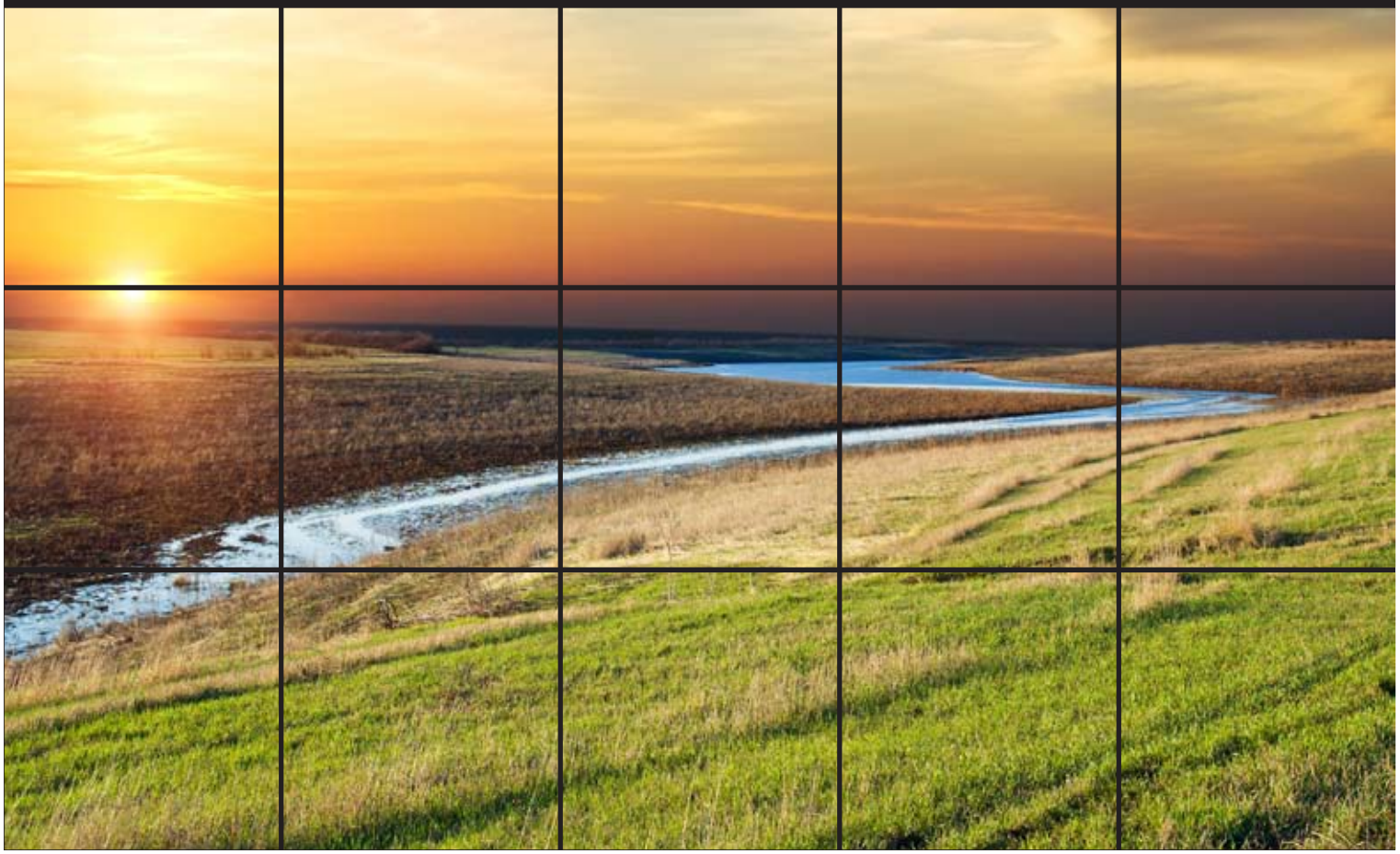
AEA

DEPARTMENT OF ENERGY & CLIMATE CHANGE

2012

UK Greenhouse Gas Inventory:
National Statistics User Guide



Title	UK Greenhouse Gas Inventory: National Statistics User Guide
Customer	Department of Energy & Climate Change
Confidentiality, copyright and reproduction	Crown copyright, prepared by AEA Technology plc. under contract to DECC. The contents of this report may not be reproduced in whole or in part, nor passed to any organisation or person without the specific prior written permission of DECC. AEA Technology plc. accepts no liability whatsoever to any third party for any loss or damage arising from any interpretation or use of the information contained in this report, or reliance on any views expressed therein.
File reference	N:\naei10\8_ghgi\9_User friendly inventory\ NatStatsUserGuide_2010_Issue1
Reference number	ED56968802 - issue 2

AEA
The Gemini Building
Harwell
Didcot
Oxfordshire
OX11 0QR

t: 0870 190 3857
f: 0870 190 6318

AEA is a business name of AEA Technology plc.
AEA is certificated to ISO9001 and ISO14001

Authors	Sarah Choudrie, Neil Passant, Joanna MacCarthy
Approved by	John Watterson

26th March 2012

Executive Summary

This report is a companion to the UK National Statistics and is a simple guide to the origins and use of data used in the compilation of the UK Greenhouse Gas Inventory, which underpins the National Statistics publication and other International and National reporting requirements for greenhouse gases.

The guide explains where to find the official data on UK greenhouse gas emissions; it is short and is not intended to cover all technical and reporting aspects in full detail. For further information, Section 7 provides links to resources and publications where more detail about the UK's Greenhouse Gas Inventory can be found.

This inventory contains estimates of all greenhouse gas emissions by sources and removals by sinks from 1990 to the latest available year of reporting, currently 2010. The inventory includes the Kyoto 'basket' of six greenhouse gases, which are: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. The gases are discussed in more detail in the guide. Summarised below are some important features of the UK's Greenhouse Gas Inventory.

+ The UK's emissions of the basket of six greenhouse gases fell by 23.9% between the base year and 2010 (The meaning of base year is defined later in this guide).
+ Carbon dioxide emissions accounted for 84.3% of total greenhouse gas emissions in 2010, making carbon dioxide the most important greenhouse gas emitted by the UK. The main sources of emissions are power stations, road transport, and residential, industrial, commercial and institutional combustion sources.
+ Methane emissions accounted for around 7.0% of total greenhouse gas emissions in 2010. Significant sources include emissions from landfills, agriculture and leakage from the natural gas distribution network. Emissions of methane have decreased by 57.6% since 1990.
+ Nitrous oxide emissions accounted for 6.0% of total greenhouse gas emissions in 2010. Since 1990, emissions have decreased by 47.6%. The most significant source of nitrous oxide emissions is agricultural soils.
+ F-gas emissions are small in relation to the other gases, accounting approximately 3% of emissions in 2010. Emissions arise from a variety of sources, including commercial and industrial refrigeration, mobile air conditioning, aerosols and metered dose inhalers.
+ In 2010, energy supply was by far the largest contributor to greenhouse gas emissions, followed by transport.

The main reason for the downward trend in emissions since 1990 has been the change in the fuel mix used for power generation, moving away from coal to less carbon-intensive fuels such as natural gas, together with the growth in renewable power generation. Emissions of methane and nitrous oxide have also decreased significantly since 1990 due to declining animal numbers in the agriculture sector, abatement improvements in the industrial processes sector and improvements to waste management practices.

Contents

1. Introduction

This guide presents, in a simple way, the mechanisms the UK uses to estimate greenhouse gas emissions and the procedures it uses for reporting these emissions. It explains where to find the official sets of UK greenhouse gas emissions and is intended as a companion to the National Statistics release of greenhouse gas emission estimates. The guide is short and is not intended to cover all technical and reporting aspects in full detail. For further information, Section 7 provides links to resources and publications where more detail about the UK's greenhouse gas inventory can be found.

2. About the UK Greenhouse Gas Inventory

2.1 What is the UK Greenhouse Gas Inventory?

The Greenhouse Gas (GHG) Inventory contains the UK's official reported greenhouse gas emission estimates. It is the key tool for understanding the origins and magnitudes of the emissions and the assessment of policies designed to control or reduce emissions. Emissions are reported as UK National Statistics, and to the United Nations Framework Convention on Climate Change (UNFCCC) and European Union Monitoring Mechanism (EUMM). The Greenhouse Gas Inventory covers the six direct greenhouse gases under the Kyoto Protocol. These are:

+ Carbon dioxide (CO_2).
+ Methane (CH_4).
+ Nitrous oxide (N_2O).
+ Hydrofluorocarbons (HFCs).
+ Perfluorocarbons (PFCs).
+ Sulphur hexafluoride (SF_6).

The last three of these gases are collectively known as the F-gases.

Each of these gases has been assigned a global warming potential (GWP). In simple terms, the GWP defines how potent each greenhouse gas is compared with CO_2. CO_2 has a GWP of 1; the remaining greenhouse gases in the list above have much greater effects on global warming and so have much larger GWPs. HFCs and PFCs are groups of gases rather than single species, and they have a range of large GWPs. Once the emissions of greenhouse gases are converted into their GWP equivalents, the emissions can be summed and presented as CO_2 equivalent emissions, sometimes referred to as CO_2 eq.

The Greenhouse Gas Inventory contains estimates of all greenhouse gas emissions by sources and removals by sinks from 1990 to the latest available year of reporting, which at the time this guide was written, was 2010. The UK National Statistics reports emissions in nine National Communication (NC) sectors, which are listed below:

+ Agriculture.
+ Business.
+ Energy Supply.
+ Industrial Processes.
+ Land Use, Land Use Change and Forestry (LULUCF)
+ Public.
+ Residential.
+ Transport.
+ Waste Management.

The NC sectors are agreed groupings of the more detailed sectors reported to the UNFCCC. Each of the NC sectors contains all emissions associated with direct fuel use within the sector, for example, gas combustion for cooking and heating in the residential sector, or petrol use in the transport sector. Emissions associated with the extraction and processing of fuels, or the production of secondary energy sources such as electricity are included within the energy supply sector. The Waste Management and LULUCF sectors do not contain any emissions associated with fuel combustion.

2.2 Why do we need to report the Greenhouse Gas Inventory?

2.2.1 What is the Greenhouse Gas Inventory used for?

The Greenhouse Gas Inventory is a tool that provides insight into the sources of greenhouse gas emissions in the UK. It is used by Government to help formulate policies to mitigate emissions. The Greenhouse Gas Inventory responds to policies that are implemented and therefore allows for the assessment of the overall progress towards emission targets. The emission estimates presented in the UK Greenhouse Gas Inventory are used to assess progress towards domestic goals to reduce greenhouse gas emissions; the UK's commitments under the Kyoto Protocol and the Framework Convention on Climate Change, and the UK's contribution to the EU's targets under the Kyoto Protocol. In future years, the inventory will be used to assess compliance against annual emission allowances (2013-2020) set under the Effort Sharing Decision by the EU.

