

Statistical bulletin

Estimates of quarterly greenhouse gas emissions (residence basis), UK: April to June 2024

Estimates of greenhouse gas emissions using the Chow-Lin regression-based temporal disaggregation method. These are official statistics in development.

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1 . Main points

- UK greenhouse gas (GHG) emissions on a residence basis were estimated to be 114 million tonnes of carbon dioxide equivalent (Mt CO₂e) in Quarter 2 (Apr to June) 2024, 2.5% higher than in Quarter 2 2023.
- The UK emitted 0.164 tonnes of CO₂e per million pounds of economic activity (gross value added) in Quarter 2 2024, down 59.7% since Quarter 1 (Jan to Mar) 1999.
- These quarterly emissions estimates complement and draw on our annual residence-based emissions statistics.
- All emissions estimates in this release are produced using modelling techniques; estimates for all quarters of 2023 and Quarters 1 and 2 2024 are subject to greater uncertainty as final emissions estimates for 2023 are not yet available, so data are modelled over six quarters.
- As with quarterly provisional estimates of GHG emissions on a territorial basis, total emissions fell in every quarter of 2023 compared with the same quarters in 2022.

We refer to residence-based (also known as production) emissions in this release. Territorial emissions, published by the Department for Energy Security and Net Zero, is the measure generally used for greenhouse gas emissions targets, including net zero by 2050. Footprint (or consumption) emissions, published by the Department for Environment, Food and Rural Affairs, account for emissions from trade. Please see our explainer on these three [official measures of UK greenhouse gas emissions](#) for more information.

2 . Quarterly greenhouse gas emission estimates

Using modelling techniques, we have produced estimates of total quarterly UK greenhouse gas (GHG) and carbon dioxide (CO₂) emissions, on a residence basis, up to Quarter 2 (Apr to June) 2024. All GHG estimates referred to in this release are non-seasonally adjusted unless otherwise specified.

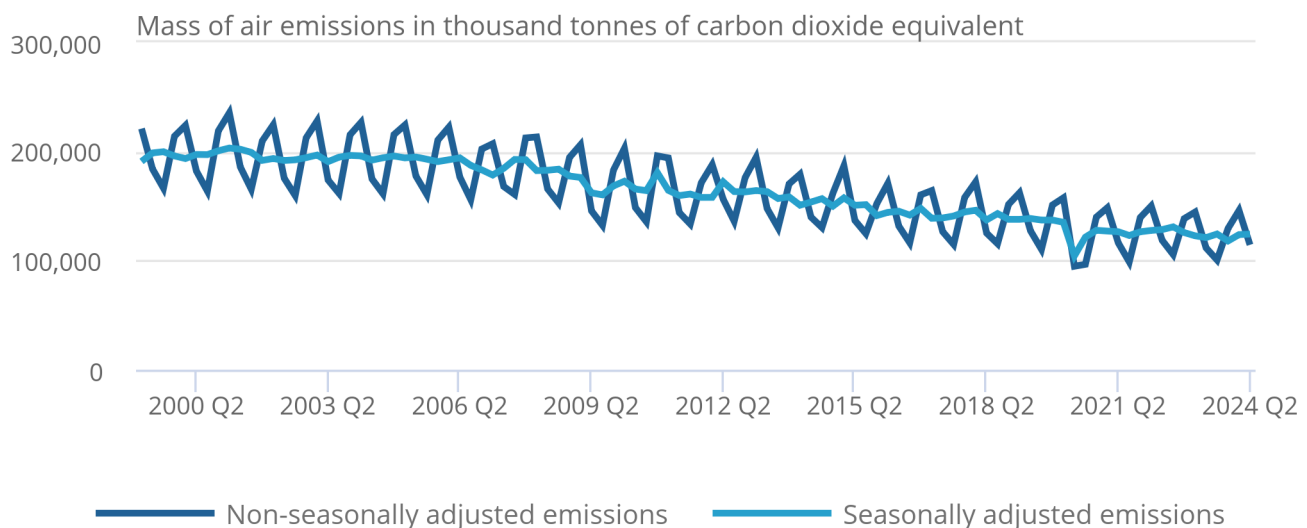
Our Quarter 2 2024 estimate of total emissions on this measure is 114 million tonnes of CO₂ equivalent (Mt CO₂e). This is an increase of 2.8 Mt CO₂e, or 2.5%, compared with the same quarter in 2023 (Figure 1). Coming after five successive quarters of estimated emissions being lower than in the same quarter in the previous year, this is the second consecutive year-on-year increase in the quarterly estimate since Quarter 3 (July to Sept) 2022.

