



# Annex: 1990 - 2014 UK Greenhouse Gas Emissions, final figures by end-user sector and uncertainties estimates

Statistical release

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Any enquiries regarding this publication should be sent to us at:  
[ClimateChange.Statistics@decc.gsi.gov.uk](mailto:ClimateChange.Statistics@decc.gsi.gov.uk).

The responsible statistician for this publication is Georgina Eaton.

Contact telephone: 0300 068 5455.

This document is also available from our website at:

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# Contents

|   |    |
|---|----|
| Executive summary .....   | 4  |
| Introduction.....   | 5  |
| 1990-2014 UK greenhouse gas emissions final figures by end-user sector..... | 7  |
| Transport .....   | 10 |
| Business .....  | 11 |
| Residential .....   | 12 |
| Agriculture.....  | 14 |
| Industrial process.....   | 15 |
| Public sector .....   | 16 |
| Waste management and Land Use, Land Use Change and Forestry (LULUCF) .....  | 17 |
| Exports.....  | 17 |
| Revisions to the estimates of end-user emissions .....                      | 19 |
| Embedded Emissions .....  | 19 |
| Uncertainties around the 2014 estimates .....                               | 20 |
| Background Information .....  | 23 |
| Coverage of emissions reporting .....                                       | 23 |
| Further information and feedback .....                                      | 23 |
| Notes .....   | 24 |

# Executive summary

- In 2014 31 percent of greenhouse gas end user emissions were from the business sector, 26 percent from transport, 23 percent from the residential sector and 10 percent from agriculture. The remainder were attributable to the industrial processes, public, waste management, land use, land use change and forestry (LULUCF) and exports sectors.
- Uncertainty in UK greenhouse gas emissions estimates is around 3 percent, based on uncertainty analysis of 2014 emissions which were published in February 2016.
- The uncertainty of UK greenhouse gas emissions estimates varies considerably by gas and sector. Carbon dioxide estimates have the least uncertainty associated with them while nitrogen trifluoride and nitrous oxide estimates are the most uncertain. At sector level, LULUCF emissions estimates are the most uncertain, followed by waste management and agriculture.

# Introduction

This Annex contains final estimates of 1990 to 2014 UK greenhouse gas emissions by end-user sector, as well as uncertainty estimates for 2014 emissions by source sector and gas. These are a follow up to, and are consistent with, the final estimates of 1990 to 2014 emissions by source sector which were published on 2<sup>nd</sup> February 2016.

There have been changes to the way we publish these statistics this year. Previously this annex detailing final end-user greenhouse gas emissions estimates and uncertainty estimates was part of the [Provisional UK Greenhouse Gas Emissions Statistics](#), however these statistics are now being published as an annex to the [Final UK Greenhouse Gas Emissions Statistics](#).

Emissions by end user and by fuel type have now been incorporated into updated spreadsheet data tables alongside the final estimates by source sector for [Final UK Greenhouse Gas Emissions Statistics](#). Also published in this spreadsheet is uncertainties analysis for 2014 emissions by gas and sector. Note that this Annex does not discuss 2014 emissions by fuel type, but these are included in the updated spreadsheet data tables published alongside this document.

The geographic coverage of emissions by end user and by fuel type in this report has changed from the UK and Crown Dependencies (Jersey, Guernsey, and the Isle of Man) to UK only from this year. This change has been made to better align with the needs of users of the statistics, and with the geographical coverage of the UK's domestic carbon budget targets.

For the purposes of reporting, greenhouse gas emissions are allocated into sectors as follows:

- Energy supply
- Business
- Transport
- Public
- Residential
- Agriculture
- Industrial processes
- Land use, land use change, and forestry (LULUCF)
- Waste management

When emissions are reported by source, emissions are attributed to the sector that emits them directly. The end-user breakdown reallocates emissions by source in to where the “end-use” occurred. The main impact is to reallocate emissions from the energy supply sector to other sectors that use the energy. Some emissions are also allocated to an “exports” category in the end-user breakdown, this is for emissions within the UK from producing fuels (for example from a refinery or coal mine), which are subsequently exported or sent to bunkers for use outside the UK. This makes it possible to see the full emissions impact of a particular end-use sector or sub-sector, and also enables the emissions to be further geographically disaggregated. Devolved administration and local authority emissions estimates, based on the end-user breakdown, will be published in June 2016.

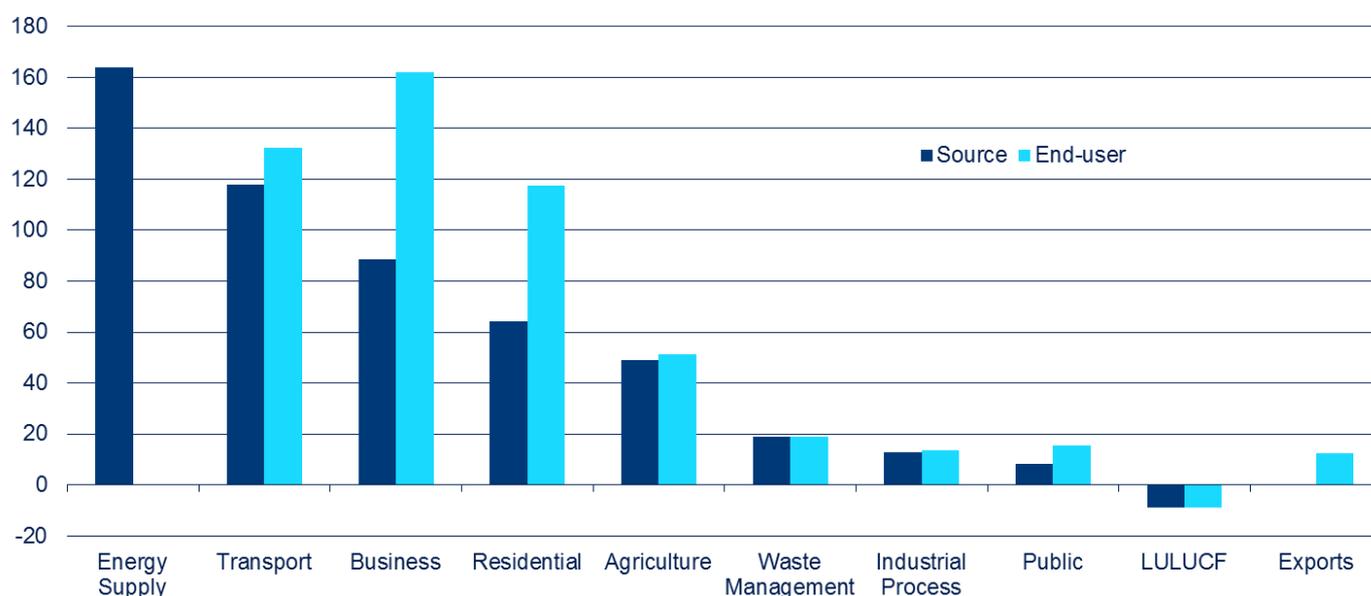
The uncertainty estimates are used to prioritise further research into improving emissions estimates, and more generally give users an indication of the robustness of the emissions estimates for different sectors. The geographic coverage of the uncertainty estimates includes the UK, Crown Dependencies and Overseas Territories.

# 1990-2014 UK greenhouse gas emissions final figures by end-user sector

These results are based on and consistent with, the breakdown by gas and sector of 2014 emissions by source which was published on 2<sup>nd</sup> February 2016. Total 2014 greenhouse gas emissions for the UK were 514.4 million tonnes carbon dioxide equivalent (MtCO<sub>2</sub>e).

The end-user breakdown reallocates emissions by source to where the “end-use” occurred. The main impact is to reallocate emissions from the energy supply sector to other sectors, the business and residential sectors in particular. Amongst other things, this therefore reallocates emissions occurring at power stations in generating electricity to where the electricity is actually consumed. It should be noted that the results shown by this breakdown are based on a number of assumptions, and we would therefore expect them to be subject to greater uncertainty than the breakdown of emissions by source.

