Department for Business, Energy & Industrial Strategy

ANNEX: 1990 - 2016 UK GREENHOUSE GAS EMISSIONS, FINAL FIGURES BY END USER

Statistical Release: National Statistics

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This publication is available for download at https://www.gov.uk/government/collections/final-uk-greenhouse-gas-emissions-national-statistics.

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Executive Summary

This publication is an extension of emissions estimates by source for 1990-2016 published in February earlier this year. It provides the latest estimates of 1990-2016 UK greenhouse gas emissions for end users and by fuel type, which are presented in carbon dioxide equivalent units throughout this statistical release. The total emissionspresented here are consistent with the data published in February by source sectors. The uncertainty in UK greenhouse gas emissions is also presented by gas and sector.

Key findings

- In 2016 27 per cent of greenhouse gas end user emissions were from the business sector, 29 per cent from transport, 22 per cent from the residential sector and 10 per cent from agriculture. The remainder were attributable to the industrial processes, public, waste managementand exports sectors. The land use, land use change and forestry (LULUCF) sector is excluded from the sector statistics as it acted as net sink of emissions.

- Uncertainty in UK greenhouse gas emissions estimates is around 3 per cent, based on uncertainty analysis of 2016 emissions which were published in February 2018.

- 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 2016 UK greenhouse gas emissions by end user sector, as well as uncertainty estimates for 2016 emissions by source sector and gas. These are a follow up to, and are consistent with, the final estimates of 1990 to 2016 emissions by source sector which were published on 6th February 2018.

Emissions by end user and by fuel type are incorporated into updated data tables published alongside the Final UK Greenhouse Gas Emissions Statistics. Also published in the data tables is uncertainty analysis for 2016 emissions by gas and sector. Note that this Annex does not discuss 2016 emissions by fuel type, but these are included in the updated data tables published alongside this document.

The geographic coverage of emissions by end user and by fuel type in this report is UK only. 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 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 the production of 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 2018.

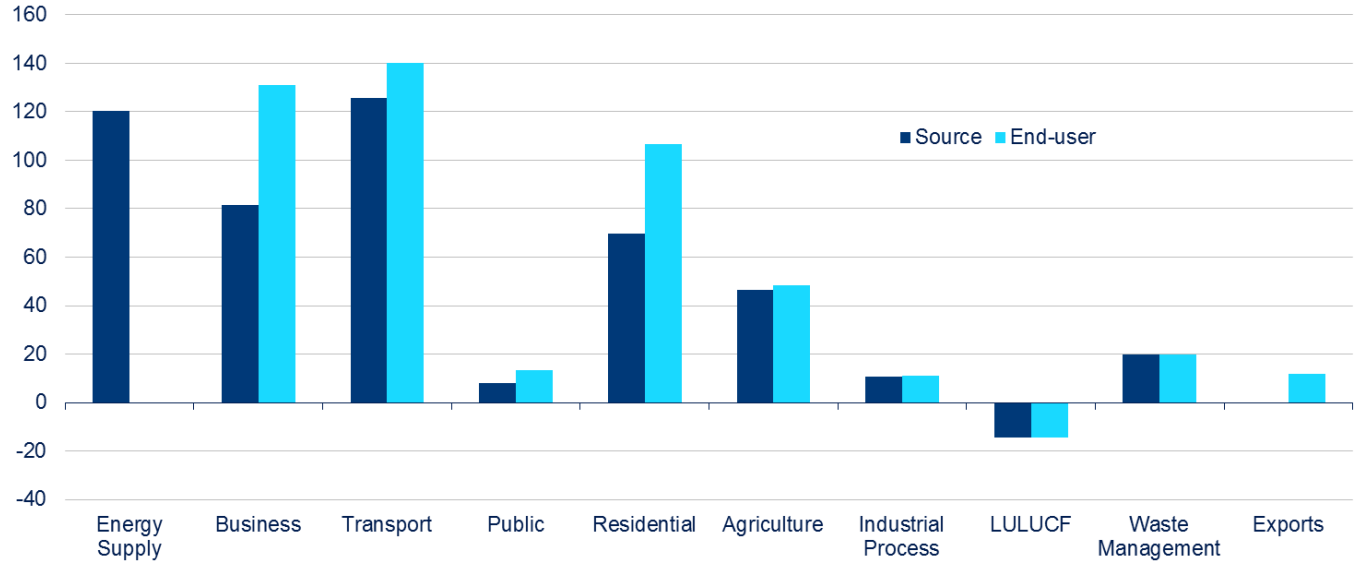
The uncertainty estimates are used to prioritise further research into improving emissions estimates, and more generally give users an indication of the robustness of the emissions estimates for different sectors. The geographic coverage of the uncertainty estimates includes the UK, Crown Dependencies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

1990-2016 total greenhouse gas emissions by end user

These results are based on and consistent with the breakdown by gas and sector of 2016 emissions by source which was published on 6th February 2018. Total 2016 greenhouse gas emissions for the UK were 467.9 million tonnes carbon dioxide equivalent ($MtCO_2e$).

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 2016 greenhouse gas emissions from source sectors to end user sectors, UK ($MtCO_2e$)