Figure 1: Residence-based UK greenhouse gas emissions have declined since 1999

Experimental estimates of greenhouse gas emissions, UK (residency basis), Quarter 1 (Jan to Mar) 1999 to Quarter 2 (Apr to June) 2024

Figure 1: Residence-based UK greenhouse gas emissions have declined since 1999

Experimental estimates of greenhouse gas emissions, UK (residency basis), Quarter 1 (Jan to Mar) 1999 to Quarter 2 (Apr to June) 2024



Source: Environmental Accounts from the Office for National Statistics, Energy Trends from the Department for Energy Security and Net Zero

Notes:

1. Q1 refers to Quarter 1 (Jan to Mar), Q2 refers to Quarter 2 (Apr to June), Q3 refers to Quarter 3 (July to Sept) and Q4 refers to Quarter 4 (Oct to Dec).
2. These estimates have been modelled using the Chow-Lin regression-based temporal disaggregation method.
3. For seasonal adjusted estimates, the predictor indicators used within the modelling were seasonally adjusted using X-13ARIMA-SEATS.

Table 1 shows the change in total quarterly non-seasonally adjusted emissions estimates compared with the same quarter in the previous year.

Table 1: Quarter 2 (Apr to June) 2024 sees the first increase in two consecutive quarters since Quarter 3 (July to Sept) 2022

Change in non-seasonally adjusted estimates, Quarter 1 (Jan to Mar) 2020 to Quarter 2 (Apr to June) 2024

Time Period	Change in quarterly totals from same quarter in the previous year (%)
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Quarter 1 2020 -2.9%

Quarter 2 2020 -25.5%

Quarter 3 2020 -12.5%

Quarter 4 2020 -7.4%

Quarter 1 2021 -5.8%

Quarter 2 2021 22.6%

Quarter 3 2021 2.3%

Quarter 4 2021 -0.3%

Quarter 1 2022 1.1%

Quarter 2 2022 2.0%

Quarter 3 2022 6.8%

Quarter 4 2022 -0.7%

Quarter 1 2023 -3.7%

Quarter 2 2023 -5.9%

Quarter 3 2023 -4.7%

Quarter 4 2023 -6.5%

Quarter 1 2024 1.0%

Quarter 2 2024 2.5%

Source: Environmental Accounts from the Office for National Statistics, Energy Trends from the Department for Energy Security and Net Zero

Notes

1. These estimates have been modelled using the Chow-Lin regression-based temporal disaggregation method.
2. Quarter 1 refers to January to March, Quarter 2 refers to April to June, Quarter 3 refers to July to September and Quarter 4 refers to October to December.

3 . Per head estimates of greenhouse gas emissions and gross value added

In per head terms, residence-based greenhouse gas (GHG) emissions were 1.80 tonnes of carbon dioxide equivalent (CO₂e) per person in Quarter 2 (Apr to June) 2024, unchanged from Quarter 1 (Jan to Mar) 2024.

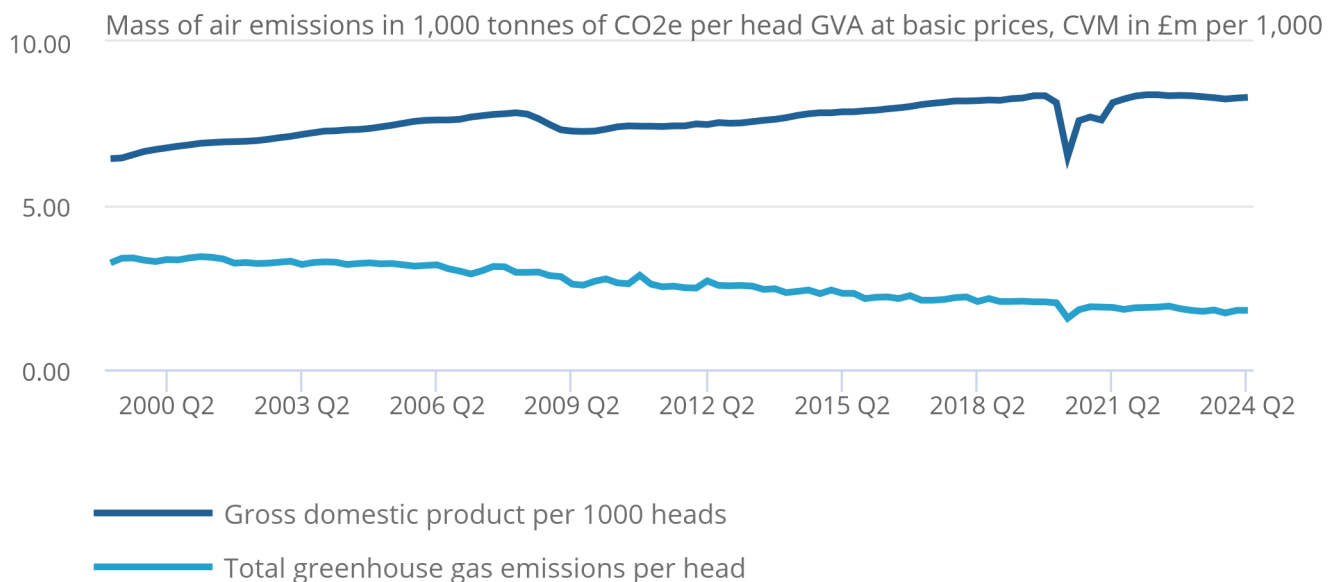
Since 1999, the start of the data time series for this measure, residence-based GHG emissions have decreased by 44.7%, or 1.45 tonnes of CO₂e per person (Figure 2).

