uncertainty by gas; and indicative-only estimates of sector level uncertainties.
- For agriculture, the uncertainty is dominated by the uncertainty in the emission factor for agricultural soils. The uncertainty distribution for total agricultural N_2O is skewed, with the 97.5th percentile 50 times greater than the 2.5th percentile. The uncertainty estimate for this source indicates that the true value of the emission is within the range 2 to 101 Mt CO_2 equivalent in 2010.
- The uncertainties for methane emissions are around +/-20-30% for each of the categories, as a 95% confidence interval.
- The uncertainty in the emission for a given year is much greater than the uncertainty in the trend, since the emission factor is considered to be correlated across years.

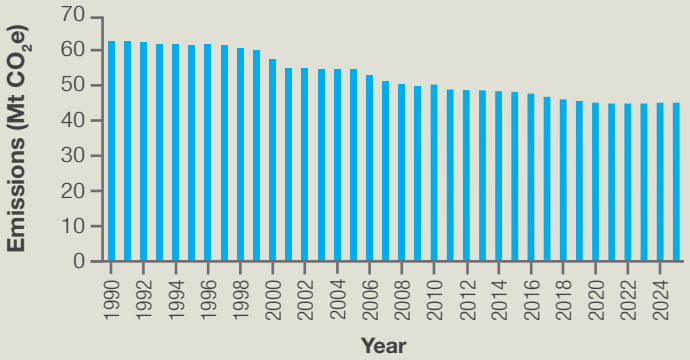
Improvements

- Further research is being conducted through the UK GHG agriculture research platform to review and try to improve the estimates for agricultural soils.
- Continued inventory improvement will include research to develop more detailed emission factors and improve activity data from across the UK. There is particular focus on improving temporal and spatial resolution, sectoral reporting and improved representation of on farm mitigation measures.
- A key objective of the ongoing inventory research is to produce a model that allows the agricultural industry to track emissions reduction progress by sector and devolved administrative region.
- The latest inventory includes improvements to the method for emissions from enteric fermentation, to use new parameters related to the time spent grazing for cattle and to move from the method in the 1996 IPCC Guidelines to the 2000 Good Practice Guidance.
- Improvements to emissions from animal wastes have been made in line with recommendations from the UNFCCC's review of the inventory (these also impact on emissions from soils) and the changes outlined for enteric fermentation.

Projections

- Projected emissions from the agriculture sector are expected to decrease by 12% from 2010 levels by 2025.
- Emissions continue to be dominated by N_2O from agricultural soils.
- The overall decrease in agricultural emissions between 1990 and 2025 is estimated to be 28%.
- The projections presented here exclude the impact of emissions trading.
- The projections are taken from Updated Energy and Emissions Projections: October 2011 (DECC); historic data taken from the 2012 inventory.

Historic and Projected Emissions from Agriculture



Source: Updated Energy and Emissions Projections: October 2011 (DECC).

Links

- UK GHG Inventory: http://ghgi.decc.gov.uk/
- UK GHG National Statistics: http://www.statistics.gov.uk/hub/agriculture-environment/environment/climate-change/index.html
- Projections data: http://www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/en_emis_projs/en_emis_projs.aspx
- Defra: http://www.defra.gov.uk/
- Rothamsted Research: http://www.rothamsted.ac.uk/

Business

GHG Inventory summary Factsheet

Territorial coverage: UK including Crown Dependencies and Overseas Territories
Total emissions: Quoted with respect to emissions including net LULUCF
Sector Definition: National Communication

Sector summary – historic emissions

- Overall contribution of emissions to UK GHG emissions in 2010 was 15%.
- Emissions from the business sector have decreased by 21% since 1990, driven mostly by decreases in emissions from iron and steel, and other industrial combustion.
- CO_2 is the dominant GHG emitted.
- Emissions from industrial combustion dominate business sector emissions in the UK.

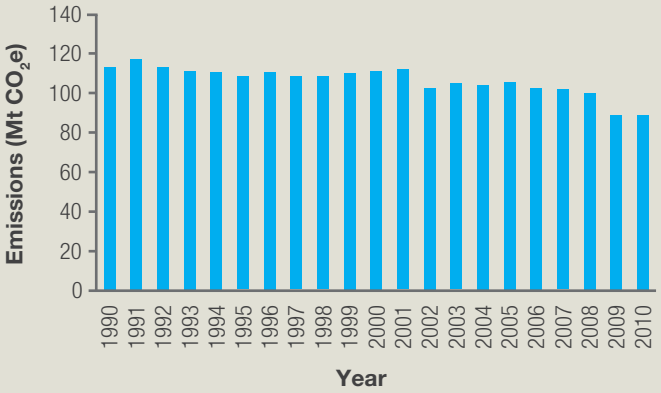
Sources of emissions and data sets

- Stationary combustion (commercial combustion, industrial combustion in: iron and steel; non-ferrous metals; chemicals; pulp, paper and print; food, drink and tobacco; and other industrial sectors) includes all emissions from the direct combustion of fuel, either to provide the heat required for certain industrial processes or for heating. The main data set used is DECC's Digest of UK Energy Statics (DUKES), and for iron and steel data are provided by Tata Steel.
- Industrial off-road machinery includes emissions from equipment such as portable generators and forklift trucks. A detailed study was undertaken in 2004 to estimate the total UK population of this equipment. Annual estimates are based on population growth drivers (such as economic growth) or sales data.
- Emissions of HFCs from refrigeration are modelled, based on bottom up statistics for the number of various types of refrigeration units in use in the UK.
- Other emissions in this sector include emissions from foam blowing, fire extinguishers, solvents, and energy recovery in the chemicals industry. Data are taken from a range of industry experts, literature and the Environment Agency's Pollution Inventory.

Methodology

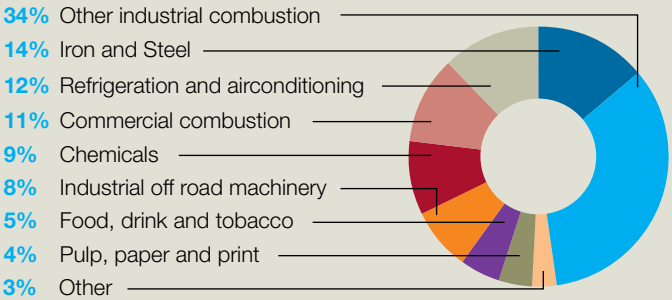
- Stationary fuel combustion emissions are estimated by multiplying the fuel use estimates in DUKES by an emission factor (either UK specific or default, taken from published inventory guidelines

Business Emissions 1990-2010



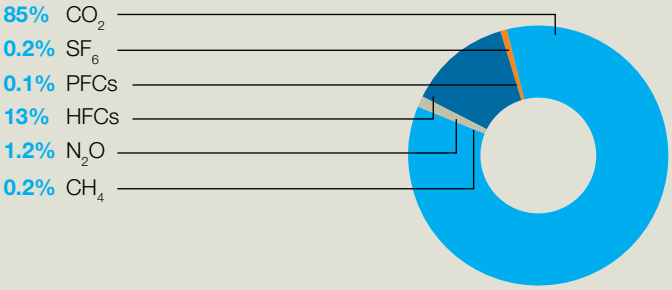
Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Business Emissions by Source (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Business Emissions by Gas (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

(IPCC and UNECE)). For some sources, independent estimates of fuel use are provided by industry, and therefore the sector allocations in DUKES are modified. The total fuel consumption estimates remain consistent with DUKES (aside from the estimates for petroleum coke).