**Figure 1: Allocation of 2014 greenhouse gas emissions from source sectors to end-user sectors, UK (MtCO<sub>2</sub>e)**

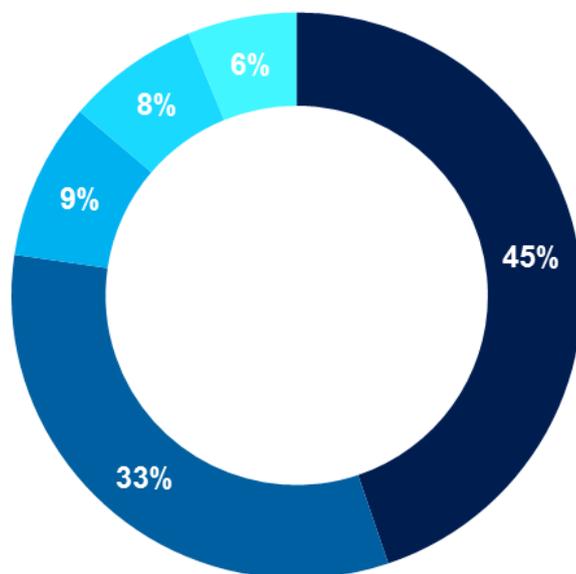


Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

Looking at the end-user sector breakdown, in 2014 31 percent of greenhouse gas emissions were from the business sector, 26 percent from transport, 23 percent from the residential sector and 10 percent from agriculture. The remainder were attributable to the industrial processes, public, waste management, land use, land use change and forestry (LULUCF) and exports sectors. No emissions are reallocated to the waste management or LULUCF sectors.

The majority of emissions from energy supply are reallocated to two sectors, with business accounting for nearly half and residential accounting for around a third of reallocated emissions.

**Figure 2: Breakdown of greenhouse gas emissions reallocated from the energy sector to end-user sectors, UK, 2014**



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■ Business ■ Residential ■ Transport ■ Exports ■ Other

Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

Data tables showing the full end-user breakdown by sector, from 1990 to 2014, can be found on the [Final UK Greenhouse Gas Emissions Statistics](#) page of the Gov.uk website. These tables were originally published on 2<sup>nd</sup> February 2016 showing emissions by source only, but were updated with end-user and fuel type breakdowns on 31<sup>st</sup> March 2016.

**Table 1: UK greenhouse gas emissions by gas and end-user sector**  
UK, 2014

|                    | <b>MtCO<sub>2</sub>e</b> |             |               |                   |              |
|--------------------|--------------------------|-------------|---------------|-------------------|--------------|
|                    | Carbon dioxide           | Methane     | Nitrous oxide | Fluorinated gases | Total        |
| Transport          | 130.6                    | 0.7         | 1.2           | 0.0               | 132.5        |
| Business           | 142.6                    | 2.9         | 1.9           | 14.6              | 161.9        |
| Residential        | 111.3                    | 3.5         | 0.5           | 2.2               | 117.4        |
| Industrial Process | 12.8                     | 0.3         | 0.3           | 0.3               | 13.7         |
| Public             | 15.1                     | 0.4         | 0.0           | 0.0               | 15.5         |
| Agriculture        | 7.4                      | 27.5        | 16.3          | 0.0               | 51.1         |
| Waste Management   | 0.3                      | 17.6        | 0.9           | 0.0               | 18.8         |
| LULUCF             | -9.7                     | 0.0         | 0.7           | 0.0               | -9.0         |
| Exports            | 11.7                     | 0.5         | 0.1           | 0.0               | 12.4         |
| <b>Total</b>       | <b>422.0</b>             | <b>53.5</b> | <b>21.9</b>   | <b>17.0</b>       | <b>514.4</b> |

Source: Tables 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

**Table 2: Greenhouse gas emissions by end-user sector**  
UK, 1990-2014

|                    | <b>MtCO<sub>2</sub>e</b> |              |              |              |              |              |              |
|--------------------|--------------------------|--------------|--------------|--------------|--------------|--------------|--------------|
|                    | 1990                     | 1995         | 2000         | 2005         | 2010         | 2013         | 2014         |
| Transport          | 139.9                    | 143.3        | 146.8        | 150.3        | 137.3        | 131.5        | 132.5        |
| Business           | 249.5                    | 219.7        | 218.1        | 212.5        | 186.8        | 177.4        | 161.9        |
| Residential        | 171.5                    | 157.4        | 158.1        | 162.4        | 155.8        | 139.6        | 117.4        |
| Industrial Process | 63.1                     | 53.5         | 29.3         | 21.3         | 13.5         | 13.6         | 13.7         |
| Public             | 31.5                     | 29.0         | 24.3         | 22.4         | 19.3         | 18.2         | 15.5         |
| Agriculture        | 62.6                     | 61.3         | 57.3         | 53.7         | 50.9         | 50.5         | 51.1         |
| Waste Management   | 68.8                     | 71.0         | 66.5         | 52.1         | 29.9         | 21.1         | 18.8         |
| LULUCF             | 0.3                      | -0.1         | -2.9         | -5.5         | -7.8         | -8.6         | -9.0         |
| Export             | 9.4                      | 13.4         | 13.1         | 17.1         | 16.3         | 14.1         | 12.4         |
| <b>Total</b>       | <b>796.6</b>             | <b>748.5</b> | <b>710.6</b> | <b>686.3</b> | <b>602.1</b> | <b>557.3</b> | <b>514.4</b> |

Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

Details of changes over time for each sector are set out in the following sections of this statistical release. The commentary in these sections focuses on the differences between end user and by source breakdowns. Further information on trends of emissions by source sector can be found in the statistics release of the [Final UK Greenhouse Gas Emissions Statistics](#) published on 2<sup>nd</sup> February 2016.

## Transport

The transport sector was responsible for around 26 percent of UK greenhouse gas end-user emissions in 2014, almost entirely through carbon dioxide emissions. Emissions of carbon dioxide are closely related to the amount of fuel used, whilst nitrous oxide and methane emissions are influenced more by the vehicle type and age.

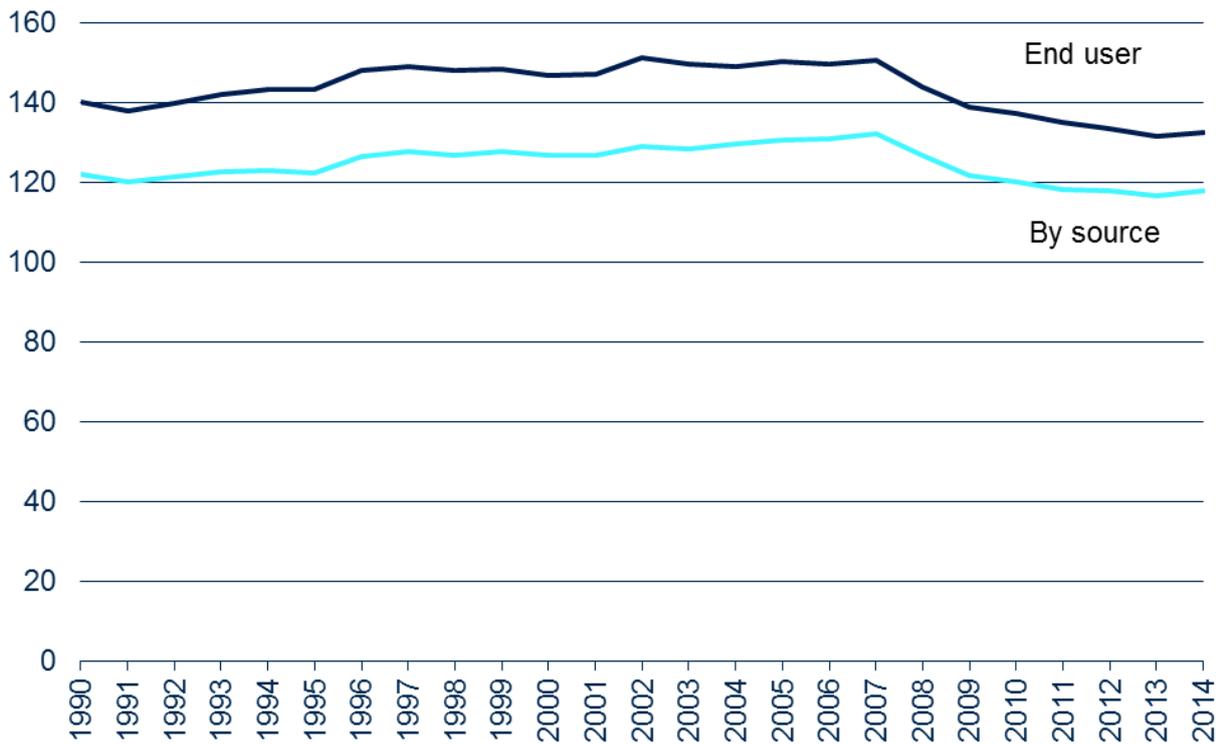
End user emissions from the transport sector are around 15 to 22 MtCO<sub>2</sub>e higher than by source emissions across the time series, but follow a very similar trend.

