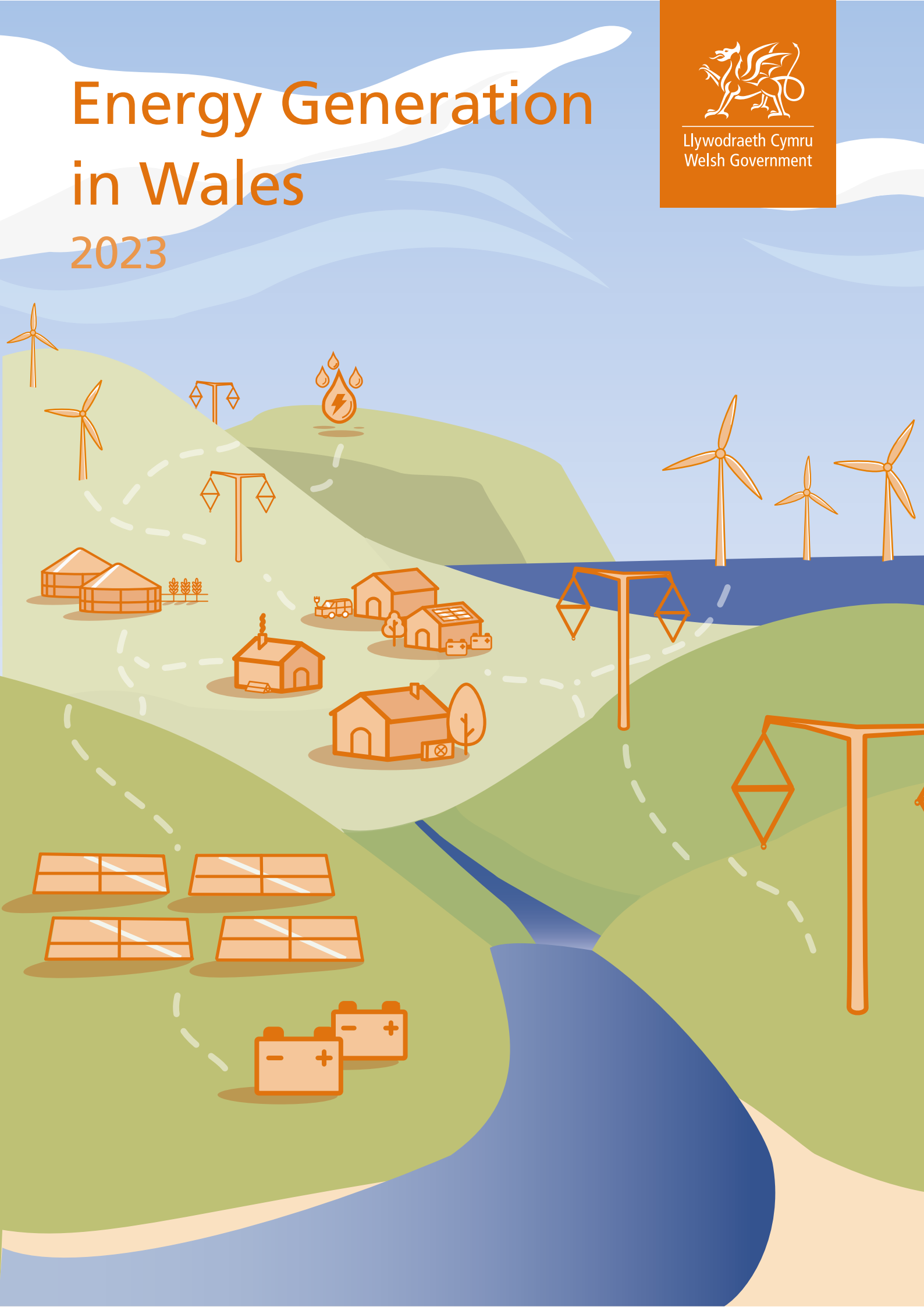
Energy Generation in Wales

2023

Llywodraeth Cymru
Welsh Government



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Ministerial foreword

Our vision is for Wales to generate renewable energy to meet our needs now and for the future. Paramount to this, is ensuring renewable energy generation in Wales has tangible economic and social benefits that are retained and realised by local communities across Wales.

Rebecca Evans MS
Cabinet Secretary for Economy, Energy and Planning

We are making progress towards our renewable energy targets. This progress is impacted by changes to both electricity consumption and generation. Within this report, the impact of increased electricity demand and reduced electricity generation overall shows the scale of the challenges we face and the need for action to unblock barriers to new renewable generation in Wales.

We have taken action to reform the planning system making it more streamlined for renewable energy projects, to delegate decisions for smaller scale projects and to boost resources across the planning and consenting system. Wales maintains a strong pipeline of renewable energy projects. Additionally, we saw a record number of renewable energy projects being built in 2023 thanks to an increase in solar and heat pump installations. The publication of the UK Government's Clean Power 2030 has ensured there is an action plan to accelerate the delivery of low carbon energy. This will support the delivery of projects in Wales, and we will continue to engage with UK Government to ensure that the action plan delivers for Wales.

Our previous 2030 renewable electricity target did not include losses, whereas our 2035 target does. This will provide a more accurate representation of the total energy needed to deliver electricity to homes and businesses in Wales. This new reporting metric has provided better insights to the demand and generation of electricity, and we can see that renewable electricity generation in Wales was equivalent to 53% of its electricity consumption, including losses.

I am pleased with the progress being made in Wales, across all renewable energy technology developments as well as the reduction of energy generation made by fossil fuels. I have listened to the industry and the new planning procedures and additional funding to planning will provide a strong basis for sustainable projects to come forward. Total electricity generation from fossil fuels decreased by 5.6TWh between 2022 and 2023 bringing fossil fuel generation close to the lowest levels in the last two decades. This does not mean we can slow down, and we continue to strive to lead the way in achieving our targets and showcasing what Wales has to offer. We will also continue to support the industry, and we are committed to a sector deal to overcome barriers and maximise the opportunities for Wales.

This next edition of Energy Generation in Wales report provides a complete and transparent picture of energy generation and a consistent measure against our Welsh Government energy targets. This, alongside other work will support our policymaking and our understanding of what is needed to achieve a just energy transition.

Introduction

The Energy Generation in Wales 2023 report sets out the energy generation capacity in Wales at the end of 2023 and analyses changes over time. The report aims to support the Welsh Government in developing energy policy and help to evidence the economic, social, and environmental benefits of Welsh energy projects.

The report compiles a range of data sources to analyse renewable and fossil fuel electricity generation, as well as renewable heat and electricity storage in Wales. It also looks at the development of renewable energy in 2022, reviewing the growth prospects of each technology. The analysis builds on prior publications:

- Previous Energy Generation in Wales reports.
- The first and second editions of the Energy Use in Wales reports, which set out how energy is used in Wales and how energy use has changed over time.

Energy generation deployment is broken down into the 22 local authority areas and four regions in Wales. This allows analysis of the local factors, including natural resources, local policies and other demographic elements, which may influence the deployment of different technologies.

The Welsh Government has recognised the value of local ownership of energy assets, which is a key part of Wales' energy strategy. This report also examines the current ownership of energy generation assets in Wales, providing a measure against Wales' target of 1.5 GW of locally owned renewable energy capacity by 2035.

This report

- Breaks down Welsh electricity and renewable heat generation and storage by technology, capacity and local authority area to the end of 2023.
- Estimates that Welsh renewable electricity generation is equivalent to 53% of Wales' current electricity consumption and to 27% of Wales' estimated 2035 electricity demand.
- Estimates that 34% of total electricity generation in Wales comes from renewable sources.
- Estimates 900 MW of installed renewable energy capacity is locally owned.