- Emissions from industrial off road machinery are modelled based on the population of the various machinery types, the age profile, the lifetime of the equipment, and average annual usage.
- Emissions of F-gases, arising from their use in products can occur in a range of phases: when the product is manufactured and filled; during the lifetime of the product as it operates; and when the product is decommissioned or disposed of. Emissions of F-gases during each phase of the product's lifetime are estimated using a model. The model takes account of parameters such as leakage rates at each phase and product lifetime.
- Estimates of CO_2 emissions from the energy recovery in the chemicals industry (the use of waste solvents as a fuel) are based on an estimate of the amount of solvent recovered, as reported to the Environment Agency's pollution inventory, and the carbon content of solvents, supplied by the Mineral Products Association MPA).

Uncertainties

- The GHG Inventory quantifies uncertainties on emission factors and activity data, which in turn allow for the production of uncertainty estimates on the: emissions; overall uncertainty by gas; and indicative-only estimates of sector level uncertainties.
- Total emissions within this category are dominated by fuel combustion. CO_2 emissions from fuel combustion are relatively certain, since the carbon content of fuel is well known, and the energy statistics are of good quality.
- CH_4 and N_2O emissions from fuel combustion are dependent on more factors than just the fuel quality, and are therefore more uncertain.
- F-gas emissions reported within this sector are also uncertain, since they are based on modelled data. Uncertainties for these sources range from +/-7 to 30%, as a 95% confidence interval.
- The overall uncertainty for the business sector is estimated to be +/-4% as a 95% confidence interval in 2010.

Improvements

- The refrigeration model was rebuilt during 2011, to replace top down estimates based on total refrigerant inputs with bottom up data for various refrigerant units. All parameters in the model were extensively reviewed to ensure that they are up to date and appropriate for the UK, and in line with international inventory guidance.
- Emissions from industrial combustion have been reported at a more detailed sector level for the first time in 2012.

Projections

- Projected emissions from the business sector are expected to decrease by 13% from 2010 to 2025.
- Emissions continue to be dominated by CO_2.
- The overall decrease in business sector emissions between 1990 and 2025 is estimated to be 32%. This excludes the impact of emissions trading.
- The projections are taken from DECC's Updated Energy and Emissions Projections: October 2011 although historic emissions presented here are from the 2012 inventory.

Historic and Projected Emissions from Business

Source: Updated Energy and Emissions Projections: October 2011 (DECC).

Links

- UK GHG Inventory: http://ghgi.decc.gov.uk/
- UK GHG National Statistics: http://www.statistics.gov.uk/hub/agriculture-environment/environment/climate-change/index.html
- UK Updated Energy Projections: http://www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/en_emis_projs/en_emis_projs.aspx
- The Environment Agency: http://www.environment-agency.gov.uk/business/topics/pollution/32254.aspx

Energy Supply

GHG Inventory summary Factsheet

Territorial coverage: UK including Crown Dependencies and Overseas Territories
Total emissions: Quoted with respect to emissions including net LULUCF
Sector Definition: National Communication

Sector summary – historic emissions

- Energy supply is the biggest single contributor to the UK's CO_2 emissions.
- Overall contribution of energy supply sector to UK GHG emissions in 2010 was 35%.
- Emissions have decreased by 25% since 1990, due to fuel switching to less carbon-intensive energy sources and reduced energy intensity of the economy.
- CO_2 is the dominant GHG emitted by the energy supply sector.
- Emissions from power stations dominate the energy supply sector emissions in the UK.

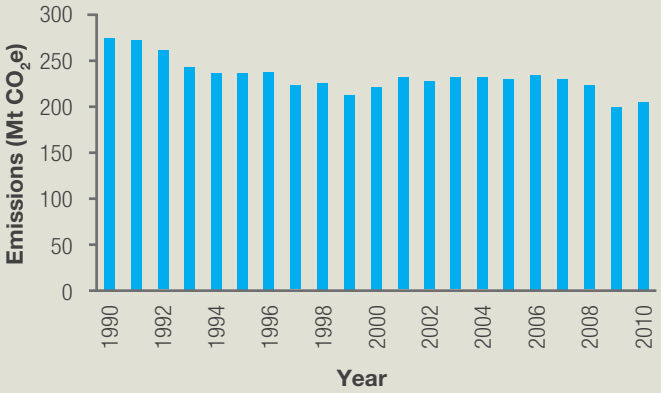
Sources of emissions and data sets

- Power generation is the largest source in this sector.
- Other significant sources include refineries, emissions from offshore oil and gas production and coal mines.
- Key data sources include DECC's Digest of UK Energy Statistics (DUKES), offshore oil and gas industry data provided by Oil and Gas UK, the Environment Agency's Pollution Inventory, EU-Emissions Trading System (EU-ETS) data and information provided by the British Geological Survey and the Iron & Steel Statistics Bureau.

Methodology

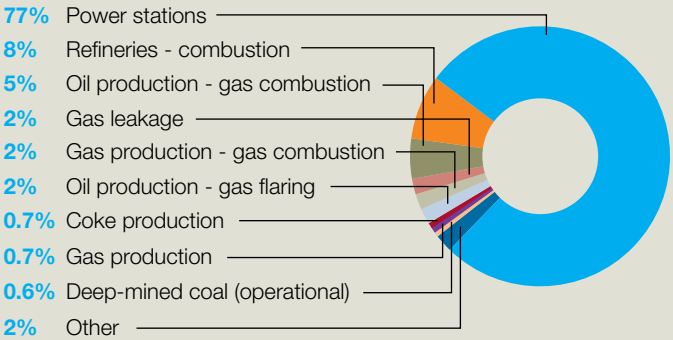
- Emissions associated with fuel combustion are estimated by using fuel consumption data and appropriate emission factors.
- General fuel consumption data are taken from DUKES.
- Emission factors are taken from a variety of sources including the EU-ETS, data provided by industry groups and literature based sources.
- For some sectors, site specific data are available from the EU-ETS and the Pollution Inventory.

Energy Supply Emissions 1990-2010



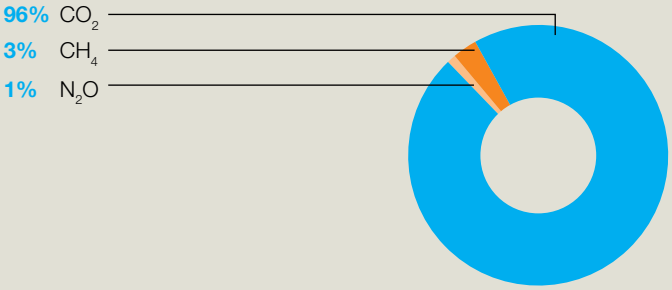
Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Energy Supply Emissions by Source (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Energy Supply Emissions by Gas (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

- Fugitive CH_4 emissions occur from coal mining activities. Emission estimates for open mines are based on data from UK Coal and estimates for closed coal mines are based on researched commissioned by DECC and Defra.
- Emissions from the offshore oil and gas sector are based on data provided by the trade organisation Oil and Gas UK, through their annual emissions reporting mechanism to DECC called the Environmental Emissions Monitoring System (EEMS).