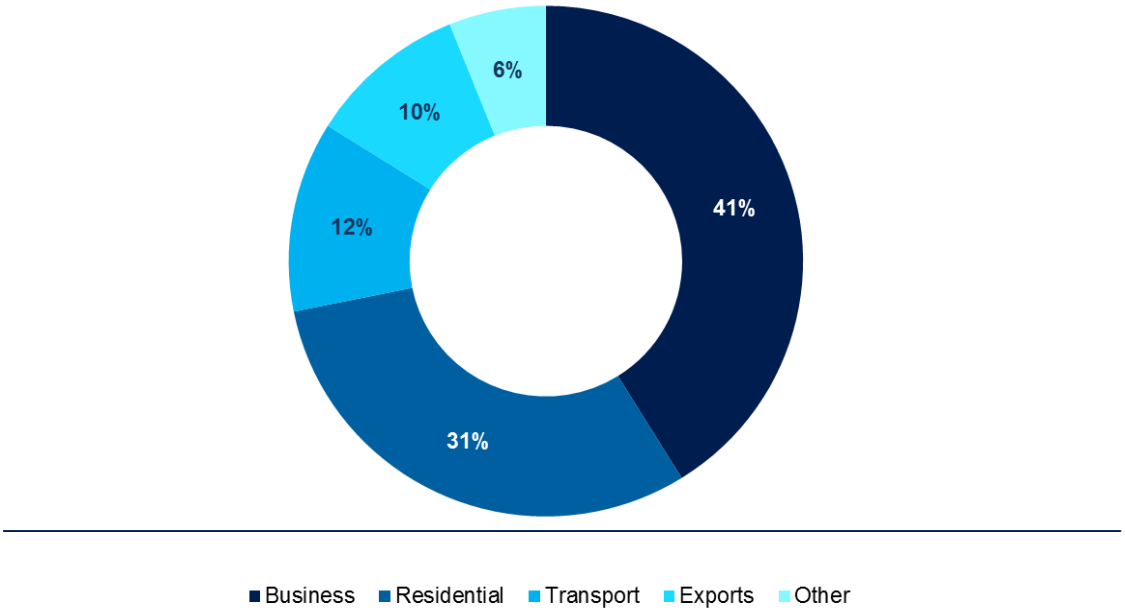


Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Looking at the end user sector breakdown, in 2016 27 per cent of greenhouse gas emissions were from the business sector, 29 per cent from transport, 22 per cent from the residential sector and 10 per cent from agriculture. The remainder were attributable to the industrial processes, public, waste managementand exports sectors. The land use, land use change and forestry (LULUCF) sector is excluded from the sector statistics as it acted as net sink of emissions. No emissions are reallocated to the waste management or LULUCF sectors and hence they are assumed to be equal to the by source emissions.

The majority of emissions from energy supply are reallocated to two sectors, with business accounting for over 40 per cent and residential accounting for around a third of reallocated emissions as shown in figure 2 below.

Figure 2: Breakdown of greenhouse gas emissions reallocated from the energy sector to end user sectors, UK, 2016



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Data tables showing the full end user breakdown by sector, from 1990 to 2016, can be found on the Final UK Greenhouse Gas Emissions Statistics page of the Gov.uk website. These tables were originally published on 6th February 2018 showing emissions by source only, but were updated with end user and fuel type breakdowns on 29th March 2018.

Table 1: UK greenhouse gas emissions by gas and end user sector
UK, 2016

$MtCO_2e$

	Carbon dioxide	Methane	Nitrous oxide	Fluorinated gases	Total
Business	113.0	2.2	1.7	14.0	131.0
Transport	138.2	0.6	1.4	0.0	140.2
Public	13.0	0.3	0.0	0.0	13.3
Residential	101.4	3.2	0.4	1.7	106.7
Agriculture	7.2	26.3	14.7	0.0	48.2
Industrial Process	10.3	0.2	0.3	0.3	11.0
LULUCF	-16.0	0.0	1.4	0.0	-14.6
Waste Management	0.3	18.3	1.4	0.0	19.9
Exports	11.5	0.4	0.1	0.0	12.0
Total	**378.9**	**51.6**	**21.4**	**16.0**	**467.9**

Source: Tables 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Table 2: Greenhouse gas emissions by end user sector
UK, 1990-2016

$MtCO_2e$

	1990	1995	2000	2005	2010	2015	2016
Business	248.5	218.7	217.4	212.6	187.0	149.0	131.0
Transport	146.6	151.3	153.8	156.3	141.8	138.3	140.2
Public	31.5	28.9	24.4	22.4	19.0	14.5	13.3
Residential	171.4	157.1	158.0	162.3	155.9	113.1	106.7
Agriculture	59.2	57.5	54.3	51.9	48.4	48.3	48.2
Industrial Process	63.3	53.6	29.2	21.4	13.6	13.3	11.0
LULUCF	-2.1	-5.0	-7.9	-11.4	-14.4	-15.1	-14.6
Waste Management	66.7	69.1	62.9	49.0	29.7	19.0	19.9
Exports	9.1	13.0	12.8	16.7	16.1	12.0	12.0
Total	**794.2**	**744.3**	**705.0**	**681.3**	**597.1**	**492.4**	**467.9**

Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2016 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 the 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 6th February 2018.

Transport

The transport sector was responsible for around 29 per cent of UK greenhouse gas end user emissions in 2016, 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 14 to 22 $MtCO_2e$ higher than emissions by source across the time series, so follow a very similar trend.

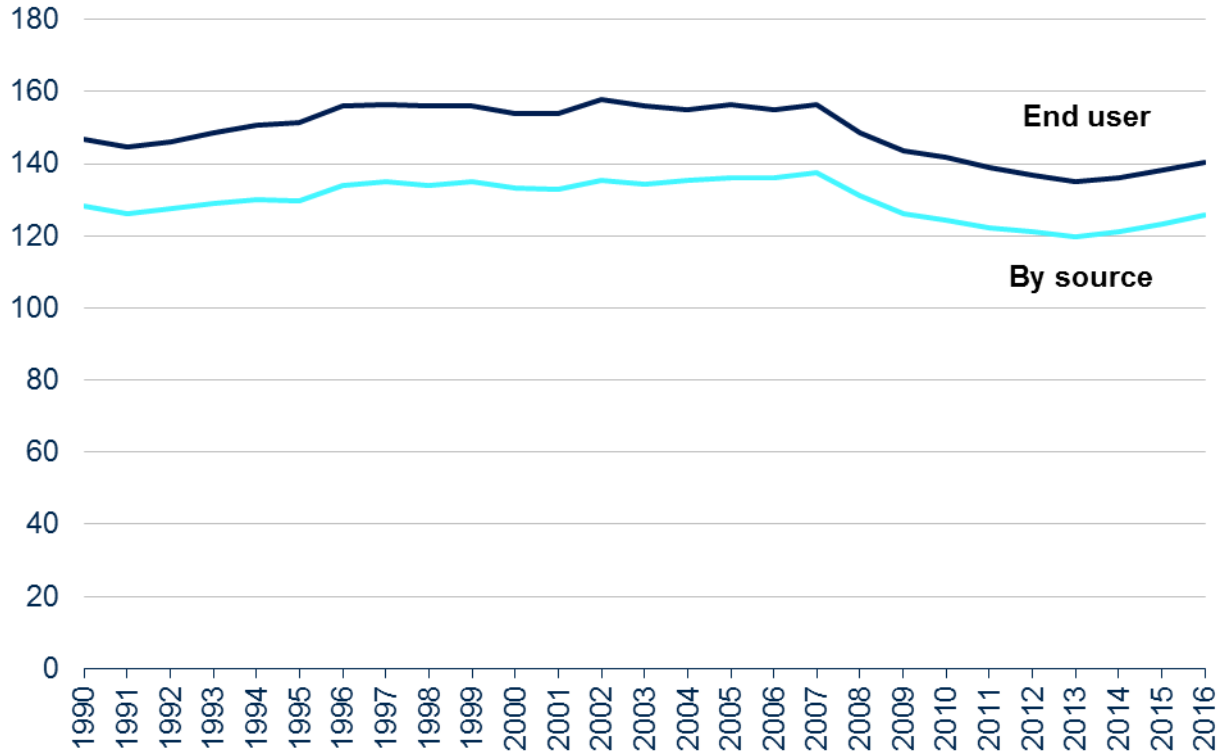
Table 3: Transport sector end user emissions by gas
UK, 1990-2016