Technologies analysed

- Renewable electricity and heat technologies.
- Electricity storage technologies.
- Fossil fuel electricity generation (generation from coal, gas and diesel).

Electricity generation in Wales

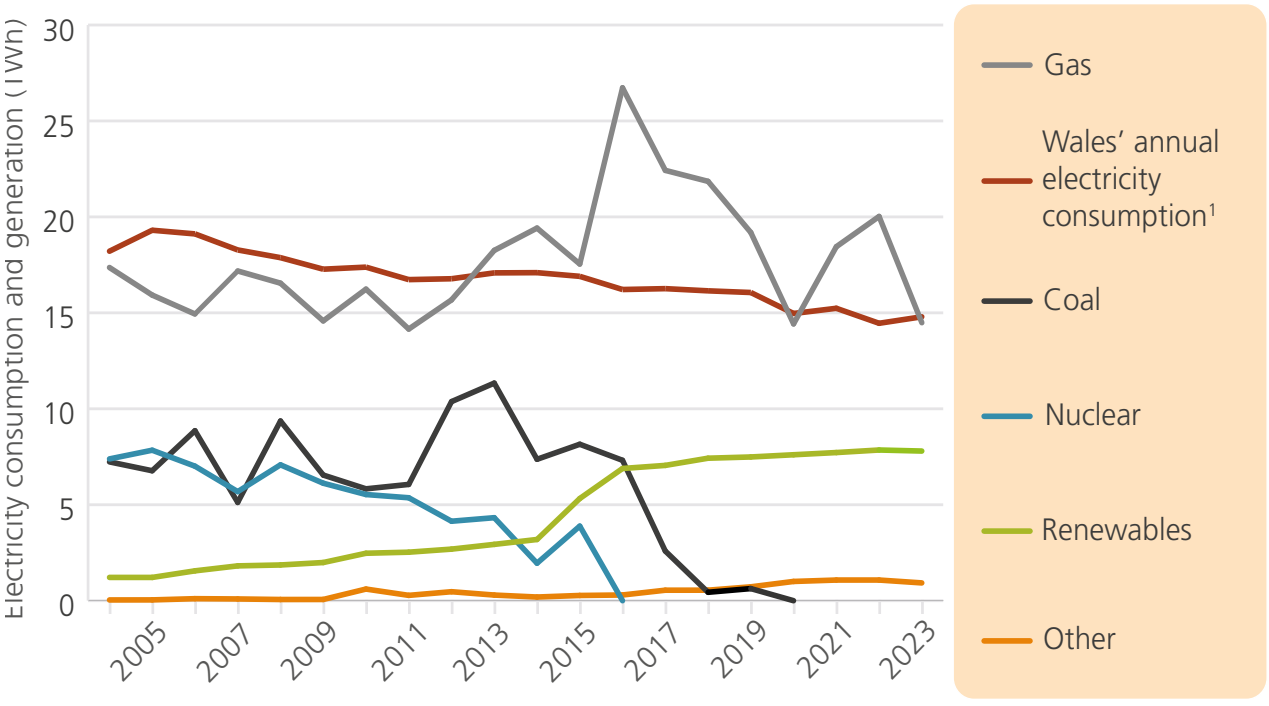
In 2023, Wales generated 23.2 TWh of electricity while consuming 14.8 TWh.[1] This means that Wales remains a net exporter of electricity to the rest of the UK, Ireland and the wider European electricity network.

Wales generated approximately 7.8 TWh from renewables and 15.4 TWh from fossil fuels in 2023. Most fossil fuel electricity generation in Wales is from fossil gas, particularly from two large plants at Pembroke and Connah's Quay. Total electricity generation from fossil fuels decreased from over 21 TWh in 2022 to 15.4 TWh in 2023, largely due to a reduced output from these two major power plants. This decrease brings fossil fuel generation close to the lowest levels in the last two decades.

As a result of falling fossil gas generation, renewable electricity generation now makes up 34% of all electricity generated in Wales, up from 27% in 2022. Although total renewable electricity capacity increased in 2023, total generation reduced from 7.9 TWh to 7.8 TWh. This was due to small changes in average annual load factors, particularly for onshore wind. Approximately, 68% of Welsh renewable electricity generation is from onshore and offshore wind, with much of the remainder from solar PV and biomass electricity generation.

Electricity generation trends versus Welsh electricity consumption

Data source: (1)



[1] Includes losses. Welsh electricity consumption data for 2023 has not yet been published, so an estimate for 2023 has been produced using data from DESNZ (DESNZ, 2024: Sub-national electricity consumption data). See methodology section for more information.

Electricity generation in Wales

- 109 MW of new renewable electricity capacity was installed in 2023, up from 38 MW in 2022. This is the second highest increase in renewable capacity since 2019, but still far below the peak in 2015, when 966 MW was added in a single year. There is now a total of 3,663 MW of renewable electricity capacity in Wales.
- Renewable electricity generation output in Wales has increased by 5% in the last five years, from c. 7.4 TWh in 2018 to c. 7.8 TWh in 2023.
- There has been no electricity generation from nuclear and coal in Wales since 2015 and 2019 respectively.

Electricity capacity trends

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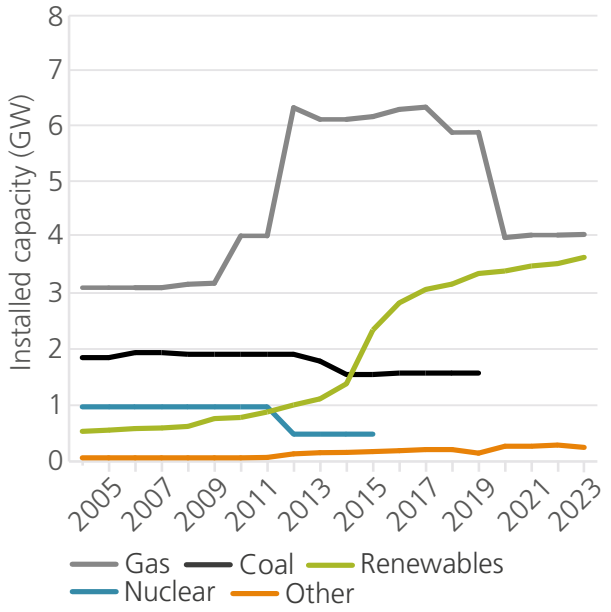

Electricity generation in Wales

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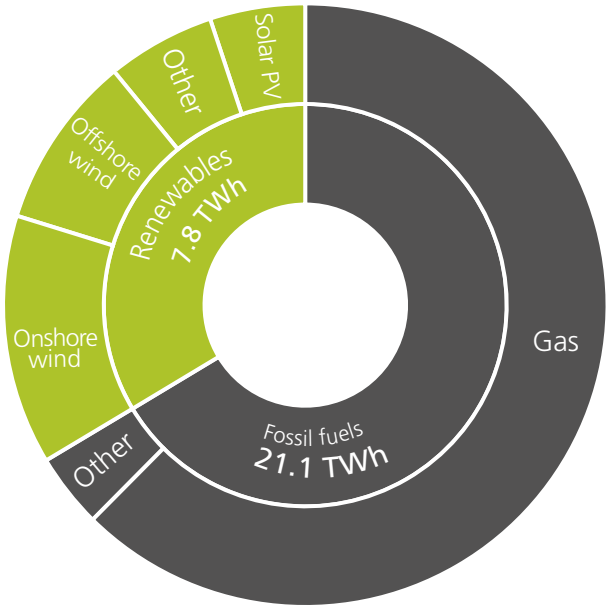


Electricity generation in Wales key statistics

Data source: (1)

Technologies	Number of projects	Electrical capacity (MW)	Estimated annual electricity generation (GWh)
Fossil fuels	**104**	**4,325**	**15,413**
Coal	-	-	-
Diesel	20	226	792
Gas	82	4,073	14,487
Energy from Waste[2]	1	26	134
Storage	**8**	**2,161**	**n/a**
Battery storage	6	73	n/a
Pumped hydropower	2	2,088	n/a
Hydrogen	-	-	-
Renewables	**87,664**	**3,663**	**7,798**

[2] For the purpose of this report, half of energy from waste's generation is assumed to be fossil fuel and half renewables, due to the nature of non-biogenic waste being incinerated.

