

Energy Use in Wales 2018



Llywodraeth Cymru
Welsh Government



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Ministerial foreword



Last year I accepted the UK Committee on Climate Change (UK CCC) recommendation to increase the ambition of our 2050 climate change target. This year we will bring forward legislation to adopt a 95% target for greenhouse gas reduction over the next 30 years. This represents Wales' fair contribution to the UK's commitments under the Paris Agreement and is a huge increase in ambition from our current 80% target. We have declared an ambition to go beyond 95% and will work with the UK CCC and other stakeholders to explore how this could be done.

Energy is a key part of delivering our climate goals. We must decarbonise our energy system in a way which improves wellbeing in Wales. We must use energy more efficiently, reduce emissions from fossil fuel generation and increase generation from renewable and low carbon sources. We will need more renewable energy generation if we are to meet the increased electricity demand resulting from decarbonising heat and transport. We have had considerable success in increasing renewable generation in Wales: in 2018 enough renewable electricity was generated to meet half of our electricity use. Our target is 70% by 2030.

I have also set targets around local ownership of energy projects, to ensure we capture the benefits for Wales from new energy developments. Locally owned generation provides a strong opportunity to retain economic value, contributing to prosperity. In February I issued a policy statement on local ownership which sets out our expectation of local and shared ownership.¹ I am supporting the Wales Growth Deal regions to develop evidence based energy planning, which can identify the economic and social benefits for Wales's regions from a future low carbon energy system.

This is the first time we have commissioned the Energy Use in Wales study. The study sets out how energy is used in Wales and analyses how the use of energy has changed since 2005. Overall, energy usage in Wales has reduced by 11% over this period. This report complements the Energy Generation in Wales report, which sets out the energy generation capacity of Wales. Together, they provide important data and analysis on energy in Wales to help us as Government and decision makers across Wales to accelerate our transition to a low carbon economy.

A handwritten signature in cursive script that reads "Lesley Griffiths".

Lesley Griffiths AM

Minister for Environment, Energy and Rural Affairs

¹ <https://gov.wales/local-ownership-energy-generation-wales-policy-statement>

Introduction

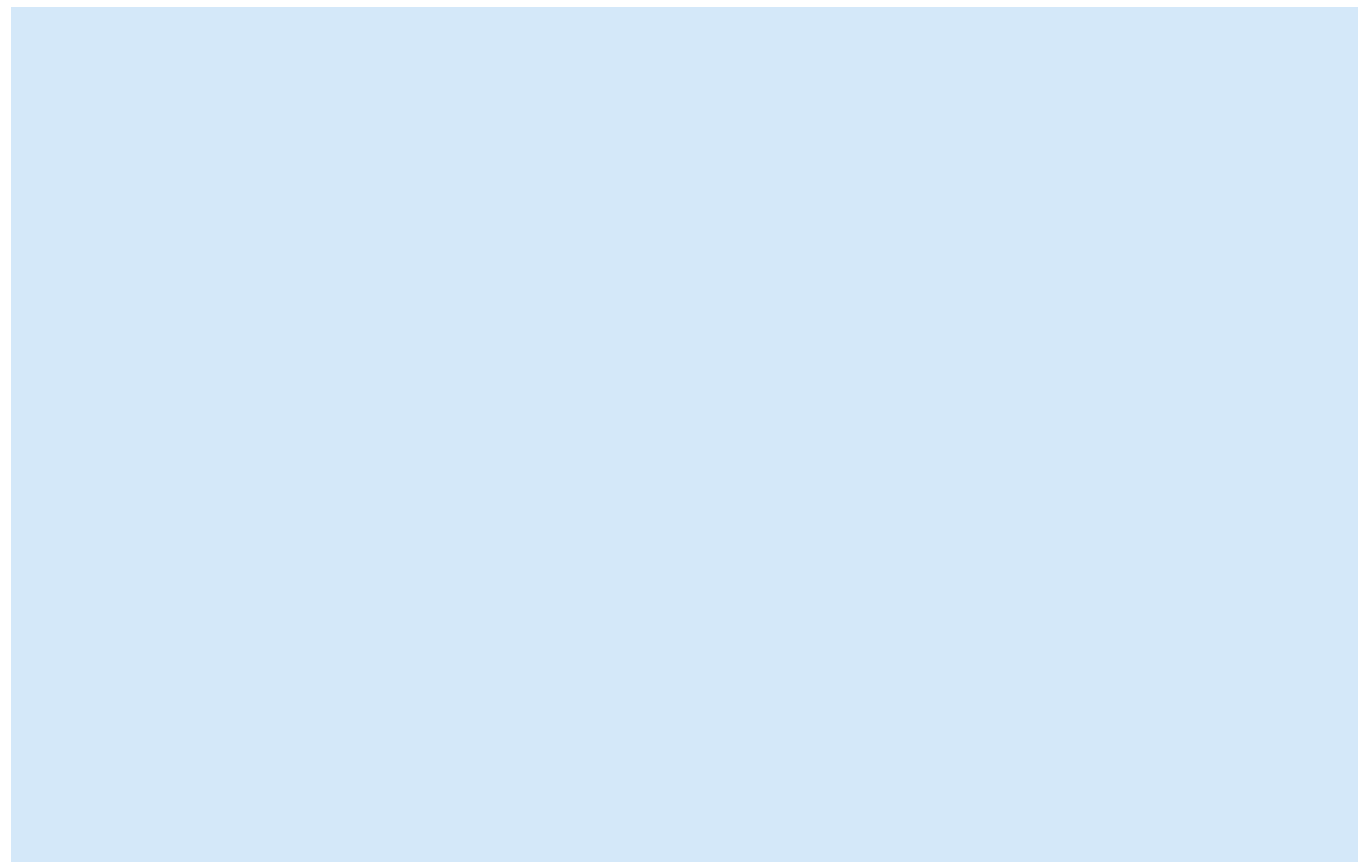
The Energy Use in Wales 2018 report sets out how energy is used in Wales and analyses how the use of energy has changed over time.

The aim of this report is to provide information to Welsh Government to support the development of energy policy. The report provides a picture of energy use across Wales, presented by sector, end use, fuel and geographical area.

Between 2005 and 2017, the population in Wales has grown by 150,000 to 3.12 million and the average productivity² per head in Wales has grown by 31%. In the same period, total energy use in Wales has reduced across all local authority regions, from a total of 111.2 TWh in 2005 to 90.5 TWh in 2017: a reduction of 19% over a 12-year period.

The largest reduction in energy demand between 2005 and 2017 was from the industrial sector, with a 31% drop in demand across heat and electricity.

Electricity use in Wales reduced by 15% since 2005, and demand for fossil fuels (i.e. oil, coal, petroleum products and manufactured fuels) has dropped by 23% over the same period.



² Gross Value Added (GVA), a metric used by the Office for National Statistics to compare the impact of regional population growth.