2.2.2 To whom is the Greenhouse Gas Inventory reported?

The Greenhouse Gas Inventory is reported to:

+ The United Nations Framework Convention on Climate Change and under the Kyoto Protocol
+ The European Union Monitoring Mechanism
+ UK Government
+ The Devolved Administrations

The UK has signed up to international agreements for reducing greenhouse gas emissions. In the early 1990's a number of countries joined the United Nations Framework Convention on Climate Change (UNFCCC) treaty in an effort to begin discussions on how to mitigate and adapt to climate change, with the aim of returning emissions of greenhouse gases to 1990 levels by the year 2000. In 1997, an addition to this treaty – the **Kyoto Protocol** – was adopted.

A country's progress against its Kyoto Protocol target is monitored through mandatory reporting to the United Nations Framework Convention on Climate Change (UNFCCC). Under the Kyoto Protocol, the European Union also has an emission reduction target. The UK's share of this is a reduction in emissions of the six greenhouse gases by 12.5% during the first commitment period (2008-2012) against a base line of emissions in 1990 (for carbon dioxide, methane and nitrous oxide) and 1995 (for the F gases). The sum of these emissions in 1990 and 1995 is called the **base year** emissions.

The UK has also set tough, legally binding national targets to reduce greenhouse gas emissions. These targets are in the form of **carbon budgets**. Introduced in the Climate Change Act, carbon budgets set legally binding limits on the total greenhouse gas emissions allowed from the UK over a period of five years. The first of the budgets began in 2008 and will run until 2012, with subsequent budgets set for 2013-2017 and 2018-2022. These budgets require the UK to reduce emissions of greenhouse gases by 34% on 1990 levels by 2020, with a long term target of an 80% reduction by 2050.

The Greenhouse Gas Inventory is also presented for direct public access at: **www.decc.gov.uk/en/content/cms/statistics/climate_change/climate_change.aspx**

2.3 How do we calculate emissions?

2.3.1 Basic method

The basic equation used for calculating most emissions is:

Emission = Emission factor x Activity

The majority of emissions within the UK arise from the combustion of fuel, in which case the activity is usually the amount of fuel consumed. In other cases, the activity statistics used include the amount of a product produced, the number of animals, and distances travelled by different vehicle types in the UK fleet.

The emission factor is the emission per unit of activity. Emission factors for energy sources are either dependent on the fuel characteristics (for emissions of CO_2) or how the fuel is burned, for example the size and efficiency of equipment used. For other sources, the emission factor can be dependent on a range of parameters, such as feed characteristics for livestock or the chemical reactions taking place for industrial process emissions. Emission factors are typically derived from measurements on a number of representative sources and the resulting factor applied to all similar sources in the UK.

For some sources, the calculation of emissions is more complicated, and therefore a model is used to estimate emissions. This is particularly the case for emissions of methane from waste disposed to landfills. This is more complicated because the emissions occur over a long timeframe from the initial disposal of waste. Emissions are also affected by the level of capture and utilisation of the methane produced. The carbon fluxes (emissions and sinks) from land use, land use change and forestry are also modelled.

2.4 Guidelines and principles

2.4.1 Guidelines

The UK Greenhouse Gas Inventory compilers follow detailed guidance produced by the Intergovernmental Panel on Climate Change (IPCC). The function of the IPCC is to publish reports and guidelines relevant to the implementation of the UN Framework Convention on Climate Change. As part of this function, the IPCC produce the Guidelines for National Greenhouse Gas Reporting and these are then adopted by the UNFCCC. These guidelines set out the acceptable methods for estimating greenhouse gases for reporting to the UNFCCC. This guidance is periodically updated and the Greenhouse Gas Inventory compilers need to have regard to updates in the guidance. The guidelines do not pre-empt the accounting choices that are used currently, for example under the Kyoto Protocol, and that might be used in the future. All countries must adhere to these guidelines and each year every submission is reviewed and checked to ensure these standards are met.

2.4.2 Overarching principles

The compilation of the UK GHG inventory is conducted in accordance with international protocols and methodological guidance, which are designed to ensure that all country inventories attain similar standards and are therefore comparable. The underlying principles of inventory compilation are defined within IPCC guidance and can be summarised as follows:

+ **Accuracy.** Accuracy is a relative measure of the exactness of an emission or removal estimate. Estimates should be accurate in the sense that they are systematically neither over nor under true emissions or removals, so far as can be judged, and that uncertainties are reduced so far as is practicable. Appropriate methodologies conforming to guidance on good practices should be used to promote accuracy in inventories.

+ **Completeness.** Completeness means that an inventory covers all sources and sinks for the full geographic coverage, as well as all gases included in the IPCC Guidelines in addition to other existing relevant source/sink categories which are specific to individual Parties (and therefore may not be included in the IPCC Guidelines).

+ **Transparency.** Transparency means that the assumptions and methodologies used for an inventory should be clearly explained to facilitate replication and assessment of the inventory by users of the reported information. The transparency of inventories is fundamental to the success of the process for the communication and consideration of information.

+ **Comparability.** Comparability means that national inventory estimates should be comparable among Parties. This is achieved by all countries following the reporting guidance and presenting their data in a set format. The EU and UN then review the country inventories to check that the guidance has been followed, and finalised national inventories can easily be compared as they all present the same level of information for each emission source.

+ **Consistency.** Consistency means that an inventory should be internally consistent in all its elements over a period of years, to make sure that reported emission **trends** are as accurate as they can be. Ideally, emission estimates should be calculated using one method across all reported years, and the UK inventory therefore relies heavily on long-term National Statistics such as energy balance data to underpin the estimates.

3. Emissions data and trends

3.1 Differences in reported totals

There are various totals of UK greenhouse gases which are reported to the different authorities. All totals are valid and so it is important to understand the differences, ensuring that the correct data are used for specific purposes of reporting or analysis.

Firstly, differences arise in the totals reported to the UNFCCC and the Kyoto Protocol, which centre around the Land Use, Land Use Change and Forestry sector. Under the UNFCCC, all emissions and removals from this sector are included, whereas under the Kyoto Protocol, only selected emissions and removals are included. This report does not go into more detail about these reporting differences, but the executive summary of the UK National Inventory Report contains more information.

Secondly, different geographical coverages are reported. The UK Greenhouse Gas Inventory defines the UK using differing geographical coverages, depending on the reporting requirements. Overseas Territories and Crown Dependencies that are associated with the UK are sometimes included or excluded from the emissions totals. The list below sets out the three main geographical coverages of the Greenhouse Gas Inventory:

1. **UK National Statistics** – The geographical coverage of these statistics is based on the UK and the Crown Dependencies of Jersey, Guernsey and the Isle of Man.
2. **Kyoto Protocol commitment** – The UK's progress against the Kyoto Protocol commitment is based on a geographical coverage of the UK, the Crown Dependencies of Jersey, Guernsey and the Isle of Man and the Overseas Territories that have ratified the Kyoto Protocol (Cayman Islands, Falkland Islands, Bermuda, Montserrat and Gibraltar).
3. **Commitment under the EU Monitoring Mechanism – Coverage only includes parts of the UK which are also parts of the EU** – the UK and Gibraltar. All Crown Dependencies and Overseas Territories are excluded.

For the purposes of this report, unless otherwise stated, the emission estimates reported correspond to the coverage of the UK plus Crown Dependencies.

3.2 Tracking progress against targets

Progress towards the UK's Kyoto Protocol reduction commitment is assessed against base year emissions. An assigned amount is calculated using the base year emission estimate. Emissions in the base year from the UK are calculated from the sum of emissions in 1990 (for carbon dioxide, methane and nitrous oxide) and in 1995 (for the F-gases). The base year total used for the UK was calculated from the last version of the 2004 greenhouse gas inventory presented in the 2006 National Inventory Report and is now fixed. We refer to this as the **fixed base year**.

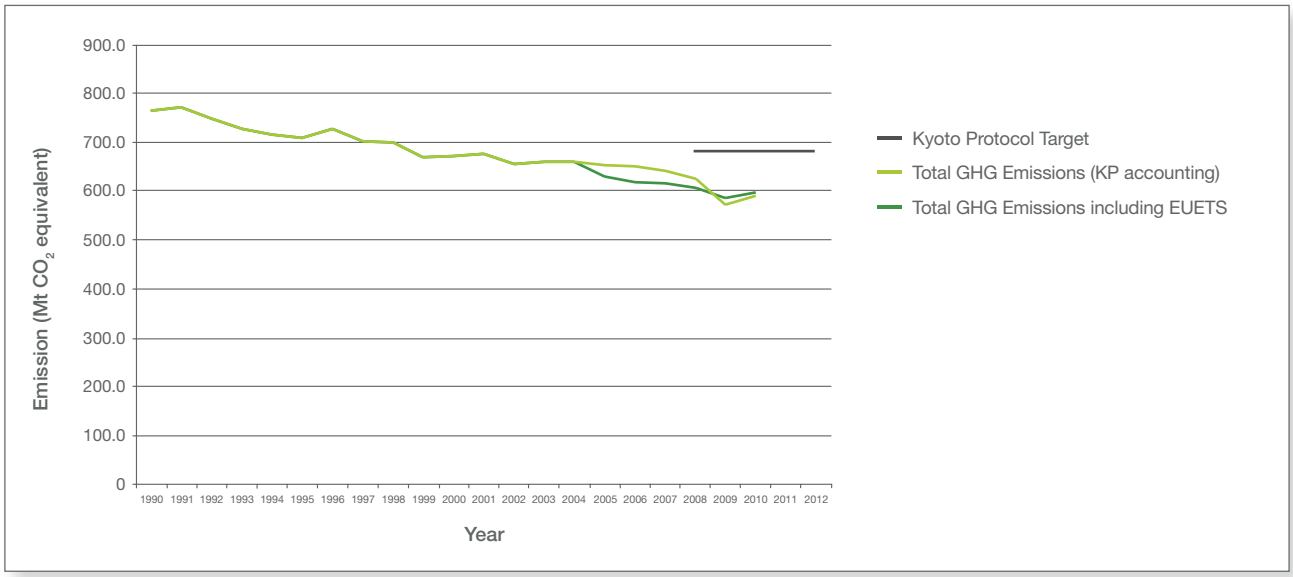
Each year, the UK Greenhouse Gas Inventory is updated and existing activity data and/or emissions factors may be revised. It is also extended to include a new inventory year. The updates may affect the estimates of emissions in 1990 and 1995, and so the base year emissions quoted in each release of the Greenhouse Gas Inventory may change, but the fixed base year will not alter.

3.3 Headline results

Total UK net emissions of greenhouse gases were **587.8 Mt CO_2 equivalent** in 2010. This represents a **decrease of 24%** from 1990.

For tracking progress towards the UK's Kyoto Protocol target, total emissions are calculated to include only certain components of land use, land use change and forestry, and the full geographical coverage of the UK. In addition, emissions can be traded with other parties and accounted for as an increase in UK emissions (allowances sold) or a decrease (allowances bought). On this basis, total emissions in 2010 were **598.1 Mt CO_2 equivalent**. Progress towards the Kyoto Protocol target is measured against a fixed base year figure of **779.9 Mt CO_2 equivalent**; emissions in 2010 were **23.3% lower** than the base year. This compares with the UK's target of a 12.5% reduction.

