



UK GREENHOUSE GAS EMISSIONS: PROVISIONAL ESTIMATES

Methodology Summary

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Introduction

BEIS currently publishes the [Final UK Greenhouse Gas Emission Estimates](#) 13 months after the end of the reference year. However, BEIS is able to provide more timely provisional greenhouse gas (GHG) emissions estimates, which are usually published in March, 3 months after the end of the reference year. These are based on the energy use statistics published in [Energy Trends](#) (for carbon dioxide emissions), and the latest published [Energy and emissions projections](#) (for non-CO₂ GHG emissions).

While the provisional figures for CO₂ emissions include breakdowns by sector and fuel type, only overall totals for non-CO₂ emissions are included in the provisional estimates.

The [Provisional UK Greenhouse Gas Emissions publication](#) also includes:

- Quarterly greenhouse gas emissions estimates for the years 2008 onwards
- Temperature adjusted greenhouse gas emissions for the years 2008 onwards

Only UK emissions are included in the provisional estimates. The Crown Dependencies and Overseas Territories for which estimates are made in the final GHG emissions publication are not included. Provisional estimates are also not made for emissions from UK-based international aviation and shipping bunkers, which are reported separately in the final UK GHG emissions estimates.

This document summarises how the provisional annual, quarterly and temperature adjusted GHG emissions are derived.

The provisional annual and quarterly greenhouse gas emissions estimates

For the purpose of producing the provisional annual and quarterly estimates, GHG emissions are classified into three categories:

1. Carbon dioxide (CO₂) emissions based on energy use data
2. CO₂ emissions not based on energy use data
3. Other greenhouse gas emissions (non-CO₂).

When deriving the provisional annual UK GHG emissions estimates and the quarterly estimates a different approach is taken for each of these three categories of emissions, as summarised in Table A.

Table A: The approaches taken for estimating provisional annual UK GHG emissions and quarterly emissions

	Provisional annual estimates	Quarterly estimates
CO₂ emissions based on energy use data	For individual activities/fuel types, year on year growth factors are applied to the latest final emissions figures to derive provisional estimates for the following year. These are based on looking at year on year changes in energy use for the closest corresponding sector/fuel type included in the <i>Energy Trends</i> publication.	For a given activity/ fuel type, annual emissions are allocated to individual quarters within each year in proportion to the quarterly energy use. This is based on the looking at same sector/fuel types in <i>Energy Trends</i> as for the provisional annual estimates.
CO₂ emissions not based on energy use data	For these activities/fuel types, the provisional figures are taken to be the same as the final figures for the previous year, so no change is assumed between the two years.	For each year in the series these emissions are allocated equally between the four quarters.
Non-CO₂ greenhouse gas emissions	A growth factor is applied to the final non-CO ₂ emissions for the previous year. This growth factor is based on the year on year growth in total non-CO ₂ GHG emissions forecast in the latest published <i>Energy and Emissions Projections</i> .	For each year in the series these emissions are allocated equally between the four quarters.

Carbon dioxide emissions derived from energy use

For the vast majority of net CO₂ emissions (97% in the 2017 final UK figures), the provisional emissions estimates are based on energy use data. It is assumed that the percentage change in CO₂ emissions between the latest two years is the same as the percentage change in energy use for a particular activity and fuel for the latest two years. The underlying energy dataset is published in Energy Trends.

Carbon dioxide emissions not derived from energy use

The remainder of CO₂ emissions are assumed to have remained unchanged from the previous year. While this is only the case for 3% of net CO₂ (based on the 2017 final UK figures) this is particularly relevant for some sectors. For the *agriculture, waste management, and land use, land use change and forestry* (LULUCF) sectors all CO₂ emissions are treated in this way. This is also the case for the majority of emissions from the *industrial processes* sector. Based on the final 2017 UK emissions estimates, Table B shows for each sector the proportion of CO₂ emissions for which the provisional estimates are not derived from energy use, and are therefore taken to be unchanged from the previous year.

Table B: Percentage of CO₂ emissions for which the provisional emissions estimates are not derived from energy use data, based on the final 2017 UK emissions

Sector	Percentage of CO ₂ emissions not derived from energy use data
Energy supply	9%
<i>from power stations</i>	7%
<i>other Energy supply</i>	13%
Business	1%
Transport	0%
Public	0%
Residential	0%
Agriculture	100%
Industrial processes	68%
Waste management	100%
LULUCF	100%
Total CO₂ emissions	3%

Non carbon dioxide emissions

Non-CO₂ GHG emissions make up around a fifth of total GHG emission in the UK when measured on a carbon dioxide equivalent basis. The provisional annual total for non-CO₂ emissions is derived from applying a year on year growth factor to the previous year's total, based on looking at the percentage change between the projections for non-CO₂ emissions for the two years in the latest published [Energy and emissions projections](#).

This approach was first introduced for the 2018 provisional estimates. Previously the provisional estimates had assumed that the total non-CO₂ emissions remained unchanged from the previous year. But as they have been consistently falling in recent years, and this is projected to continue, this approach was found to be consistently overestimating non-CO₂ emissions and using the projections would have been more reliable.