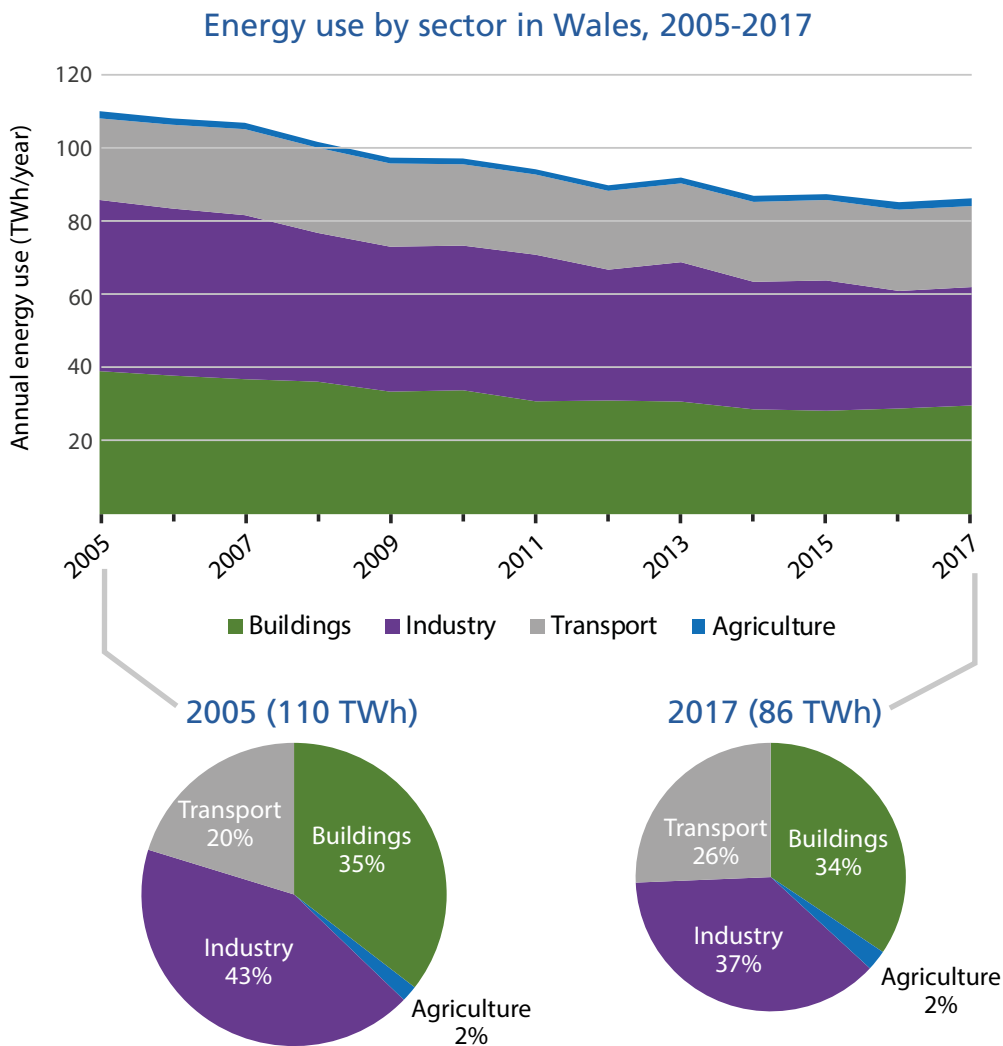
Energy use by sector

Energy use in Wales has been split into four sectors: **transport, buildings, industry and agriculture**.

Three of the four sectors have seen reductions in energy use since 2005. Only agriculture, which represents a small proportion (less than 2.5%) of overall energy use in Wales, used more energy in 2017 than 2005.

Energy use in Wales (TWh/year)					
Year	Transport	Buildings	Industry	Agriculture	Total
2005	22.2	39.0	46.7	1.9	109.8
2017	22.1	29.6	32.3	2.1	86.1 ³

Of these four sectors, industry still accounted for the highest energy use in Wales in 2017, but this use has been steadily declining since 2005. Industry now accounts for just 3% more energy use than buildings (32.3 TWh against 29.6 TWh for buildings in 2017), with transport energy use not far behind (22.1 TWh).



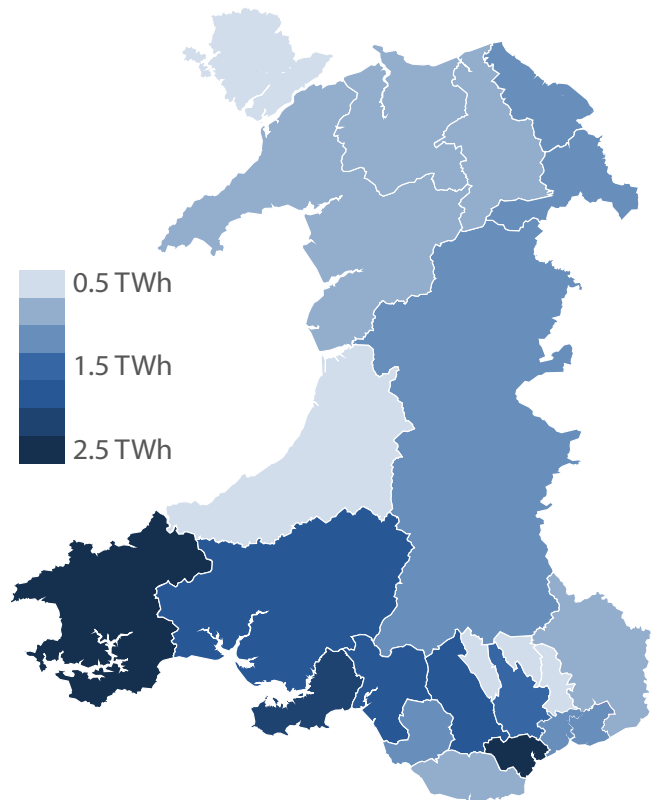
³ This sectoral split excludes energy generated from bioenergy and waste, as it is a relatively small proportion of overall energy use and is not clearly apportionable between the four sectors using publicly available data. Including bioenergy and waste, the total energy consumption in 2017 was 90.5 TWh compared to 111.22 TWh in 2005.

Buildings

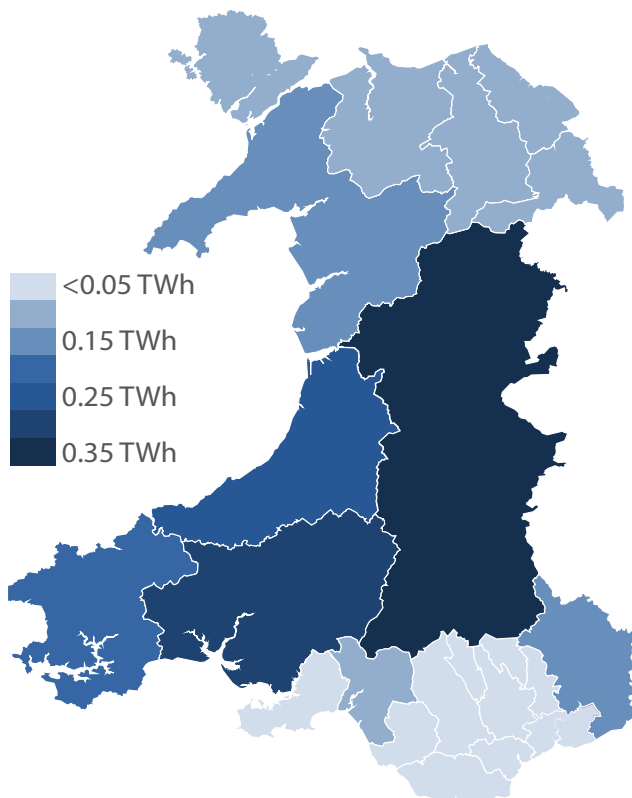
Annual energy use in buildings⁴ has reduced steadily, by some 24%, since 2005, when it was 39 TWh. In 2017 it accounted for just over a third of the energy use in Wales – 29.6 TWh.

Most of this use is centred around locations with a high level of commercial activity in industrial areas, such as Pembrokeshire or areas with high population, such as Cardiff.

