

Article

# Insulation and energy efficiency of housing in England and Wales: 2022

Wall and roof insulation based on property type, age and tenure, and the relationship with overall energy performance of properties for national and subnational geographies.

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# 1 . Main points

- The percentage of existing dwellings with walls rated “average” or above has increased since 2012 in all English regions and Wales, with the North East consistently having the best wall ratings and the West Midlands showing the greatest improvement.
- Since 2012, the percentage of existing houses with a roof rating of "good" or "very good" has increased in Wales and in all English regions except London.
- Despite receiving the lowest ratings for both roof and wall insulation, London has the highest median current energy efficiency score and the smallest median difference between current and potential energy efficiency.
- Dwellings built in or before 1929 and terraced houses have the lowest ratings of wall and roof insulation.
- There is greater scope for improving the energy efficiency of houses than flats, with houses having both lower current energy efficiency and higher potential energy efficiency.
- Energy efficiency remains better in social-rented dwellings than in owner-occupied or private-rented dwellings, but these latter categories have improved since 2012.

## 2 . Insulation and energy efficiency in England and Wales

The overall energy performance of a dwelling is based on several factors, including the insulation of the roof, walls, and floors, and the energy performance of light fixtures and large appliances such as the boiler. All these factors are assessed and combined into the energy performance of dwellings measured by the Energy Performance Certificate (EPC) score.

The scores associated with each energy efficiency band are:

- band A – 92 plus (most efficient)
- band B – 81 to 91
- band C – 69 to 80
- band D – 55 to 68
- band E – 39 to 54
- band F – 21 to 38
- band G – 1 to 20 (least efficient)

The energy performance of walls and roofs are assessed during the inspection and categorised into either “very good”, “good”, “average”, “poor”, or “very poor” based on the measured or assumed thermal transmittance of the walls or roof. Especially for existing properties, the assessment is often based on assumptions around the property’s age and does not involve visual inspection of insulation. The insulation rating is based on one or more of a number of factors, including cavity insulation or the insulating qualities of the original building materials. To effectively compare energy performance across properties, all assessments are carried out using the Standard Assessment Process (SAP), a framework which lays out precisely how the overall ratings are calculated. The SAP is regularly reviewed and updated and takes into account energy prices at the time of the assessment, which means the same property assessed at different times could achieve different ratings. This can affect the comparability of EPC ratings over time.

This analysis uses EPC data to present wall and roof insulation and energy efficiency of dwellings with an EPC for England and Wales at subnational level. It is based on the latest record per dwelling, using records from April 2012 to March 2022.

## The relationship between insulation ratings and overall energy efficiency

The wall and roof insulation ratings are closely related to the overall energy efficiency of dwellings. A high percentage of dwellings with “very good” wall insulation achieve an EPC of C or above, at 98% for England and 97% for Wales. Dwellings with a higher EPC rating use less energy for the same amount of heat retained, and so are more cost-effective.

For most ratings of wall insulation, London dwellings are more likely to score an EPC of C or above than dwellings of the same wall insulation rating in other regions. This could be because of London’s dwelling stock composition, which contains a higher proportion of flats in our sample than the other English regions and Wales. Wall insulation is less impactful on the EPC score for flats than for houses because flats tend to have less outward facing wall surface area. Other factors, including the high prevalence of community heating schemes are also likely to contribute to these higher EPC scores.

### Figure 1: For most levels of wall insulation, London dwellings are more likely to score an EPC of C or above

**Percentage of dwellings (houses and flats) achieving an Energy Performance Certificate (EPC) of C or above by wall insulation rating, English regions and Wales, up to March 2022**

**Download the data**

[.xlsx](#)

The results differ for roof insulation of houses across the English regions and Wales. Roof insulation has a weaker relationship with the overall energy efficiency of houses. In the South East, 54% of houses with a “very good” or “good” roof rating achieve an EPC of C or above, compared with 41% in London (Figure 2). The percentage of dwellings with “very good” roof insulation which achieve an EPC of C or above are 69% for England and 63% for Wales, lower than for the dwellings with “very good” wall insulation.

In London and the South East, 7% of houses with “very poor” or “poor” roof insulation still achieve an EPC of C or above, which is highest among the English regions and Wales (Figure 2). This is likely because of the composition of the dwelling stock and heating characteristics in those regions. To learn more about the energy efficiency of different properties, view our [Energy efficiency of housing in England and Wales: 2022 article](#).