Renewable energy in Wales

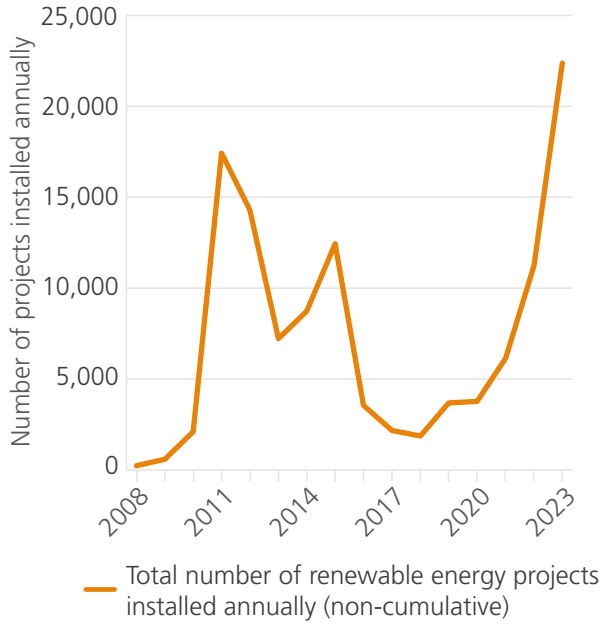
In 2023, 176 MW of renewable energy capacity was installed in Wales, comprising 109 MW of electrical capacity and 67 MW of new heat technologies. This is the highest renewables installation rate in the last five years, yet it remains six times lower than the peak rate of over 1 GW achieved in 2015.

The re-emergence of small-scale PV was evident in 2023, which saw the largest percentage increase in domestic solar PV capacity (<10 kW) since 2012. Approximately 64% of the 108 MW of solar PV projects installed across the year were under 10 kW.

In 2023, 67 MW of heat capacity was installed, marking the highest rate since 2017, though still just under half of the 2014 peak of 142 MW. This increase is largely driven by the rising adoption of heat pumps, now numbering more than 22,000 across Wales.

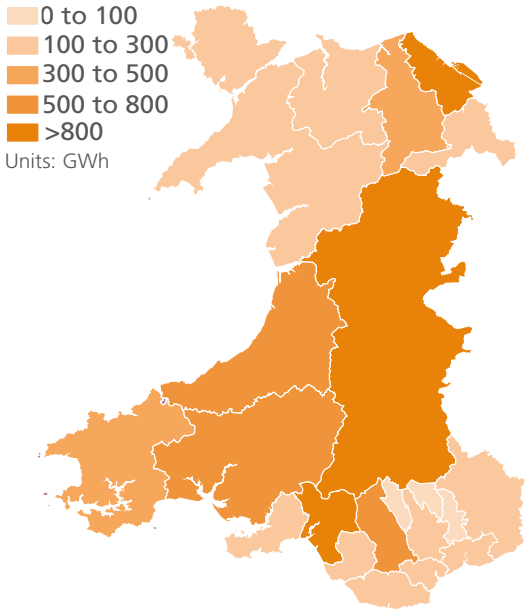
Wales' annual renewable energy installation rate

Data source: (1)



Total renewable electricity and heat generation by local authority

Data source: (1)



Renewable electricity in Wales

- 2023 saw an uplift in the rate of deployment of solar PV projects. More than 15,300 solar PV projects were commissioned in 2023, compared to c. 7,300 in 2022 and c. 3,900 in 2021.

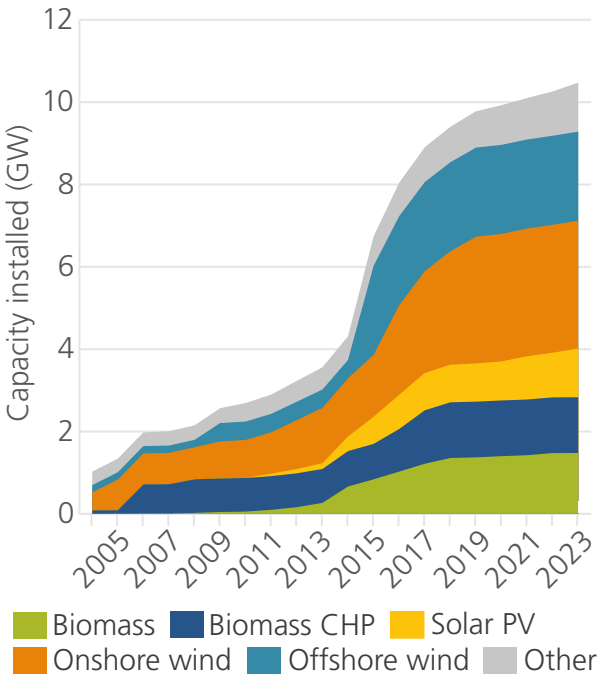
- Approximately 68% of renewable electricity generation in Wales is from onshore and offshore wind. However, for the first time since the 1990s, no wind projects (either onshore or offshore) were identified to have been commissioned in Wales in 2023.

Renewable heat in Wales

- There is now 869 MW of renewable heat in Wales, 55% of which is from biomass projects.
- 2023 saw the highest installation rate of heat pumps ever in Wales, with 6,876 installed in primarily domestic applications. This is almost double the number installed in 2022.
- It is estimated that Welsh renewable heat projects produced nearly 2.7 TWh in 2023, compared to 2.5 TWh in 2022.

Wales' renewable energy installation rate

Data source: (1)



Renewable energy in Wales key statistics

Data source: (1)