Annual energy use in buildings by local authority area in Wales, 2017



Annual energy use in agriculture by local authority area in Wales, 2017



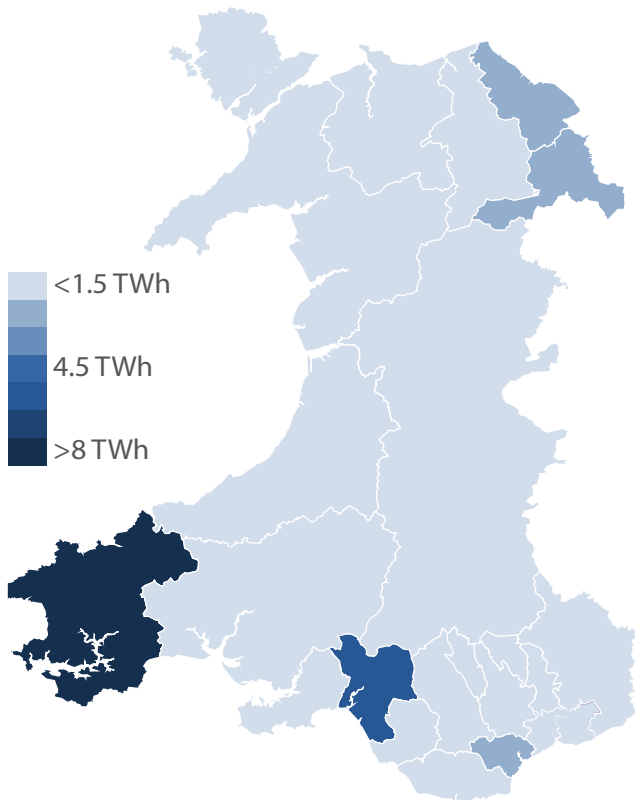
Agriculture

As a sector, agriculture has consistently accounted for around 2% of annual energy use in Wales from 2005 to date.

Agricultural energy use is greatest in the rural local authority areas of Ceredigion and Powys which, due to their livestock farming activity, have relatively high demand for farming fuels.

⁴ The Prosperity for All: A Low Carbon Wales report considered the buildings sector to include domestic homes, public buildings and commercial spaces that weren't classed as industrial.

Annual energy use in industry by local authority area in Wales, 2017



accounting for 25% of total Welsh industrial energy use in 2017. Pembrokeshire is responsible for a fifth of all petroleum products used in Wales, and second only to Neath Port Talbot for manufactured fuels like coke.

Transport

Energy use for road and rail transport⁶ has remained fairly constant in Wales over the last decade, with 22.1 TWh consumed in 2017, compared to 22.2 TWh in 2005, despite a population increase of 150,000 over the same period.

The highest use of transport energy is clustered around highly populated urban areas like Cardiff and Newport. Western coast authority areas of Wales have lower levels of transport energy use.

As overall energy use in Wales continues to fall, transportation energy is accounting for an increasing share of the total energy use in Wales, rising from 20% in 2005 to 26% in 2017.

⁵ The largest industrial users of gas, including power stations, are excluded from the datasets used for this analysis.

⁶ Aviation, shipping and electricity for trains and cars are not included in these datasets.

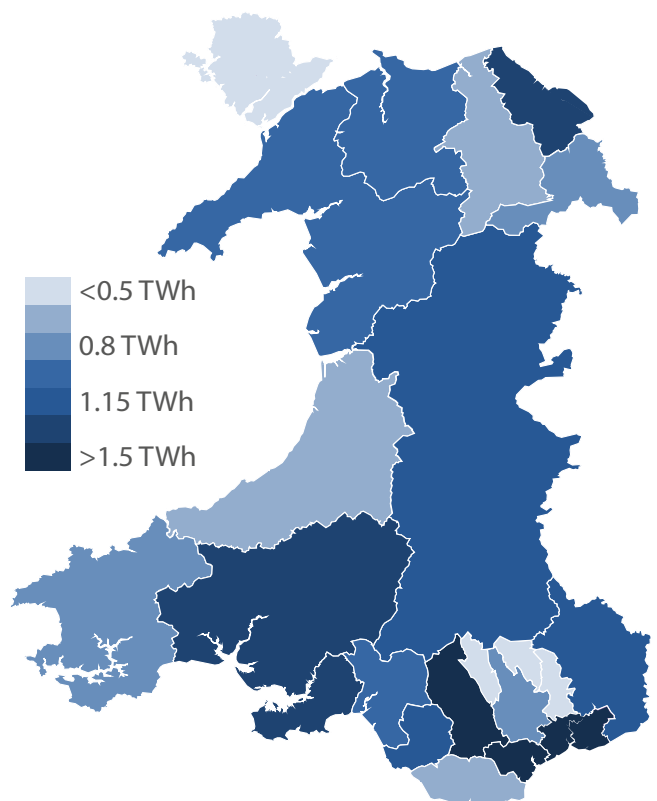
Industry

Industry is the sector in Wales that has seen the greatest decrease in energy use since 2005, falling by 31% from 46.7 TWh in 2005 to 32.3 TWh in 2017.⁵ This fall in industrial energy use is partly caused by a reduction in industrial activity but is also likely to be a result of increased process and wider energy efficiency measures.

Employment across all industry sectors has fallen by some 8% in Wales since 2005, mostly in manufacturing, although some other industrial sectors are going against this trend. For example, employment in the ‘electricity generation, gas, steam and air conditioning’ sector, as defined by the Department for Business, Energy and Industrial Strategy (BEIS), has increased by 124% in Wales (approximately 7,800 in 2017 compared to 3,400 in 2005), whilst energy use in this sector has decreased by 14% since 2005.

Pembrokeshire dominates industrial energy use,

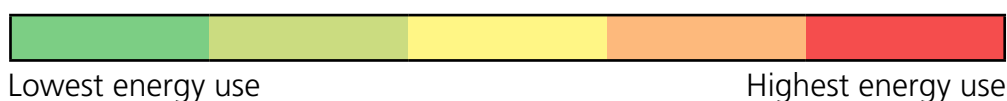
Annual energy use in transport by local authority area in Wales, 2017



The energy use by sector, distributed by local authority area, can also be viewed on a per capita basis (e.g. annual MWh/person, within each local authority area). This analysis highlights the following:

- Ceredigion has the highest agriculture energy use per capita and the second lowest industry energy use per capita in Wales
- Newport has the joint lowest agriculture energy use per capita and the second highest transport energy use per capita.

Energy use by sector per capita, 2017 (MWh/capita/yr)				
Local authority area	Agriculture	Industry	Transport	Buildings
Blaenau Gwent	0.17	4.99	3.99	9.05
Bridgend	0.17	6.39	7.54	9.07
Caerphilly	0.09	4.27	4.62	8.18
Cardiff	0.01	6.07	6.39	7.09
Carmarthenshire	1.74	5.12	8.2	9.63
Ceredigion	3.52	3.47	7.23	10.21
Conwy	0.54	2.47	8.35	8.95
Denbighshire	0.93	3.86	7.17	9.37
Flintshire	0.41	14.26	8.75	8.82
Gwynedd	1.06	4.32	7.96	9.07
Isle of Anglesey	1.38	4.21	6.84	9.28
Merthyr Tydfil	0.1	4.54	5.23	9.25
Monmouthshire	1.44	4.34	12.87	9.58
Neath Port Talbot	0.79	40.07	7.58	13.2
Newport	0.1	8.46	10.6	8.57
Pembrokeshire	1.67	73.61	6.29	21.42
Powys	2.96	4.59	8.69	9.78
Rhondda Cynon Taff	0.06	4.14	6.61	8.28
Swansea	0.07	4.81	5.19	9.51
Torfaen	0.08	6.53	5.02	8.22
Vale of Glamorgan	0.34	6.31	5.87	8.66
Wrexham	0.67	15.24	5.99	9.1