Figure 3.1 UK emissions of greenhouse gases and progress towards the Kyoto Protocol target

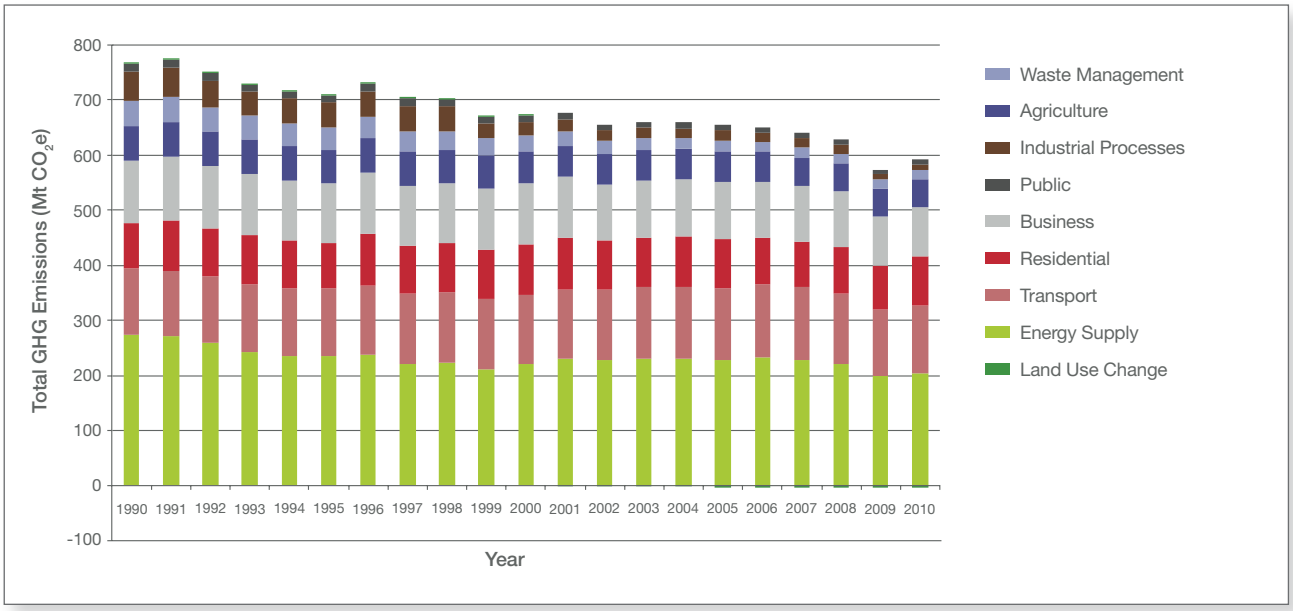


3.4 Trends in emissions

3.4.1 Total emissions of greenhouse gases

Figure 3.2 shows the total greenhouse gas emissions in the UK between 1990 and 2010 divided into nine sectors. The largest contribution to emissions arises from the energy supply sector.

Figure 3.2 Trends in total UK greenhouse gas emissions, 1990 to 2010



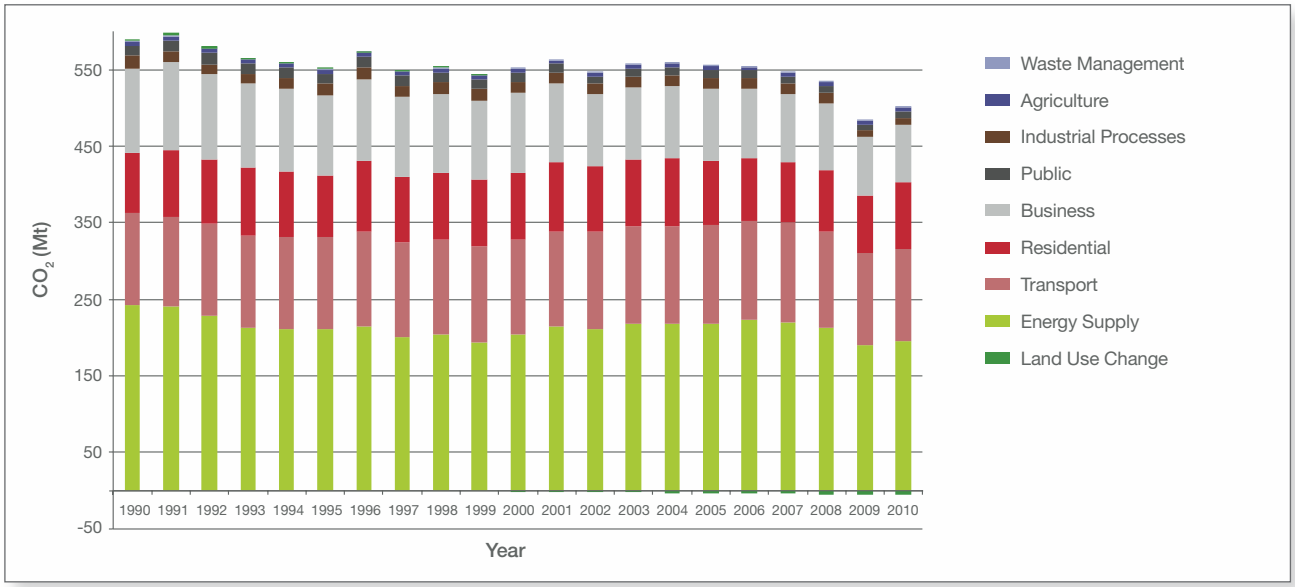
Key statistics

+ Total emissions have decreased by 24% since 1990.
+ The sectors contributing most to the decrease between 1990 and 2010 were:
  > Energy Supply (-25%) – decrease predominantly due to fuel switching in the power generation sector, reduced emissions of methane from coal mines and upgrades and reduced leakage from the natural gas distribution network.
  > Industrial Processes (-80%) – decrease mainly due to plant closures and abatement equipment fitted at major adipic acid and F-gas manufacturing plants.
  > Waste Management (-64%) – decrease primarily due to the implementation of methane recovery systems at landfill sites.
+ Emissions in both the transport sector and the residential sector have increased since 1990.
+ Emissions from the transport sector in 2010 are 0.3% higher than in 1990 mainly due to increased emissions from cars and vans.
+ The residential sector shows an increase of 11% since 1990, with a 15% increase in emissions between 2009 and 2010. An increase in gas use due to the colder than average year in 2010 is mainly responsible for this rise in emissions.
+ The Land Use, Land Use Change and Forestry sector was a net source of emissions in 1990, and a net sink in 2010. Therefore, emissions from this sector have decreased by more than 100%.
+ Between 2008 and 2010, UK GHG emissions have decreased by 5.7%, partly due to the impacts of the recent economic down-turn.

3.4.2 Carbon dioxide

Figure 3.3 shows carbon dioxide emissions in the UK between 1990 and 2010 divided into the nine NC sectors.

Figure 3.3 Trends in UK emissions of carbon dioxide, 1990 to 2010



Key statistics

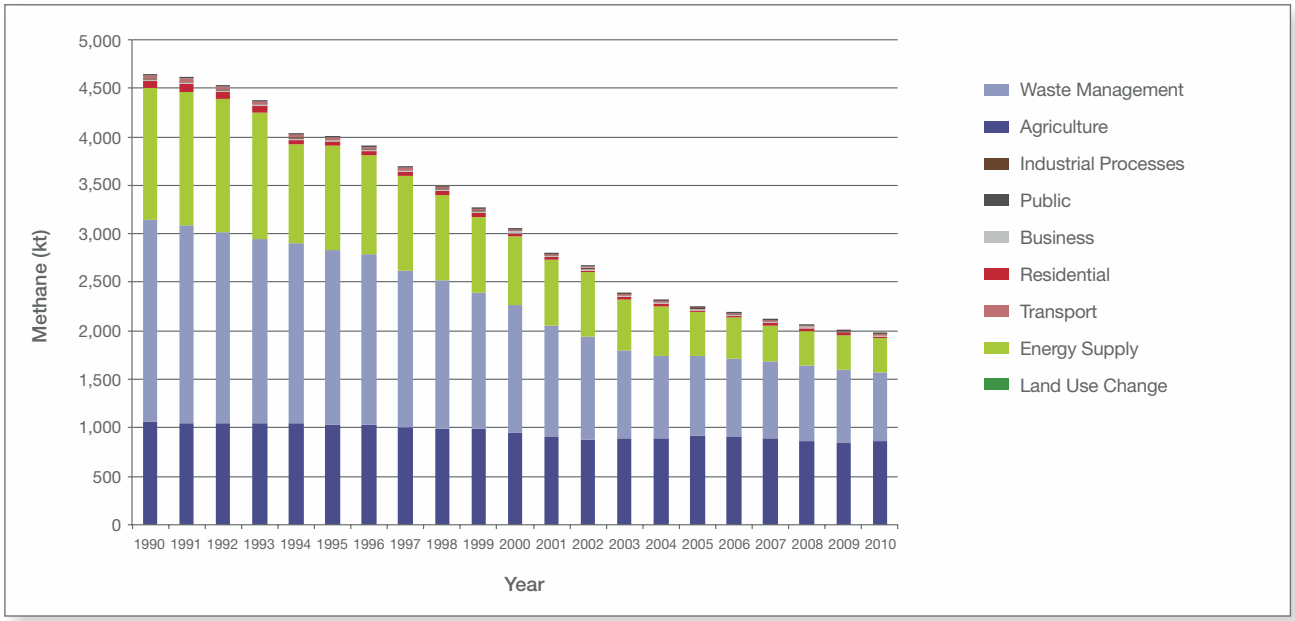
+ CO_2 emissions accounted for around 84% of total greenhouse gas emissions in 2010.
+ Total emissions of CO_2 have decreased by 16% since 1990.
+ Between 2008 and 2010, carbon dioxide emissions decreased by 6.3%, influenced by the economic downturn and a reduction in emissions from key sectors such as power generation, business, industrial processes (such as cement manufacture and iron and steel-making) and also from transport.
+ The five most significant sources of CO_2 in 1990 and 2010 were:
  - > Power stations.
  - > Road transport.
  - > Residential combustion.
  - > Industrial combustion (part of the Business sector)
  - > Commercial/institutional combustion (part of the Business sector).
+ Together, these five sources made up around 84% of total emissions in 2010.
+ Three of these five sources have decreased from 1990 to 2010.
  - > Power station emissions have decreased the most out of all sources (by 47 Mt across the period) primarily due to the move away from coal-fired generation towards the use of natural gas and renewable fuels.
  - > Industrial combustion emissions have decreased due to decreased fuel use, in part due to efficiency improvements.
  - > Emissions in the commercial and public sector decreased due to fuel switching to gas.
+ Road transport increased across the time series by 2.7 Mt.
+ Residential emissions increased by 7 Mt between 1990 and 2010. This was mainly due to 2010 being an exceptionally cold year and hence gas use in the sector increased.