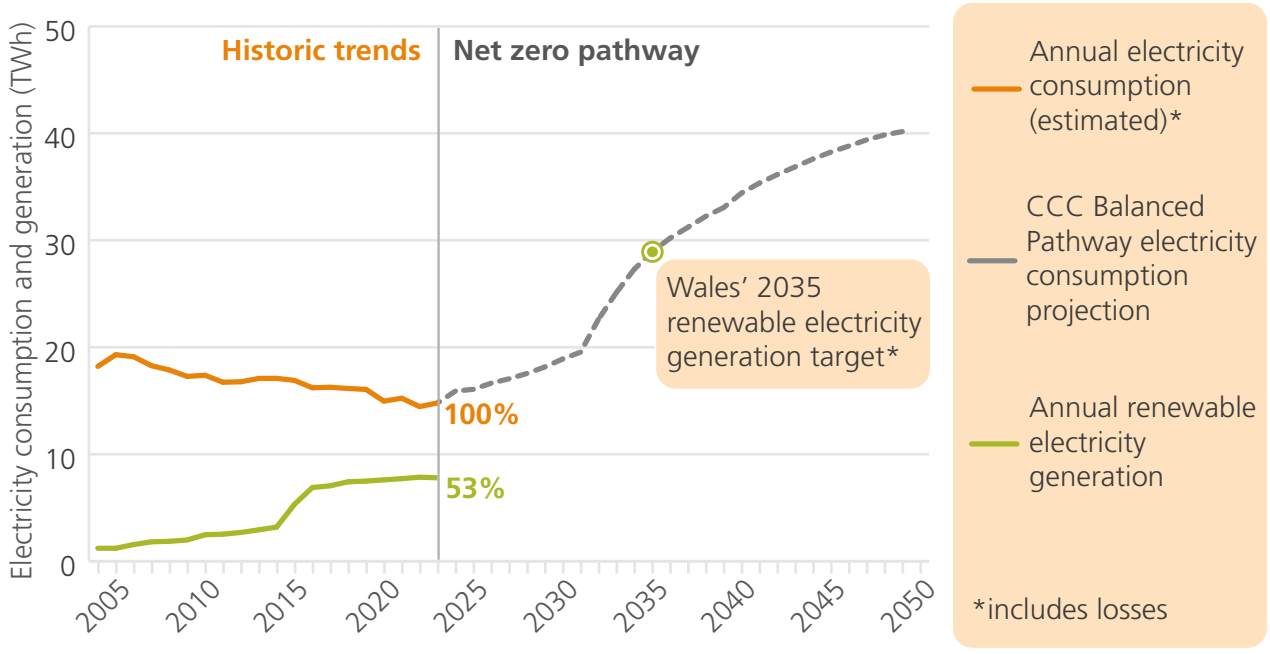
Renewable energy technologies	Number of projects	Electricity		Heat	
		Capacity (MW)	Estimated generation (GWh)	Capacity (MW)	Estimated generation (GWh)
Anaerobic digestion	50	18	94	9	54
Biomass	3,691	-	-	482	1,479
Biomass electricity and CHP	51	132	691	120	663
Energy from Waste	2	26	134	-	-
Heat pump	22,067	-	-	231	396
Hydropower	380	170	332	-	-
Landfill gas	21	22	53	-	-
Offshore wind	3	726	2,163	-	-
Onshore wind	754	1,267	3,106	-	-
Sewage gas	4	11	41	13	78
Solar PV	86,398	1,291	1,184	-	-
Solar thermal	4,828	-	-	14	8
Total	118,249	3,663	7,798	869	2,678

Progress towards targets

The Welsh Government has set a target for renewable electricity generation to be equivalent to 100% of annual electricity consumption by 2035. In 2023, renewable electricity generation in Wales was equivalent to 53% of its electricity consumption, including losses.[3] However, as electricity consumption is projected to increase significantly, this target is effectively a moving one.

Although electricity consumption in Wales has reduced over the last two decades, it is projected to increase again as Wales decarbonises. Fossil fuel consumption in heat and transport is anticipated to shift largely to electricity,[4,5] and, while electrification reduces total energy demand due to improved efficiencies, electricity demand could nearly triple by 2050.[4] Meeting this demand will require a significant increase in renewable generation to sustain progress toward Wales' targets.

Welsh renewable electricity generation needs to increase nearly fourfold by 2035 to achieve its targets Data source: (1)



[3] See feature box below for further information on the target's approach to losses. Excluding losses, renewable electricity generation in 2023 was equivalent to 58% of electricity consumption. This is down from 59% in 2022, largely due to an estimated increase in electricity consumption.

[4] CCC 6th Carbon Budget, 2019.

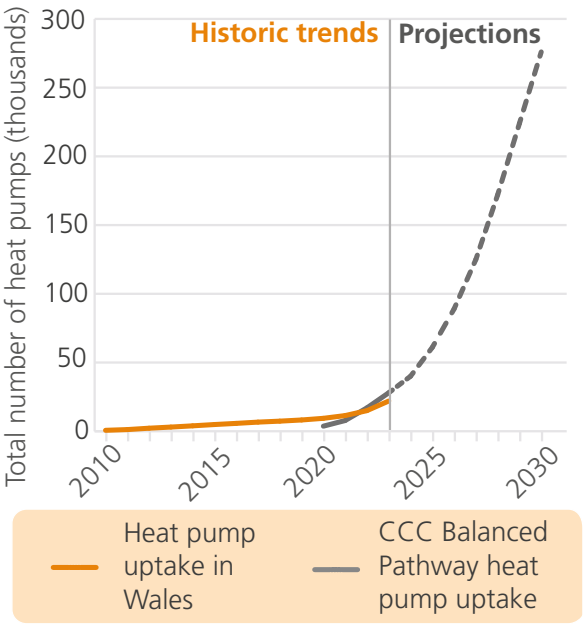
[5] Welsh Government, 2024. Heat Strategy for Wales

In the adopted net zero pathway for Wales, electricity consumption is projected to approximately double by 2035: increasing from 14.8 TWh in 2023[6] to 29 TWh.[7] Consequently, although renewable electricity generation is equivalent to 58% of consumption in 2023, that same figure is equivalent to only 27% of Wales' estimated electricity consumption in 2035 (when losses are included). Therefore, to achieve the 100% by 2035 target, renewable electricity generation in Wales needs to nearly quadruple.

The Welsh Government has also set a target for 580,000 heat pumps to be installed by 2035. As of 2023, there are estimated to be 22,000 heat pumps across Wales, with nearly 7,000 installed in 2023 alone. This marks a significant increase from the fewer than 1,000 heat pumps installed annually between 2010 and 2020.

The annual rate of heat pump installations in Wales has increased tenfold since 2018

Data source: (1)



Wales' 2035 renewable electricity target considers system operation

The Welsh Government's 2035 target aims for renewable electricity generation to meet 100% of Wales' electricity consumption, on an annual basis. The target does not seek to balance energy at less than an annual granularity: recognising that Wales is a part of an interconnected GB, UK, Ireland and European energy system. As part of this energy system, Wales can import electricity during periods of low local generation and export excess power when generation is high, helping to reduce costs and enhance system resilience.

Approximately 9% of electrical energy is lost during the transmission and distribution of electricity from where it is generated to where it is consumed. This energy is predominantly lost as heat in transformers and along cables. While Wales' previous 2030 renewable electricity target did not include losses, the 2035 target does. This adjustment reflects the additional energy required from generators to compensate for losses, providing a more accurate representation of the total energy needed to deliver electricity to homes and businesses.

[6] DESNZ, 2023. Sub-national electricity consumption statistics 2005 to 2022. Includes 9% assumed efficiency losses. (N.B. Welsh electricity consumption data for 2023 has not yet been published, so an estimate has been produced. See methodology for information.)

[7] CCC 6th Carbon Budget, 2019. Includes 9% assumed efficiency losses.

Locally owned renewable energy

In 2023, the Welsh Government raised its local ownership target for renewable energy to 1.5 GW by 2035, having already nearly reached its initial 1 GW goal for 2030.[8] At 0.9 GW, Wales is 60% of the way towards its new target as of 2023.