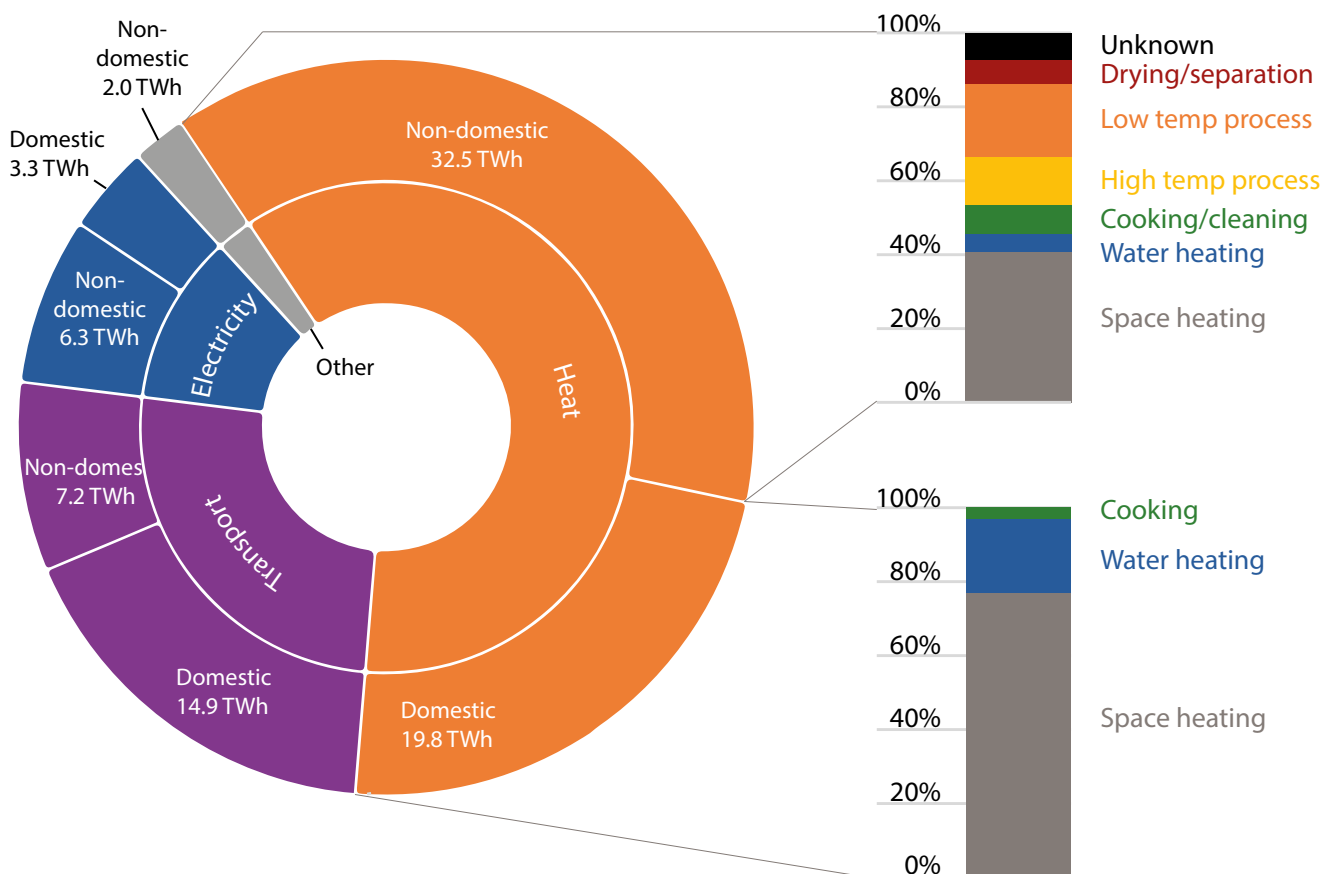


Types of energy use

Other than transportation, energy use generally falls into two prime categories; electricity and heat. In this context, electricity used for heating (1.6 TWh) falls under the 'Heat' category.⁷

Nearly two thirds of the energy used in Wales provides heat to homes, businesses and industry (61%). Of this heat energy demand, 38% was used for providing domestic space heating, hot water and cooking, with the remaining 62% being used to supply high and low temperature processes, drying/separation or other uses.

Annual energy in Wales broken down into heat, electricity and transport use, 2017⁸



In 2017, 27% of total electricity and heat energy used in Wales was for domestic properties, some 23.1 TWh.

Of this, electricity and gas account for 84% of the fuels used, with coal and LPG making up most of the remaining 16%.

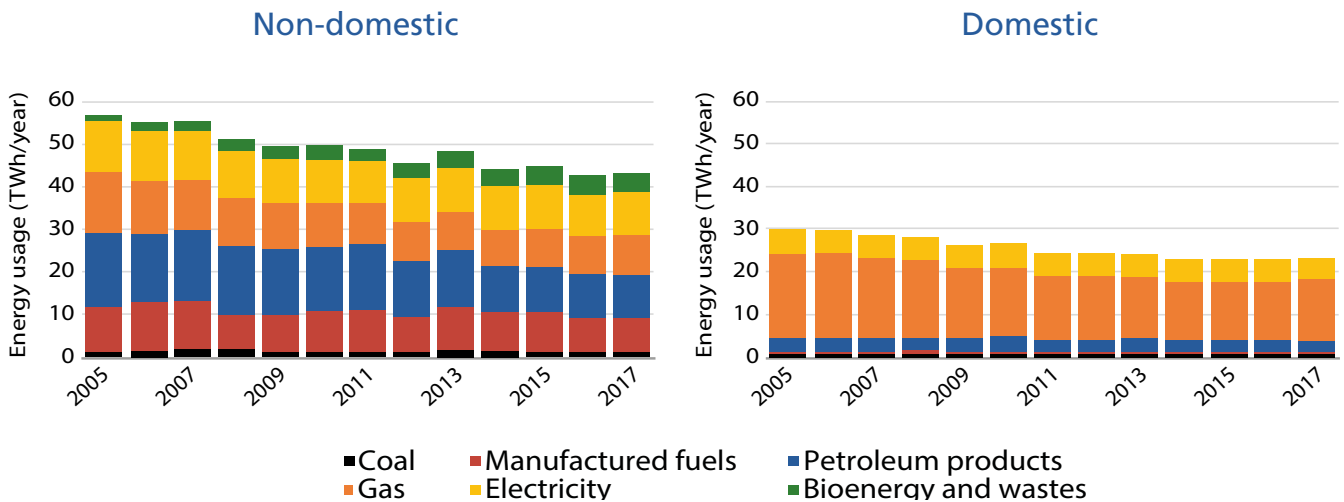
⁷ Based on analysis of heating fuel categorisation by Regen.

⁸ Data from BEIS total energy use figures, split using EPC and Energy Consumption in the UK figures, 2017.

Energy use by fuel

Most types of fuel have seen a fall in their use in Wales since 2005. The exception is bioenergy and waste, which has seen a significant increase from 3 TWh in 2005 to 4.4 TWh in 2017.