## Figure 2: The correlation between roof insulation rating and an EPC score of C or above is weakest in London

Percentage of houses with an Energy Performance Certificate (EPC) of C or above by roof insulation rating, English regions and Wales, up to March 2022

Download the data

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## 3 . Wall insulation across England and Wales

Across England and Wales, 60% of houses have a wall insulation rating of “average” or above. This varies by region with 73% in the North East compared with 27% in London.

For flats, 66% have a wall insulation rating of “average” or above, regionally ranging from 78% in the East Midlands and the East of England to 52% in London.

In Wales and all English regions except the North East, the percentage of walls rated “average” or above is higher for flats than houses.

### Figure 3: Wall insulation ratings are better for flats than houses in most English regions and Wales

Percentage of houses and flats with wall insulation rated “average” or above, English regions and Wales, up to March 2022

Download the data

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Of all local authority districts, Sunderland (82%) has the highest rate of houses where walls are rated “average” or above. Milton Keynes (92%) has the highest rate for flats. Flintshire (69%) shows the highest percentage of houses with walls rated “average” or above among the Welsh local authority districts and Wrexham (88%) has the highest percentage of flats achieving the same ratings.

To explore the wall insulation ratings of dwellings in local areas, use our interactive tool.

### Figure 4: Wall insulation ratings in your area

Download the data

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To look more closely at how insulation ratings differ between dwellings, we have broken the wall insulation ratings down by property type, property age, and tenure. For a subnational distribution of property type and tenure across England and Wales, view our [Housing in England and Wales: 2021 compared with 2011 census article](#).

We have found that:

- detached houses have the highest proportion (74%) of walls rated “average” or above among all property types
- social-rented dwellings have the highest rated walls, with 75% having walls rated “average” or above, whereas private-rented dwellings have the lowest proportion (45%)
- the walls of dwellings built from 2012 onwards are almost exclusively (91%) rated as “very good”, and more than 99% are rated “average” or above, which compares with only 10% for dwellings built in or before 1929

## Figure 5: Wall insulation ratings are highest for detached, social-rented and newer dwellings

Percentage of dwellings with walls rated “average” or above, by characteristic, England and Wales, up to March 2022

Download the data

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To investigate how insulation ratings have changed over time we have created an overlapping five-year time series starting from Quarter 2 (Apr to June) 2012 until Quarter 1 (Jan to Mar) 2022. For the time series analysis, we focus on existing dwellings, as insulation ratings and energy efficiency differ between newly-built and existing dwellings. More information on the methodology of the time series can be found in [Section 8: Data sources and quality](#).

## Figure 6: Wall insulation ratings in your area since 2012

Percentage of existing dwellings with “good” or “very good” wall insulation, English regions and Wales and local authority districts in England and Wales, up to Quarter 2 (Apr to June) 2017 to Quarter 1 (Jan to Mar) 2022

Download the data

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The rate of existing houses and flats with “average” or above wall insulation remains consistent with a slight increase over time for most English regions and Wales. The West Midlands saw the greatest increase in the percentage of dwellings with walls rated “average” or above.

The local authority district with the largest increase in the rate of existing houses with a wall insulation rating of “average” or above is Neath Port Talbot. Compared with the average rate across all local authority districts, the rate of existing houses with “average” or above wall insulation is lowest in Haringey across the time series and shows the greatest decrease. This decrease could be because of changes in the composition of the sample, as well as changes to the energy efficiency calculation criteria which occurred in the time period.

## 4 . Roof insulation across England and Wales

For the analysis of roof insulation across England and Wales we have focused on roof ratings for houses, excluding flats from the sample. We see similar results for the roof insulation of houses as for the wall insulation of houses across the English regions and Wales. London has the lowest rate of roofs categorised as “good” or above, at only 40%. This compares with an average of 64% across all other English regions and Wales.

The five local authority districts with the highest percentage of houses with either “good” or “very good” roof insulation are Richmondshire, South Derbyshire, North Kesteven, Hambleton, and South Norfolk. In these local authority districts, more than 76% of houses show a roof insulation rating of “good” or “very good”.