$MtCO_2e$

	1990	1995	2000	2005	2010	2015	2016
Carbon dioxide	142.4	147.0	150.4	153.7	139.9	136.4	138.2
Methane	2.5	2.2	1.5	1.0	0.8	0.6	0.6
Nitrous oxide	1.7	2.2	1.9	1.5	1.2	1.3	1.4
F gases	:	:	:	:	:	:	:
Total	**146.6**	**151.3**	**153.8**	**156.3**	**141.8**	**138.3**	**140.2**

Source: Tables 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables
Note: A semi-colon (:) means data are not available as there are no F Gas emissions in this sector

Figure 3: Greenhouse gas end user emissions from transport, UK, 1990-2016 ($MtCO_2e$)



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Business

The business sector was responsible for 27 per cent of UK greenhouse gas end user emissions in 2016, 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 2016, there was a general downward trend in greenhouse gas end user emissions from the business sector, resulting in an overall decrease of 47 per cent. Between 2015 and 2016 emissions decreased by 18.0 $MtCO_2e$ (12 per cent). This is larger than the decrease of 4.6 $MtCO_2e$ (5 per cent) seen in emissions by source from this sector between 2015 and 2016, 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 broadly similar to the trend for emissions by source. However there has been a larger reduction of emissions by end user, particularly since 2012, than by source due to a reduction in emissions from power supply

resulting in lower electricity generation reallocated to this sector from the energy supply sector as well as a small reduction in electricity used in this sector..

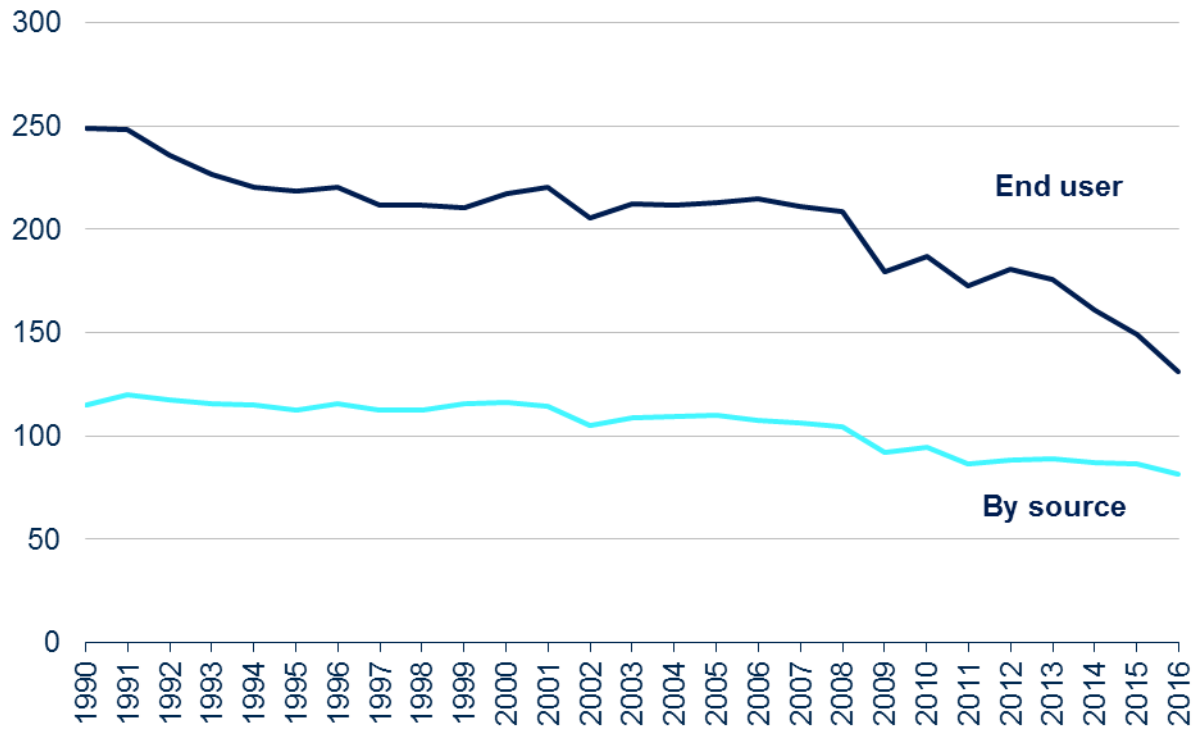
Table 4: Business sector end user emissions by gas
UK, 1990-2016

$MtCO_2e$

	1990	1995	2000	2005	2010	2015	2016
Carbon dioxide	229.8	203.1	202.3	194.6	166.6	129.7	113.0
Methane	15.5	11.7	7.4	4.8	3.7	2.7	2.2
Nitrous oxide	2.3	2.1	2.0	2.1	1.8	1.9	1.7
F gases	1.0	1.8	5.7	11.1	14.9	14.7	14.0
Total	**248.5**	**218.7**	**217.4**	**212.6**	**187.0**	**149.0**	**131.0**

Source: Table 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Figure 4: Greenhouse gas end user emissions from business, UK, 1990-2016 ($MtCO_2e$)



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Residential

The residential sector was responsible for around 22 per cent of UK greenhouse gas end user emissions in 2016, 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 2016, 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 emissions by source.