Non-domestic and domestic total energy use in Wales by fuel type, 2005 - 2017⁹



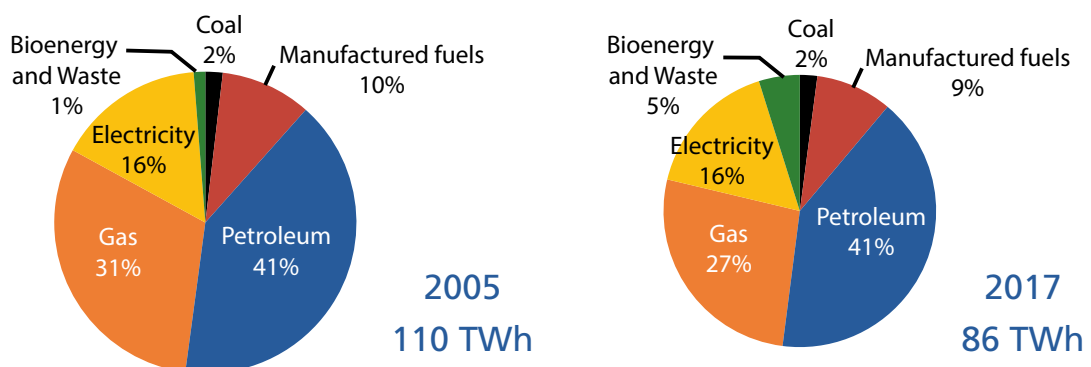
Both domestic and non-domestic energy use has fallen since 2005, with a reduction in domestic gas fuel use and non-domestic petroleum products being the main drivers of change.

Proportionally, fuel use has remained fairly similar over the last 12 years, with bioenergy and waste seeing the biggest change, growing from 1% in 2005 to 5% by 2017.

The single largest fuel demand (by kWh) is petroleum products, accounting for 41% of all major fuels used in Wales in 2017, which is a mix of transportation and industrial / commercial energy use.

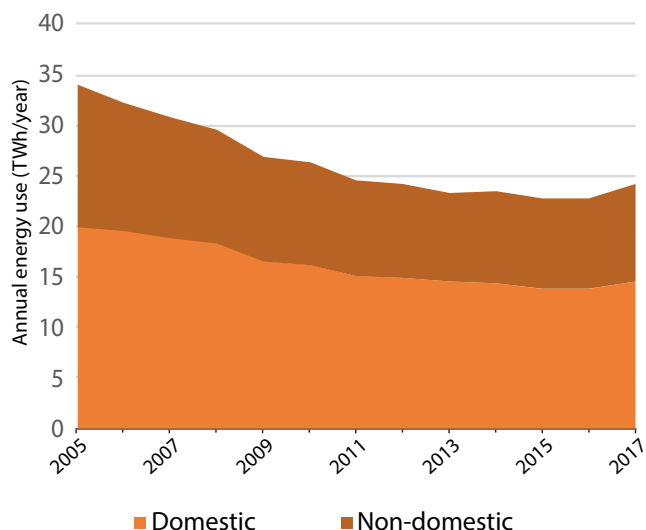
Already in rapid decline by 2005, coal use has seen a further 10% drop in Wales, falling from 2.1 TWh in 2005 to 1.9 TWh in 2017. This has fallen even further since 2017 and is expected to fall to close to zero in the near future.

Total energy use in Wales by fuel type, 2005 and 2017

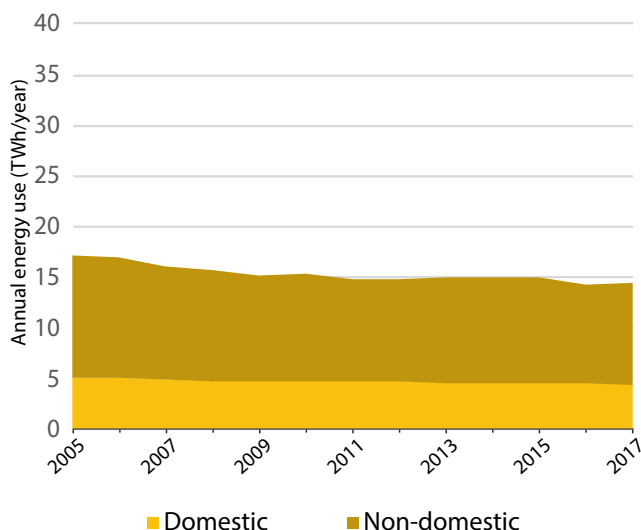


⁹ Not including energy use in Transport.

Gas use in Wales, 2005 - 2017



Electricity use in Wales, 2005 - 2017



Alongside petroleum products, gas and electricity are the two fuels with the largest overall use in Wales.

Electricity Use

Total electricity use in Wales has been steadily decreasing year on year, falling by 15.4%, from 17.6 TWh in 2005 to 14.8 TWh in 2017. This has been driven mainly by reductions in non-domestic use in the late 2000's; a 12% reduction between 2005 and 2017. Domestic electricity use has also been falling since 2005, with use remaining steady for the last three years at around 4.8 TWh: a reduction of 17% by 2017.

Unlike the publicly available data on gas use, electricity use data published by BEIS is not corrected for temperature. Winter 2017 was particularly cold in comparison to the previous three years, which may have contributed to the slight increase in demand.

Average monthly temperature in Wales (°C)				
Year	November	December	January	February
2014-15	4.9	2.3	1.7	0.4
2015-16	6.3	6.8	2.7	1.4
2016-17	2.4	3.3	1.8	3.2
2017-18	3.6	2.3	2.1	-0.1

Gas Use

Total gas use in Wales in 2017 was 24.1 TWh, with nearly 59.6% being used for domestic space heating and hot water.¹⁰ Proportionally, the ratio of domestic to non-domestic gas use in Wales has been similar year on year since 2005.

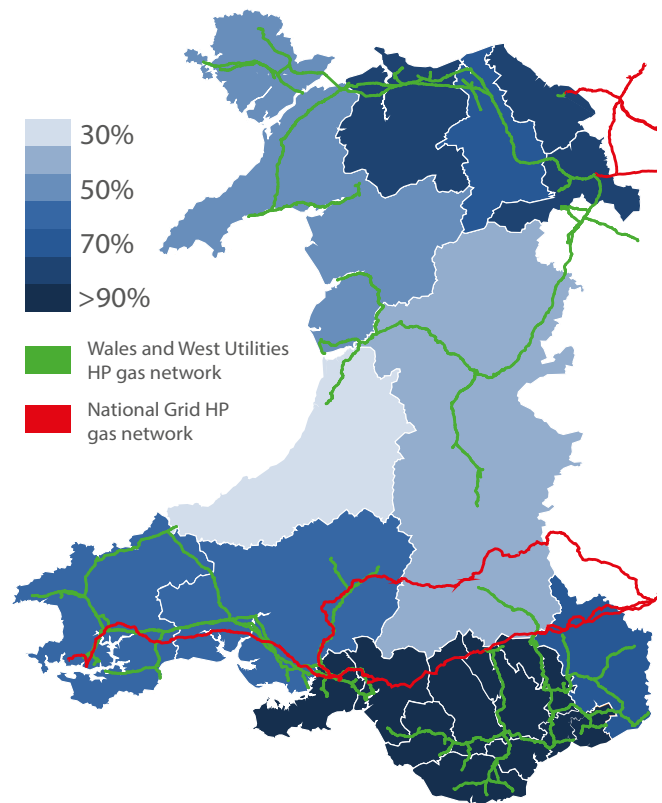
The largest single reduction in fuel use in Wales since 2005 by TWh has been gas. Between 2005 and 2017, there has been a 10.1 TWh, (42%), drop in demand for gas to 24.1 TWh, driven by increasing efficiency in domestic appliances and a fall in industrial demand for gas.