The five local authority districts with the lowest percentage of houses with either “good” or “very good” roof insulation are in London: Islington (30%), Camden (28%), Westminster (27%), Kensington and Chelsea (23%), and City of London (10%).

To explore the roof insulation ratings of dwellings in local areas, use our interactive tool.

## Figure 7: Roof insulation ratings in your area

Download the data

[.xlsx](#)

Looking at the property characteristics associated with good roof insulation, we see a very similar pattern as with wall insulation. Detached, social-rented, and newer houses perform the best in their categories:

- 70% of EPCs for detached houses have roofs rated “good” or above, with this number decreasing to 62% for semi-detached, and terraced houses having the smallest proportion at 55%
- the levels of “good” or “very good” roof ratings for owner-occupied and private-rented houses are similar at 56% and 51% respectively, while 76% of social-rented houses achieved the same ratings
- the roofs of more than 99% of houses built from 2012 onwards are rated “good” or “very good”
- the roofs of houses built in or before 1929 are rated lowest, with only 43% rated “good” or “very good”

Looking at the trends in roof insulation, we see London has the lowest percentage of existing houses with “good” or “very good” roofs overall and this rate stagnates at a similar level over the time series. The North East and Yorkshire and The Humber both show the greatest improvement in roof rating across the time series.

Of all local authority districts, Wakefield and Sunderland show the greatest increase in the percentage of houses with roofs rated “good” or “very good”, whereas Harlow and Hammersmith and Fulham show the largest decrease. As with wall ratings, this decrease does not suggest the roof insulation of houses has become worse, but is more likely because of a change in the property composition within our sample or changes in the Standard Assessment Process framework over time.

To look at the roof ratings since 2012 in your local area, use our interactive time series.

**Figure 8: London has a lower rate of existing houses with “good” or “very good” roofs across the time series than the other English regions and Wales**

**Percentage of existing houses with “good” or “very good” roof insulation, English regions and Wales and local authority districts in England and Wales, up to Quarter 2 (Apr to June) 2017 to Quarter 1 (Jan to Mar) 2022**

Download the data

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## 5 . Current and potential energy efficiency

The potential energy efficiency is calculated as part of the Energy Performance Certificate (EPC) assessment process measuring the energy efficiency achievable if all the recommended measures were installed at the dwelling. To analyse which dwellings have the biggest room for improvement in energy efficiency, we have taken a closer look at the distribution of the difference between current and potential energy efficiency across England and Wales.

England has a median energy efficiency difference between its current and potential energy efficiency of 15, while Wales’ median difference is 18. Across the English regions and Wales, we see a similar potential for energy efficiency of housing. London has the lowest median potential energy efficiency and is closest to it with a current median of 68. Of the 13 local authority districts with the lowest potential median energy efficiency score, 12 are in London, showing a median potential energy efficiency of 79 or lower. Five of the six local authority districts with the highest current energy efficiency are in London, showing a median of 72 or above. Of the 20 local authority districts with the lowest current energy efficiency, seven are in Wales showing a median of 63 or below.

Wales shows the biggest gap between its current and potential energy efficiency of housing, but is at a similar level as most English regions outside of London.

**Figure 9: London has a smaller gap between its median current and potential energy efficiency than any other English region and Wales**

**Median current and potential energy efficiency, all dwellings, English regions and Wales, up to March 2022**

## Download the data

[.xlsx](#)

Overall, the median current energy efficiency scores are more even between the English regions and Wales in recent years than at the start of the time series, whereas the potential energy efficiency has remained at a similar level. All English regions and Wales have been able to decrease the gap between their median current and potential energy efficiency of existing dwellings since 2012.

Looking more closely at the current and potential energy efficiency among different property characteristics, we have found that:

- flats have the highest median current energy efficiency of any property type at 72, but the lowest median potential energy efficiency at 78
- there is a greater potential for improving houses than flats; the median difference between current and potential energy efficiency for flats is 4, rising to 20 for terraces
- owner-occupied homes have the greatest potential for improvement, followed by private-rented homes
- the median potential energy efficiency is lowest for properties built in or before 1929, and highest for properties built from 2012 onwards with a median potential score of 87, showing that construction methods and materials have evolved over time
- homes built in or before 1929 have the lowest median current energy efficiency of all groups at 59
- the median current energy efficiency of homes built in 2012 and onwards is 83, which is as high as or higher than the potential for all other property age groups