Figure 2: Total greenhouse gas emissions per head have steadily declined since 1999

Experimental estimates of quarterly greenhouse gas emissions per head and gross value added per 1,000 heads, UK, Quarter 1 (Jan to Mar) 1999 to Quarter 2 (Apr to June) 2024

Figure 2: Total greenhouse gas emissions per head have steadily declined since 1999

Experimental estimates of quarterly greenhouse gas emissions per head and gross value added per 1,000 heads, UK, Quarter 1 (Jan to Mar) 1999 to Quarter 2 (Apr to June) 2024



Source: Environmental Accounts from the Office for National Statistics

Notes:

1. Q1 refers to Quarter 1 (Jan to Mar), Q2 refers to Quarter 2 (Apr to June), Q3 refers to Quarter 3 (July to Sept) and Q4 refers to Quarter 4 (Oct to Dec).
2. Per head estimates are calculated by dividing the level of greenhouse gas emissions and gross value added (GVA) by quarterly population estimates. GVA is the difference for any given industry between the value of goods and services produced (output) and the cost of raw materials and other inputs, which are used up in production (intermediate consumption). GVA are chained volume measures, in constant prices with 2022 as the base and reference year.

Importantly, these official statistics in development estimates are subject to [uncertainty](#), so should be interpreted with caution. The underlying input data, estimates informing the model and the modelling process itself each introduce uncertainty affecting the accuracy of these estimates. The level of uncertainty is particularly high for all quarters of 2023, Quarter 1 and Quarter 2 2024 in this release, as the final annual estimate of GHG emissions on a residence basis to which we constrain these estimates will not be published until summer 2025.

More information can be found in [Section 6 of the accompanying Quality and Methodology Information](#).

4 . Intensity of quarterly greenhouse gas emissions

Our residence-based emissions estimates are compiled in accordance with the UN System of Environmental Economic Accounting, which aligns with the UK System of National Accounts. This enables comparisons with the main economic indicators such as gross value added (GVA), and also the calculation of greenhouse gas (GHG) emissions intensity, or emissions per unit of economic output.