Uncertainties

- The GHG Inventory quantifies uncertainties on emission factors and activity data, which in turn allow for the production of uncertainty estimates on the: emissions; overall uncertainty by gas; and indicative-only estimates of sector level uncertainties.
- The energy supply sector is dominated by emissions from combustion in power stations and refineries. Since the carbon content of the fuels and the fuel consumption is well known, the CO_2 emissions from this source are relatively certain, whereas the emissions of N_2O and CH_4 are more uncertain due to the number of factors that affect emissions of these gases.
- Fugitive emissions from fuels can arise from a large number of small release points, and are typically difficult to control and measure. They are therefore more uncertain than emissions from fuel combustion.
- The overall uncertainty for this sector is estimated to be +/-2% in 2010, as a 95% confidence interval.

Improvements

- The emissions estimates for closed coal mines have been reviewed and updated, to take account of up to date data for recent mine closures, and utilisation of the methane released.
- Analysis of data available from operator returns under the EU-ETS has led to improvements in activity data and emission factors for certain fuels and sources within this sector.

Projections

- The overall decrease in emissions from the energy supply sector between 2010 and 2025 is estimated to be 47%, excluding the impact of emissions trading.
- Projected emissions from energy supply are expected to decrease, due to a change in the fuel mix for power generation and reduced emissions from offshore oil and gas.
- The projections are taken from DECC's Updated Energy and Emissions Projections: October 2011 although historic emissions presented here are taken from the 2012 inventory.

Historic and Projected Emissions from Energy Supply

Source: Updated Energy and Emissions Projections: October 2011 (DECC).

Links

- UK GHG Inventory: http://ghgi.decc.gov.uk/
- UK GHG National Statistics: http://www.statistics.gov.uk/hub/agriculture-environment/environment/climate-change/index.html
- UK Updated Energy Projections: http://www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/en_emis_projs/en_emis_projs.aspx
- Digest of UK Energy Statistics: http://www.decc.gov.uk/en/content/cms/statistics/publications/dukes/dukes.aspx

Industrial Processes

GHG Inventory summary Factsheet

Territorial coverage: UK including Crown Dependencies and Overseas Territories
Total emissions: Quoted with respect to emissions including net LULUCF
Sector Definition: National Communication

Sector summary – historic emissions

- Overall contribution of the industrial processes sector to UK GHG emissions in 2010 was 1.8%.
- Emissions from the industrial processes sector have decreased by 80% since 1990, mostly due to changes in emissions from the chemical production and metal processing industries.
- The decrease in emissions between 1998 and 1999 is mostly due to abatement equipment being fitted at halocarbon production facilities and the UK's adipic acid plant.

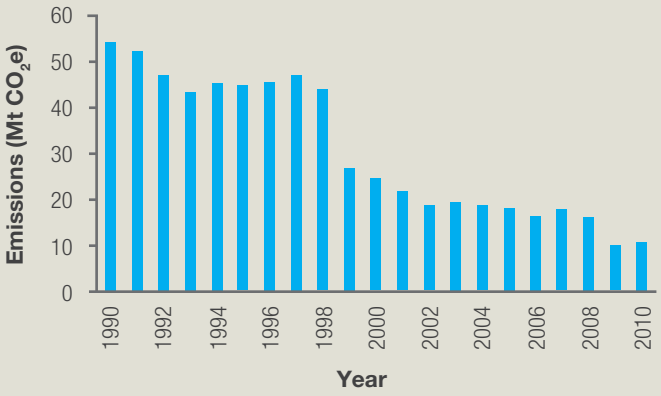
Sources of emissions and data sets

- CO_2 is the dominant GHG emitted by the industrial sector.
- Emissions of N_2O across the time series occur mainly from the production of nitric and adipic acid. These emissions have decreased significantly since 1990 due to the installation of abatement equipment, and plant closures (the UK's only adipic acid production closed in 2009).
- Significant sources of emissions are cement production and the iron and steel sector (sinter production and process emissions).
- Data are supplied by a wide range of sources. Key datasets include DECC's Digest of UK Energy Statistics (DUKES), the Environment Agency's Pollution Inventory, the Scottish Environment Protection Agency's Scottish Pollutant Release Inventory, UK Minerals Yearbook (BGS) and data from the Iron & Steel Statistics Bureau, Mineral Products Association, Tata Steel and British Glass.

Methodology

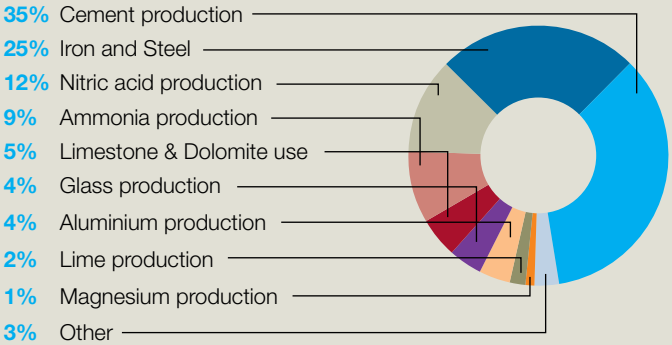
- Different sources require different methodologies for estimating emissions.
- Emission factors and activity data are used to calculate the following sources: use of limestone and dolomite; steel-making; cement; lime and nitric acid/adipic acid (early data).

Industrial Processes Emissions 1990-2010



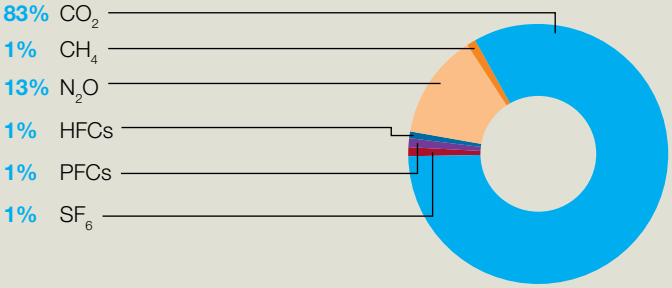
Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Industrial Processes Emissions by Source (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Industrial Processes Emissions by Gas (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

- The use of emissions data reported by process operators is used for the following sources: nitric acid/adipic acid (later data); other chemical processes and fletton brickworks.
- F-gases emissions arising from halocarbon production, aluminium production and their use as magnesium cover gas are estimated based on operator reported data to the Regulators' Inventories (e.g. Pollution Inventory), or data supplied directly from operators.

Uncertainties

- The GHG Inventory quantifies uncertainties on emission factors and activity data, which in turn allow for the production of uncertainty estimates on the: emissions; overall uncertainty by gas; and indicative-only estimates of sector level uncertainties.
- Emissions in this sector are dominated by cement and iron & steel. The uncertainties for both of these sources are low as the processes involved are well understood and data are complete.
- Other sources within this sector have high uncertainties associated with them. This can be the case where estimates are based on operator reported emissions in the Regulators' Inventories, where sometimes emissions are below reporting thresholds and therefore gaps need to be filled, or where it is not possible to obtain a complete data set directly from operators.
- The overall uncertainty for this sector is estimated to be +/-6% in 2010 as a 95% confidence interval.

Improvements

- Emissions from ammonia production have been revised to ensure consistency with international reporting guidelines
- Emissions from limestone and dolomite use for the production of glass have been moved from the "limestone and dolomite use" category to the "glass production" category, in order to harmonise reporting at EU level. This has not affected the sector emissions total.