**Table 3: Transport sector end-user emissions by gas**  
UK, 1990-2014

|                | <b>MtCO<sub>2</sub>e</b> |              |              |              |              |              |              |
|----------------|--------------------------|--------------|--------------|--------------|--------------|--------------|--------------|
|                | 1990                     | 1995         | 2000         | 2005         | 2010         | 2013         | 2014         |
| Carbon dioxide | 135.9                    | 139.1        | 143.5        | 147.9        | 135.5        | 129.7        | 130.6        |
| Methane        | 2.5                      | 2.1          | 1.4          | 1.0          | 0.7          | 0.7          | 0.7          |
| Nitrous oxide  | 1.6                      | 2.1          | 1.8          | 1.4          | 1.1          | 1.2          | 1.2          |
| F gases        | 0.0                      | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| <b>Total</b>   | <b>139.9</b>             | <b>143.3</b> | <b>146.8</b> | <b>150.3</b> | <b>137.3</b> | <b>131.5</b> | <b>132.5</b> |

Source: Tables 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

**Figure 3: Greenhouse gas end-user emissions from transport, UK, 1990-2014 (MtCO<sub>2</sub>e)**



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

## Business

The business sector was responsible for 31 percent of UK greenhouse gas end-user emissions in 2014, with carbon dioxide being the most prominent gas. Emissions from this sector primarily relate to fossil fuel combustion in industry and commerce, although emissions of F gases from the use of fluorinated compounds in certain applications, particularly refrigeration and air-conditioning, are significant. The business sector is responsible for the majority of emissions from F gases.

Between 1990 and 2014, there was a general downward trend in greenhouse gas end-user emissions from the business sector, resulting in an overall decrease of 35 percent. Between 2013 and 2014 emissions decreased by 15.5 MtCO<sub>2</sub>e (9 percent). This is larger than the decrease of 2.3 MtCO<sub>2</sub>e (3 percent) seen in emissions by source from this sector between 2013 and 2014, and is due to a reduction in emissions from electricity generation reallocated to this sector from the energy supply sector for the end user breakdown.

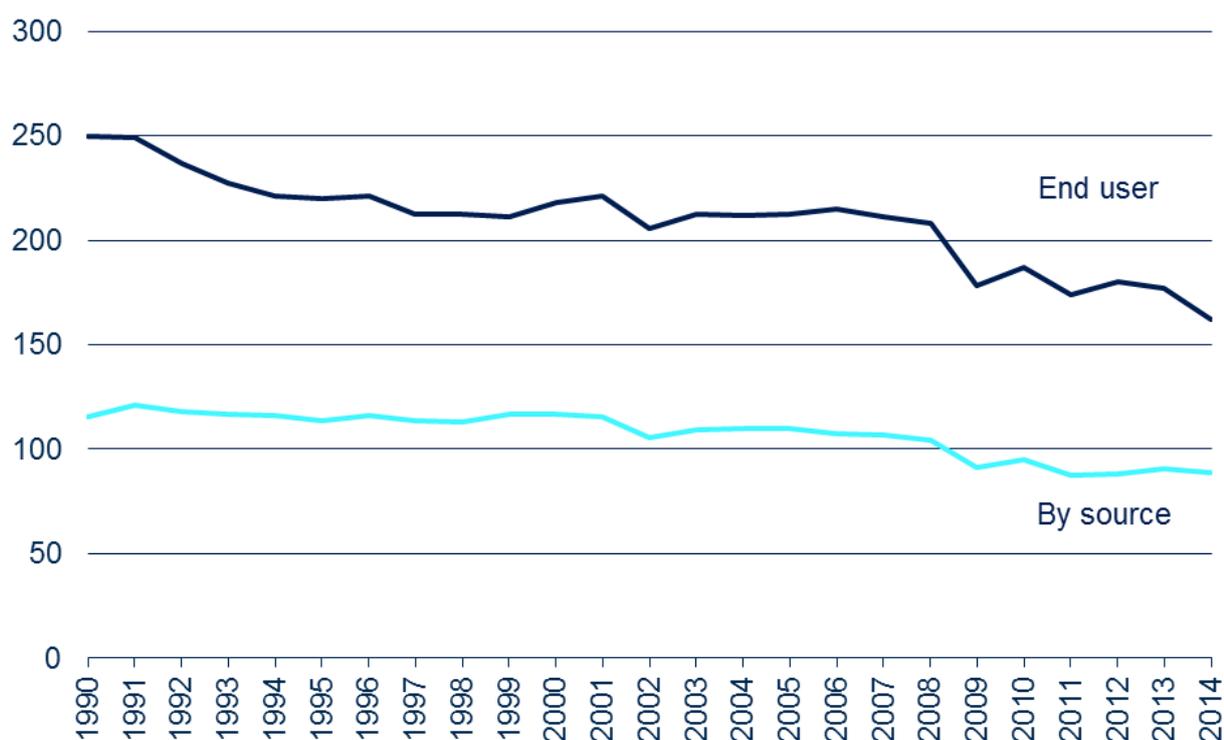
The overall downward trend for end-user emissions since 1990 is similar to the trend for by source emissions, though end-user emissions are much higher due to the inclusion of emissions from electricity generation.

**Table 4: Business sector end-user emissions by gas**  
UK, 1990-2014

|                | <b>MtCO<sub>2</sub>e</b> |              |              |              |              |              |              |
|----------------|--------------------------|--------------|--------------|--------------|--------------|--------------|--------------|
|                | 1990                     | 1995         | 2000         | 2005         | 2010         | 2013         | 2014         |
| Carbon dioxide | 230.7                    | 204.1        | 203.0        | 194.6        | 166.5        | 158.3        | 142.6        |
| Methane        | 15.6                     | 11.7         | 7.4          | 4.7          | 3.6          | 2.9          | 2.9          |
| Nitrous oxide  | 2.3                      | 2.1          | 2.0          | 2.1          | 1.8          | 1.9          | 1.9          |
| F gases        | 1.0                      | 1.8          | 5.7          | 11.1         | 15.0         | 14.4         | 14.6         |
| <b>Total</b>   | <b>249.5</b>             | <b>219.7</b> | <b>218.1</b> | <b>212.5</b> | <b>186.8</b> | <b>177.4</b> | <b>161.9</b> |

Source: Table 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

**Figure 4: Greenhouse gas end-user emissions from business, UK, 1990-2014 (MtCO<sub>2</sub>e)**



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

## Residential

The residential sector was responsible for around 23 percent of UK greenhouse gas end-user emissions in 2014, with carbon dioxide being the most prominent gas for this sector. It should be noted that, unlike emissions by source which only cover activities related to residential fossil fuel use, emissions reported by end-user also include emissions from residential electricity use which have been re-allocated from the energy supply sector.