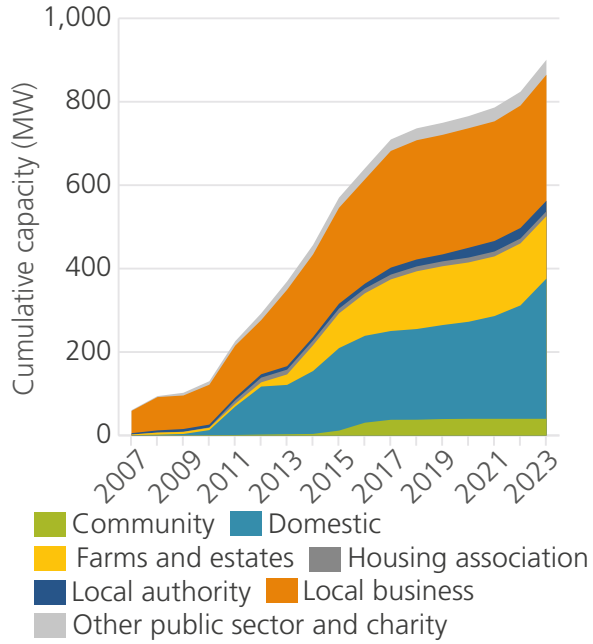
Twice as many locally owned renewable energy projects were installed in 2023 compared to 2022, primarily due to the accelerating uptake of domestic solar PV. In 2023, 79 MW of locally owned capacity was commissioned, including 78 MW of electrical capacity from solar PV and 1 MW of heat capacity, comprising c. 0.8 MW from biomass and c. 0.1 MW from solar thermal. Nearly two-thirds of all locally owned capacity comes from electricity generation sources, such as solar PV and onshore wind.

Wales is now estimated to have more than 89,500 locally owned renewable electricity and heat projects, 90% of which are classified as domestic. These domestic projects are typically small-scale rooftop solar PV and biomass systems, so only account for 37% of all locally owned capacity.

The Welsh Government's Ynni Cymru programme supports community and collaborative projects delivering local benefits. In autumn 2024, it launched a £10 million grant fund for organisations developing smart local energy systems in Wales, to be completed by March 2025.

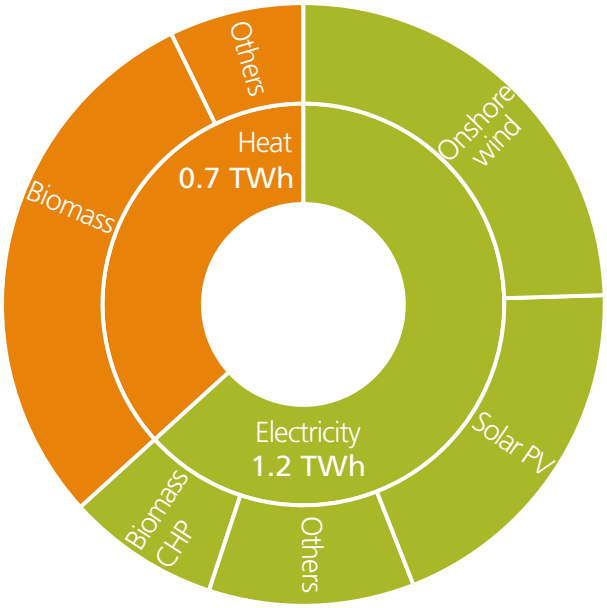
Locally owned renewable capacity by ownership type

Data source: (1)



Locally owned renewable energy generation by technology (TWh)

Data source: (1)



[8] This target does not include the installation of heat pumps, which are instead accounted for in the Welsh Government's target to install 580,000 heat pumps by 2035.

Definition of ownership

The definition of 'locally owned' is set out in the Welsh Government's policy statement on local ownership of energy generation in Wales.[9] It covers energy installations located in Wales that are owned by households, communities, local authorities, housing associations, other public sector bodies, charities (including faith organisations), further education establishments, local businesses (registered in Wales) and Welsh farms and estates. Due to source data limitations, the figures are likely to be underestimated.

Summary of locally owned renewable energy in Wales

Data source: (1)

Ownership category	Total number of projects	Capacity (MWe)	Capacity (MWth)	Estimated generation (GWh)
Community	198	40	0	55
Domestic	80,454	296	40	394
Farms and estates	825	24	126	485
Housing association	5,622	7	3	9
Local authority	272	22	3	35
Local business	1,727	286	16	820
Other public sector and charity	534	13	23	87
Total	89,632	688	211	1,885

Heat pumps

In response to the Consultation on Wales' Renewable Energy Targets published in 2023, the Welsh Government set a target of installing 580,000 heat pumps in Wales by 2035. As of 2023, there are just over 22,000 heat pumps installed in Wales. The majority of these installations are domestic and locally owned. However, heat pumps are excluded from the Welsh Government's local ownership target since they are better quantified in numbers of installations rather than by capacity, and have their own uptake target.

[9] Welsh Government, 2020. Policy Statement: Local ownership of energy generation in Wales – benefiting Wales today and for future generations

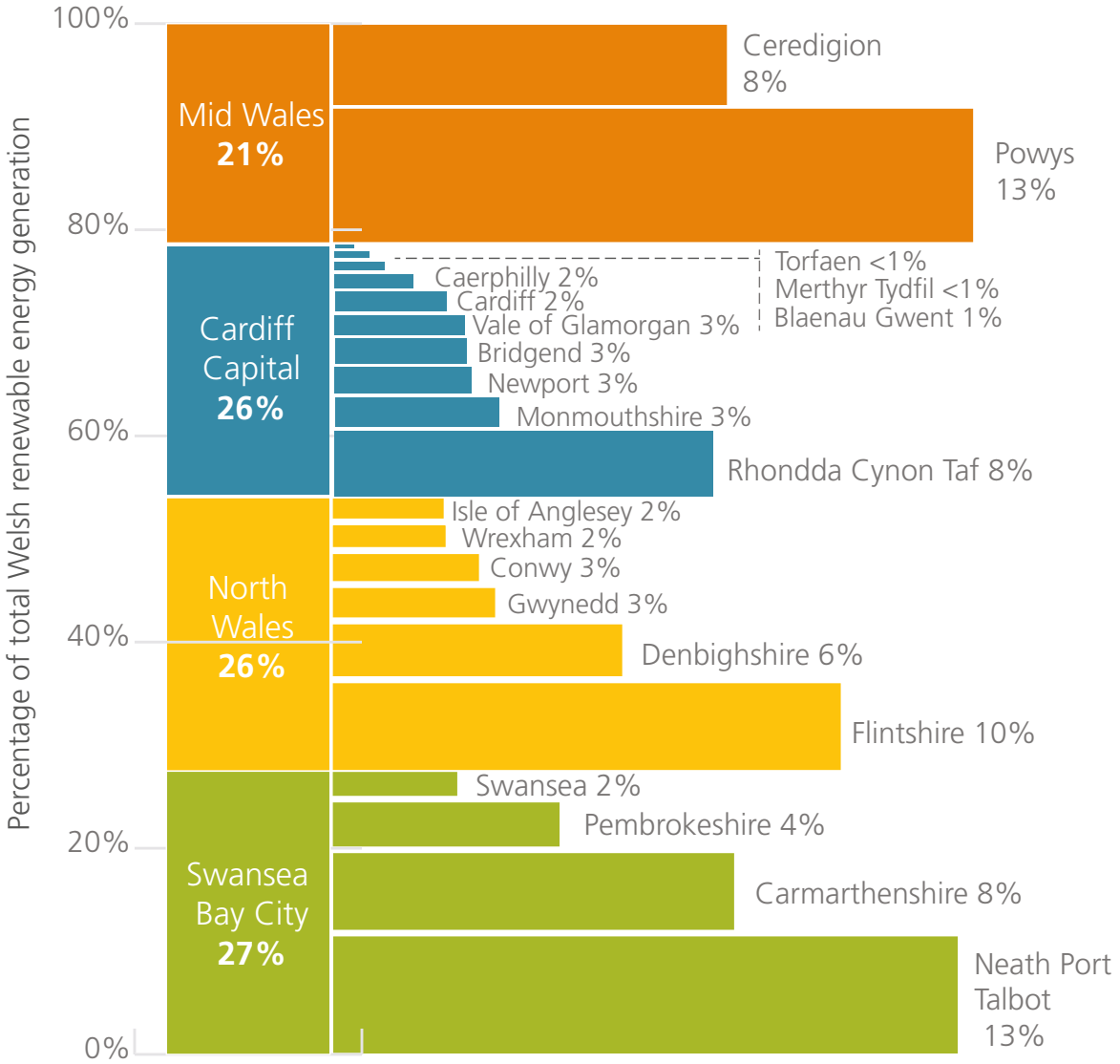
Renewable energy trends

Regional context

In 2023, each of the four regions contributed similar amounts to Wales' total renewable energy generation. However, renewable generation capacity is typically concentrated in a few local authorities within each region. Over 40% of Wales' total renewable electricity generation is concentrated in each region's top contributing local authority.