## Figure 10: Flats, social-rented, and newer homes are closest to their energy efficiency potential

**Median current and potential energy efficiency, all dwellings, by characteristic, England and Wales, up to March 2022**

## Download the data

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Our time series analysis of existing dwellings shows that the potential has remained at a similar level from 2012 onwards across the different property characteristics. In current and potential median energy efficiency across the property characteristics:

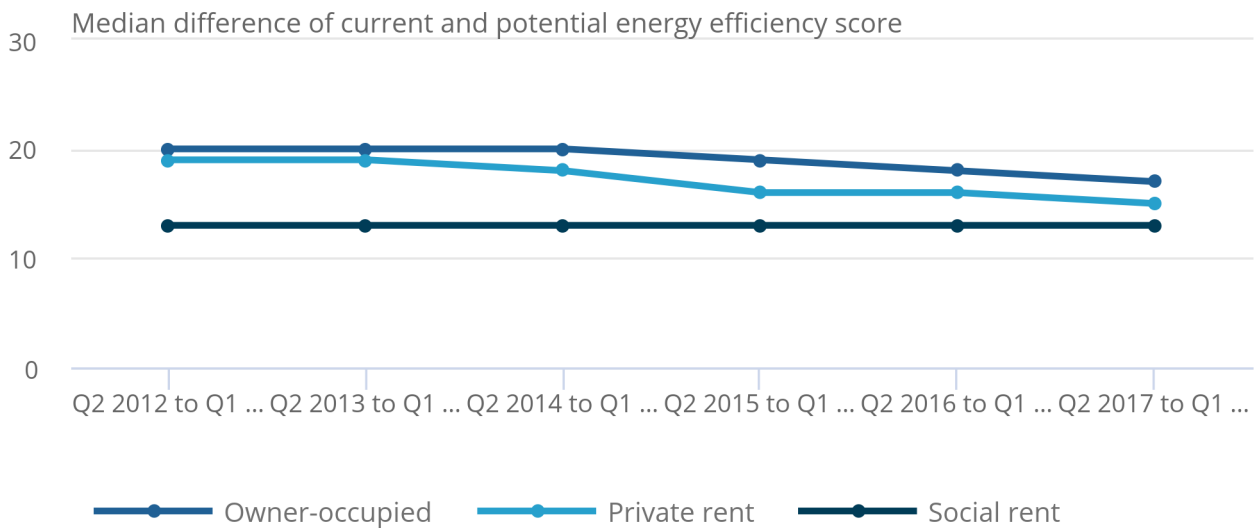
- the median current energy efficiency has remained at the same level for social-rented homes (Figure 11)
- owner-occupied and private-rented dwellings have decreased the gap between current and potential energy efficiency among existing dwellings (Figure 11)
- the median current energy efficiency has increased across all types of properties – reducing the gap between current and potential energy efficiency for all property types (Figure 12)

**Figure 11: The median energy efficiency difference of owner-occupied and private-rented dwellings has decreased**

Median energy efficiency difference over time for existing dwellings, by tenure, England and Wales, up to Quarter 2 (Apr to June) 2017 to Quarter 1 (Jan to Mar) 2022

Figure 11: The median energy efficiency difference of owner-occupied and private-rented dwellings has decreased

Median energy efficiency difference over time for existing dwellings, by tenure, England and Wales, up to Quarter 2 (Apr to June) 2017 to Quarter 1 (Jan to Mar) 2022



Source: Energy Performance Certificate data on Open Data Communities from the Department for Levelling Up, Housing and Communities, and Property Attributes data from the Valuation Office Agency