Projections

- Emissions from industrial processes are projected to be 9% above 2010 levels, and 78% below 1990 levels by 2025
- Projected emissions continue to be dominated by CO_2
- The projections are taken from DECC's Updated Energy and Emissions Projections: October 2011 although historic emissions presented here are from the 2012 inventory.

Historic and Projected Emissions from Industrial Processes

Source: Updated Energy and Emissions Projections: October 2011 (DECC).

Links

- UK GHG Inventory: http://ghgi.decc.gov.uk/
- UK GHG National Statistics: http://www.statistics.gov.uk/hub/agriculture-environment/environment/climate-change/index.html
- Projections data: http://www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/en_emis_projs/en_emis_projs.aspx
- The Environment Agency: http://www.environment-agency.gov.uk/
- SEPA: http://www.sepa.org.uk/
- UK Minerals Yearbook (British Geological Society): http://www.bgs.ac.uk/mineralsuk/statistics/UKStatistics.html
- Iron and Steel Statistics Bureau: http://www.issb.co.uk/

Land Use, Land Use Change and Forestry (LULUCF)

GHG Inventory summary Factsheet

Territorial coverage: UK including Crown Dependencies and Overseas Territories
Total emissions: Quoted with respect to emissions including net LULUCF
Sector Definition: National Communication

Sector summary – historic emissions

- Overall contribution of LULUCF to UK GHG emissions in 2010 was -3.8 Mt CO_2e (from a total of 590 Mt CO_2e).
- Emissions from the LULUCF sector have changed from a source of +3.9 Mt CO_2e in 1990 to a sink of -3.8 Mt CO_2 e in 2010.
- CO_2 is the dominant GHG.
- Land converted to cropland is the dominant source of CO_2, and land converted to forest land is the dominant sink.

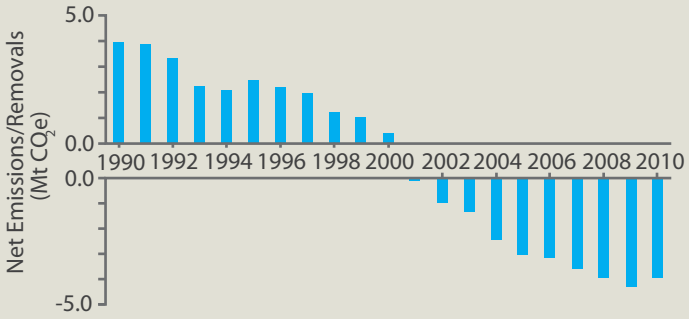
Sources of emissions and data sets

- Sources/sinks include Forestland (5A), Cropland (5B), Grassland (5C), Settlements (5E) and Harvested Wood Products (5G).
- The main datasets which provide areas of land use and land use change are the Countryside Surveys for the UK constituent countries and statistics published by the Forestry Commission.
- Changes in carbon stocks in vegetation and soils produce emissions and removals of CO_2.
- Emissions of CH_4 and N_2O can also be produced.
- Separate land use change (LUC) matrices for each country in the UK are also produced, as well as estimates for the Crown Dependencies and Overseas Territories.

Methodology

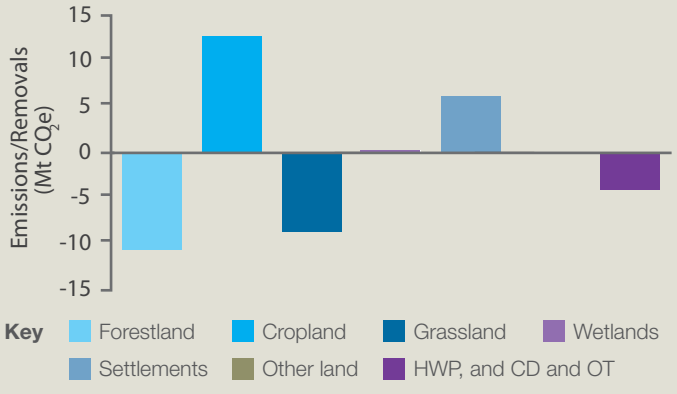
- Inventory compilers for the LULUCF sector are the centre for Ecology and Hydrology (CEH).
- The estimates for forest carbon emissions and removals are based largely on data from the Forestry Commission, which has carried out inventories of woodlands in Great Britain at 15-20 year intervals since 1924.
- Annual planting data and management information are used to update on the picture of the size and age structure of the national forest estate between the periodic inventories. This information, together with data derived from the growth characteristics of UK forests (so-called 'yield classes') is used

LULUCF, 1990-2010



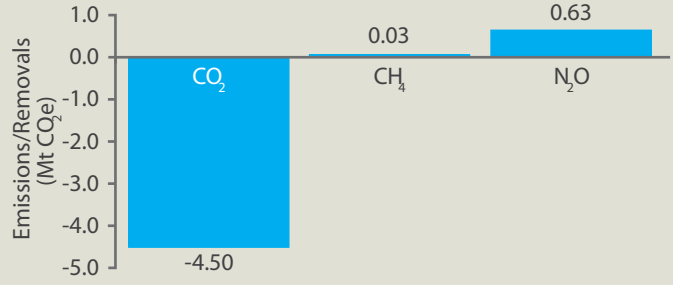
Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

LULUCF Emissions/Removals by category, 2010



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Net LULUCF Emissions/Removals by Gas 2010



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

in a dynamic carbon accounting model (C FLOW) to estimate annual uptake and storage of atmospheric carbon by trees.

- Estimates of land use change emissions rely on separate land use change matrices for each country in the UK. These matrices are derived from surveys on land use conducted in 1947, 1980, 1984, 1990, 1998 and 2007. The matrices show the pattern of land use change between different categories of land which have been grouped into the broad land types of Grassland, Cropland, Forest Land, Settlements and Other Land.
- Changes in soil carbon density for the types of land undergoing transition are estimated from soil survey data and used in a dynamic model to estimate annual gains and losses of soil carbon associated with the land use transitions in the matrix.

Uncertainties

- Uncertainties in this sector arise both from natural variability in vegetation and soils and incomplete knowledge about the extent of activities and the underlying processes affecting sinks and sources.
- Typically, uncertainties in the estimates associated with the soil carbon pool are much greater than those in above ground standing biomass in trees.
- A formal uncertainty analysis to support the UK's Kyoto Protocol LULUCF submission has been carried out and is set out in the 2012 NIR.
- This indicated that the land use change data, and the parameterisation of the forest model and its parameters are the largest contributor to overall uncertainty in this sector.

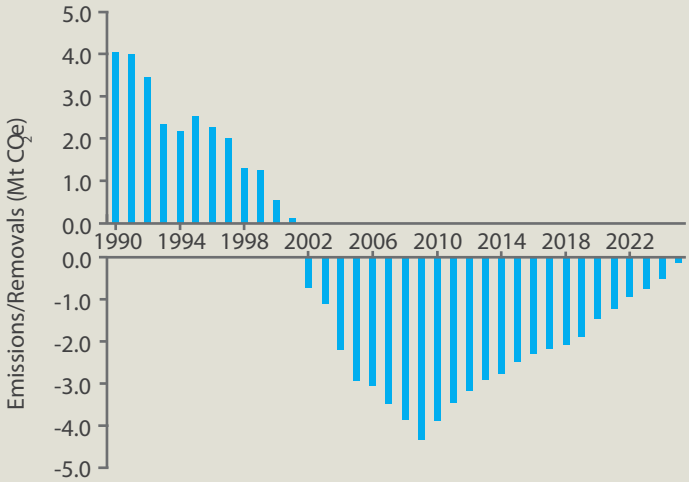
Improvements

- There is a development programme for the LULUCF inventory sector which takes into account review recommendations, new sources of data and improved scientific understanding of the relevant ecosystems.
- The sector has been internally restructured over the past two years so that a 20-year transition period is now used for reporting land use change, in line with IPCC methodology.
- There have been minor changes to data in the 1990-2010 inventory for deforestation, liming and peat extraction. Emissions and removals estimates for the Overseas Territories and Crown Dependencies were also revised.
- Future planned improvements include the incorporation of new forest data from the National Forest Inventory, improved representation of land management (including rotational crop-grass systems), the inclusion of emissions from non-forest wildfires and improved representation of land use change through data assimilation.