Between 2015 and 2016, end user emissions in the residential sector decreased by 6.4 $MtCO_2e$ (6 per cent), this is the reverse of the trend in source emissions which showed a 4 per cent increase. This is due to a reduction in emissions from power supply resulting in lower electricity generation reallocated to this sector from the energy supply sector.

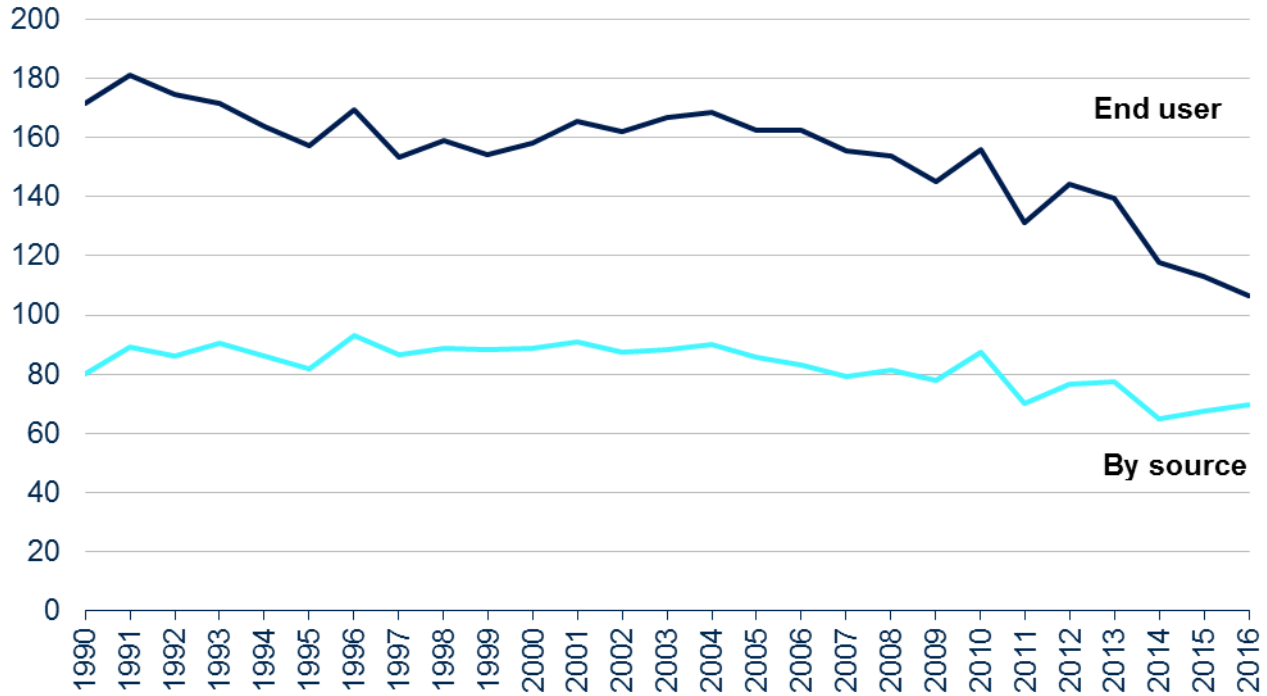
Table 5: Residential sector end user emissions by gas
UK, 1990-2016

$MtCO_2e$

	1990	1995	2000	2005	2010	2015	2016
Carbon dioxide	156.4	145.2	148.9	154.5	149.0	107.3	101.4
Methane	14.3	10.7	6.7	4.9	4.5	3.5	3.2
Nitrous oxide	0.7	0.6	0.5	0.5	0.5	0.5	0.4
F gases	0.0	0.7	2.0	2.4	2.0	1.8	1.7
Total	**171.4**	**157.1**	**158.0**	**162.3**	**155.9**	**113.1**	**106.7**

Source: Tables 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Figure 5: Greenhouse gas end user emissions from the residential sector, UK, 1990-2016 ($MtCO_2e$)



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Agriculture

The agriculture sector was responsible for 10 per cent of UK greenhouse gas end user emissions in 2016. Emissions of methane (55 per cent) and nitrous oxide (30 per cent) dominate this sector. End user and by source emissions are very similar for this sector due to the fact that only a small proportion of emissions from this sector are as a result of electricity use. The most significant sources are 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 19 per cent since 1990 due to a fall in animal numbers over the period, together with a decrease in synthetic fertiliser use. Between 2015 and 2016 there was very little change in emissions from the agriculture sector.