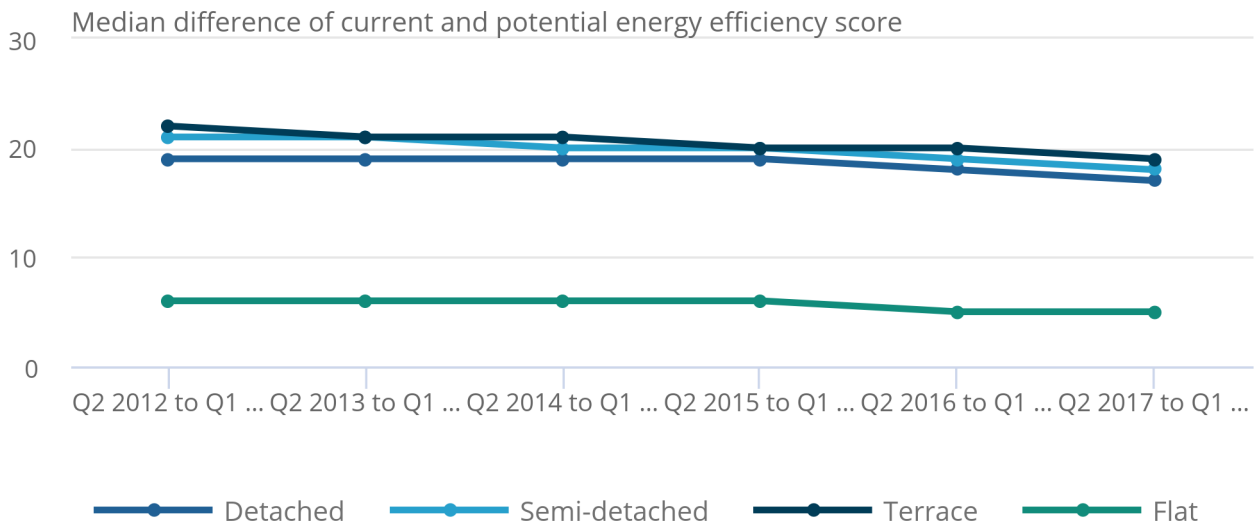


**Figure 12: Flats have maintained the smallest gap between median current and potential energy efficiency, but other property types have shown more improvement**

Median energy efficiency difference over time for existing dwellings, by property type, England and Wales, up to Quarter 2 (Apr to June) 2017 to Quarter 1 (Jan to Mar) 2022

Figure 12: Flats have maintained the smallest gap between median current and potential energy efficiency, but other property types have shown more improvement

Median energy efficiency difference over time for existing dwellings, by property type, England and Wales, up to Quarter 2 (Apr to June) 2017 to Quarter 1 (Jan to Mar) 2022



Source: Energy Performance Certificate data on Open Data Communities from the Department for Levelling Up, Housing and Communities, and Property Attributes data from the Valuation Office Agency

## 6 . Insulation and energy efficiency of housing in England and Wales data

[Energy Performance Certificate wall ratings, England and Wales](#)

Dataset | Released 3 May 2023

Wall insulation ratings in England and Wales at the country and subnational level and for five-year groups. These are broken down by property type, tenure, and property age.

[Energy Performance Certificate roof ratings, England and Wales](#)

Dataset | Released 3 May 2023

Roof insulation ratings in England and Wales at the country and subnational level and for five-year groups. These are broken down by property type, tenure, and property age.

[Current and potential energy efficiency of housing, England and Wales](#)

Dataset | Released 3 May 2023

Energy efficiency in England and Wales at the country and subnational level and for five-year groups. These are broken down by property type, tenure, and property age.

## 7 . Glossary

### Dwelling

A dwelling is an address containing a unit of accommodation that can comprise one or more household spaces.

### Energy efficiency

Energy efficiency relates to the concept of efficient energy use, which means using less energy to provide a given amount of heating or lighting. Using less energy reduces emissions of carbon dioxide.

### Energy efficiency score

The energy efficiency score (SAP score) is a measure of the current overall efficiency of a building. This score is based on the performance of the building and its fixed services (such as heating and lighting). The higher the score, the more energy efficient the home. The score is produced during an Energy Performance Certificate (EPC) assessment and is based on standardised assumptions for occupancy and behaviour. This enables a like-for-like comparison of a property's energy efficiency performance.

### Energy Performance Certificate

Energy Performance Certificates (EPCs) are required for all buildings (domestic and non-domestic), when constructed, sold, or rented. There are some exemptions, for example for buildings used as places of worship. EPCs are valid for 10 years. The EPC records how energy efficient a property is as a building. The EPC uses an A to G rating scale, where A is the most efficient and G is the least efficient. The certificate also lists the potential rating of the building if all the cost-effective measures are installed.