Domestic use of gas has fallen, despite the population in Wales growing by 150,000 to 3.12 million and average productivity (as defined by GVA per head in Wales) growing by 31%. It is likely, therefore, that energy efficiency measures deployed in Wales over the last decade have been important in reducing demand for natural gas.

The gas distribution network has a significant impact on how domestic energy use varies across Wales. There is strong correlation between areas that have low numbers of homes connected to the gas network and higher than average energy use.

Ceredigion has the lowest percentage of homes connected to the gas network, and the second highest energy use per capita, just behind Powys.

Percentage of on-gas homes by local authority area in Wales, 2017

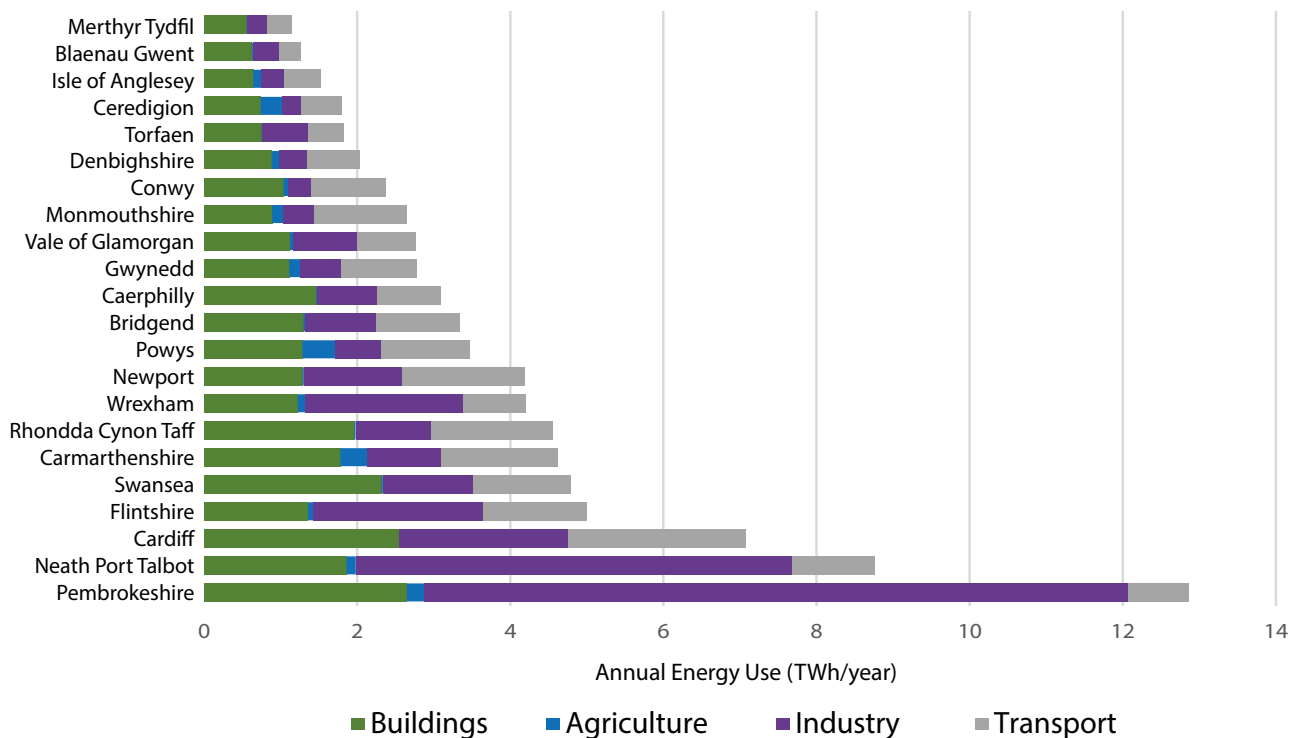


¹⁰ Gas used for electricity generation and large industrial users is excluded from this data, in line with how BEIS report their figures. See methodology section for more details.

Energy use by local authority area

Annual energy consumption in 2017 across the 22 local authority areas in Wales varies considerably, from Merthyr Tydfil using just 1.2 TWh of energy to Pembrokeshire using 12.9 TWh.

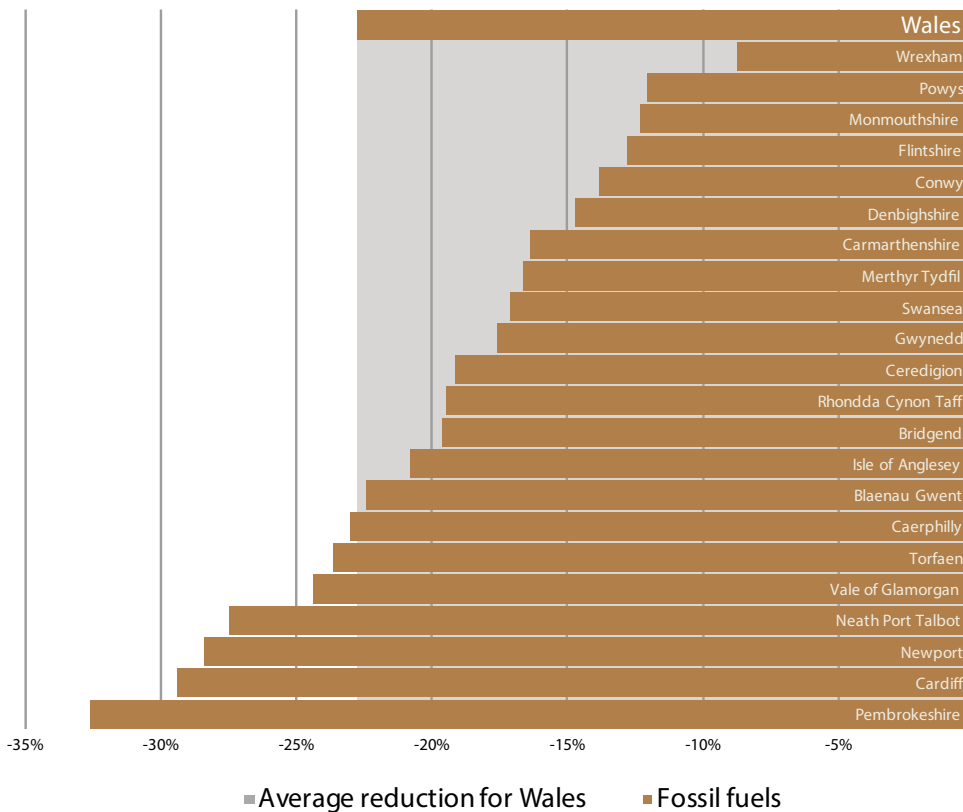
Total energy use by local authority in Wales, by 'Prosperity for All' sector, 2017



Key points:

- Energy use in all local authority areas in Wales has reduced since 2005
- Pembrokeshire accounts for 14.3% of the total energy use in Wales
- Local authority areas containing the largest industrial centres can easily be picked out, with Wrexham, Flintshire, Cardiff, Neath Port Talbot and Pembrokeshire all using significant levels of energy for their industrial areas

Percentage reduction in fossil fuel use per local authority area in Wales between 2005 and 2017