The chart shows that carbon dioxide emissions have decreased over time, but have fluctuated rather than declining steadily. The overall trend is dominated by the power generation sector, where emissions have decreased predominantly due fuel switching from coal to gas. There are two relatively significant peaks in the time series, in 1996 and 2001. The year 1996 was colder than average therefore, emissions in the power generation and domestic sectors were higher. In 2001, relatively high gas prices made coal-fired power generation more financially competitive, leading to higher emissions in the energy sector.

3.4.3 Methane

Figure 3.4 shows methane emissions in the UK between 1990 and 2010 divided into the nine NC sectors.

Figure 3.4 Trends in UK emissions of methane, 1990 to 2010



Key statistics

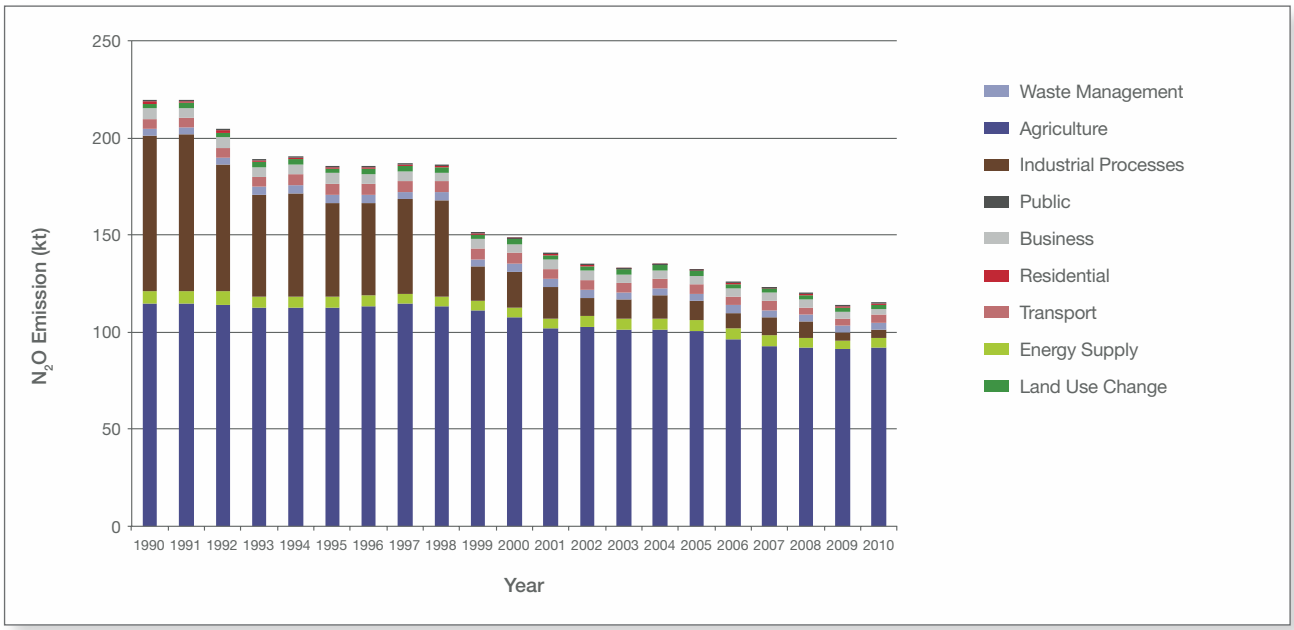
+ Methane emissions accounted for around 7% of total greenhouse gas emissions in 2010.
+ Total emissions of methane have decreased by around 58% since 1990.
+ The five most significant sources of methane in both 1990 and 2009 were:
  - > Landfills.
  - > Enteric fermentation – cattle.
  - > Leakage from the gas distribution network.
  - > Enteric fermentation – sheep.
  - > Coal mining.
+ Together, these five sources made up around 87% of total emissions in 2010, and 90% of the total in 1990.
+ All of these sources have decreased significantly across the time series.
  - > The largest reduction is from landfills. Emissions have decreased by 28 Mt CO_2 equivalent since 1990, due to tighter regulation of landfills and increased utilisation of landfill methane in gas flares and engines.
  - > Emissions from cattle and sheep have decreased due to a decline in animal numbers.
  - > Leakage from the gas distribution network has declined due to improvement work on the network, including the replacement of old pipes.
+ No significant sources of methane have increased across the time series.

The overall trend in methane emissions is a relatively steady decline. The main contributors to this decline are falling emissions from waste management and coal mining. Methane emissions from coal mining have declined in line with the decline in UK coal production.

3.4.4 Nitrous oxide

Figure 3.5 shows nitrous oxide emissions in the UK between 1990 and 2010 divided into the nine NC sectors.

Figure 3.5 Trends in UK emissions of nitrous oxide, 1990 to 2010



Key statistics

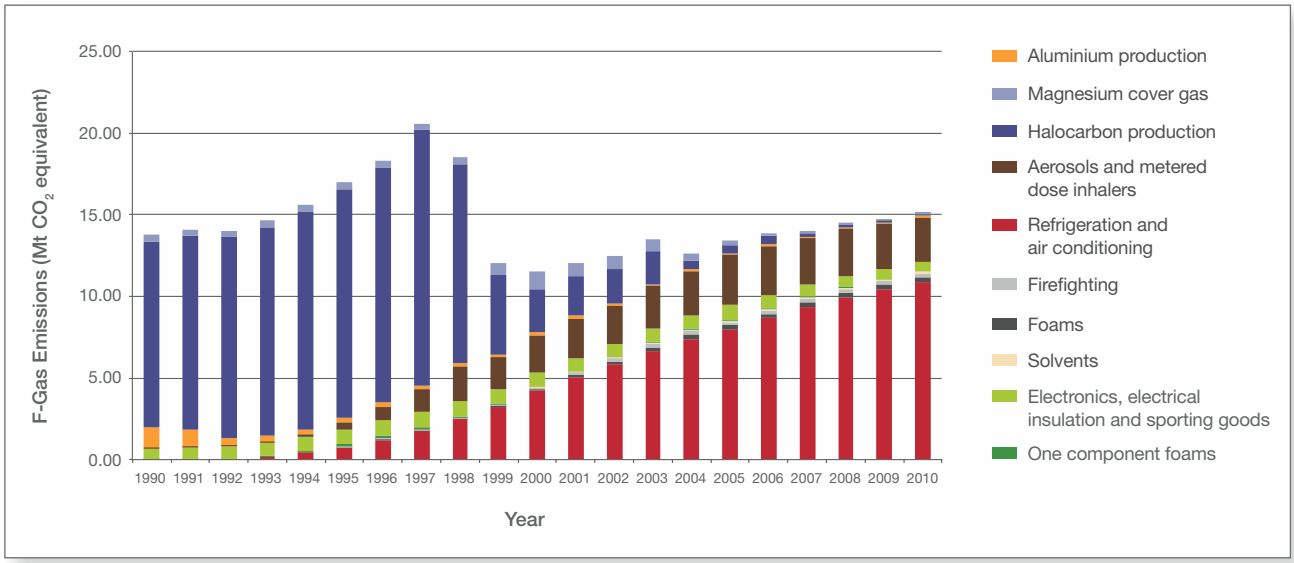
+ Nitrous oxide emissions accounted for around 6% of total greenhouse gas emissions in 2010.
+ Total emissions of nitrous oxide have decreased by 48% since 1990.
+ By far the largest source of nitrous oxide in 2010 is agricultural soils, accounting for around 74% of total nitrous oxide emissions, despite declining by 20% since 1990 due to improvements in farm management practices.
+ In 1990, adipic acid manufacture was also a major source of nitrous oxide emissions in the UK. Emissions from this source declined significantly in 1998 following the installation of abatement equipment at the UK's only adipic acid plant, the impact of which can clearly be seen in the graph above. The adipic acid plant closed in 2009.
+ Emissions of nitrous oxide from nitric acid manufacture are another key component of the Industrial Process sector emissions, and these emissions have also declined since 1990 due to plant closures and consolidation of nitric acid production across UK sites.
+ No sources of nitrous oxide have shown a large increase across the time series.

The main feature in the time series of nitrous oxide emissions is the large decline from industrial processes from 1998 to 1999, following the introduction of abatement equipment at the UK's only adipic acid manufacturing plant, which has since ceased production in early 2009.

3.4.5 F-gases

Figure 3.6 shows combined emissions of F-gases in the UK between 1990 and 2010. These sectors are different to those in the figures reporting emissions from carbon dioxide, methane and nitrous oxide. The sectors in this figure are sub sectors in the business, residential and industrial process sectors. This is due to the small number of F-gas emission sources relative to other gases.

Figure 3.6 Trends in UK emissions of F-gases, 1990 to 2010



Key statistics

+ F-gases is the collective term used to describe hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).
+ HFCs and PFCs are mostly used as replacements for ozone-depleting substances. The
+ F-gases are all used for specific, specialised applications.
+ In 1995 (the base year for the F-gases), the major emissions source was HFC and HCFC manufacture, accounting for 83% of F-gas emissions.
+ Due to the installation of abatement equipment at both UK HFC and HCFC manufacturing sites, this source no longer appears in the top five F-gas sources. In 2010, these were:
  > Mobile air conditioning.
  > Commercial refrigeration.
  > Stationary air conditioning.
  > Metered dose inhalers.
  > Refrigerated transport.
+ The F-gases only accounted for around 2.6% of total greenhouse gas emissions in 2010.
+ Emissions have decreased by 11% since 1995, predominantly due to the installation of abatement at F-gas manufacturing facilities.

The overall trend in F-gas emissions is determined by a number of competing factors. The sudden decline in total F-gas emissions between 1998 and 1999 was due to the installation of abatement equipment at HFC and HCFC manufacturing sites to mitigate fugitive and by-product emissions. Countering that reduction, there has been a steady increase in emissions in the emissions from the refrigeration and air conditioning sectors, aerosols and MDIs, from 1993 to 2002 as HFCs were used to replace ozone depleting substances previously used as refrigerants like chlorofluorocarbons (CFC) and hydrochlorofluorocarbons (HCFC). The rate of emission increase from refrigeration and air conditioning has slowed down in recent years due to tighter control on emission leakages from units and the introduction of low GWP replacements on the market.

4. Focus on...

This chapter looks at an important source sector in the UK GHG inventory and explains in more detail the methods used to estimate emissions. The 'UK Greenhouse Gas Inventory: National Statistics User Guide' accompanying the UK National Statistics released in 2011 focused on the waste management and industrial process sectors. This year the focus is on the energy supply sector.

This chapter also explains two important methodological updates that have occurred; one to the refrigeration and air conditioning sector and the other to estimates of methane emissions from coal mines.

4.1 Energy Supply

4.1.1 Overview

Emissions from the energy supply sector include those from the combustion of fuels to generate electricity, the transformation of fuels from one form to another (for example the conversion of coal to coke), energy used in the production of refined fuels, fugitive emissions from activities related to the exploration and production of oil and gas, fugitive emissions from the transportation and distribution of natural gas, and, fugitive emissions from coal mining.