Between 1990 and 2014, there has been considerable variation in greenhouse gas end-user emissions from year to year in the residential sector. Both the end-user and by source emissions from this sector are heavily influenced by external temperatures. End-user emissions have seen a bigger overall decrease since 1990 than by source emissions, due to a decrease in emissions from electricity consumption which are included in the residential end-user sector but are in the energy supply sector for the by source emissions.

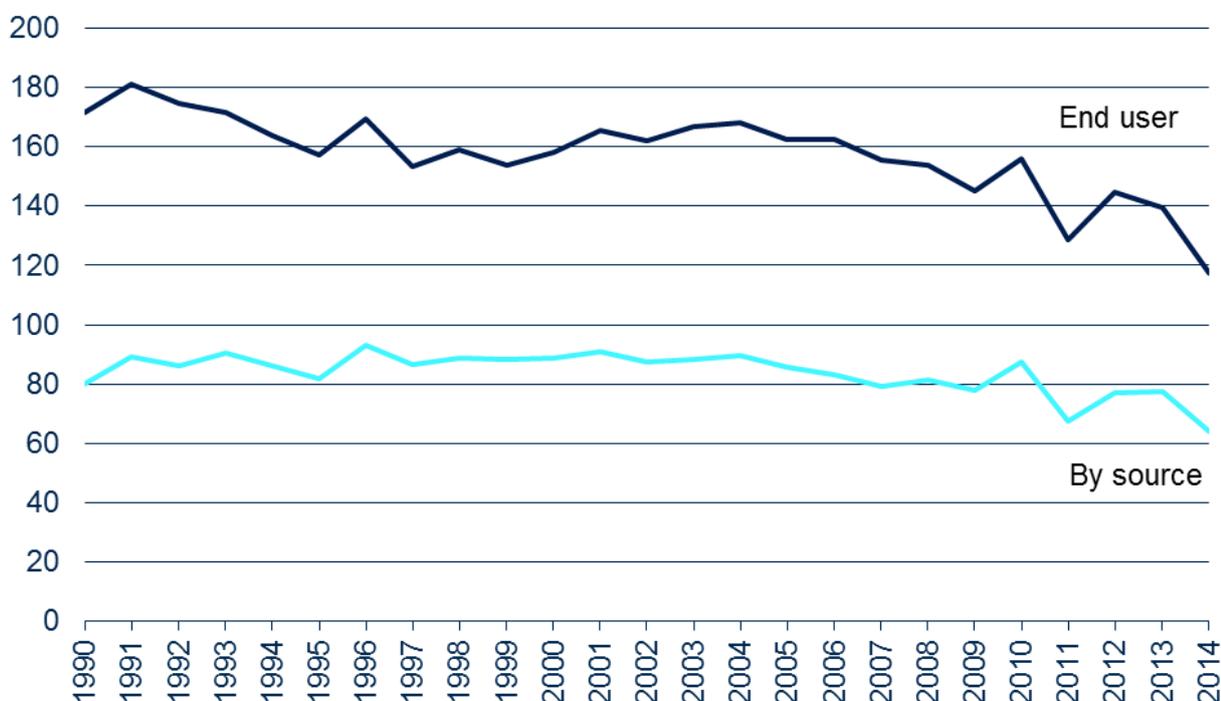
Between 2013 and 2014, end user emissions in the residential sector decreased by 22.2 MtCO<sub>2</sub>e (16 percent), a similar trend to the 17 percent decrease in by source emissions.

**Table 5: Residential sector end-user emissions by gas**  
UK, 1990-2014

|                | 1990         | 1995         | 2000         | 2005         | 2010         | 2013         | 2014         |
|----------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Carbon dioxide | 156.5        | 145.5        | 149.0        | 154.5        | 148.8        | 133.0        | 111.3        |
| Methane        | 14.2         | 10.7         | 6.6          | 4.9          | 4.4          | 3.9          | 3.5          |
| Nitrous oxide  | 0.7          | 0.6          | 0.5          | 0.5          | 0.5          | 0.5          | 0.5          |
| F gases        | 0.0          | 0.7          | 2.0          | 2.4          | 2.1          | 2.1          | 2.2          |
| <b>Total</b>   | <b>171.5</b> | <b>157.4</b> | <b>158.1</b> | <b>162.4</b> | <b>155.8</b> | <b>139.6</b> | <b>117.4</b> |

Source: Tables 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

**Figure 5: Greenhouse gas end-user emissions from the residential sector, UK, 1990-2014 (MtCO<sub>2</sub>e)**



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

## Agriculture

The agriculture sector was responsible for 10 percent of UK greenhouse gas end-user emissions in 2014. Emissions of methane (54 percent) and nitrous oxide (32 percent) dominate this sector. End-user and by source emissions are very similar for this sector, with the most significant sources being emissions of methane due to enteric fermentation from livestock, particularly cattle, and nitrous oxide emissions related to the use of fertilisers on agricultural soils.

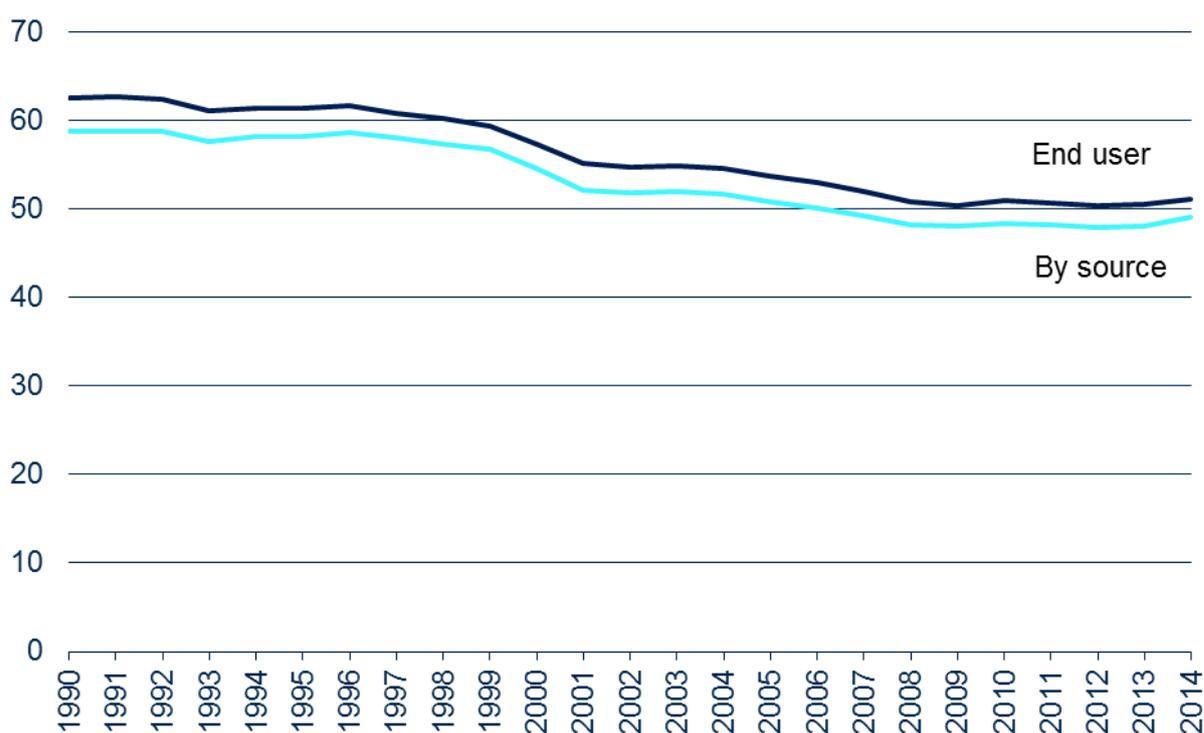
End user emissions follow a similar trend to by source emissions. Emissions have decreased by 18 percent since 1990 due to a fall in animal numbers over the period, together with a decrease in synthetic fertiliser use. Between 2013 and 2014 there was very little change in emissions from the agriculture sector.