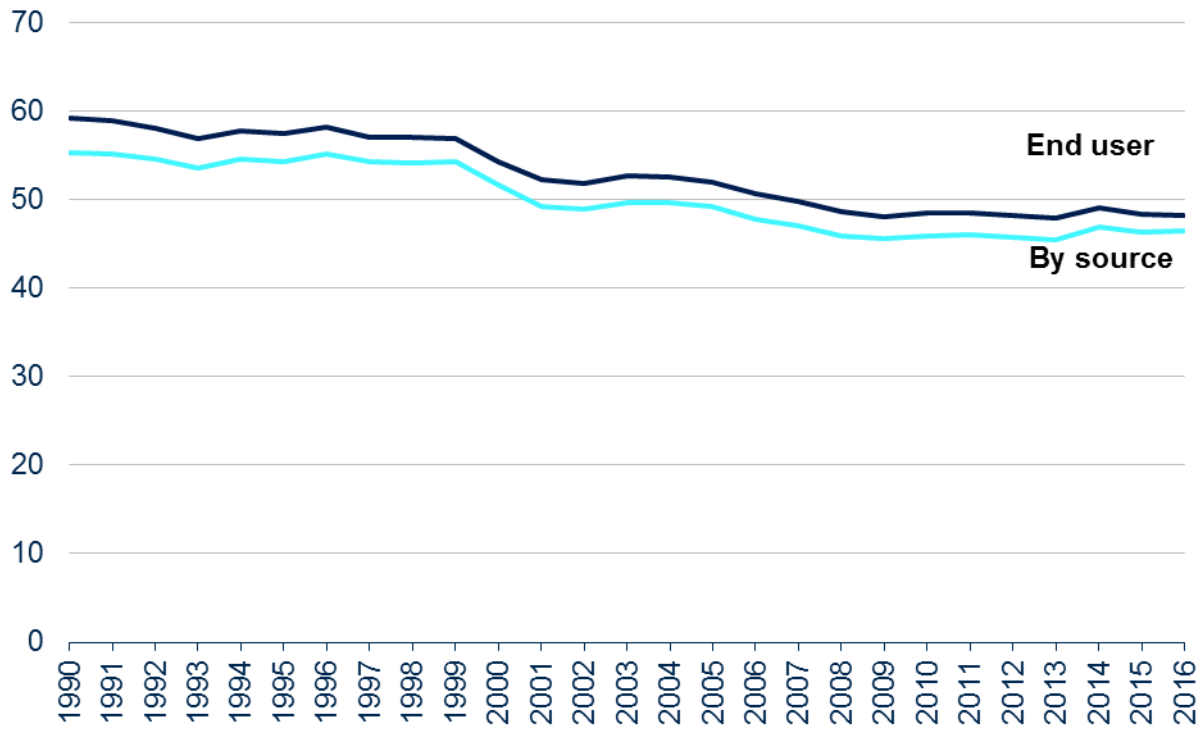
Table 6: Agriculture sector end user emissions by gas
UK, 1990-2016

$MtCO_2e$

	1990	1995	2000	2005	2010	2014	2015
Carbon dioxide	10.0	9.4	8.0	8.8	7.9	7.4	7.2
Methane	31.4	30.6	29.5	27.6	26.0	26.3	26.3
Nitrous oxide	17.8	17.4	16.8	15.5	14.6	14.6	14.7
F gases	:	:	:	:	:	:	:
Total	**59.2**	**57.5**	**54.3**	**51.9**	**48.4**	**48.3**	**48.2**

Source: Tables 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables
Note: A semi-colon (:) means data are not available as there are no F Gas emissions in this sector

Figure 6: Greenhouse gas end user emissions from agriculture, UK, 1990-2016 ($MtCO_2e$)



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Industrial process

The industrial process sector was responsible for 2 per cent of UK greenhouse gas end user emissions in 2016. 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 emissions by source, and follow a very similar trend, with a decrease of around 83 per cent since 1990. This is mainly due to a large reduction in emissions from adipic acid production and halocarbon production between 1998 and 1999 (combined emissions from which are now almost zero).

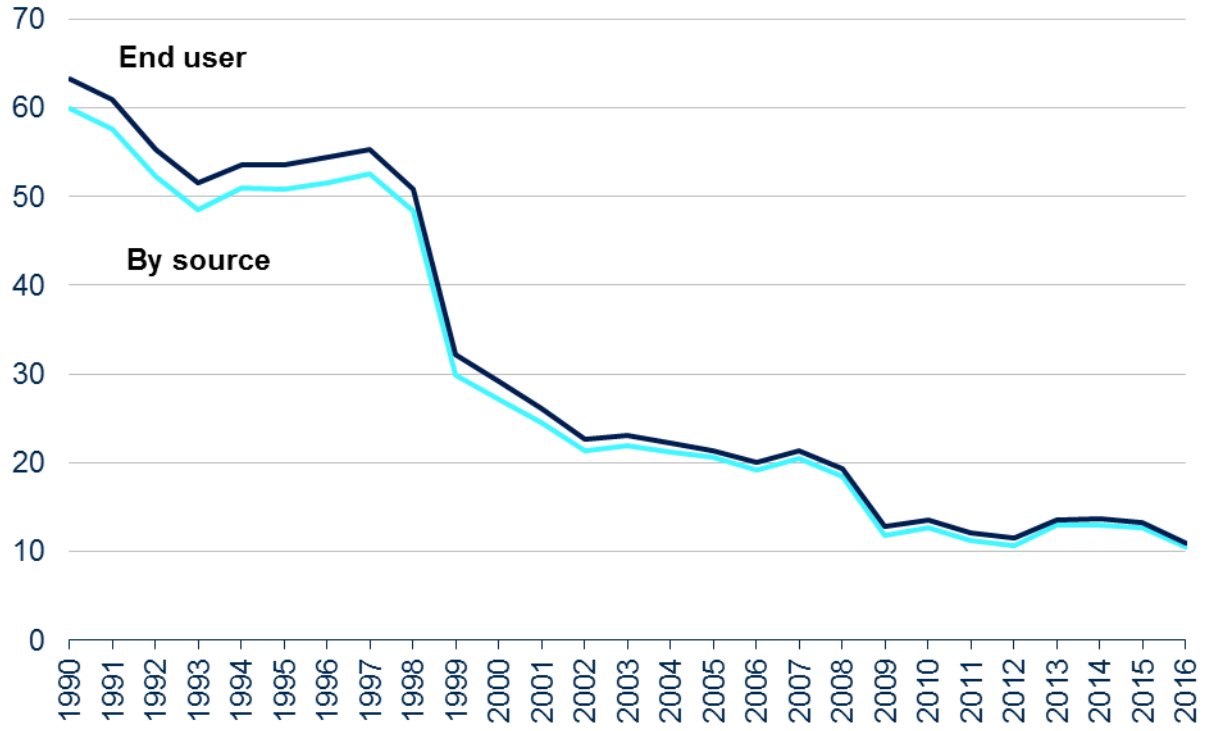
Table 7: Industrial process sector end user emissions by gas
UK, 1990-2016

$MtCO_2e$

	1990	1995	2000	2005	2010	2015	2016
Carbon dioxide	20.9	18.9	18.1	16.8	11.2	12.5	10.3
Methane	2.2	1.7	1.1	0.5	0.4	0.2	0.2
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
Total	**63.3**	**53.6**	**29.2**	**21.4**	**13.6**	**13.3**	**11.0**

Source: Tables 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Figure 7: Greenhouse gas end user emissions from industrial processes, UK, 1990-2016 ($MtCO_2e$)



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Public sector

The public sector was responsible for 3 per cent of UK greenhouse gas end user emissions in 2016, with carbon dioxide making up almost all of these emissions.