Estimated annual renewable energy generation by region and local authority, 2023

Data source: (1)



Local authority areas with the highest increase in renewable energy capacity in 2023

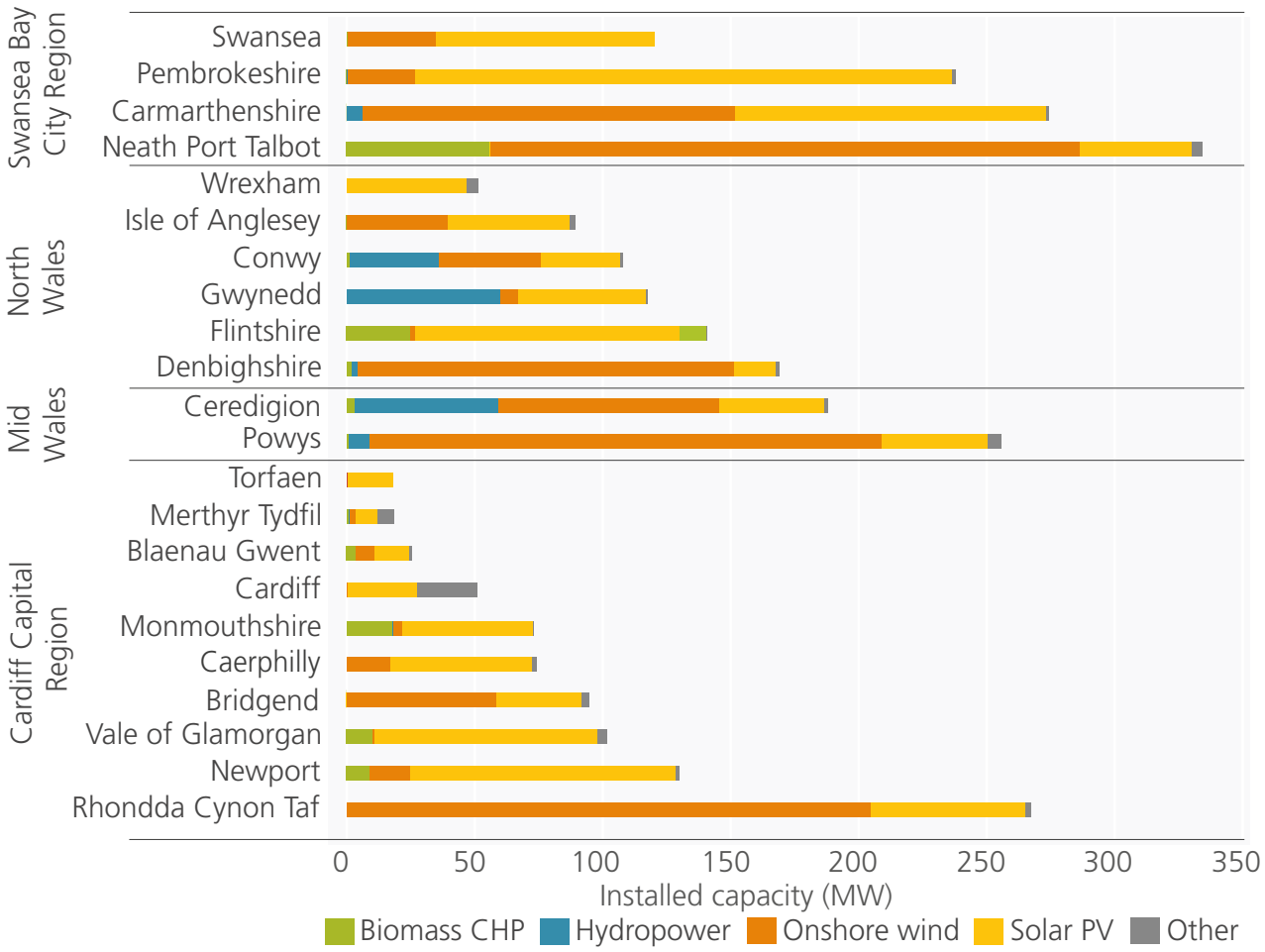
Data source: (1)

Local authority area	Region	Increase in renewable energy capacity (MW)
Powys	Mid Wales	23.3
Swansea	Swansea Bay City	17.0
Pembrokeshire	Swansea Bay City	16.2

In 2023, all 22 Welsh local authority areas saw an increase in their total renewable energy capacity compared to the previous year. Over half of the local authorities saw a 5% or greater increase in renewable energy capacity, with three achieving a 10% or greater increase. This progress marks an improvement from the previous two years, during which only three local authorities experienced a renewable capacity increase exceeding 5%.

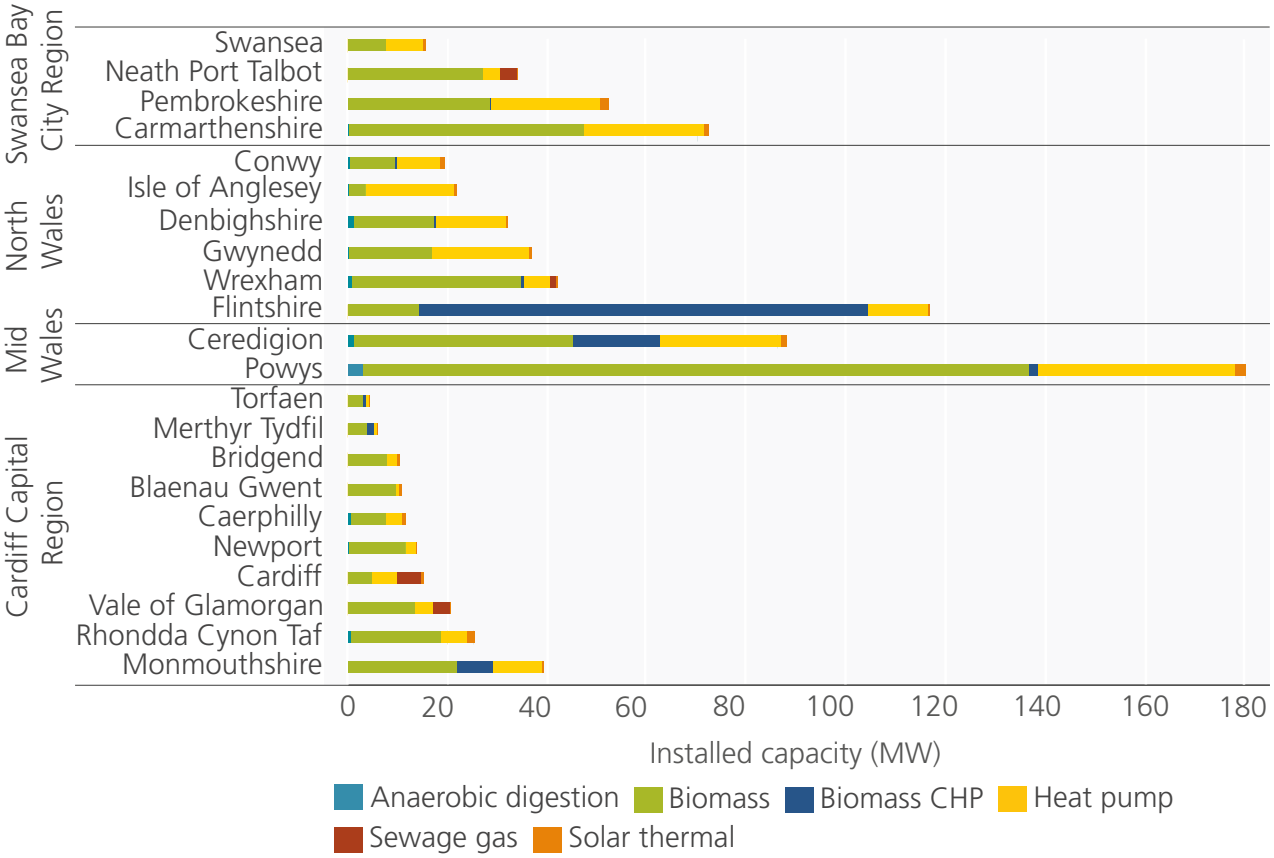
As with the previous year, Swansea saw the largest growth in renewable energy capacity, increasing its percentage of installed capacity by 14%. Powys saw the largest value increase in installed capacity, with an additional 23 MW installed in 2023.