The energy supply sector is the largest emitter of greenhouse gases in the U.K. In 2010, 35% of direct greenhouse gas emissions came from this sector.

Power stations and crude oil refineries emit most of these emissions (through fuel combustion), with smaller contributions from oil and gas exploration and production, coal mining, manufacture of coke and other solid fuels, and distribution of natural gas. The greater proportion of greenhouse gas emissions from the energy supply sector arise during the transformation of energy contained in fossil fuels into a different form of energy (e.g. the conversion of coal or gas into electricity in power stations, the manufacture of fuel oils and transport fuels from crude oil in refineries, or the transformation of coal into coke in a coke oven). A proportion of the energy in the fossil fuels is lost during the transformation, while the remainder is exported from the process as a saleable product.

The energy supply sector also uses some fossil fuels to provide their own energy needs e.g. to provide electricity used to power machinery, or to provide heat needed for the transformation processes in refineries and coke ovens.

The distinction between energy transformation and own use of energy is important for the UK GHG inventory. Energy transformations, as well as involving a transfer of energy from one form to another, can also involve a transfer of carbon from one form to another. In other words, whilst almost all carbon in a fossil fuel is released to atmosphere as carbon dioxide during conventional combustion of fuel, in some transformation processes this is not the

case; carbon is transferred from one fossil fuel e.g. coal to another e.g. coke. Appropriate and in some cases quite complex methods are used to estimate emissions from all of these energy transformations in the GHG inventory.

Finally, some emissions of greenhouse gases from the sector are 'fugitive' in nature. In this context, fugitive refers to intentional or unintentional emissions that arise from the extraction, processing, storage, and distribution of coal, crude oil and natural gas, from sources other than energy transformation, or fuel combustion which is related to the production of energy. For example, emissions from flaring or venting of waste gases, leakage of gases from pipelines or coke ovens, and emissions of methane from coal seams are all classed as fugitive emissions.

4.1.2 Calculating emissions

For most emissions in the energy supply sector, there is a direct link between fuel consumption and emissions. Therefore only two pieces of information are needed:

+ Fuel consumed (activity)
+ Emission factor of pollutant

Fuel consumption data are generally taken from the DECC publication, 'Digest of UK Energy Statistics' (DUKES) which gives the annual consumption of all fuels in the UK, broken down by sector.

Emission factors are taken from a number of sources:

+ Direct measurements of fuel characteristics and quality, including the carbon content
+ UK industry
+ A wide range of literature including IPCC publications, and scientific papers
+ EU-Emission Trading Scheme (EU ETS)

The EU ETS dataset is a major source of emission factors and is very large and complex. These data include the quantity of fuels consumed at individual sites, as well as the characteristics of the fuels and other parameters important for understanding emissions of carbon. EU ETS data are used to produce average emission factors for certain fuel types and sectors, such as coal and natural gas burnt in power stations. Data are available from 2005 onwards. The EU ETS scheme does not cover all industrial users of fossil fuels but the energy supply sector is very well represented with all significant power stations and all oil refineries, coke ovens, blast furnaces and oil and gas production facilities included. The EU ETS data do also represent an alternative source of fuel consumption data and in a limited number of cases, these data have been used in preference to figures from DUKES. This is generally done where the EU ETS data can provide greater detail or where the EU ETS data are believed to be the more accurate.

At present, detailed EU ETS data are not analysed for offshore oil and gas facilities, partly because these data have only recently become available but also because other site-specific data are available via EEMS – the UK oil and gas industry environmental database. The data in EEMS includes emissions data both for fuel combustion and for fugitive emissions from sources such as flaring and venting of gases.

Emission estimates for some fuel transformation processes are calculated using a 'mass balance' approach. The mass balance involves quantifying the amount of carbon entering and leaving each stage of the transformation and ensuring the inputs and outputs of carbon are equal. This is used in instances where fuel transformations involve the creation of a secondary fossil fuel e.g. coke-oven coke or blast furnace gas.

Emission estimates for methane and nitrous oxide, as well as estimates for some minor sources of carbon are based on the use of 'literature' emission factors, for example taken from the guidance documents published by the Intergovernmental Panel on Climate Change (IPCC).

4.1.3 Trends in Energy Supply Emissions

Figure 4.1 Trends in Energy Supply GHG emissions, 1990 to 2010

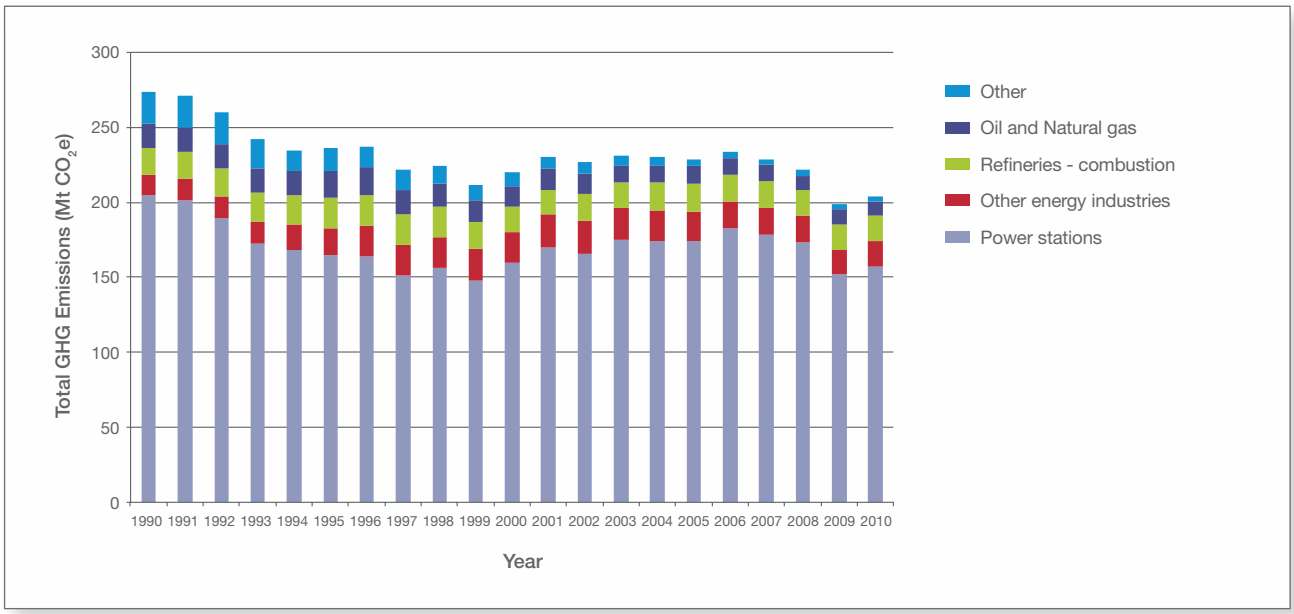


Figure 4.1 shows the trends in the energy supply sector between 1990 and 2010. Greenhouse gas emissions from the energy supply sector have fallen by 25% since 1990, with the lowest emissions reported in 2009. This overall trend reflects the reductions that have occurred in most of the subsectors within the energy supply industry, particularly 'other' (which includes fugitive releases from coal mining and use of solid fuels), 'oil and natural gas' (fugitive emissions from the offshore oil and gas industry) and power stations. The main reasons for these changes are as follows:

+ Large reduction in deep-mine coal extraction
+ Decrease in the use of coal in UK power stations
+ Increase in the use of natural gas in UK power stations (less carbon intensive than coal)

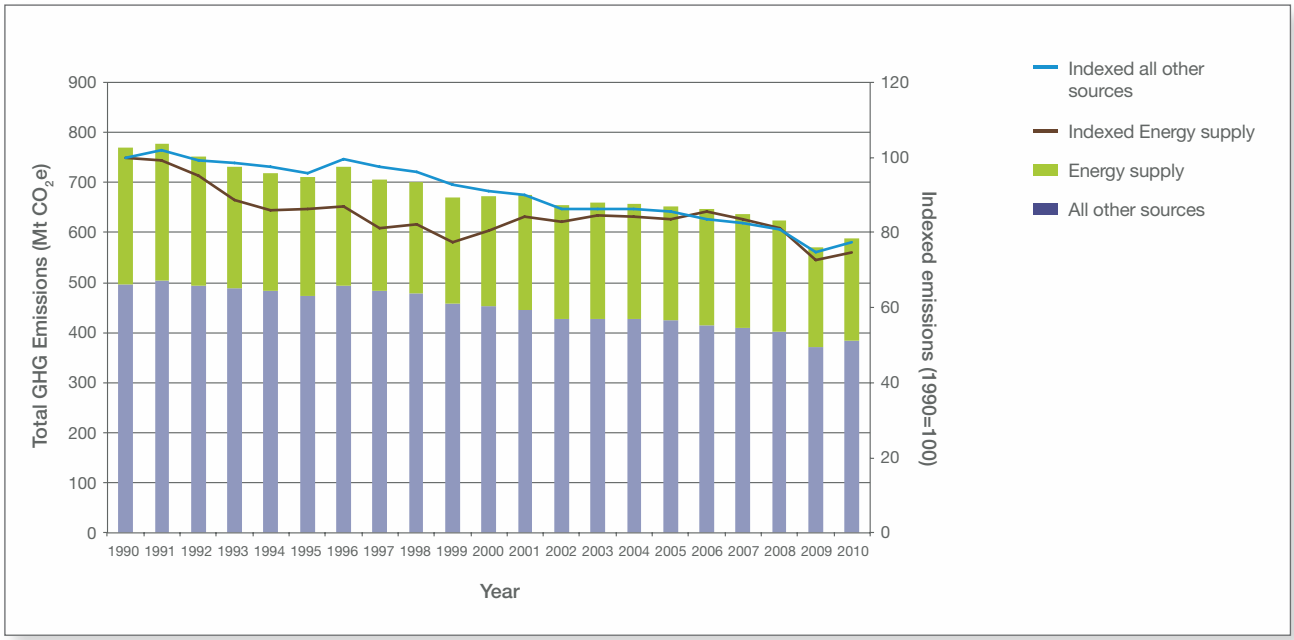
Emissions from refineries have remained fairly constant across the time series whilst emissions from 'other energy industries' have increased.

Carbon dioxide contributes 96% to total greenhouse gases from this sector in 2010. Since 1990, emissions of carbon dioxide from this sector have decreased. This is mostly as a result of a decrease in emissions from power stations which has occurred because of the switch in fuel use from coal to gas.

Almost all of the remaining greenhouse gas emissions from the energy supply sector are of methane. Since 1990, emissions of methane from this sector have decreased by 75%. This decrease can mainly be attributed to the sharp decline in underground coal mining and the resultant decrease in emissions from deep mines. Reductions in the levels of leakage of natural gas from low pressure gas mains have also contributed.

Emissions of nitrous oxide from energy supply are small and contribute less than 1% to the total GHG emissions from this sector across all years. As with carbon dioxide and methane, emissions have decreased between 1990 and 2010.