End user emissions from the public sector are roughly double emissions by source across the time series, due to the inclusion of emissions from electricity generation in the end user breakdown. However, the difference between end user and by source emissions has been decreasing in recent years, as shown in figure 8, due to a reduction in emissions from electricity generation reallocated to this sector from the energy supply sector. Since 1990 end user emissions have shown a more pronounced decrease than emissions by source, driven by a reduction in emissions from electricity generation.

Table 8: Public sector end user emissions by gas
UK, 1990-2016

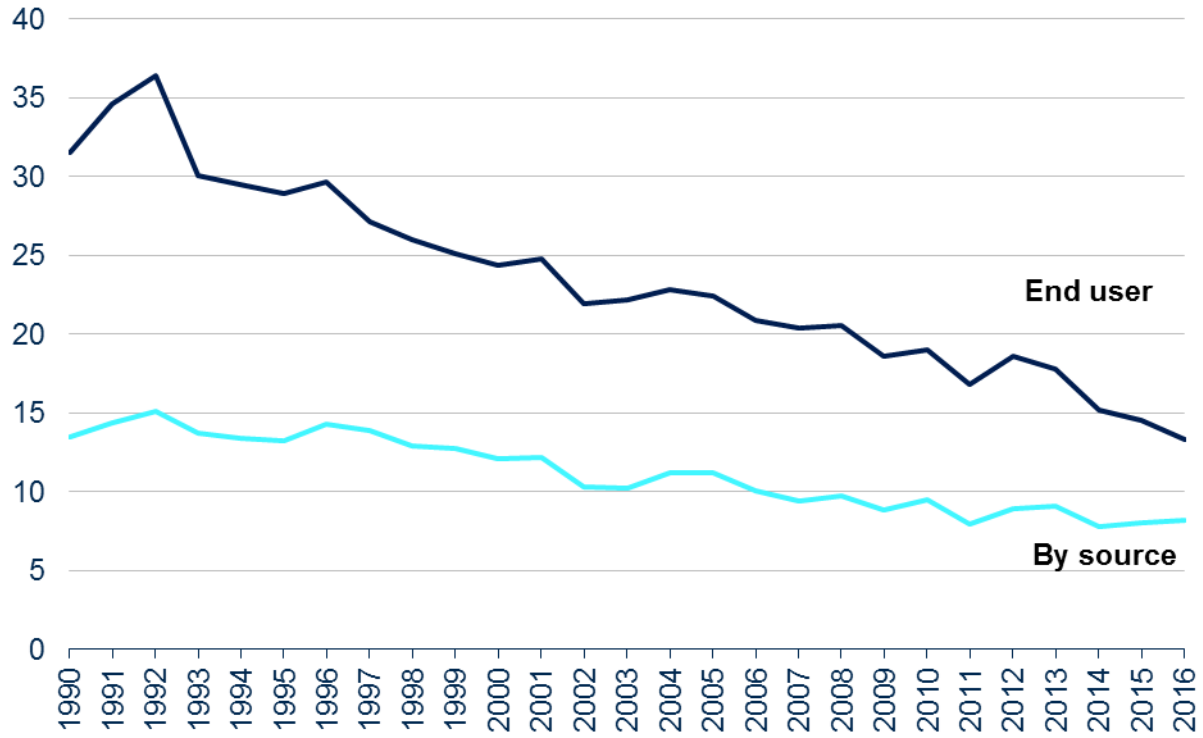
$MtCO_2e$

	1990	1995	2000	2005	2010	2015	2016
Carbon dioxide	29.2	27.1	23.3	21.7	18.5	14.1	13.0
Methane	2.1	1.7	0.9	0.6	0.5	0.4	0.3
Nitrous oxide	0.1	0.1	0.1	0.1	0.0	0.0	0.0

F gases	:	:	:	:	:	:	:
Total	**31.5**	**28.9**	**24.4**	**22.4**	**19.0**	**14.5**	**13.3**

Source: Table 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables
Note: A semi-colon (:) means data are not available as there are no F Gas emissions in this sector

Figure 8: Greenhouse gas end user emissions from the public sector, UK, 1990-2016 ($MtCO_2e$)



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2016 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 per cent of UK greenhouse gas end user emissions in 2016, 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[1] 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 2015 and 2016, emissions from the exports sector remained broadly similar.