**Table 6: Agriculture sector end-user emissions by gas**  
UK, 1990-2014

|                | <b>MtCO<sub>2</sub>e</b> |             |             |             |             |             |             |
|----------------|--------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                | 1990                     | 1995        | 2000        | 2005        | 2010        | 2013        | 2014        |
| Carbon dioxide | 10.5                     | 10.1        | 8.3         | 8.3         | 7.7         | 7.6         | 7.4         |
| Methane        | 32.9                     | 32.2        | 31.0        | 28.8        | 27.3        | 27.1        | 27.5        |
| Nitrous oxide  | 19.2                     | 19.0        | 18.0        | 16.6        | 15.9        | 15.8        | 16.3        |
| F gases        | 0.0                      | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         |
| <b>Total</b>   | <b>62.6</b>              | <b>61.3</b> | <b>57.3</b> | <b>53.7</b> | <b>50.9</b> | <b>50.5</b> | <b>51.1</b> |

Source: Tables 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

**Figure 6: Greenhouse gas end-user emissions from agriculture, UK, 1990-2014 (MtCO<sub>2</sub>e)**



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

## Industrial process

The industrial process sector was responsible for 3 percent of UK greenhouse gas end-user emissions in 2014. The main source of emissions is cement production, with other processes such as sinter, lime, iron and steel production also contributing significantly.

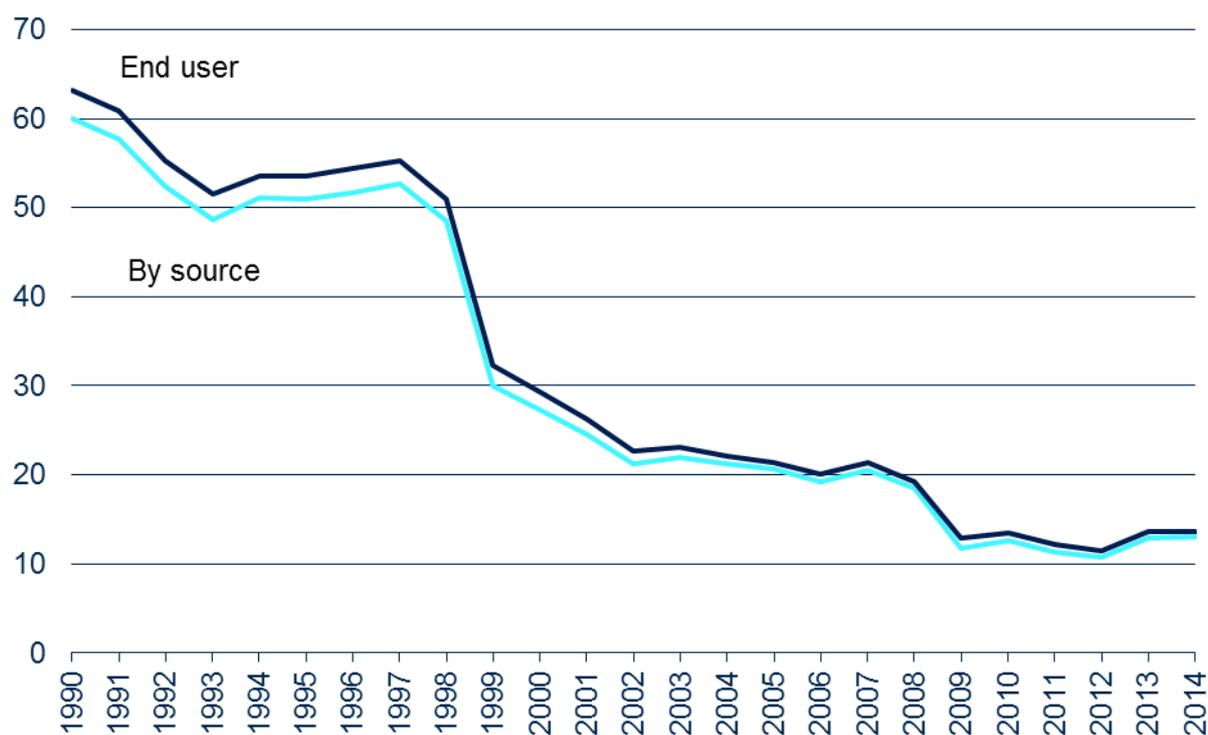
The end-user emissions from this sector are only slightly higher than by source emissions, and follow a very similar trend, with a decrease of around 80 percent since 1990.

**Table 7: Industrial process sector end-user emissions by gas**  
UK, 1990-2014

|                | MtCO <sub>2</sub> e |             |             |             |             |             |             |
|----------------|---------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                | 1990                | 1995        | 2000        | 2005        | 2010        | 2013        | 2014        |
| Carbon dioxide | 20.9                | 19.0        | 18.2        | 16.8        | 11.2        | 12.7        | 12.8        |
| Methane        | 2.0                 | 1.7         | 1.1         | 0.5         | 0.4         | 0.3         | 0.3         |
| Nitrous oxide  | 23.9                | 14.4        | 5.4         | 3.1         | 1.5         | 0.3         | 0.3         |
| F gases        | 16.3                | 18.5        | 4.6         | 1.0         | 0.5         | 0.3         | 0.3         |
| <b>Total</b>   | <b>63.1</b>         | <b>53.5</b> | <b>29.3</b> | <b>21.3</b> | <b>13.5</b> | <b>13.6</b> | <b>13.7</b> |

Source: Tables 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

**Figure 7: Greenhouse gas end-user emissions from industrial processes, UK, 1990-2014 (MtCO<sub>2</sub>e)**



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

## Public sector

The public sector was responsible for 3 percent of UK greenhouse gas end-user emissions in 2014, with carbon dioxide making up almost all of these emissions.

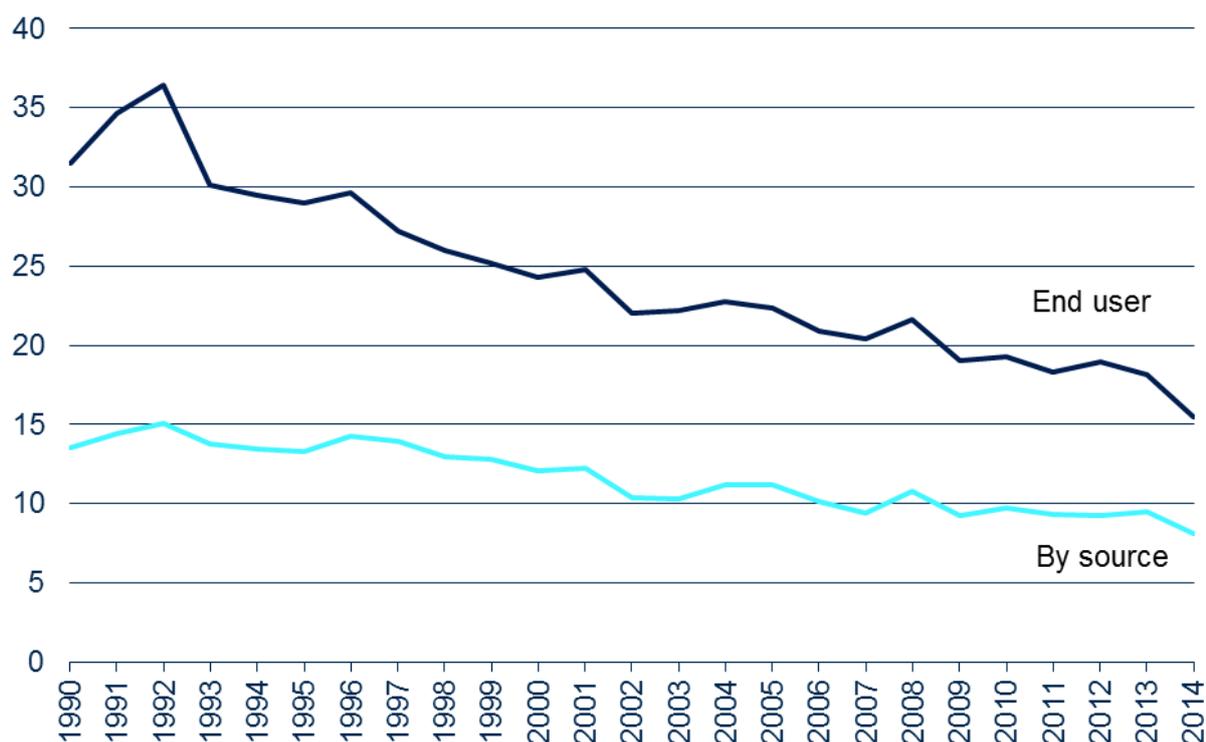
End user emissions from the public sector are roughly double by source emissions, due to the inclusion of emissions from electricity generation in the end user breakdown. Since 1990 end user emissions have shown a more pronounced decrease than by source emissions, driven by a reduction in emissions from electricity generation.