Figure 4.2 UK Energy supply GHG emissions in context



4.1.4 Energy supply emissions in context

Figure 4.2 shows energy supply emissions in the context of the total UK emissions inventory. The columns illustrate total emissions from energy supply (in blue) and all other sources (in red). The lines show indexed emissions since this approach allows time series of emissions with very different magnitudes to be easily compared. The emissions in 1990 are given a value of 100 and the index of an emission in a later year is calculated as the ratio of the emissions in that year to the emissions in 1990. These are plotted on the secondary axis, and show a decreasing trend for both energy supply and total emissions from all other sources. Emissions from energy supply contributed to 35% of total emissions in 2010 and 36% of total emissions in 1990. The contribution of emissions from energy supply to total greenhouse gas emissions remains fairly constant across the time series.

4.1.5 The changing impact of the Electricity Supply sector

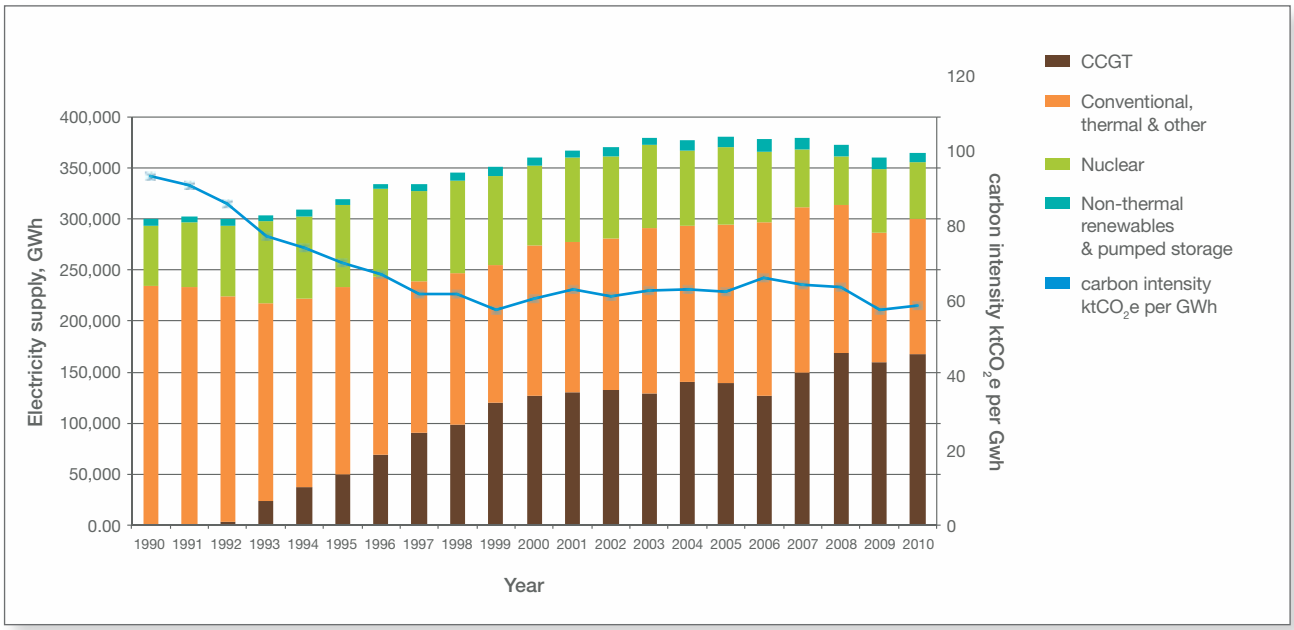
The electricity supply sector has undergone some fundamental changes in the period between 1990 and 2010 which have had significant impacts on the emissions of greenhouse gases from the sector. During this period of time, electricity supplied has increased, but emissions have decreased. Changes to the electricity supply sector have led to lower emissions of greenhouse gases for each unit of electricity supplied in 2010 compared with 1990.

There are various reasons for this:

+ Electricity generation in conventional thermal power station burning coals and oils has decreased sharply;
+ Electricity generation in combined cycle gas turbine (CCGT) stations burning natural gas has increased markedly;
+ Electricity generation using wastes and renewable energy sources has increased;
+ Electricity generation using nuclear energy increased across the first half of the time period, although this trend reversed in the second half, and roughly the same quantity of electricity was generated from nuclear sources in 2010 as in 1990.

Electricity generation in conventional thermal stations using coal or oil leads to direct emissions of greenhouse gases, largely in the form of carbon dioxide, as does the use of CCGTs. But, crucially, natural gas used in CCGTs has a lower carbon content per unit of energy than coal or oil and so less carbon dioxide is emitted for a given input of energy into a power station. In addition, CCGTs are able to convert a higher proportion of the energy in the fossil fuel into electricity and so produce more electrical energy for each unit of energy in the fuel burnt. In 2010, major power producers in the UK were able to convert about 48% of the energy in fuels at CCGTs into electricity, but only 36% of the energy at coal-fired stations.

Figure 4.3 U.K. Electricity supply & carbon intensity (gross), 1990-2010



The contrasting trends in generation using coal and gas over the period have led to a significant reduction in carbon dioxide emissions from power stations despite increases in electricity produced.

Use of wastes and renewable energy sources for electricity generation can mean minimal direct emissions of greenhouse gases, although some wastes will contain fossil carbon (for example plastics in municipal solid waste) and therefore lead to emissions of carbon dioxide during electricity generation.

There are no major emissions of greenhouse gases from electricity generation using nuclear fuels so increased use of nuclear power, such as occurred throughout the 1990s, did not lead to significant increases in greenhouse gas emissions. Nuclear power has, however, contributed less of the UK's electricity in the past decade.

Figure 4.3 shows the change in the electricity supply between 1990 and 2010 and also the decrease in carbon intensity over the same period[1].

4.2 Methodological updates

In order for an inventory to maintain quality, it is important to constantly review the methods used to calculate emissions and to update these if necessary. Two significant methodological updates which were included in the inventory submission this year are described below.

4.2.1 Methane emissions from Abandoned (Closed) Coal Mines

Emissions from abandoned coal mines are one of the significant sources of methane emissions in the UK inventory. Most emissions from abandoned coal mines arise from deep mines. Within a deep mine, methane gas is contained within coal seams that, once closed, continue to emit the gas. The methane reaches the surface through many possible flow paths: vents, old mine entries, diffuse emission through fractured and permeable rock strata. Emissions usually continue to arise until the cavity of the mine is flooded with water, which usually happens as a result of groundwater inflow following closure of the mine[2]. Once flooded, methane emissions tend to stop.

Emissions from abandoned coal mines in the UK inventory were first included in the 2006 GHG inventory. These estimates were calculated in two studies by White Young Green, one considering historic emissions (1990-2004) and the other considering projections (2005 onwards). In 2011, DECC commissioned a study[2] to update this work to reflect known changes in the mining industry (e.g. mines that closed earlier or remained open longer than projected). The results of this study were included in the 2012 inventory submission.

[1] Electricity supply figures taken from DUKES, 2011

[2] Update of Estimated Methane Emissions from U.K. Abandoned Coal Mines, WSP, 2011

Figure 4.4 Emissions from closed coal mines, pre and post the update

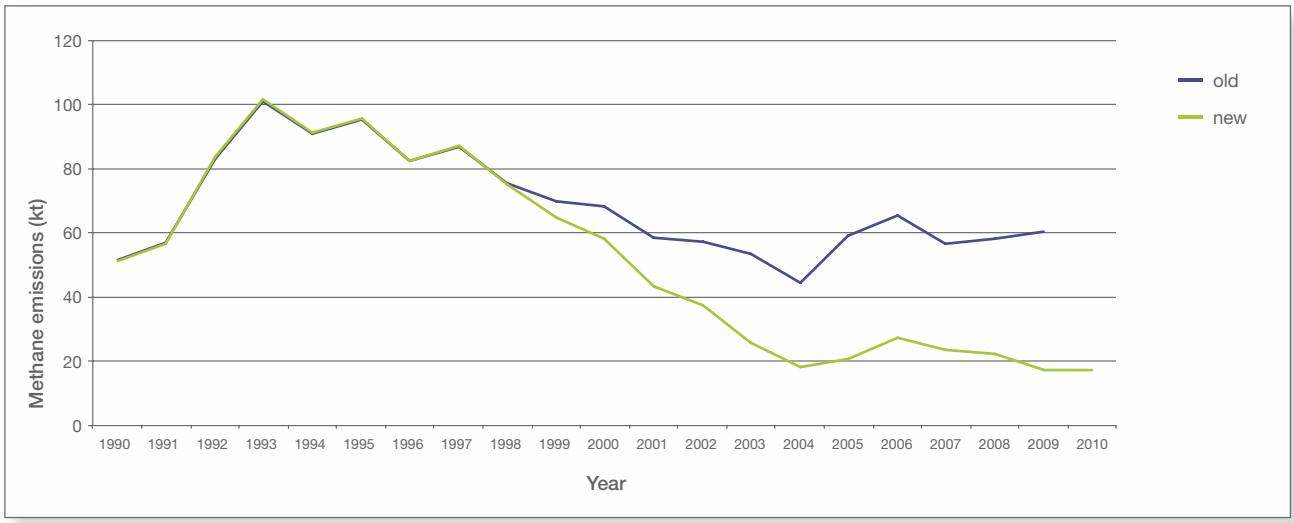


Figure 4.4 shows methane emissions from abandoned coal mines before and after the update. The main change in emissions results from a better understanding of methane recovery. Methane utilisation is forecast to be implemented across 90% of large abandoned mines and this is reflected in the new, lower emission estimates.

4.2.2 Refrigeration and air conditioning

Refrigerators and air conditioning units can contain HFCs, and during the manufacture, lifetime and disposal of the units, emissions of HFCs can occur. Emissions of HFCs from this source are a small fraction of total emissions in 2010 (approximately 1%) but there are good reasons to keep the accuracy of the historical and projected emissions under review. Emissions have grown steadily from 1991 and are predicted to continue to increase until 2013. The GWPs of HFCs are large, and so small increases in HFC emissions have a proportionally greater effect on the national GHG totals in comparison to identical increases in emissions of CO_2.

Estimating emissions from this source is difficult, because of the wide range of types of refrigeration units there are, and the number of industrial and non-industrial sectors across which they are used. As such, there is no single source of statistics available for calculating the emissions, and therefore the emissions data are modelled.

In 2011, DECC funded a project to rebuild the model, to make better use of available data. The project, carried out by ICF, included extensive literature searches and stakeholder consultation to decide on the best parameters to use in the UK's model. Emissions are calculated based on:

+ The amount of HFC refrigerant filled into new units
+ The amount of HFC which leaks during manufacture of new units
+ The amount of HFC which leaks annually
+ The lifetime of the units
+ The amount of HFC which leaks at disposal

Each of these parameters can differ for specific types of unit (e.g. mobile air conditioning in cars, domestic refrigerators, industrial cold stores). The parameters are also not static in time – an older unit is likely to leak more, on an annual basis, than a newer unit. The term "HFCs" relates to a number of species, and refrigerants are usually a mixture, or blend, of various HFCs (and sometimes other substances too). To further complicate the calculations, the mix of refrigerant blends in use in a certain sector may also change in time.