Projections

- The time series of net LULUCF CO2 emissions (all sources and sinks) indicates the sector is an increasing net sink from 2001 until 2009, with the magnitude of the net sink decreasing from 2010 onwards.
- Forest land is a sink (removal) from 1990 to 2020.
- Cropland is a source (emission) from 1990 to 2020
- Grassland is a sink because conversion to grassland generally results in a gain in soil carbon.
- Grassland is projected to become a bigger sink than forests by 2020 but note the forest sink will recover again after 2020.
- The projections are taken from DECC's Updated Energy and Emissions Projections: October 2011 although the historic emissions presented here are from the 2012 inventory.

Historic and Projected Emissions/Removals from LULUCF



Source: Updated Energy and Emissions Projections: October 2011 (DECC).

Links

- UK GHG Inventory: http://www.ghgi.org.uk/
- UK GHG National Statistics: http://www.statistics.gov.uk/hub/agriculture-environment/environment/climate-change/index.html
- UK Updated Energy Projections: http://www.decc.gov.uk/en/content/cms/statistics/projections/projections.aspx
- CEH: http://ceh.ac.uk

Public Sector

GHG Inventory summary Factsheet

Territorial coverage: UK including Crown Dependencies and Overseas Territories
Total emissions: Quoted with respect to emissions including net LULUCF
Sector Definition: National Communication

Sector summary – historic emissions

- This sector covers public sector stationary combustion and emissions from natural gas combustion dominate.
- Overall contribution of emissions to UK GHG emissions in 2010 was 1.4%.
- Emissions from the public sector have decreased by 36% since 1990, driven mostly by a decrease in liquid and solid fuel combustion. This was partially offset until 2004 by an increase in natural gas use.
- CO_2 is the dominant GHG emitted.

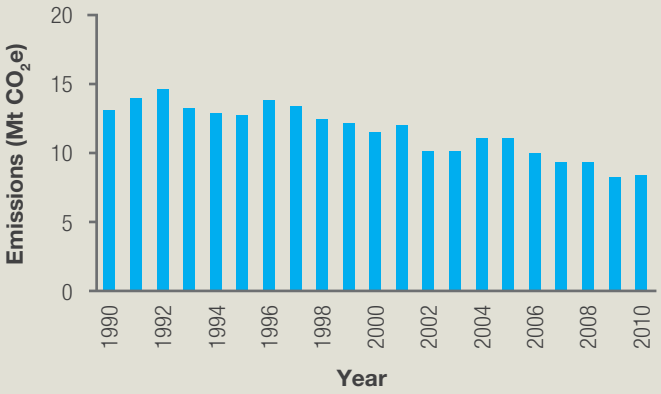
Sources of emissions and data sets

- Emissions of GHGs from this sector occur from the combustion of fuel within the public sector.
- Activity data (fuel use) is taken from DECC's Digest of UK Energy Statistics (DUKES).
- The DUKES category "Public Administration" includes:
  - Public Administration and Defence; Compulsory Social Security
  - Education
  - Health and Social work
- Emission factors for CO_2 are UK specific, based on the Carbon Factors Review, conducted in 2004.
- Emission factors for CH_4 and N_2O are based on IPCC default values.

Methodology

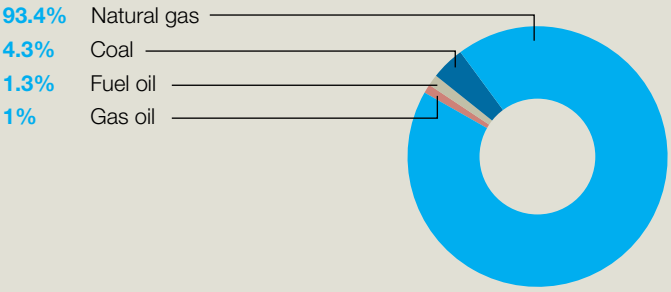
- Fuel combustion emissions are estimated by multiplying the fuel use by an emission factor.
- The estimate for the UK is based on a top-down method, using the total fuel combustion from DUKES. It is not possible to further break this down into different areas of the public sector.
- Emissions from public sector transport sources (including ambulances, for example) are not estimated explicitly, and are included in the transport sector of the inventory.

Public Sector Emissions, 1990-2010



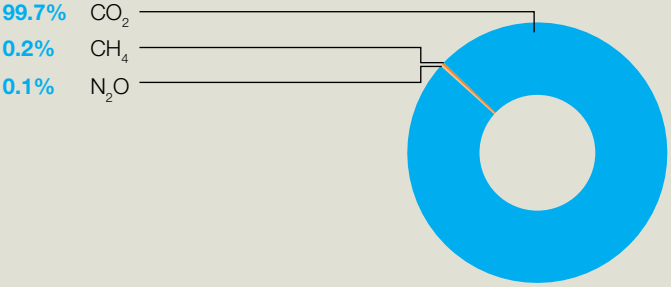
Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Public Sector Emissions by Fuel (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Public Sector Emissions by Gas (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Uncertainties

- The GHG Inventory quantifies uncertainties on emission factors and activity data, which in turn allow for the production of uncertainty estimates on the: emissions; overall uncertainty by gas; and indicative-only estimates of sector level uncertainties.
- The uncertainty associated with the emission factors for CO_2 is low, since the carbon content of the fuels used is well known. For non-CO_2 gases, the emission factors are dependent on a range of contributing factors, such as boiler size and efficiency, and therefore the uncertainty on the emission factors used to represent the whole sector across the UK is high, although the contribution to total emissions is much lower.
- The uncertainty associated with total fuel use in the UK is relatively low; however the sectoral split is more uncertain.
- The indicative uncertainty for the public sector is +/-5%, as a 95% confidence interval.

Improvements

- A The latest inventory included a review on the combustion of gas oil in different sectors. This has led to a reallocation of gas oil consumption between public and other sectors.
- The combustion of sewage gas in heat plants has been reallocated to the Energy Supply sector following UNFCCC recommendation.

Projections

- Projected emissions from the public sector are expected to be 10% below 2010 levels in 2025.
- Emissions continue to be dominated by CO_2.
- The overall decrease in public sector emissions between 1990 and 2025 is estimated to be 42%.
- The projections are taken from DECC's Updated Energy and Emissions Projections: October 2011 although historic emissions presented here are taken from 2012 inventory data.

Historic and Projected Emissions from the Public Sector

Source: Updated Energy and Emissions Projections: October 2011 (DECC).