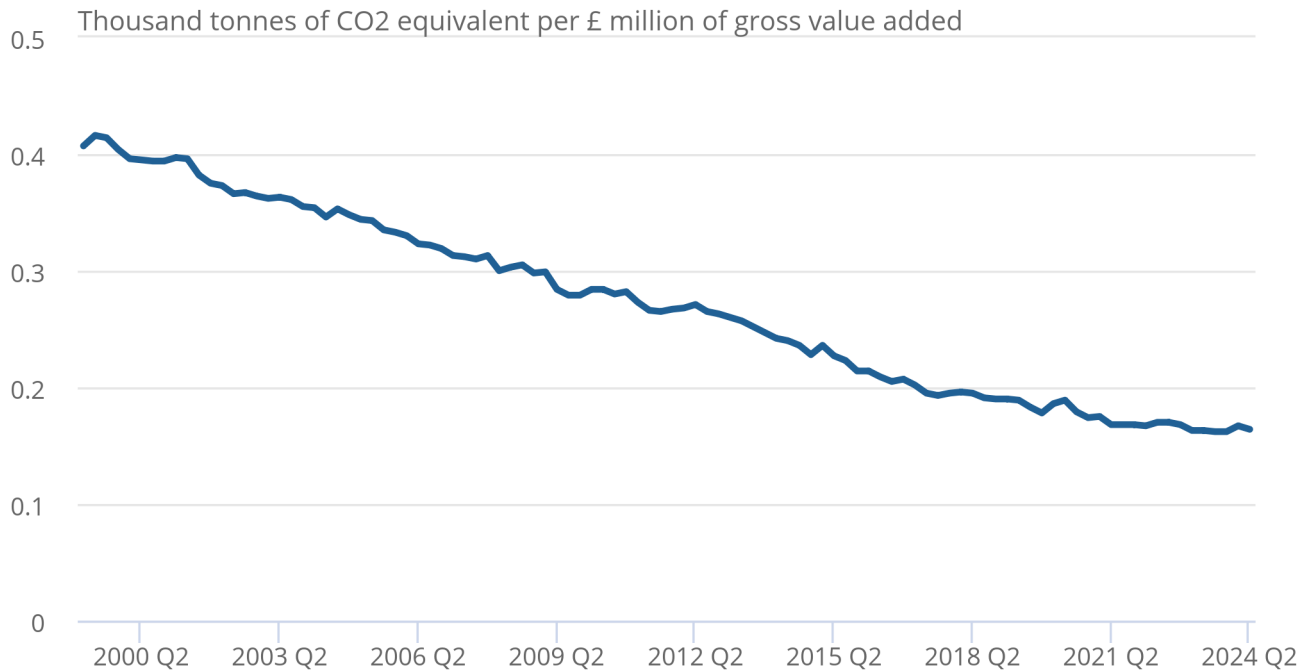
The UK emitted 0.164 tonnes of carbon dioxide equivalent (CO₂e) per million pounds of GVA in Quarter 2 (Apr to June) 2024. This was similar to levels seen since Quarter 2 2021. Emissions intensity has fallen 59.7% from 0.407 tonnes of CO₂e per million pounds of GVA in 1999 (Figure 3).

Figure 3: UK residence-based emissions intensity fell almost 60% between 1999 and 2024

Experimental estimates of greenhouse gas emissions intensity of gross value added (GVA) (seasonally adjusted), UK (residency basis), Quarter 1 (Jan to Mar) 1999 to Quarter 2 (Apr to June) 2024

Figure 3: UK residence-based emissions intensity fell almost 60% between 1999 and 2024

Experimental estimates of greenhouse gas emissions intensity of gross value added (GVA) (seasonally adjusted), UK (residency basis), Quarter 1 (Jan to Mar) 1999 to Quarter 2 (Apr to June) 2024



Source: Environmental Accounts from the Office for National Statistics

Notes:

1. Q1 refers to Quarter 1 (Jan to Mar), Q2 refers to Quarter 2 (Apr to June), Q3 refers to Quarter 3 (July to Sept) and Q4 refers to Quarter 4 (Oct to Dec).
2. Emissions intensity is calculated by dividing the level of greenhouse gas emissions by gross value added (GVA). GVA is the difference for any given industry between the value of goods and services produced (output) and the cost of raw materials and other inputs, which are used up in production (intermediate consumption). GVA are chained volume measures, in constant prices with 2022 as the base and reference year.
3. All emissions intensity figures are calculated using seasonally adjusted estimates of greenhouse gas emissions excluding those from households that refer to consumer expenditure travel and non-travel.
4. For seasonal adjusted estimates, the predictor indicators used within the modelling were seasonally adjusted using X-13ARIMA-SEATS.

Emissions intensity can be used to examine the relationship between economic growth and GHG emissions on a residence basis. The reduction in overall emissions intensity on this measure is an indication that the UK is moving towards a lower carbon economy.

This could be driven by several factors, including changes in the structure of the economy and behavioural changes that may depict the interaction between the economy and the environment. For example, it could be related to some industries becoming more efficient in their production processes through the adoption of lower emission technologies, changes in the composition of the economy, where there is a growing shift from higher- to lower-emitting economic activities, for example, manufacturing to services activities, or a combination of these factors.

All estimates of gross value added are subject to revisions. For more information, please see [GDP quarterly national accounts, UK: April to June 2024](#).

5 . Data on quarterly greenhouse gas emissions

[Estimates of quarterly greenhouse gas emissions](#)

Dataset | Released 6 November 2024

Estimates of UK quarterly greenhouse gas emissions (GHG) and carbon dioxide (CO₂) emissions on a residence basis. These are official statistics in development.