### Existing dwellings

Statistics for existing dwellings were created using data from the latest EPC record available for existing dwellings. Existing dwellings are those that are required to undergo an energy performance assessment as they are either being sold or let and are not newly constructed or converted.

### Median energy efficiency difference

The median energy efficiency difference is calculated by subtracting the current energy efficiency score from the potential energy efficiency score of each dwelling and subsequently finding the median of these differences.

### Potential energy efficiency score

The potential energy efficiency is produced during the EPC assessment and provides an estimate of the building's energy efficiency score if all measures recommended on the EPC were carried out.

### Roof insulation rating

The roof insulation rating is based on multiple factors reviewed during the EPC assessment, such as the shape and size of the roof, the materials used for decking the roof, and the location and amount of added insulation. These factors feed into the assessed energy performance of the roof and are captured by the roof insulation rating on the EPC, which ranges from "very good" to "very poor".

### Wall insulation rating

The wall insulation rating is based on multiple factors reviewed during the EPC assessment, such as the building material used and the thickness of the walls, what kind and the amount of added insulation, the age of the property, and the net wall area, which is the total wall area excluding windows and doors. These factors feed into the assessed energy performance of the walls and are captured by the wall insulation rating on the EPC, which ranges from "very good" to "very poor".

## 8 . Data sources and quality

This analysis uses the Energy Performance Certificate (EPC) database to investigate the current ratings of wall and roof insulation as well as current and potential energy efficiency across England and Wales. The EPC database does not cover all dwellings in England and Wales. It covers dwellings which have been issued with an EPC in England and Wales. Since 2007 properties are obliged to have a valid EPC when they are constructed, rented out or sold. EPCs remain valid for 10 years.

For our analysis we used the latest EPC record for each dwelling from April 2012 until March 2022. Our analysis is based on the energy efficiency scores and insulation ratings at the time the EPC was assessed. This means that our statistics do not necessarily reflect energy efficiency improvements as most alterations don't require a new EPC to be generated.

The time series analysis covers the financial year ending 2013 to financial year ending 2022 to show recent trends in the energy performance of roofs and walls at subnational level. We have grouped the data into five-year overlapping groups (that is, Quarter 2 (Apr to June) 2016 to Quarter 1 (Jan to Mar) 2021 and Quarter 2 2017 to Quarter 1 2022). This grouping gives an indication of change over time, which is less easily biased by large changes in the types of properties with a recorded EPC each year.

We have used the same data for the main analysis as for the time series, keeping only the latest EPC record per dwelling. This means dwellings which had a valid EPC in June 2012 and were issued a new EPC in July 2016 only appear in July 2016 in the time series.

EPC data for England and Wales are available from the [Department for Levelling Up, Housing and Communities \(DLUHC\) Open Data Communities website](#).

To analyse areas for improvement for different properties, we have linked the EPC database with the Valuation Office Agency (VOA) property attributes data at the address level. The property attributes data contain information on properties such as property type, age, tenure, and size for properties in England and Wales.

We have done various cleaning steps to remove duplicates and atypical records from the analysis, including:

- EPC records which no longer existed, which were removed from the data
- EPC records where there was inconsistent information on property type and property age band between the VOA and EPC databases, which were excluded
- records with implausible values for important variables, which were filtered out
- duplicated EPC records based on multiple variables including Unique Property Reference Number and inspection date, which were removed
- EPC records that have been superseded by a later record for the same dwelling, which were removed and only the latest record was kept in the data
- EPC records that are older than 10 years, which were removed

We retained 10,788,788 EPC records for use in the analysis.

## 9 . Related links

### [Energy efficiency of housing in England and Wales: 2022](#)

Article | Released 25 October 2022

Insights on the energy efficiency, environmental impact, carbon dioxide emissions and central heating main fuel type for new and existing homes by property type, tenure and property age.

### [Energy Performance of Buildings Certificates](#)

Collection | Last updated 27 April 2023

The Department of Levelling Up, Housing and Communities (DLUHC) publish quarterly Energy Performance Certificate (EPC) statistical releases. These focus primarily on describing the EPCs themselves, presenting timely information for domestic and non-domestic buildings in England and Wales.

### [UK climate change statistics portal](#)

Statistics Dashboard | Updated regularly

A prototype portal for data and insights on climate change.

## 10 . Cite this article

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