Links

- UK GHG Inventory: http://ghgi.decc.gov.uk/
- UK GHG National Statistics: http://www.statistics.gov.uk/hub/agriculture-environment/environment/climate-change/index.html
- UK Updated Energy Projections: http://www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/en_emis_projs/en_emis_projs.aspx
- DUKES: http://www.decc.gov.uk/en/content/cms/statistics/publications/dukes/dukes.aspx

Residential

GHG Inventory summary Factsheet

Territorial coverage: UK including Crown Dependencies and Overseas Territories
Total emissions: Quoted with respect to emissions including net LULUCF
Sector Definition: National Communication, by source, consistent with UK GHG national statistics

Sector summary – historic emissions

- Overall contribution of emissions to UK GHG emissions in 2010 was 15%.
- CO_2 is the dominant GHG (96%).
- Emissions from the residential sector are 11% higher in 2010 than in 1990. This is largely due to a 16% increase in emissions from residential combustion between 2009 and 2010.
- Emissions from stationary combustion dominate residential sector emissions (95%), and have increased by 8% since 1990.

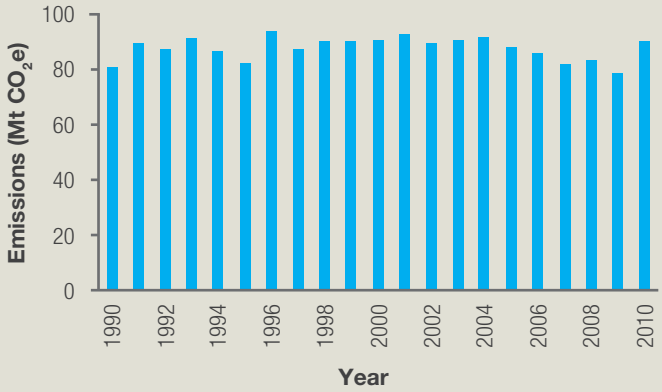
Sources of emissions and data sets

- Domestic combustion includes all emissions from the direct combustion of fuel for heating or cooking. The main dataset used is DECC's Digest of UK Energy Statistics (DUKES).
- Emissions from aerosols and metered dose inhalers (MDI) relate to HFCs used as a propellant. The main data sources for these emissions are BAMA (the British Aerosol Manufacturers' Association) and sales data for metered dose inhalers.
- Emissions from the breakdown of household products arise from the decomposition of products such as soaps and detergents.
- Other emission sources include household and garden machinery and accidental vehicle fires.

Methodology

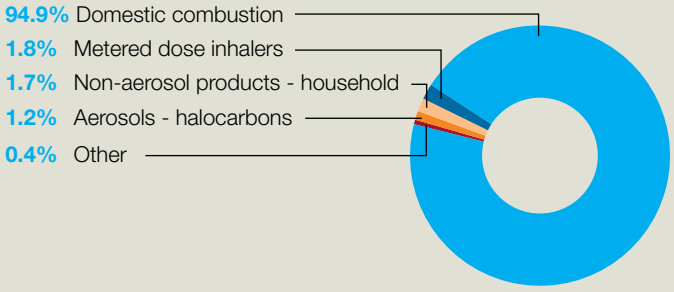
- Domestic fuel combustion emissions are estimated by multiplying the fuel use estimates in DUKES by an emission factor. Emission factors are either UK specific or are taken from published inventory guidelines (IPCC and UNECE).
- Emissions from aerosols and MDI are based on estimates of the total HFCs in aerosols in each year, combined with estimates of how much HFC is released at manufacture, during use, and at disposal.

Residential Sector Emissions, 1990-2010



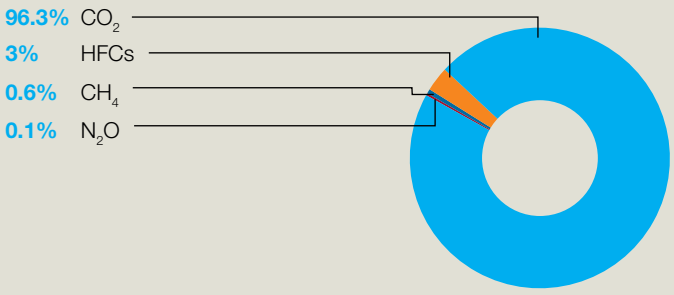
Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Residential Emissions by Source (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Residential Emissions by Gas (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

- For the breakdown of consumer products, estimates of the carbon content of these products are combined with an estimate of how much carbon is stored, and how much is released. These estimates are based on a study conducted by Atlantic Consulting, supplemented by sales data from the Cosmetics, Toiletries & Perfumery Association, and data from the US EPA.

Uncertainties

- The GHG Inventory quantifies uncertainties on emission factors and activity data, which in turn allow for the production of uncertainty estimates on the: emissions; overall uncertainty by gas; and indicative-only estimates of sector level uncertainties.
- The uncertainty associated with the emission factors for CO_2 is low, since the carbon content of the fuels used is well known. For non-CO_2 gases, the emission estimates are dependent on a range of contributing factors, such as boiler size and efficiency. Therefore the uncertainty on the emission factors used to represent the whole sector across the UK is high, although the contribution to total emissions is much lower.
- The uncertainty associated with total fuel use in the UK is relatively low; however the sectoral split is more uncertain.
- The indicative uncertainty for the residential sector is +/-1%, as a 95% confidence interval.

Improvements

- Some petrol and diesel use has been reallocated from road transport to household and garden machinery following a review of gas oil and diesel consumption across different sectors.

Projections

- Projected emissions from the residential sector are expected to decrease by 23% from 2010 to 2025.
- Emissions continue to be dominated by CO_2.
- The overall decrease in residential sector emissions between 1990 and 2025 is projected to be 14%.
- The projections are taken from DECC's Updated Energy and Emissions Projections: October 2011 although historic emissions presented here are from the 2012 inventory.

Historic and Projected Emissions from the Residential Sector

Source: Updated Energy and Emissions Projections: October 2011 (DECC).

Links

- UK GHG Inventory: http://ghgi.decc.gov.uk/
- UK GHG National Statistics: http://www.statistics.gov.uk/hub/agriculture-environment/environment/climate-change/index.html
- UK Updated Energy Projections: http://www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/en_emis_projs/en_emis_projs.aspx
- DUKES: http://www.decc.gov.uk/en/content/cms/statistics/publications/dukes/dukes.aspx
- BAMA: http://www.bama.co.uk/

Transport

GHG Inventory summary Factsheet

Territorial coverage: UK including Crown Dependencies and Overseas Territories
Total emissions: Quoted with respect to emissions including net LULUCF
Sector Definition: National Communication

Sector summary – historic emissions

- Overall contribution of the transport sector to UK GHG emissions in 2010 was 21%.
- Emissions from the transport sector have increased 0.5% since 1990.
- Road transport emissions have increased by 2% since 1990 reflecting the increase in vehicles on the road and total vehicle km travelled, although a decrease in vehicle km has been observed since 2007.
- The increase in road transport emissions is less than it could otherwise have been due to improving fuel efficiency. Vehicle km travelled over the same period has increased by 22%.