**Table 8: Public sector end-user emissions by gas**  
UK, 1990-2014

|                | MtCO <sub>2</sub> e |             |             |             |             |             |             |
|----------------|---------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                | 1990                | 1995        | 2000        | 2005        | 2010        | 2013        | 2014        |
| Carbon dioxide | 29.3                | 27.2        | 23.3        | 21.7        | 18.8        | 17.7        | 15.1        |
| Methane        | 2.1                 | 1.7         | 0.9         | 0.6         | 0.5         | 0.4         | 0.4         |
| Nitrous oxide  | 0.1                 | 0.1         | 0.1         | 0.1         | 0.0         | 0.1         | 0.0         |
| F gases        | 0.0                 | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         |
| <b>Total</b>   | <b>31.5</b>         | <b>29.0</b> | <b>24.3</b> | <b>22.4</b> | <b>19.3</b> | <b>18.2</b> | <b>15.5</b> |

Source: Table 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

**Figure 8: Greenhouse gas end-user emissions from the public sector, UK, 1990-2014 (MtCO<sub>2</sub>e)**



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

## Waste management and Land Use, Land Use Change and Forestry (LULUCF)

For the waste management and LULUCF sectors, emissions measured by end-user are the same as those measured by source, since no emissions from the energy supply sector are reallocated to these sectors.

## Exports

The exports sector represents emissions associated with the production of fuels within the UK (for example, from a refinery or a coal mine) which are subsequently exported or sent to bunkers for use outside the UK. Since these fuels are ultimately used for activities which occur outside the UK, it would not be appropriate to allocate the emissions from their production to any of the other end user sectors, so they are reported under a separate, additional sector.

The exports sector was responsible for around 2 percent of UK greenhouse gas end user emissions in 2014, with carbon dioxide representing the majority of these emissions.

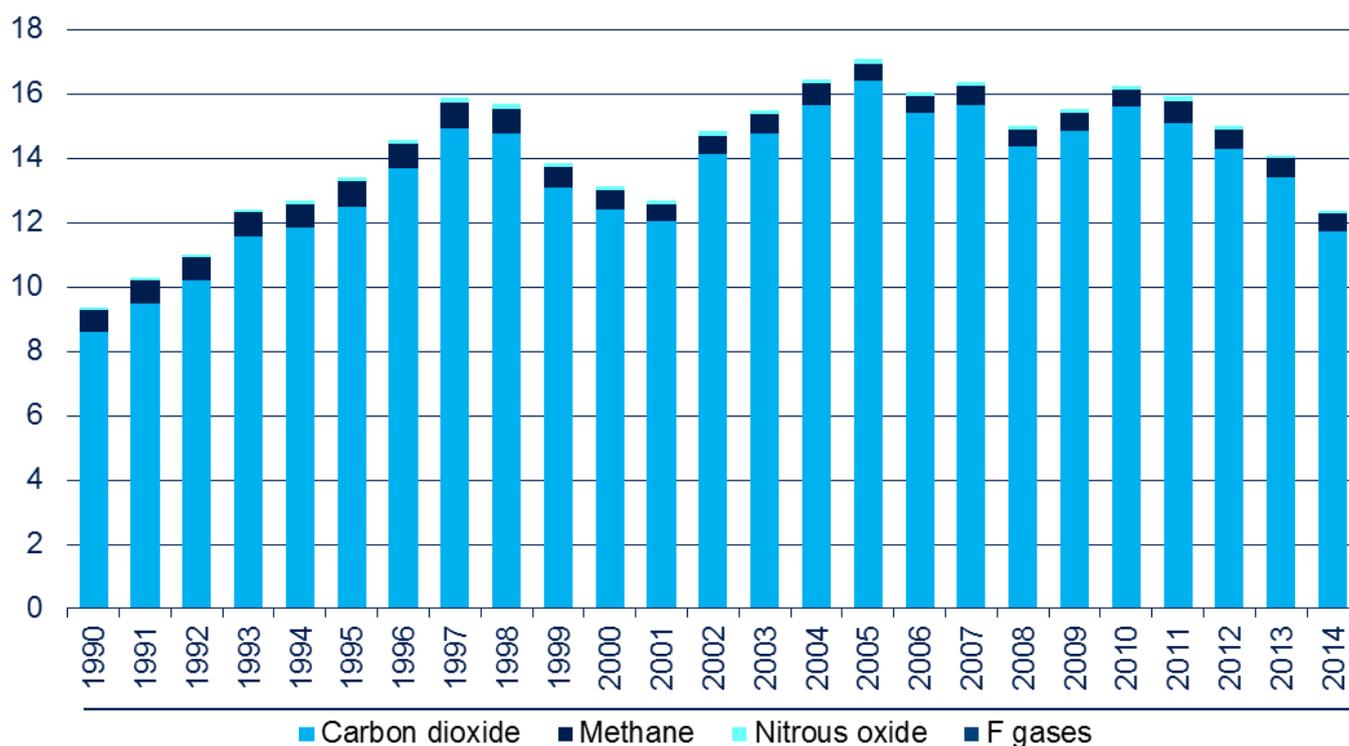
Emissions from the exports sector increased during most of the 1990s, largely driven by changes in throughput at refineries, which have fed through to increased exports rather than increased deliveries to the domestic market. Since then the overall trend has been fairly flat, though with some year on year variation. Between 2013 and 2014, emissions from the exports sector decreased by 1.7 MtCO<sub>2</sub>e (12 percent) which is directly linked to changes to exports information in the [Digest of UK Energy Statistics](#).

**Table 9: Exports sector emissions by gas**  
UK, 1990-2014

|                | <b>MtCO<sub>2</sub>e</b> |             |             |             |             |             |             |
|----------------|--------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                | 1990                     | 1995        | 2000        | 2005        | 2010        | 2013        | 2014        |
| Carbon dioxide | 8.6                      | 12.5        | 12.4        | 16.4        | 15.6        | 13.4        | 11.7        |
| Methane        | 0.7                      | 0.8         | 0.6         | 0.5         | 0.5         | 0.6         | 0.5         |
| Nitrous oxide  | 0.1                      | 0.1         | 0.1         | 0.1         | 0.1         | 0.1         | 0.1         |
| F gases        | 0.0                      | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         |
| <b>Total</b>   | <b>9.4</b>               | <b>13.4</b> | <b>13.1</b> | <b>17.1</b> | <b>16.3</b> | <b>14.1</b> | <b>12.4</b> |

Source: Table 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

**Figure 9: Greenhouse gas end-user emissions from the exports sector, UK, 1990-2014 (MtCO<sub>2</sub>e)**



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

## Revisions to the estimates of end-user emissions

It should be noted that the historical time series of emissions by end-user is revised each year to reflect any revisions made to either the estimates of emissions by source or the other energy consumption data used in the end-user emissions calculation. In this publication, this has resulted in revisions to end-user emissions figures for all years up to and including 2013. Further details of these revisions can be found in [Final UK Greenhouse Gas Emissions Statistics](#), which covered 2014 UK greenhouse gas emissions by source.