The reliability of the provisional annual GHG emissions figures

Table C looks at the estimated year on year growth in GHG emissions (both total GHG emissions and total CO₂ emissions), comparing the results based on the provisional figures with those based on the final figures published almost a year later. Overall, the year on year percentage change indicated by the provisional figures has usually been within a percentage point of the change shown by the final figures.

Table C: Differences between provisional and final GHG emissions estimates

	CO ₂ emissions			Year on year percentage change Total GHG emissions		
	Provisional estimate	Final estimate	Percentage point difference	Provisional estimate	Final estimate	Percentage point difference
2012	+4.5%	+4.4%	+0.1	+3.4%	+3.2%	+0.2
2013	-2.1%	-1.8%	-0.3	-1.9%	-2.4%	+0.5
2014	-9.7%	-8.9%	-0.8	-8.4%	-7.7%	-0.7
2015	-4.1%	-4.1%	0.0	-3.4%	-3.8%	+0.4
2016	-7.4%	-5.9%	-1.5	-6.0%	-5.0%	-1.0
2017	-3.2%	-3.3%	+0.1	-2.6%	-2.7%	+0.1

Temperature adjusted emissions estimates

Carbon dioxide emissions are indirectly influenced by external temperatures. During the winter months, emissions are generally higher than in summer months, due to higher demand for fuel for space heating. During a particularly cold winter for example, it is likely that more fuel will be burnt for domestic or commercial use than during an average winter, and therefore emissions will be higher due to the additional fuel consumption.

Temperature adjusted quarterly emissions estimates therefore remove the effect of external temperatures. In a particularly cold winter quarter, for example, this will result in temperature adjusted emissions being lower than actual emissions, reflecting the lower fuel consumption which would have occurred if temperatures had been at average levels. The temperature adjustment makes use of figures on the number of heating degree days, and how they deviate from the long-term average for the given time of year. This information is published in the *Weather* section of *Energy Trends*: www.gov.uk/government/statistics/energy-trends-section-7-weather

Emissions are only temperature adjusted for certain activities and fuel types, as not all emissions are affected by external temperatures. To decide whether emissions from a given activity/fuel type should be temperature adjusted or not, and if so by how much, the following procedure has been followed:

- A simple linear regression is established between the quarterly emissions for a given sector/fuel type and the quarterly average heating degree days, from 2002 to the latest year for which a final GHG emissions estimates are available.
- Identify the coefficient of determination (R^2), which measures how well the regression line approximates the data points. This takes a value between 0 and 1. The closer the R^2 is to 1, the stronger the correlation between the emissions from the given sector/fuel type and the number of heating degree days, while values closer to 0 indicate little to no correlation between them.
- Conduct a statistical test on the coefficient of each individual regression. If the coefficient is statistically significantly different from zero, and the R^2 is sufficiently high, then emissions for that given activity/fuel type are temperature adjusted. Otherwise there is assumed to be no temperature effect, and therefore no adjustment required.

- CO₂ emissions are adjusted for each sector and fuel by using the gradient from the regression model as an estimate of the additional emissions per additional heating degree day. For a given quarter we look at the number of heating degree days by which it deviated from what the typical amount of heating required at that time of the year (as given by the long-term average for the period 1981-2010).
- Multiplying this deviation by our estimate of the additional emissions per additional heating degree day for the given sector/fuel type gives the estimated temperature effect on CO₂ emissions. This temperature effect is then removed to give the temperature adjusted emissions for that quarter.

It should be noted that the temperature adjustment is intended to remove the effect of temperatures varying between years, and it does not adjust for the usual within-year seasonal variation in temperatures.

The non-CO₂ GHG emissions estimates are not temperature adjusted.

The reporting of the greenhouse gas emissions

Emissions by source and end-user

The provisional, quarterly and temperature adjusted greenhouse gas (GHG) emissions figures are all presented on a “by source” basis only. This means that emissions are attributed to the sector that emits them directly.

This is different from emissions on a “by end-user” basis, where emissions from energy production are re-allocated to the final user of the energy. For example, all GHG emissions produced by a power station are allocated to the power station when reporting on a by source basis. However, when applying the end-user method, these emissions are re-allocated to the users of this electricity, e.g. households and businesses.

The final GHG emissions figures are published on both a “by source” and a “by end-user” basis.

National Communication sectors

For the purposes of reporting, greenhouse gas emissions are allocated to National Communication (NC) sectors. This small number of high level sectors is listed in Table D.

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, submitted to the United Nations Framework Convention on Climate Change (UNFCCC) each year.

Table D: Examples of activities for each National Communication sector

National Communications sector	Examples include
Energy supply	Power stations, refineries, manufacture of solid fuels
Transport	Road transport, domestic aviation, domestic shipping, railways
Business	Heating buildings, refrigeration, air conditioning
Residential	Heating households
Agriculture	Emissions from livestock, manure management, miscellaneous combustion
Waste management	Waste disposal, waste incineration
Industrial process	Production of mineral products, chemical industry
Public	Heating in health, education and government buildings
LULUCF	Forest land or grassland acting as a carbon sink, converting land to cropland (and vice versa)

This publication is available from: www.gov.uk/government/publications/uk-greenhouse-gas-emissions-explanatory-notes

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