As part of the project, new data were gathered to build a "bottom up" picture of the refrigeration sector in the UK, for example supermarket floor space to estimate the total refrigerant needs for that sector, or the total number of standalone air conditioning chillers in use in the UK. From these data, and an estimate of the typical amount of refrigerant used in each equipment type, it was possible to estimate the total "bank" of refrigerant in each sector, and using growth data it was possible to project and back cast data for new units for all years in the time series. This method replaced the old model, which was based on a "top down" estimate of total refrigerant in use, broken down by equipment type.

Leakage rates and typical equipment lifetimes were estimated through an initial literature search, and refined through consultation with stakeholders. The refrigerant blends used were estimated based on consultation with stakeholders, and sense checked against available sales data for the whole sector. For more information, the full report is available from here: **www.decc.gov.uk/assets/decc/11/cutting-emissions/3844-greenhouse-gas-inventory-improvement-project-deve.pdf**

5. Uncertainties and verification

5.1 Greenhouse Gas Inventory uncertainty analysis

Estimates of greenhouse gas emissions will always have a degree of uncertainty associated with them. Inventory compilers can estimate emissions of CO_2 very accurately, but there is greater uncertainty associated with the emissions of the other five greenhouse gases. This feature is present in most greenhouse gas inventories and is not unique to the UK.

In the UK inventory, the inventory compilers quantify the uncertainties on emission factors and activity data. In turn, this allows uncertainty estimates on the emissions to be produced. To do this, the compilers make use of a wide range of data. This includes uncertainties on the measurements of carbon contents of fuels, the statistical difference in fuel use totals reported in UK energy statistics and expert judgement on uncertainties of total emissions from the output of models. These uncertainties on emission factors, activity data, and total emissions are then used in a model to estimate uncertainty on total greenhouse gas emissions, on each greenhouse gas, and on emissions in each sector.

The UK model has to account for the interactions between the uncertainties for different sources. This is important, and if these interactions were omitted, there would be significant errors in the uncertainty analysis. These interactions can be between different sources in the same year, or between different years for the same source.

For example, estimates of emissions from the burning of coal in different sectors in one year are related, and so this needs to be accounted for in the uncertainty model. The uncertainty associated with the activity data is based on the statistical difference (supply versus demand) in the energy statistics, and this is the uncertainty associated with the total UK coal use. The sector specific uncertainties are therefore related since an overestimate in one sector would imply an underestimate in another sector.

Considering the relationship between emissions estimates in different years for the same source allows a more accurate estimate of the uncertainty in the trend, which is important when tracking progress against targets that are expressed as a percentage change from a certain year. An example of a source where this relationship has to be considered is

for emissions from agricultural soils. The emission factor for this source is highly uncertain, but the uncertainties in 1990 and the latest inventory year are not independent from each other. This means that during the model simulation, high values for the emission factor in 1990 will coincide with high values in the latest year.

Table 5.1 shows the uncertainty on emissions by gas in 1990 and 2010. The uncertainty is expressed as a 95% confidence interval. This would mean that 95% of the values from the model fall within the range plus or minus the uncertainty introduced on the national total.

Table 5.1 Uncertainties in 1990 and 2010

Gas	Uncertainty introduced on national total in 1990	Uncertainty introduced on national total in 2010
CO_2 (net)	2%	2%
CH_4	24%	20%
N_2O	See text below	See text below
HFC	15%	6%
PFC	5%	22%
SF_6	17%	15%
All	15%	16%

Table 5.1 shows that emissions estimates for CO_2 are relatively certain, but that estimates for the other gases are more uncertain. The overall uncertainty introduced on the total emissions is 15% in 1990 and 16% in 2010. The uncertainty is not quoted for N_2O as the range is very large, and the distribution of emissions is highly skewed. In terms of emissions, 95% of the estimates lie within a range of 9 to 108 Mt CO_2 equivalent in 2010.

The change in uncertainty between 1990 and 2010 for each of the gases is mostly a representation of the change in the proportion the uncertain sources account for in the total emission. For example, the most uncertain source of nitrous oxide is agricultural soils. This accounted for 48% of the nitrous oxide total in 1990, but 74% of the total in 2010, which means that the uncertainty in the overall total is higher in 2010 than 1990.

Table 5.2 shows the uncertainty on the trend. This is expressed as the range in which 95% of the values are expected to fall.

Table 5.2 The uncertainty on the trend from 1990 to 2010

Gas	Change in emissions between 1990 and 2010	Range of likely change between 1990 and 2010	
		2.5 percentile	97.5 percentile
CO_2 (net)	-16%	-18%	-14%
CH_4	-57%	-67%	-45%
N_2O	-54%	-76%	-29%
HFC	26%	10%	45%
PFC	-84%	-87%	-81%
SF_6	-32%	-45%	-18%
All	-23%	-26%	-21%

The likely range in the trend is much smaller than the overall uncertainty on the emission total in each year, ranging from -21 to -26%. The uncertainty on the trend between years (as a percentage change) is likely to be less than the uncertainty in a given year because the same methodology has to be used for the base year and the latest year. This means the Greenhouse Gas Inventory is likely to be accurate enough for showing compliance with percentage reduction targets, where it is the trend that is important.

5.2 Verification of the UK Greenhouse Gas Inventory

To provide some verification of the UK Greenhouse Gas Inventory, DECC has established and maintained a high-quality observation station at Mace Head, located on the West coast of Ireland. The station reports measured high-frequency concentrations of the key greenhouse gases. Under contract to DECC, the Met Office provides back trajectories of the air at Mace Head up to 10 days prior to its arrival at the site - air-history maps.

The trajectory data enable the observations made to be sorted into those which represent Northern Hemisphere baseline air masses, and regionally polluted air masses from Europe. The sorted data can then be used to estimate the time-varying Northern Hemisphere mid-latitude baseline concentration. Once the baseline has been removed from the observations, an inversion algorithm is used to estimate the magnitude and spatial distribution of European emissions.

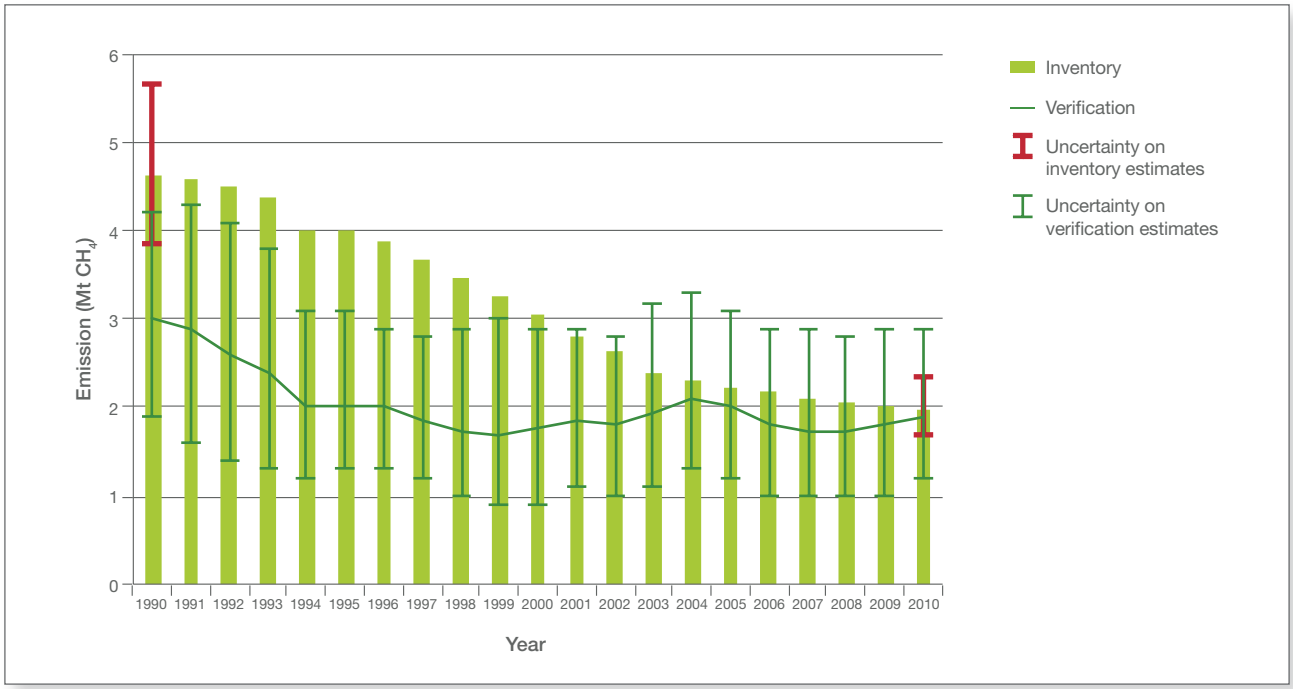
In the work presented here both the Numerical Atmospheric dispersion Modelling Environment (NAME) baseline trends and the UK emission estimates are presented. The 'top-down' NAME-inversion estimates of UK emissions are compared to the 'bottom-up' GHGI estimates.

The graphs for methane and nitrous oxide verification are shown below. These emission estimates made for the UK with the NAME-inversion methodology are compared to the GHGI emission estimates for the period 1990 onwards.

The red and green vertical bars displayed in both figures 5.1 and 5.2 represent the uncertainty in the numbers for the inventory and the verification estimates respectively. In both cases, the uncertainty is expressed as a 95% confidence interval which means that 95% of the values from the uncertainty model and the verification model fall within this range.

Methane has a natural (biogenic) component and it is estimated that 22% of the annual global emission is released from wetlands[3]. Usually natural emissions are strongly dependent on a range of meteorological factors such as temperature and diurnal, annual, growth and decay cycles. Such non-uniform emissions will add to the uncertainties in the modelling, although in North West Europe the natural emissions are thought to be small compared to the anthropogenic emissions(<5%)[4]. Due to the relatively strong local (within 20km) influence of biogenic emissions at Mace Head, a peat bog area, observations taken when local emissions will be significant (low wind speeds and low boundary layer heights) have been removed from the data set prior to applying the inversion technique.