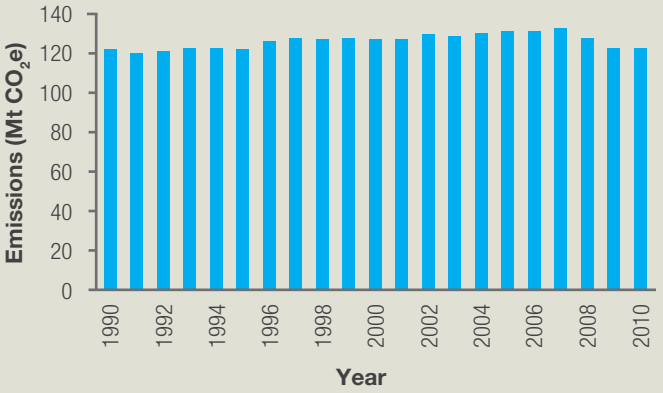
Sources of emissions and data sets

- Emissions of GHGs from this sector predominately occur from road transport.
- CO_2 is the dominant GHG emitted by the transport sector making up 99% of transport emissions.
- Other sources include aircraft support vehicles and stationary combustion from railways.
- Key data sources include DECC's Digest of UK Energy Statistics (DUKES), UK Department for Transport publication Transport Statistics Great Britain, information from the Association of Train Operating Companies (ATOC), fuel consumption data from the Ministry of Defence and Civil Aviation Authority aircraft movement data.

Methodology

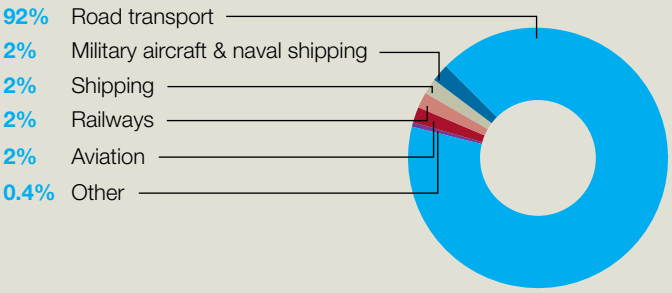
- **Aviation:** Emission estimates are based on the number of aircraft movements broken down by aircraft type at each UK airport. This complies with the highest and most detailed Tier (IPCC Tier 3) at which emissions can be estimated.
- **Railways:** Both mobile and stationary emissions are reported. Stationary emission sources are based on fuel consumption data from DUKES. Emissions from railways are calculated by multiplying emission factors by either fuel consumption or train kilometres.

Transport Emissions 1990-2010



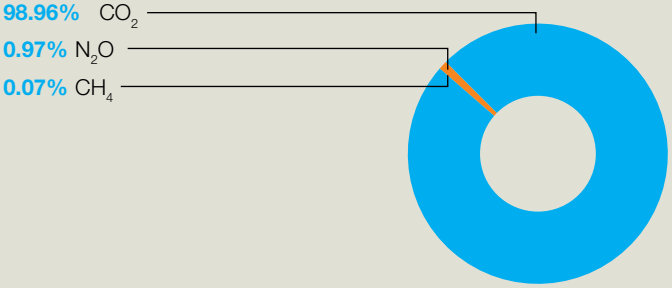
Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Transport Emissions by Source (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Transport Emissions by Gas (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

- **Road Transport:** Emissions are calculated either from a combination of total fuel consumption data and fuel properties or from a combination of drive related emission factors and road traffic data. This complies with IPCC Tier 3 specification.
- **Road Transport:** CO_2 is calculated using fuel consumed and the carbon content of the fuel.
- **Road Transport:** CH_4 and N_2O are more complex to calculate since there is not a direct link between the fuel consumed and the emissions. Emissions are dependent on a number of factors including vehicle type, age, fuel type, speed and distance travelled.
- **Coastal shipping:** A bottom-up method is used based on detailed shipping movement data for different vessel types, fuels and journeys has been used to estimate domestic (coastal) shipping emissions.
- **Inland waterways:** Emissions from inland waterways are also included in domestic shipping. These are estimated using population, engine size and hours of use of different types of craft, combined with emissions factors from the EMEP/EEA Guidebook.
- **International Marine:** The estimate for international marine emissions is derived by the difference between total fuel consumption statistics from DUKES for marine fuels and fuel consumption by domestic shipping. This is reported as a memo item.
- **Military aircraft and naval shipping:** Data from the Ministry of Defence is used to calculate emissions from naval shipping. Fuel consumption data provided by the Ministry of Defence is used in conjunction with default emission factors

Uncertainties

- The GHG Inventory quantifies uncertainties on emission factors and activity data, which in turn allow for the production of uncertainty estimates on the: emissions; overall uncertainty by gas; and indicative-only estimates of sector level uncertainties.
- The uncertainty associated with the emission factors for CO_2 is low, since the carbon content of the fuels used is well known. For non-CO_2 gases, the emission factors are dependent on a range of contributing factors, including engine size, vehicle age, speed and whether or not the vehicle has a 3-way catalyst. Therefore the uncertainty on the emission factors is high, although the contribution to total emissions is much lower.
- The uncertainty associated with total fuel use in the UK is relatively low; however the sectoral split is more uncertain.
- The overall uncertainty for the transport sector is estimated to be +/-3% as a 95% confidence interval in 2010.

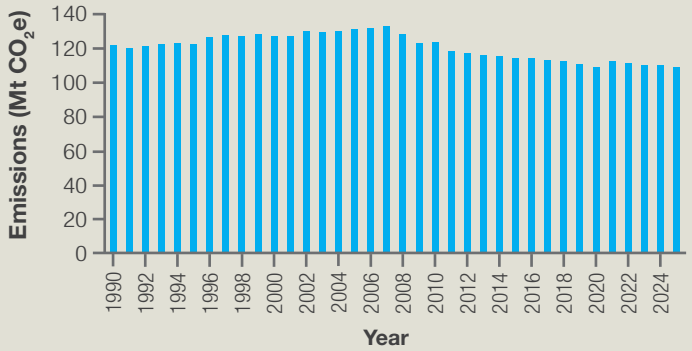
Improvements

- Some petrol and diesel use has been reallocated from road transport to off-road machinery following a review of gas oil and diesel consumption across different sectors.
- Emissions estimates from inland waterways have been included in the inventory for the first time. Fuel for this sector has been reallocated from international shipping.
- Road transport improvements have included a new approach to allocate fuel consumption among vehicle types. This incorporates Automatic Number Plate Recognition data and regional licensing data to define the fuel and age mix of vehicles on different types of roads.

Projections

- The dominant gas in transport projections is CO_2 and the dominant source is road transport.
- Emissions from transport are projected to decrease by 12% from 2010 to 2025, mostly driven by decreasing emissions from road transport.
- Projected emissions from aviation are expected to increase.
- The projections presented here exclude the impact of emissions trading.
- The projections are taken from DECC's Updated Energy and Emissions Projections: October 2011 although historic emissions presented here are from the 2012 inventory.

Historic and Projected Emissions from Transport



Source: Updated Energy and Emissions Projections: October 2011 (DECC).

Links

- UK GHG Inventory: http://ghgi.decc.gov.uk/
- UK GHG National Statistics: http://www.statistics.gov.uk/hub/agriculture-environment/environment/climate-change/index.html
- UK Updated Energy Projections: http://www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/en_emis_projs/en_emis_projs.aspx
- Department for Transport: http://www.dft.gov.uk/
- UK Civil Aviation Authority: http://www.caa.co.uk/

Waste

GHG Inventory summary Factsheet

Territorial coverage: UK including Crown Dependencies and Overseas Territories
Total emissions: Quoted with respect to emissions including net LULUCF
Sector Definition: National Communication

Sector summary – historic emissions

- Overall contribution of emissions to UK GHG emissions in 2010 was 3%.
- Emissions from the waste sector have decreased by 64% since 1990. This is mostly due to the implementation of CH_4 recovery systems at UK landfill sites.
- CH_4 is the dominant GHG emitted.
- Emissions from landfill dominate waste sector emissions in the UK.