## Embedded Emissions

End-user emissions do not take account of the emissions “embedded” within the manufactured goods and services which the UK imports and exports. Embedded emissions capture what is sometimes referred to as the UK’s “carbon footprint”. This calculation of emissions on a “consumption” basis, reporting on emissions embedded in goods and services across international borders, is considerably more challenging. Statistics on the [UK’s Carbon Footprint](#) are available from the Department for Environment, Food and Rural Affairs (Defra).

# Uncertainties around the 2014 estimates

This section sets out the uncertainty ranges associated with the final 2014 emissions estimates by source, which were published on 2<sup>nd</sup> February 2016.

Estimates of uncertainty are produced each year, broken down by sector and gas. The emissions estimates are compiled with the principle of accuracy, meaning that estimates should not be consistently more or less than the actual totals, and that uncertainty is reduced as much as possible. Estimates of uncertainty allow users to see how reliable the emissions estimates are and give them an idea of what we do and do not know.

The uncertainty analysis takes into account a number of different known sources of uncertainty associated with emissions factors and activity data, for example, the statistical difference<sup>1</sup> between energy supply and demand reported in the [Digest of UK Energy Statistics](#). The different sources of uncertainty are then entered into a model using specialist software which produces uncertainty estimates by running the model a large number of times.

The uncertainties are expressed as a 95 percent confidence interval. In terms of the uncertainty model, this means that 95 percent of the simulated values fell between the stated parameters.

The uncertainty estimates vary a lot for different sectors and gases. For gases, carbon dioxide estimates have the least uncertainty associated with them while nitrogen trifluoride and nitrous oxide estimates are the most uncertain. At sector level, the land use, land use change and forestry (LULUCF), waste management and agriculture sectors are the most uncertain.

The overall uncertainty around total greenhouse gas emissions for 2014 is estimated to be 3 percent, which is a decrease from the 2013 overall uncertainty estimate of 4 percent. This change is mainly due to ongoing improvement work to emissions estimates from the agriculture sector. As a result of these improvements the estimate of nitrous oxide uncertainty for 2014 is around half of that estimated in 2013, which indicates a significant increase in the confidence of the nitrous oxide emissions estimate. There is additionally a less significant, but notable reduction in methane uncertainty, which is also mostly due to improvements to agriculture emissions estimates.

At sector level, there has been a significant decrease from 2013 to 2014 LULUCF uncertainty estimates of around 60 percentage points. This increase in the confidence of LULUCF uncertainty estimates is due to methodology improvements in calculating emissions estimates for the sector in 2014, which has led to changes in emissions as well as the contributions to overall uncertainty for the sector.

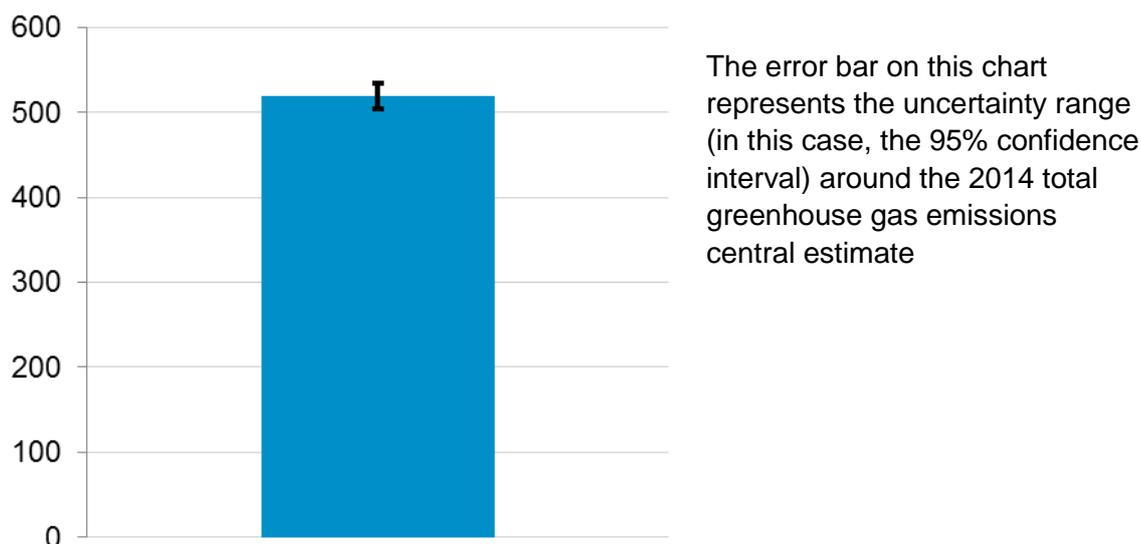
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<sup>1</sup> Statistical difference is explained on page 5 of the Energy Balance: Methodology note: <https://www.gov.uk/government/statistics/energy-balance-methodology-note>

The uncertainty in the trend in emissions reductions over time, expressed as a 95 percent confidence interval for the trend in emissions between 1990 and 2014, according to gas, is estimated to be a percentage reduction of between 39 and 32 percent, with a central estimate of a 35 percent reduction in emissions from 1990 to 2014.

The geographic coverage of the uncertainty estimates includes the UK, Crown Dependencies and Overseas Territories. Uncertainties are not calculated for different geographical coverages but uncertainty estimates for the UK only would be expected to be very similar.

**Figure 10: Illustration of uncertainty in estimates of UK Greenhouse Gas emissions, UK, Crown Dependencies and Overseas Territories, 2014 (MtCO<sub>2</sub>e)**



Source: Table 10, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

**Table 10: Uncertainty in estimates of 2014 UK greenhouse gas emissions by gas, (MtCO<sub>2</sub>e)**  
UK, Crown Dependencies and Overseas Territories, 2014

|                      | MtCO <sub>2</sub> e |   |              |
|----------------------|---------------------|---|--------------|
|                      | 2014<br>emissions   | Uncertainty around 2014 estimate, expressed as a<br>95% confidence interval |              |
|                      |                     | Lower bound   | Upper bound  |
| Carbon dioxide       | 425.1               | 414.6   | 435.4        |
| Methane              | 53.9                | 46.5  | 63.3         |
| Nitrous oxide        | 22.3                | 17.9  | 31.0         |
| Hydrofluorocarbons   | 16.4                | 14.9  | 17.9         |
| Perfluorocarbons     | 0.3                 | 0.2   | 0.4          |
| Sulphur hexafluoride | 0.5                 | 0.4   | 0.5          |
| Nitrogen trifluoride | 0.0                 | 0.0   | 0.0          |
| <b>Total</b>         | <b>518.5</b>        | <b>504.3</b>  | <b>534.5</b> |

Source: Table 10, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

Note:

1. 2014 estimates are presented as the central estimate from the model used to calculate uncertainties. These differ slightly from the actual emissions estimates.
2. The total 2014 central estimate for Table 10 differs from the total 2014 estimate for Table 11 in this annex due to the weighting of Global Warming Potentials (GWP) when estimating uncertainties by gas.