Onshore renewable electricity capacity by local authority area Data source: (1)



The Swansea Bay City Region leads Wales in onshore renewable electricity generation, contributing 33% of the total. This is mainly due to the concentration of onshore wind in Neath Port Talbot and Carmarthenshire, as well as Pembrokeshire having the highest amount of installed solar PV among all Welsh local authority areas. The Cardiff Capital City Region follows with 29%, then North Wales with 23%. Mid Wales produces the smallest share of the country's renewable electricity, accounting for only 15% of the total.

Renewable heat capacity by local authority area Data source: (1)



The North Wales and Mid Wales regions account for the greatest proportion of Wales' total renewable heat capacity, at 31% each, with Powys and Flintshire hosting the most renewable heat capacity of all local authorities. In both regions, much of this capacity is attributed to biomass heat, with heat pump projects as the second most prevalent renewable heat technology. The Swansea Bay City Region and Cardiff Capital City Regions represent 20% and 18% of Welsh renewable heat capacity, respectively. The adoption of renewable heating systems has historically correlated with the number of off-gas homes and businesses in each region – resulting in areas with the highest proportions of off-gas properties having the highest uptake of renewable heat.

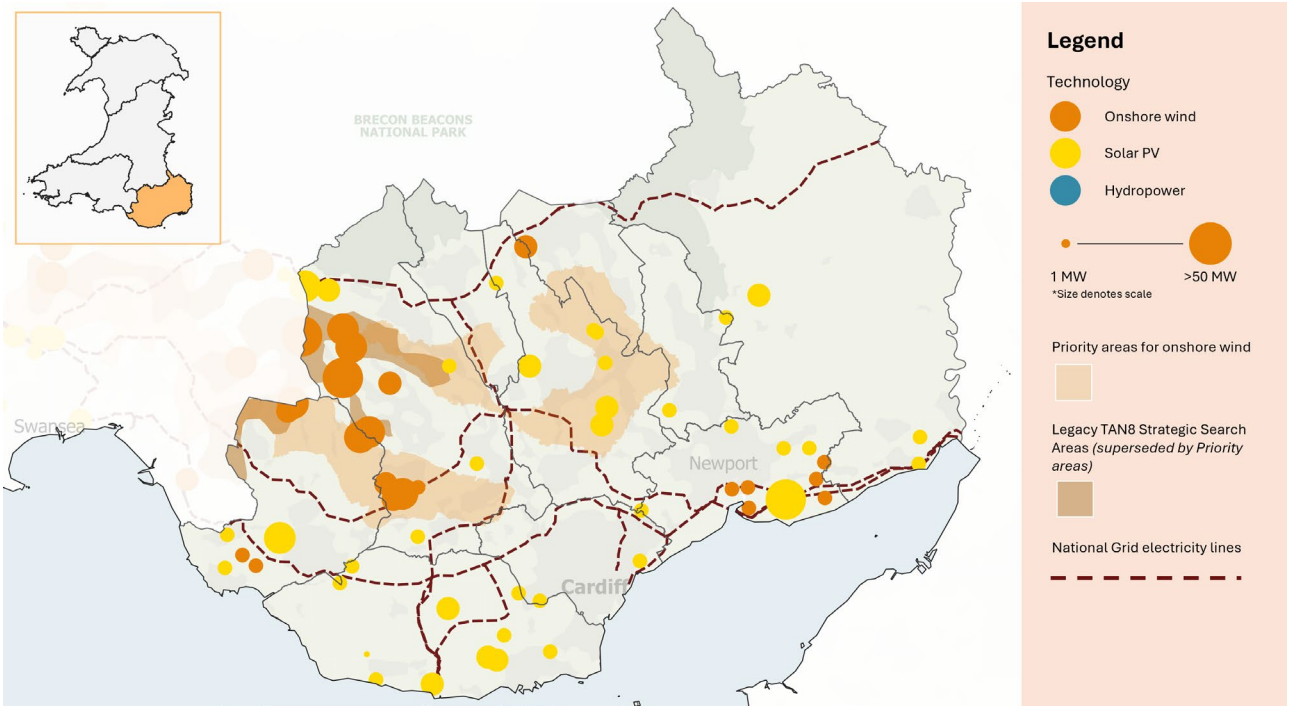
Cardiff Capital Region

In 2023, a total of 4,474 new projects were commissioned in the Cardiff Capital Region, representing 40 MW of new capacity. The majority of these installations are small-scale domestic projects.

Data source: (1)

Cardiff Capital Region technology	Total renewable heat and electricity			Commissioned in 2023	
	Number of projects	Total capacity (MW)	Estimated generation (GWh)	Number of projects	Total capacity (MW)
Anaerobic digestion	10	10	56	-	-
Biomass electricity and CHP	14	51	272	-	-
Biomass heat	531	101	310	3	0.07
Energy from Waste	1	15	79	-	-
Heat pump	3,115	33	57	567	6
Hydropower	26	1	3	-	-
Landfill gas	9	12	29	-	-
Onshore wind	97	311	763	-	-
Sewage gas	2	15	77	-	-
Solar PV	31,264	455	418	3,903	34
Solar thermal	1,708	4	3	1	0.002
Total	36,777	1,008	2,067	4,474	40

Cardiff Capital Region electricity generation landscape Data source: (1)

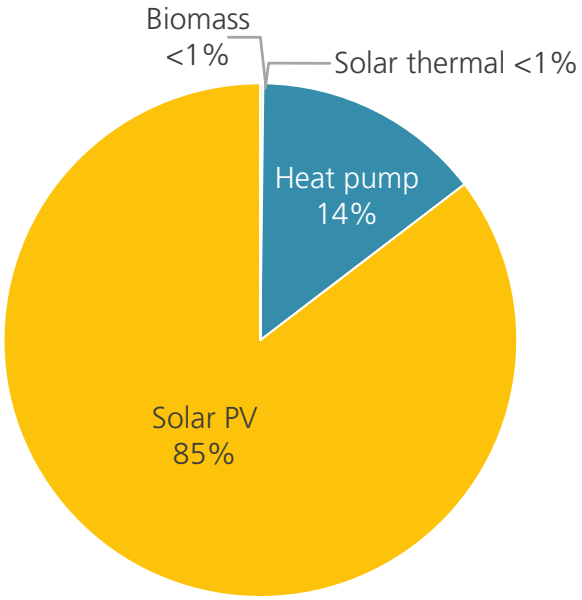


In 2023, solar PV accounted for 85% of Cardiff Capital Region's new renewable energy capacity, with 34 MW installed – more than triple the capacity installed in 2022. The largest project is the 8.9 MW Bryngolwg Solar Farm in Rhondda Cynon Taf.