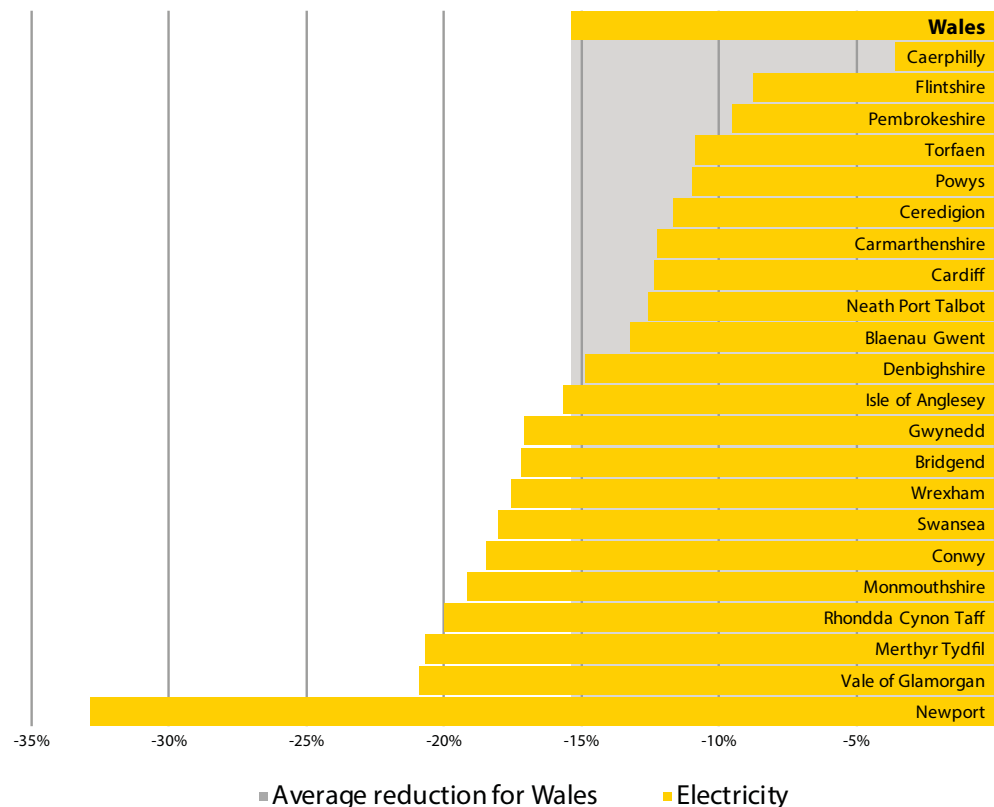
Use of fossil fuels in Wales has fallen by 23% since 2005, with all local authority areas reducing use by some degree.

Pembrokeshire has the largest reduction, using a third less fossil fuel in 2017 than 2005.

Percentage reduction in electricity use per local authority area in Wales between 2005 and 2017

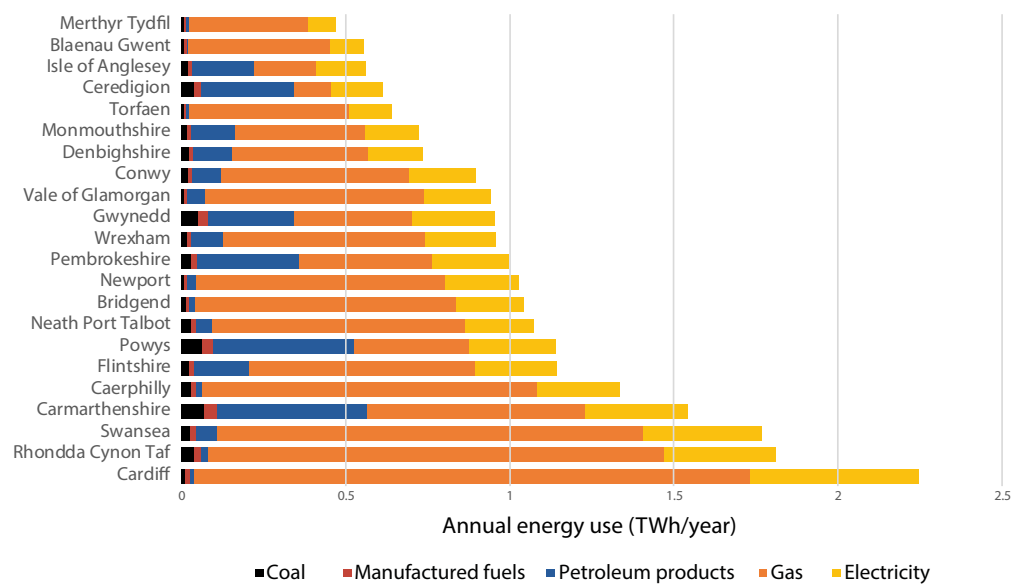
Similarly, all local authority areas have reduced electricity use since 2005, by 15% in total.

Newport has reduced electricity use by 33% since 2005.

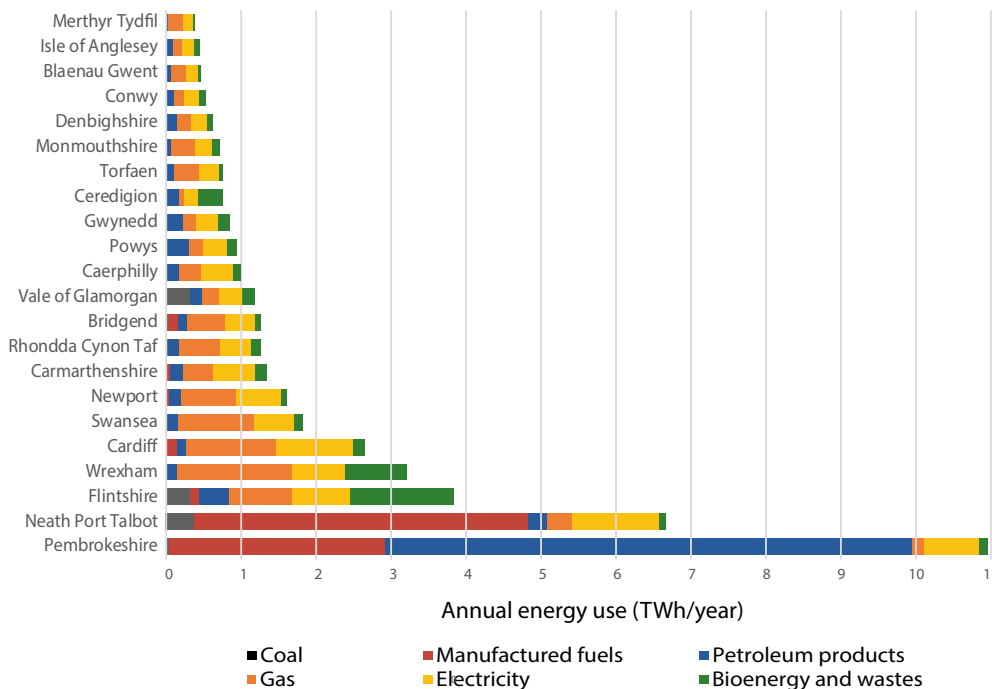


Domestic energy use per local authority area in Wales, 2017

Domestic fuel use in Wales (excluding transport) is dominated by gas for almost all the local authority areas, with Isle of Anglesey and Ceredigion as the most notable exceptions. Most local authority areas have a fairly similar mix of fuel use, other than those with substantial commercial and industrial activity or limited connection to the gas network.¹¹



Non-domestic energy use per local authority area in Wales, 2017



Non-domestic fuel use in Wales ranges from 0.4 TWh in Merthyr Tydfil to just under 11 TWh in Pembrokeshire in 2017, with the latter being 60% petroleum products.

Pembrokeshire's substantial use of petroleum products is likely to be down to the industrial activity of the oil and liquified natural gas terminals, port and refinery.

¹¹ All bioenergy and waste use has been allocated as non-domestic. This is because data on bioenergy and waste is not split by use but is likely to be almost all non-domestic.