6 . Glossary

Greenhouse gases

Greenhouse gases (GHGs) are those covered by the [Paris Agreement](#), which has superseded the Kyoto Protocol. These include:

- carbon dioxide (CO₂)
- methane (CH₄)
- nitrous oxide (N₂O)
- hydrofluorocarbons (HFCs)
- perfluorocarbons (PFCs)
- sulphur hexafluoride (SF₆)
- nitrogen trifluoride (NF₃)

These gases contribute directly to global warming and climate change, because of their positive radiative forcing effect. The potential of each GHG to cause global warming is assessed in relation to a given weight of CO₂, so all greenhouse gas emissions are measured as carbon dioxide equivalent (CO₂e).

Residence basis

Estimates compiled on a residence basis include data relating to UK residents and UK-registered businesses regardless of whether they are in the UK or overseas. Emissions released in the UK by tourists and foreign transport operations are excluded. For more detailed comparisons of UK emissions measures, please see our [Measuring UK greenhouse gas emissions methodology article](#).

Temporal disaggregation

Temporal disaggregation is the process of deriving high-frequency data (for example, quarterly) from low-frequency data (for example, annual).

7 . Data sources and quality

All estimates presented in this release and our accompanying dataset have been produced using temporal disaggregation and modelling techniques and are therefore subject to uncertainty.

The main source of information and predictor indicators for producing these official statistics in development estimates are:

- Office for National Statistics (ONS) UK annual estimates of greenhouse gas (GHG) emissions on a residence basis
- Department for Energy Security and Net Zero's [Energy trends](#), which provides information on UK energy production, consumption and trade for energy overall and specific fuels.

All estimates of the annual GHG data series and the latest quarter of Energy trends are provisional and subject to revisions. While the ONS has published provisional estimates of emissions for 2023, a complete breakdown of emission data by Standard Industrial Classification (SIC) is required for the quarterly model so 2023 annual estimates will not be incorporated until the June 2025 release. The whole data time series is updated for each iteration of this release, which means that the latest version supersedes all previous versions.

This release presents non-seasonally adjusted estimates. Both non-seasonally adjusted and seasonally adjusted data are available in our accompanying dataset.

Official statistics in development

These statistics are labelled as “official statistics in development”. Until September 2023, these were called “experimental statistics”. Read more about the change in the [Guide to official statistics in development](#).

We are developing how we collect and produce the data to improve the quality of these statistics, such as refining and optimising the code used. Once the developments are complete, we will review the statistics with the Statistics Head of Profession. We will decide whether the statistics are of sufficient quality and value to be published as official statistics, or whether further development is needed. Production may be stopped if they are not of sufficient quality or value. Users will be informed of the outcome and any changes. We value your feedback on these statistics. Contact us at environment.accounts@ons.gov.uk.

Strengths and limitations

These estimates are subject to [uncertainty](#), both in the underlying estimates used with the model and through uncertainty introduced by the modelling itself. For instance, for periods where a base or reference year is unavailable (such as this quarter), we use “nowcasting” measures to extend the series for five quarters. This implies that the estimates for those periods are less accurate compared with periods where a base or reference year is available.

For information on the strengths and limitations of the estimates presented in this bulletin, see Section 6 of our [Experimental estimates of UK quarterly greenhouse gas emissions \(residence basis\), Quality and Methodology Information](#).

8 . Related links

[UK Environmental Accounts](#)

Statistical bulletin | Released 5 June 2024

Measuring the contribution of the environment to the economy, impact of economic activity on the environment, and response to environmental issues.

[Greenhouse gas emissions, UK: provisional estimates: 2023](#)

Statistical bulletin | Released 17 October 2024

The emissions of carbon dioxide, methane, nitrous oxide, hydro-fluorocarbons, perfluorocarbons, sulphur hexafluoride, nitrogen trifluoride and total greenhouse gas emissions, by industry (SIC 2007 group – around 130 categories), UK, 1990 to 2023.

[Energy Trends: September 2024](#)

Department for Energy Security and Net Zero | Released 26 September 2024

Quarterly bulletin containing statistics on all major aspects of energy in the UK.

9 . Cite this statistical bulletin

Office for National Statistics (ONS), released 6 November 2024, ONS website, statistical bulletin, [Estimates of quarterly greenhouse gas emissions \(residence basis\), UK: April to June 2024](#)