Table 9: Exports sector emissions by gas
UK, 1990-2016

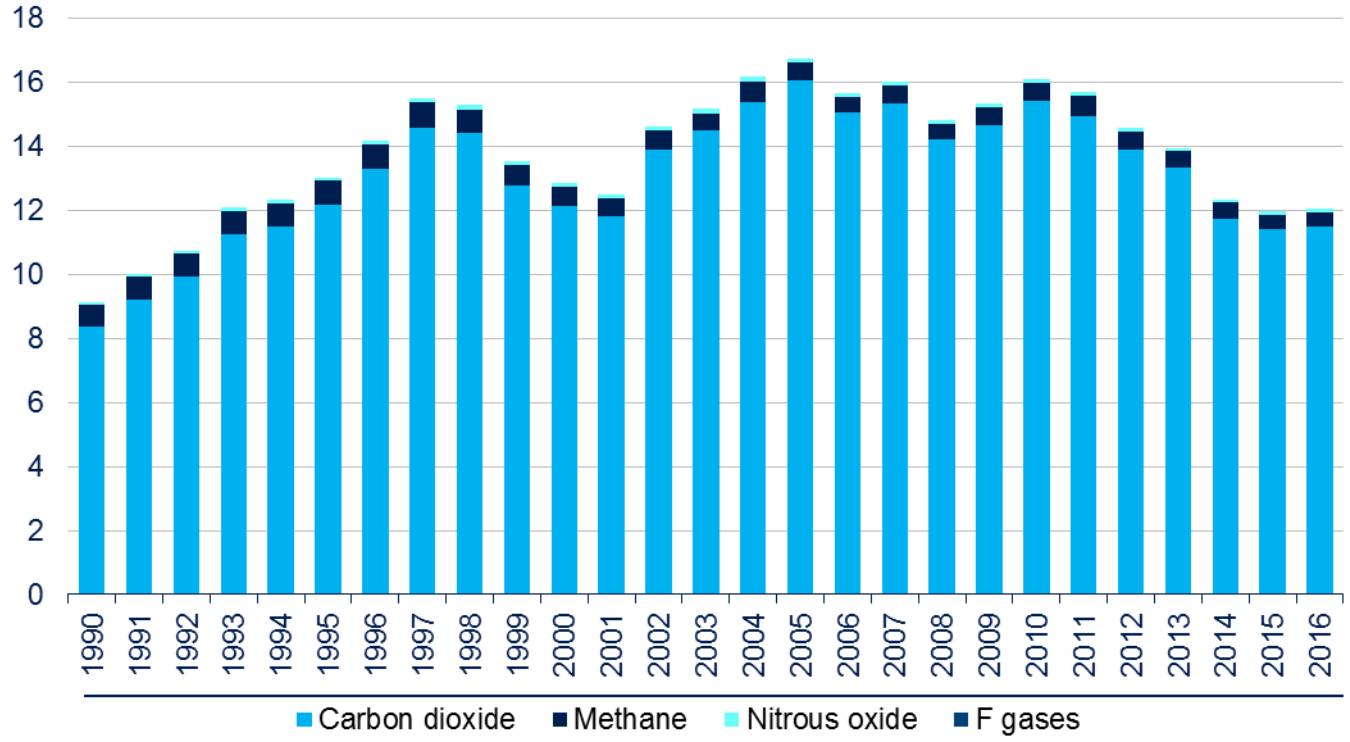
$MtCO_2e$

	1990	1995	2000	2005	2010	2015	2016
Carbon dioxide	8.4	12.1	12.1	16.1	15.4	11.4	11.5
Methane	0.7	0.8	0.6	0.5	0.6	0.4	0.4
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
Total	**9.1**	**13.0**	**12.8**	**16.7**	**16.1**	**12.0**	**12.0**

Source: Table 3, 4, 5, 6 and 7, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

[1] The capacity for refining crude oil over a given period of time

Figure 9: Greenhouse gas end user emissions from the exports sector, UK, 1990-2016 ($MtCO_2e$)



Source: Table 3, Final UK greenhouse gas emissions national statistics 1990-2016 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 2015. Further details of these revisions can be found in Final UK Greenhouse Gas Emissions Statistics, which covered 2016 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[2] are available from the Department for Environment, Food and Rural Affairs (Defra).

[2] UK's Carbon Footprint
https://www.gov.uk/government/statistics/uks-carbon-footprint

Uncertainties around the 2016 estimates

This section sets out the uncertainty ranges associated with the final 2016 emissions estimates by source, which were published on 6th February 2018.

Estimates of uncertainty are produced each year, broken down by sector and gas. The emissions estimates are compiled such that uncertainty is reduced as much as possible, meaning that estimates should not be consistently more or less than the actual totals. 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[3] 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 per cent confidence interval. In terms of the uncertainty model, this means that 95 per cent of the simulated values fell between the intervals shown below in table 10 and 11.

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; as shown in figure 11.

The overall uncertainty around total greenhouse gas emissions for 2016 is estimated to be 3 per cent. There is a continual programme to improve this uncertainty and in 2016 there is a decrease in LULUCF uncertainty estimates compared to 2015 of around 9 percentage points. This increase in the confidence of LULUCF uncertainty estimates is due to methodology improvements in calculating emissions estimates for the sector in 2016 that led to updates to the uncertainty parameters. Further details can found in the UK's National Inventory report which is due to be published on 15th April 2017[4].

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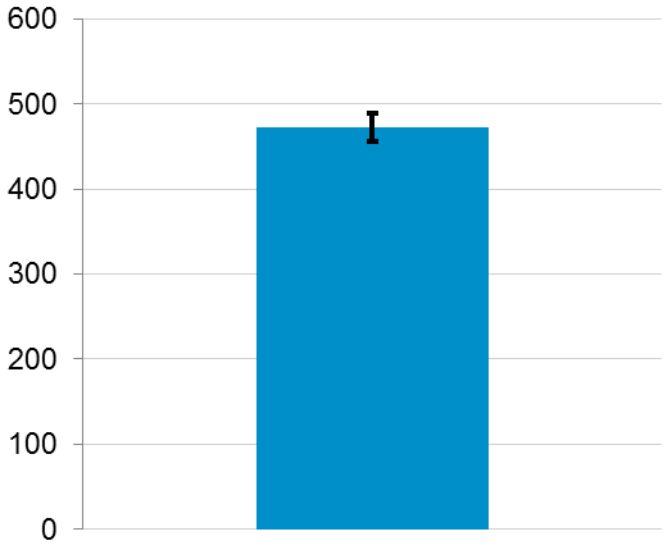
[3] Statistical difference is explained on page 5 of the Energy Balance: Methodology note: https://www.gov.uk/government/publications/energy-balance-methodology-note

[4] UK National Inventory Report http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/10116.php

The uncertainty in the trend in emissions reductions between 1990 and 2016, expressed as a 95 per cent confidence interval, is estimated to be a percentage reduction of between 38 and 44 per cent, with a central estimate of a 41 per cent reduction in emissions from 1990 to 2016.