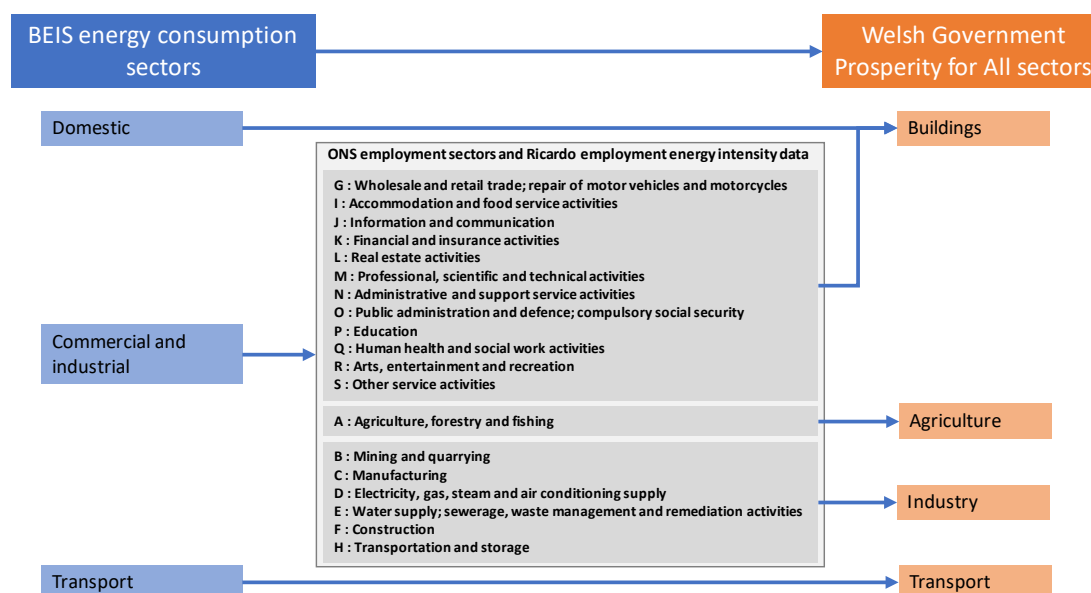
Methodology and assumptions

Regen was commissioned by the Welsh Government to collect and analyse data regarding energy use in Wales, aligned to the sectors as defined in the 'Prosperity for All: A Low Carbon Wales' report¹², published in 2019.

The 'Prosperity for All: A Low Carbon Wales' report split greenhouse gas emissions arising in Wales into eight sectors:

- Power (generation)
- Buildings
- Transport
- Industry
- Land use, land use change and forestry (LULUCF)
- Agriculture
- Waste management
- F-gases (refrigerant)

However, much of the data around energy use in Wales (produced by BEIS) uses a different set of sector definitions, so the source data definitions were mapped to the sectors as listed above.



In line with the methodologies adopted by many government institutions there are some significant sources of energy that are not included in the analysis underpinning this report, namely:

- 1. Gas used for power generation:** Data produced by the UK government on fuel consumption does not include the gas consumed by power stations to produce electricity, as the electricity itself is treated as a fuel.
- 2. Gas used by very large industrial plant:** Some of the largest energy users in Wales have their gas demand excluded from the data in this report as this would be disclosive, but the emissions from these sites are likely to be accounted for via the EU Emissions Trading Scheme (EUETS).
- 3. Bioenergy and waste:** Bioenergy and waste have been classified as entirely non-domestic use, included in the trend analyses presented in this report, but not the spatial analysis. This is due to a handful of very large plants, particularly in Flintshire and Wrexham, dominating the capacity in Wales, with other local authority areas reporting relatively low capacities by comparison.

The effect of these exclusions is to under-report actual energy use in Wales, which is difficult to quantify. However, the methodology is consistent with that used across the UK, meaning that the results will be comparable with other areas.

¹² Accessible at: https://gov.wales/sites/default/files/publications/2019-06/low-carbon-delivery-plan_1.pdf

Assumptions and references

Assumption	Source
F-gases sector	F-gases are significant greenhouse gases and so were included as a sector in the Prosperity for All: A Low Carbon Wales report, but do not have an energy demand associated with that emission, so were excluded from this study.
Power (generation) sector	BEIS data on gas use excludes gas used in the production of power, as those power stations are producing electricity as another 'primary' fuel. All power generation as a sector has also been excluded for this reason.
Estimated energy in each 'Prosperity for All' sector	Energy intensity of UK job categories were evaluated and applied to Welsh jobs at a Local Authority level, to estimate the proportional split of energy across the BEIS 'Industry and Commercial' sector. The proportional split of energy by sector was then applied to BEIS Local Authority energy use data, to get total energy demand in Buildings, Industry, Agriculture and Transport (see also the diagram on the previous page).
Estimated Welsh domestic energy end uses (heat and non-heat electricity)	Heating fuel use splits have been scaled using BEIS data and are based on the assumption that all of domestic gas use is for heat or hot water. The proportions of domestic electric heating have been estimated from previous analysis by Regen.
Estimated Welsh non-domestic energy end uses	Figures from the ECUK end use tables were used, alongside the proportion of commercial and industrial energy demand in Wales, to estimate the proportional split of non-domestic gas and electricity fuel use between heat and power. The heat provided by other remaining fuels was assumed to be based on fuel type, with petroleum fuels being allocated using BEIS data for the supply and use of petroleum products.
Estimated Welsh transport energy use	BEIS transport energy use was distributed between domestic and non-domestic by applying the proportion of 'Personal' and 'Freight' use in Wales.
Transport	Road transport does not include electricity, LPG or biofuels.
Final energy use	Final use energy consumption and energy consumption sector splits have been generated using overall UK energy consumption data as a proxy for both the energy intensity of jobs and final energy uses within domestic and non-domestic heat.
Petroleum products	Data on petroleum products excludes diesel and petrol use for vehicles. This data is found in the 'Transport' section.

The key sources of data used in the study include:

1. BEIS Sub-national total final energy consumption statistics 2017 (latest)
2. BEIS Sub-national electricity consumption statistics 2018 (latest)
3. BEIS Sub-national gas consumption statistics 2018 (latest)
4. StatsWales Workplace employment by industry and area (UK and Wales)
5. ONS Energy use by industry, source and fuel, 1990 to 2017
6. ONS Sectorial energy use in the United Kingdom
7. Nomis Labour Market Statistics - workforce jobs by industry (SIC 2007)
8. Regen internal analysis and resources from previous projects relating to heating technology splits.
9. Energy Consumption in the United Kingdom (ECUK), End use tables, 2017
10. BEIS supply and use of petroleum products 2018
11. BEIS road transport fuel consumption tables 2017
12. BEIS historical GVA data.

Units and definitions

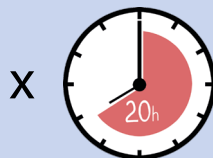
Orders of magnitude	Explanation
W	1 watt = 1 watt
kW	1,000 watts = 1 kilowatt
MW	1,000,000 watts = 1 megawatt
GW	1,000,000,000 watts = 1 gigawatt
TW	1,000,000,000,000 watts = 1 terawatt

A note on power and energy

Power (capacity) X Time = Energy (e.g. demand and generation)



50 watts

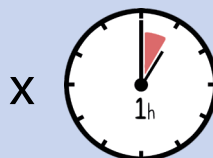


20 hours

= 1,000 Wh or 1 kWh
(of demand)



1,000,000 watts (1 MW)



1 hour

= 1,000,000 Wh or 1 MWh
(of generation)