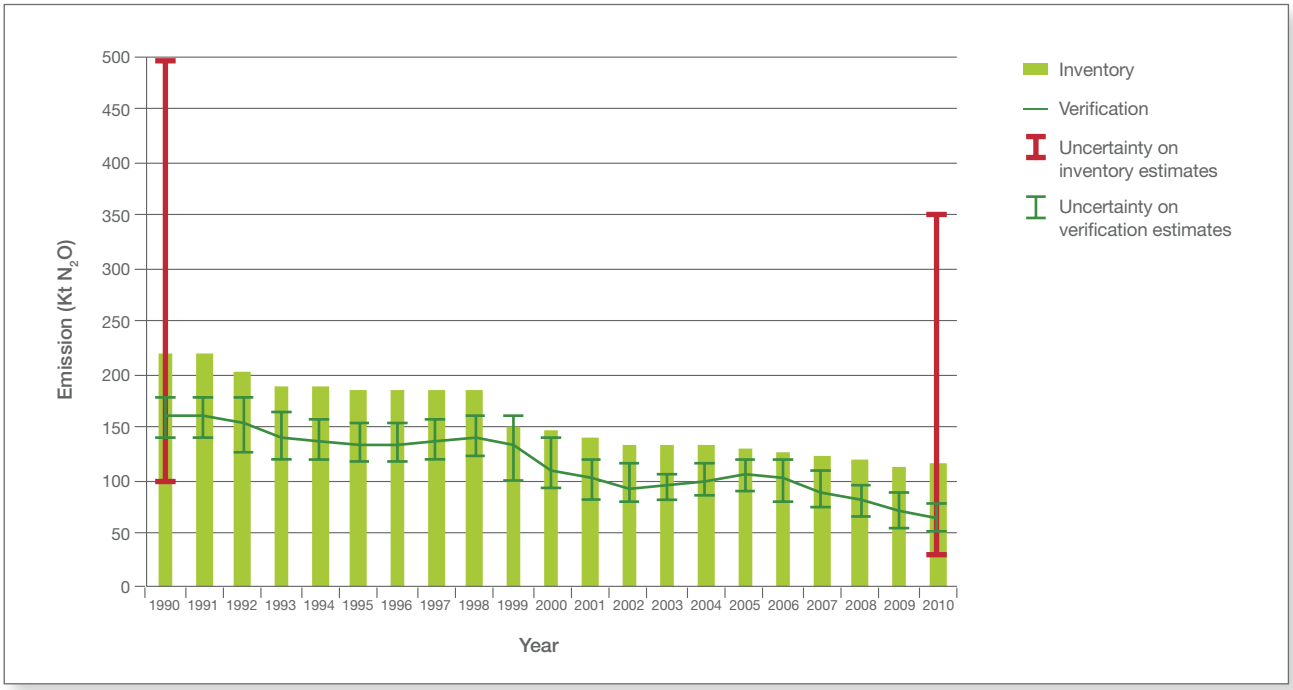
Figure 5.1 Verification of methane emissions



[3] Nilsson, M., C. Mikkela, I. Sundh, G. Granberg, B. H. Svensson, and B. Ranneby, Methane emission from Swedish mires: Natural and regional budgets and dependence on mire vegetation, J. of Geophys. Res., 106, 20847-20860, 2001.

[4] Bergamaschi, P., M. Krol, F. Dentener, A. Vermeulen, F. Meinhardt, R. Graul, M. Ramonet, W. Peters, and E. J. Dlugokencky (2005), Inverse modeling of national and European CH_4 emissions using the atmospheric zoom model TM5, Atmos. Chem. Phys., 5, 2431-2460.

Figure 5.2 Verification of nitrous oxide emissions



The median NAME-inversion estimates are approximately 30-40 kt lower than the GHGI estimates throughout the whole time period. The trends in the time-series are in good agreement. Both show declining UK totals. The GHGI estimates show a sharp decline (40Mt) between 1998 and 1999 in line with the introduction of the clean technology at an adipic acid plant in Wilton, north east England. It is estimated to have cut its emissions of N_2O by 90%, from 46 thousand tonne yr^{-1} to around 6 thousand tonne yr^{-1} (DEFRA, 2000). The NAME-inversion estimates, with a longer averaging period, show a more gradual decline from 1998 to 2003 but the overall reduction is similar.

The nature of the nitrous oxide emissions challenges the NAME technique assumption of uniformity of release both in time and space. Also the point of release to the atmosphere may not coincide with the activity generating the nitrous oxide e.g. the nitrous oxide may be transported from its source, for example by rivers to an ocean, prior to its release to the atmosphere.

Three additional UK-based monitoring stations have now been established as part of DECC's GHG Inventory verification programme, including Angus Tower, in Angus, Scotland, Tacolneston Head in Norfolk and Ridge Hill in Herefordshire. Observations data from these stations will be used to improve the resolution of the verification process.

6. Summary – Fast Facts

+ **Total** emissions of greenhouse gases in the UK in **2010** were **587.8 Mt CO_2 eq**.
+ The UK reports emissions from **nine** main National Communication sectors in its National Statistical release.
+ Emissions are estimated following the methods set out in **IPCC guidelines**.
+ Emissions of greenhouse gases have **decreased 24%** since 1990.
+ United Nations Framework Convention on Climate Change (UNFCCC) treaty was formed in the early 1990's, and the **Kyoto Protocol** (an addition to this treaty), which **sets legally binding targets** for emission reductions entered into force in 2005.
+ **UK is** required to **reduce** total **greenhouse gas emissions by 12.5%** on base year levels over the five-year period 2008-2012 under the Kyoto protocol and the EU burden sharing agreement.
+ UK has set legally binding **domestic targets** to reduce greenhouse gas emissions. This target is a requirement to **reduce** total greenhouse gas emissions by **34%** on base year levels by 2020.
+ **Carbon dioxide** emissions account for **84%** of total greenhouse gas emissions in 2010, with main sources including power stations, road transport, residential and industrial combustion.
+ **Methane** emissions account for about **7%** of total greenhouse gases emissions in 2010, with the main sources of emissions being landfill sites, agriculture and leakage from the gas distribution network.
+ **Nitrous oxide** emissions account for about **6%** of total greenhouse gas emissions in 2010, with the main source of emissions being agricultural soils.
+ **F-gases** (HFC, PFCs, and SF_6) accounted for **2.6%** of total greenhouse gas emissions in 2010. Sources include commercial and industrial refrigeration, mobile air conditioning, metered dose inhalers and aerosols.
+ Emissions from the **energy supply sector** accounted for **35%** of direct greenhouse gas emissions in the U.K. in 2010.
+ Emissions from the **energy supply** sector have **decreased** by **25% since 1990**.

+ Emissions from **power stations** have **decreased by 23% since 1990**. This reduction in emissions is mainly due to fuel switching from coal to gas and also a reduction in the energy intensity of the economy.
+ **Electricity supply** in the U.K **has increased** between1990-2010, but **emissions have decreased**, due to less carbon intensive fuels being used.
+ The overall **uncertainty** on the emissions in 2010 is **16%**. The range of the expected decrease in emissions from 1990 to 2010 is between **-21 and -26%**, which indicates that the **trend is relatively certain**.
+ The UK Greenhouse Gas Inventory is verified using **atmospheric observations** and a modelling approach. This shows a good agreement for nitrous oxide, but a higher uncertainty for methane.

7. Sources of further information

DECC – Homepage for the Department of Energy and Climate Change. Contains information about what the UK Government is doing about climate change.

http://www.decc.gov.uk/

The Committee on Climate Change – the Committee is an independent advisor to the UK Government, set up under the Climate Change Act. It provides advice about setting carbon budgets, and reports progress to parliament.

http://www.theccc.org.uk/

The UNFCCC – provides further information about the Kyoto Protocol and climate change, and official reports from all Parties to the UNFCCC.

http://unfccc.int/

UK Greenhouse Gas Inventory National System – this is the homepage for the UK Greenhouse Gas Inventory and contains the latest submissions and information about the Inventory.

http://www.ghgi.org.uk/

The National Atmospheric Emissions Inventory (NAEI) – the NAEI is the UK's air quality pollutant emissions inventory. There is considerable overlap between the air quality and greenhouse gas inventories, and the two projects are carried out together.

http://www.naei.org.uk

The UK Greenhouse Gas Report 1990-2008: Annual report for submission under the Framework Convention on Climate Change.

http://www.naei.org.uk/reports.php?list=GHG

The National Statistics release on UK greenhouse gas emissions.

http://www.decc.gov.uk/en/content/cms/statistics/climate_stats/climate_stats.aspx

UK Climate Impacts Programme (UKCIP) – UKCIP has been set up to help organisations adapt to climate change. The website contains useful background information about climate change.

http://www.ukcip.org.uk/

The Intergovernmental Panel on Climate Change (IPCC) – the IPCC assesses all of the relevant information on climate change to provide the world with a clear view on what is happening now, and what the potential impacts of climate change could be in the future. The IPCC periodically publishes reports on the most recent science, and also publishes guidance for the compilation of emissions inventories.

http://www.ipcc.ch/

Act on CO_2 – the Government's campaign to help individuals reduce their carbon footprint.

www.direct.gov.uk/actonco2

Glossary

Activity

Activity data are part of the information required for calculating an emission from a certain source. Activity data in the inventory vary, depending upon source, but two examples are quantities of fuel consumed and animal numbers.

Assigned Amount

The quantity of greenhouse gases that a country is allowed to emit during a commitment period (the first period is 2008-2012)).

Carbon budget

A carbon budget is a way of setting targets for future emissions reductions. It sets a limit on how much CO_2 can be emitted over a fixed period (typically 5 years).

Carbon dioxide (CO_2)

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

Climate change

Climate change is a long-term change in the earth's climate. This occurs naturally, but is currently believed to be accelerated by human activity.

Emission factor

An emission factor is the amount of greenhouse emitted per unit of activity. Emission factors are used in conjunction with activity statistics to estimate emissions of greenhouse gases.

F-gases

Short for fluorinated gases (HFCs, PFCs and SF_6). Typically used as replacements for ozone-depleting substances. They have very high GWPs.

Geographical coverage

The geographical coverage defines the parts of the UK that are included in the emissions estimates.

Greenhouse gas

A greenhouse gas is a gas which absorbs solar radiation and re-emits it in the thermal infrared range.

Global warming potential (GWP)

Global warming potential is a means of providing a simple measure of the relative radiative effects of the emissions of the various gases. The index is defined as the cumulative radiative forcing between the present and a future time horizon caused by a unit mass of gas emitted now, expressed relative to that of CO_2.

IPCC

The Intergovernmental Panel on Climate Change (IPCC) was established to provide scientific information on climate change. It is the body responsible for producing the official guidelines for reporting greenhouse gas emissions inventories which can then be adopted by the UNFCCC.

Kyoto Protocol

This is an international agreement which sets out legally binding emission limits or reduction targets for countries who are signed up to it.

Methane

Methane is a greenhouse gas which is approximately 21 times more potent in the atmosphere than CO_2. Main sources of methane include agriculture and landfill.

Nitrous oxide

Nitrous oxide is a greenhouse gas which is approximately 310 times more potent in the atmosphere than CO_2. The main source of nitrous oxide in the UK is agricultural soils

Percentile

A percentile is the value of a variable below which a certain percent of observations fall.

UNFCCC

The United Nations Framework Convention on Climate Change is a treaty which was set up to tackle climate change. Countries who are part of the convention are obliged to report their greenhouse gas emission estimates to the UNFCCC on a regular basis.

For more information on AEA please contact:

Joanna MacCarthy
AEA

The Gemini Building
Harwell
Didcot
Oxfordshire
OX11 0QR

t: +44 (0)870 190 3857
e: joanna.maccarthy@aeat.co.uk
w: www.aeat.com

AEA
Delivering visionary, integrated environmental solutions worldwide