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, 2016 ($MtCO_2e$)



The error bar on this chart represents the uncertainty range (in this case, the 95% confidence interval) around the 2016 total greenhouse gas emissions central estimate

Source: Table 10, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Table 10: Uncertainty in estimates of 2016 UK greenhouse gas emissions by gas, ($MtCO_2e$)
UK, Crown Dependencies and Overseas Territories, 2016

$MtCO_2e$

	2016 emissions	Uncertainty around 2016 estimate, expressed as a 95% confidence interval	
		Lower bound	Upper bound
Carbon dioxide	382.0	369.7	394.2
Methane	52.0	44.6	61.6
Nitrous oxide	21.5	17.4	28.8
Hydrofluorocarbons	15.3	13.9	16.7
Perfluorocarbons	0.4	0.3	0.4
Sulphur hexafluoride	0.5	0.4	0.6
Nitrogen trifluoride	0.0	0.0	0.0
Total	**471.7**	**456.2**	**488.5**

Source: Table 10, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Note:
1. 2016 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 2016 central estimate for Table 10 differs from the total 2016 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 2016 UK greenhouse gas emissions by sector ($MtCO_2e$)
UK, Crown Dependencies and Overseas Territories, 2016

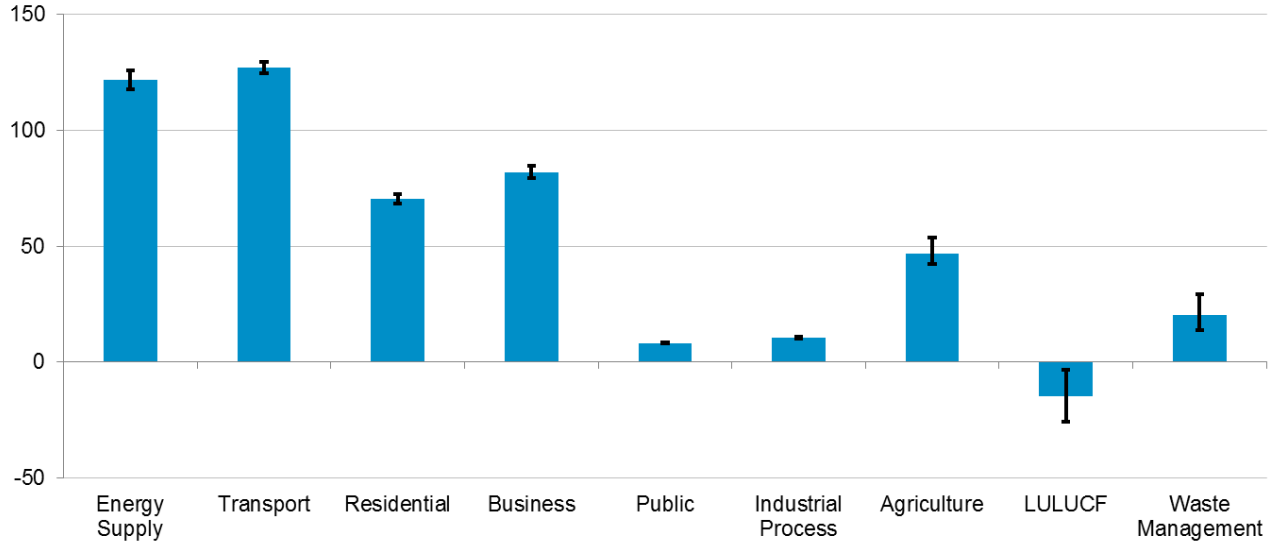
$MtCO_2e$

	2016 emissions	Uncertainty around 2016 estimate, expressed as a 95% confidence interval	
		Lower bound	Upper bound
Energy supply	121.6	117.6	125.7
Transport	126.9	124.3	129.4
Residential	70.3	68.1	72.4
Business	81.9	79.3	84.4
Public	8.2	7.9	8.5
Industrial process	10.5	10.2	11.0
Agriculture	46.8	42.2	53.7
Land use, land use change and forestry (LULUCF)	-14.5	-25.6	-3.3
Waste management	20.1	13.8	29.3
Total	**471.7**	**456.2**	**488.4**

Source: Table 11, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Note:
1. 2016 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 2016 central estimate for Table 11 differs from the total 2016 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, 2016 ($MtCO_2e$)



Source: Table 11, Final UK greenhouse gas emissions national statistics 1990-2016 Excel data tables

Note:

1. The error bars on the chart represent the uncertainty range (in this case, the 95% confidence interval) around the 2016 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)[5], and which are used in international reporting tables which are submitted to the United Nations Framework Convention on Climate Change (UNFCCC)[6] 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 2016 uncertainties estimates which include Crown Dependencies and Overseas Territories, and all figures are expressed in millions of tonnes of carbon dioxide equivalent ($MtCO_2e$).

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 2016, 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.

[5] https://www.ipcc-nggip.iges.or.jp/
[6] https://cop23.unfccc.int/

Future updates to emissions estimates

This publication will next be updated on Thursday 28th March 2019 to include 1990-2017 UK emissions by end user and by fuel type.

On Tuesday 5th February 2019 BEIS will publish 1990-2017 UK emissions by source sector.

Further information

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-statisticsBackground notes

1. A full set of data tables can be accessed via the Final UK greenhouse gas emissions national statistics pages of the Gov.uk website.
2. This statistical release and the related data tables are the first release of data from the National Atmospheric Emissions Inventory (NAEI) for 1970-2016, produced for BEIS and the Devolved Administrations by Ricardo Energy & Environment. Additional results will be released as they become available. For further information on the UK Greenhouse Gas Inventory, see the NAEI website.
3. The UK's National Inventory Report (NIR) for 1990-2016 will be submitted to the United Nations Framework Convention on Climate Change (UNFCCC) on 15th April 2018. The report will contain national greenhouse gas emissions estimates for 1990-2016 and descriptions of the methods used to produce the estimates. Previous reports can be found on the NAEI website.
4. The background quality report provides a summary of quality issues relating to statistics on UK greenhouse gas (GHG) emissions.

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