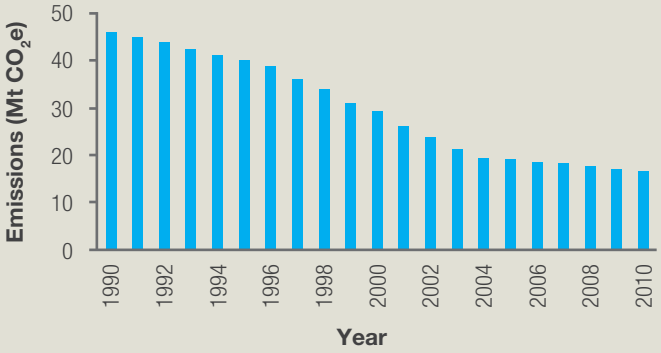
Sources of emissions and data sets

- Emissions of GHGs from this sector occur from the disposal and treatment of waste.
- Managed waste disposal on land covers emissions of CH_4 arising from waste disposed of to landfill. CH_4 is produced as organic wastes decay in the oxygen deficient lower layers of the landfills.
- Wastewater handling leads to emissions of CH_4 and N_2O.
- Waste incineration includes combustion of chemical and clinical waste, Municipal Solid Waste (MSW) and sewage sludge.
- Emissions from energy recovered from waste incineration are reported under the energy supply sector.
- Key data sources include the Environment Agency's Pollution Inventory, Expenditure and Food Survey (Defra), UK population statistics (Office National Statistics) and raw data from water companies. Waste arisings data are taken from WasteDataFlow.

Methodology

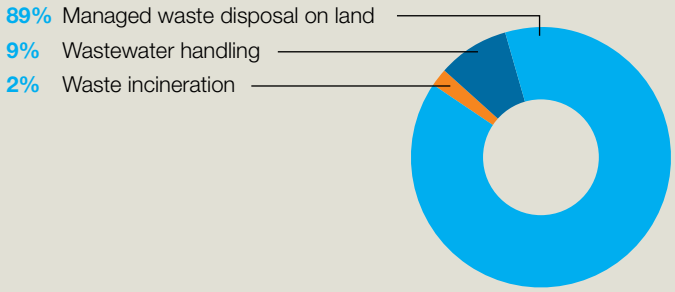
- Landfill emissions in the UK are estimated using a first order decay (Tier 2) methodology based on estimates and historical data on waste quantities, composition and disposal practices over several decades.

Waste Emissions 1990-2010



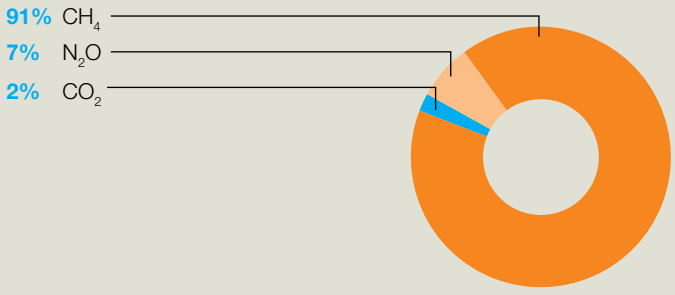
Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Waste Emissions by Source (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

Waste Emissions by Gas (2010)



Source: UK GHG Inventory (UNFCCC coverage) (AEA, 2012)

- First-order decay is simply the assumption that biodegradable carbon in the waste decays to CH_4 with a reaction rate that is proportional to the amount of carbon remaining in the waste.
- Estimates of CH_4 emitted from wastewater handling are based on activity and emissions data from the water industry annual reporting system. From these, implied emission factors for specific emission sub-sources can be derived.
- Estimates of N_2O from wastewater handling are based on protein consumption data and emission factors from the IPCC Guidelines.
- Emissions from waste incineration are estimated from a combination of data reported to the Environment Agency's Pollution Inventory, supplemented with the use of literature-based emission factors.

Uncertainties

- The GHG Inventory quantifies uncertainties on emission factors and activity data, which in turn allow for the production of uncertainty estimates on the: emissions; overall uncertainty by gas; and indicative-only estimates of sector level uncertainties.
- There are many uncertainties associated with estimating CH_4 emissions from the waste sector. For example, the landfill model is particularly sensitive to certain input values such as the amount of degradable organic carbon (DOC) present in the waste and the amount of this that is converted to CH_4 and CO_2, as well as the oxidation factor.
- The estimated uncertainty for landfill is +/-54% as a 95% confidence interval. Emissions from wastewater treatment are more uncertain, with the value of the emission falling between 0.4 and 4.2Mt CO_2 equivalent. The uncertainty for waste incineration is estimated to be +/-48%, as a 95% confidence interval.
- The estimated uncertainty for the whole waste sector is estimated to be +/-52% as a 95% confidence interval.

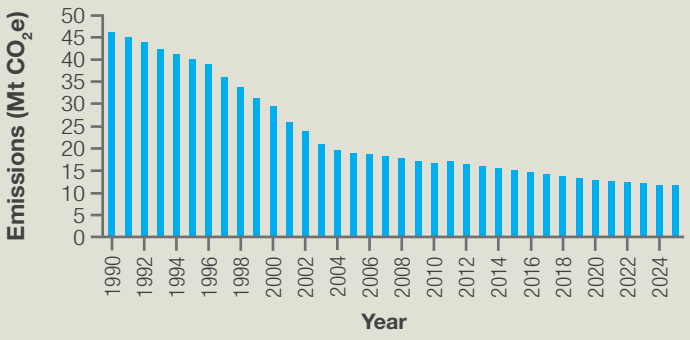
Improvements

- Defra, DECC and the Environment Agency are considering research to test landfill CH_4 measurement, which may in time provide information to improve estimates of UK landfill waste emissions.
- Model input data for the landfill model was updated for the 2011 inventory. This was done as part of a research project commissioned by Defra. A peer review on the revised model has since resulted in the revision of some values assigned to DDOC in the model.
- Emissions of N_2O from wastewater handling have been revised downwards to remove a double-count with the agricultural soils source. Emissions are now included in the agriculture sector for sewage sludge applied to agricultural land.

Projections

- Projected emissions from landfill are expected to continue the current, declining trend.
- The overall decrease in waste emissions between 1990 and 2025 is estimated to be 75%.
- The projections presented here exclude the impact of emissions trading.
- The projections are taken from DECC's Updated Energy and Emissions Projections: October 2011 although historic emissions presented here are from the 2012 inventory.

Historic and Projected Emissions from Waste Management



Source: Updated Energy and Emissions Projections: October 2011 (DECC).

Links

- UK GHG Inventory: http://ghgi.decc.gov.uk/
- UK GHG National Statistics: http://www.statistics.gov.uk/hub/agriculture-environment/environment/climate-change/index.html
- UK Updated Energy Projections: http://www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/en_emis_projs/en_emis_projs.aspx
- Defra: http://www.defra.gov.uk/environment/economy/waste/
- The Environment Agency: http://www.environment-agency.gov.uk/