**Table 11: Uncertainty in estimates of 2014 UK greenhouse gas emissions by sector (MtCO<sub>2</sub>e)**  
UK, Crown Dependencies and Overseas Territories, 2014

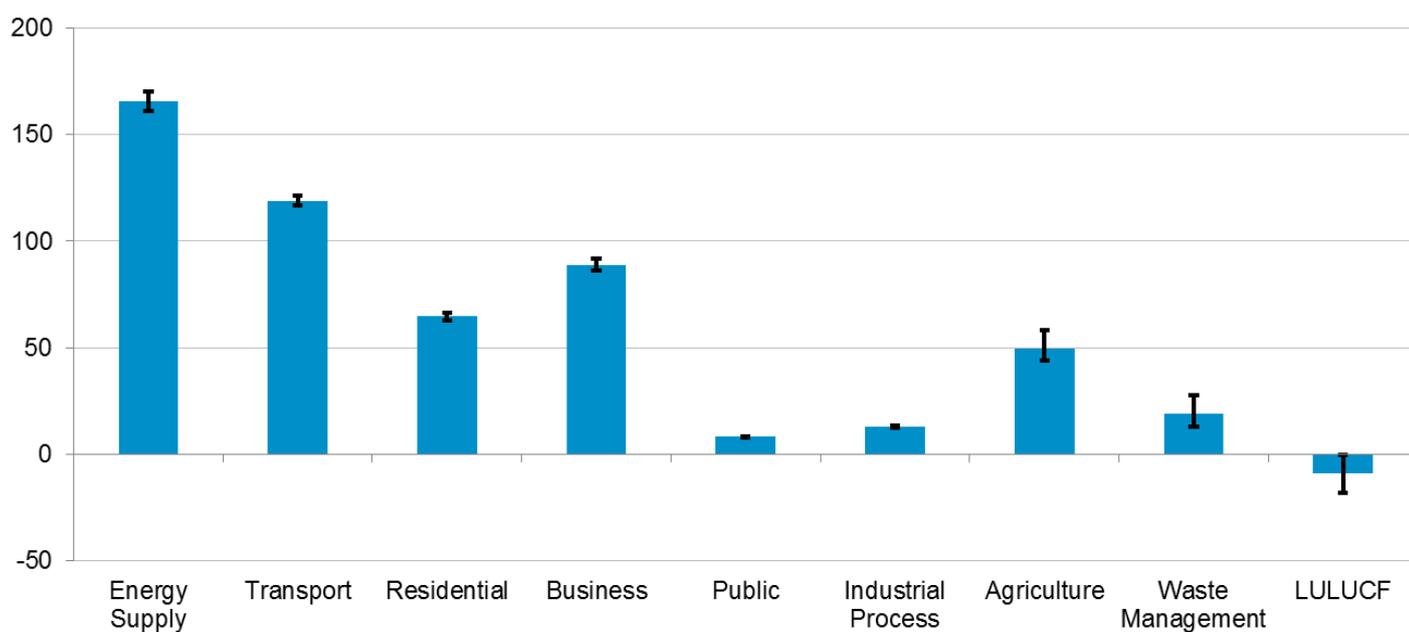
|   | MtCO <sub>2</sub> e |  |              |
|---|---------------------|--|--------------|
|   | 2014 emissions      | Uncertainty around 2014 estimate, expressed as a 95% confidence interval |              |
|   |                     | Lower bound  | Upper bound  |
| Energy supply                                   | 165.3               | 160.8  | 169.9        |
| Transport                                       | 118.9               | 116.7  | 121.0        |
| Residential                                     | 64.6                | 62.7   | 66.5         |
| Business  | 88.8                | 86.0   | 91.7         |
| Public  | 8.1                 | 7.9  | 8.4          |
| Industrial process                              | 13.0                | 12.6   | 13.5         |
| Agriculture                                     | 49.3                | 44.2   | 58.1         |
| Land use, land use change and forestry (LULUCF) | -9.0                | -17.9  | -0.05        |
| Waste management                                | 19.1                | 13.0   | 27.8         |
| <b>Total</b>                                    | <b>518.2</b>        | <b>504.3</b>   | <b>533.9</b> |

Source: Table 11, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

Note:

1. 2014 estimates are presented as the central estimate from the model used to calculate uncertainties. These differ slightly from the actual emissions estimates.
2. The total 2014 central estimate for Table 11 differs from the total 2014 estimate for Table 10 in this annex due to the weighting of Global Warming Potentials (GWP) when estimating uncertainties by gas.

**Figure 11: Illustration of uncertainty in estimates of UK Greenhouse Gas emissions by sector, UK, Crown Dependencies and Overseas Territories, 2014 (MtCO<sub>2</sub>e)**



Source: Table 11, Final UK greenhouse gas emissions national statistics 1990-2014 Excel data tables

Note:

1. The error bars on the chart represent the uncertainty range (in this case, the 95% confidence interval) around the 2014 total greenhouse gas emissions central estimates for each sector.

# Background Information

## Coverage of emissions reporting

This annex largely covers end-user emissions, meaning emissions are reallocated from the source to where the “end-use” occurred. The main impact is to reallocate emissions from the energy supply sector to other sectors, i.e. the business and residential sectors in particular. These high-level sectors are made up of a number of more detailed sectors, which follow the definitions set out by the Intergovernmental Panel on Climate Change (IPCC), and which are used in international reporting tables which are submitted to the United Nations Framework Convention on Climate Change (UNFCCC) every year.

The basket of greenhouse gases covered by the Kyoto Protocol consists of seven gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride. The last four gases are collectively referred to as fluorinated gases or F gases. In accordance with international reporting and carbon trading protocols, each of these gases is weighted by its global warming potential (GWP), so that total greenhouse gas emissions can be reported on a consistent basis. The GWP for each gas is defined as its warming influence relative to that of carbon dioxide. Greenhouse gas emissions are then presented in carbon dioxide equivalent units.

Carbon dioxide is reported in terms of net emissions, which means total emissions minus total removals of carbon dioxide from the atmosphere by carbon sinks. Carbon sinks are defined by the UNFCCC as “any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere”. The LULUCF sector is a net sink for the UK.

In this annex emissions are reported from within the UK only, apart from the 2014 uncertainties estimates which include Crown Dependencies and Overseas Territories, and all figures are expressed in millions of tonnes of carbon dioxide equivalent (MtCO<sub>2e</sub>).

References to the ‘UK Greenhouse Gas inventory’ refer to the consistent time series of emissions from 1990 to the most recent year which is updated annually and reported to the UN and the EU. The figures in these statistics are consistent with the UK’s greenhouse gas inventory for 2014, although the inventory reported to the UN includes emissions from certain overseas territories and crown dependencies which are excluded from these statistics except where specifically stated.

## Further information and feedback

Further information on UK greenhouse gas emissions statistics, including Excel tables with additional data on UK emissions, can be found on the Gov.uk website at:

<https://www.gov.uk/government/collections/uk-greenhouse-gas-emissions-statistics>

For any queries or feedback on this publication please email:

[ClimateChange.Statistics@decc.gsi.gov.uk](mailto:ClimateChange.Statistics@decc.gsi.gov.uk).

## Notes

A full set of data tables can be accessed via the [Final UK Greenhouse Gas Emissions Statistics](#) pages of the Gov.uk website.

1. The figures for 1990 to 2014 in this statistical release are from the National Atmospheric Emissions Inventory (NAEI). For further information on the UK Greenhouse Gas Inventory, see the [NAEI web site](#).
2. There are uncertainties associated with all estimates of greenhouse gas emissions. Although for any given year considerable uncertainties may surround the emissions estimates for a pollutant, it is important to note that trends over time are likely to be much more reliable. For more information on these uncertainties see Annex 2 of the [UK greenhouse gas inventory report](#). The latest national inventory report detailing information on uncertainties for 1990-2014 emissions will be submitted to the United Nations Framework Convention on Climate Change (UNFCCC) on 15<sup>th</sup> April 2016.

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Department of Energy & Climate Change

3 Whitehall Place

London SW1A 2AW

[www.gov.uk/decc](http://www.gov.uk/decc)

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