In 2023, the proportion of total generation from each renewable technology in Cardiff Capital Region remained similar to 2021 and 2022. Onshore wind remains the largest proportion at 37%, followed by solar PV at 20%, biomass heat (15%) and biomass electricity and CHP (13%).

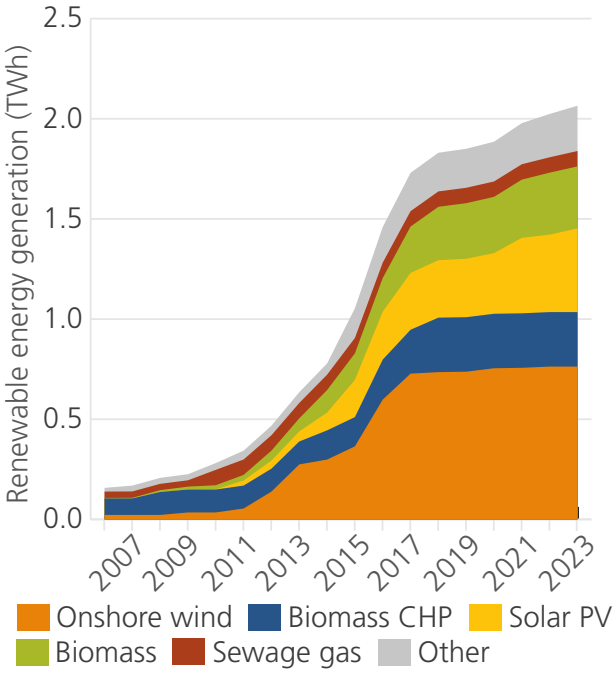
Percentage of renewable capacity commissioned in 2023, by technology

Data source: (1)



Renewable energy generation in the Cardiff Capital Region

Data source: (1)



Torfaen County Borough Council solar installations

In 2023, Torfaen County Borough Council expanded its renewable energy capacity as part of its County Plan to address climate and nature challenges.

The council installed over 720 kW of rooftop solar PV systems across schools in the county, benefitting from a loan provided by the Welsh Government. This nearly tripled the council's renewable energy portfolio to just over 1 MW, up from 350 kW in 2022. Most of this capacity is rooftop solar, alongside a 20 kW hydropower plant operated and maintained by the council.

This additional capacity increased Torfaen County Borough Council's renewable portfolio to just over 1 MW, nearly tripling its capacity as of 2022 (350 kW).

The renewable energy initiative has continued into 2024, reflecting the council's ongoing efforts to cut carbon emissions while supporting the local community.

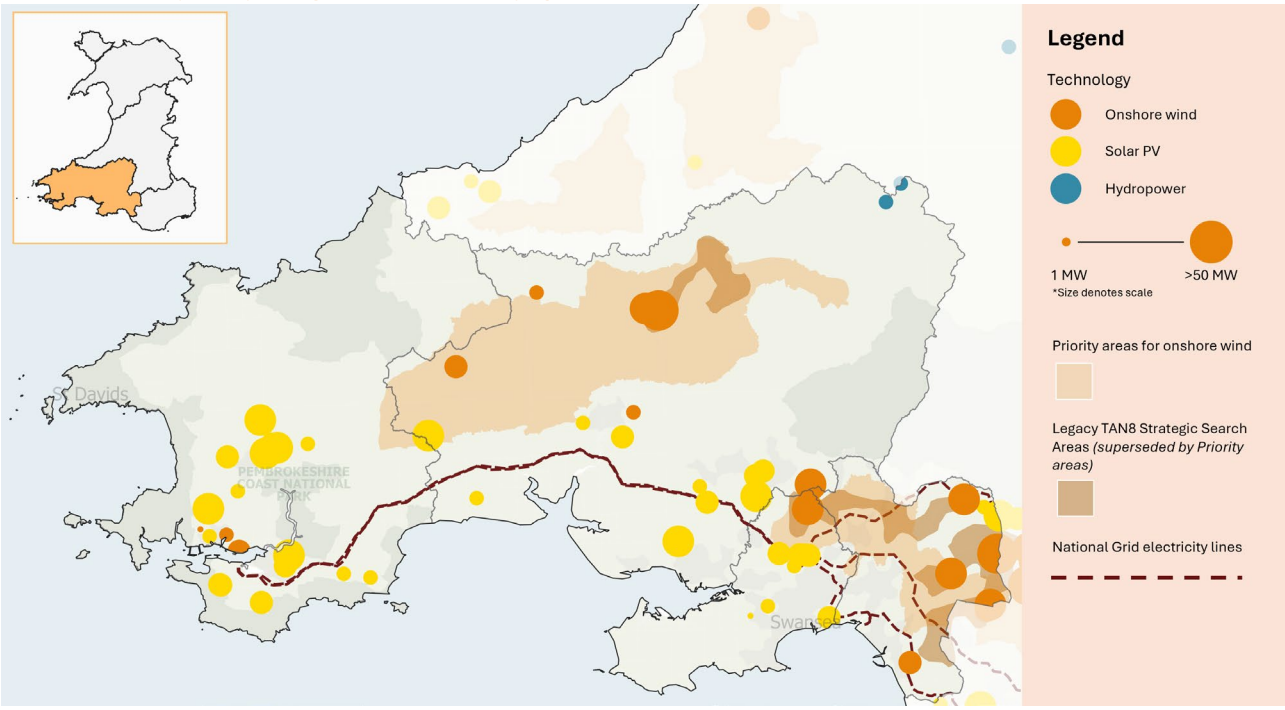
Swansea Bay City Region

In 2023, a total of 5,587 new projects were commissioned in the Swansea Bay City Region, totalling 52 MW of new capacity. The majority of these projects are small-scale installations. More than double the number of projects were commissioned in 2023 than in 2022.

Data source: (1)

Swansea Bay City Region technology	Total renewable heat and electricity			Commissioned in 2023	
	Number of projects	Total capacity (MW)	Estimated generation (GWh)	Number of projects	Total capacity (MW)
Anaerobic digestion	4	1	4	-	-
Biomass electricity and CHP	5	57	297	-	-
Biomass heat	1,046	110	339	17	0.43
Energy from Waste	-	-	-	-	-
Heat pump	5,350	57	97	1,713	17
Hydropower	41	8	15	-	-
Landfill gas	3	3	7	-	-
Onshore wind	280	435	1,067	-	-
Sewage gas	1	6	31	-	-
Solar PV	19,931	459	421	3,856	34
Solar thermal	1,090	3	2	1	0.002
Total	27,751	1,139	2,280	5,587	52

Swansea Bay City Region electricity generation landscape Data source: (1)

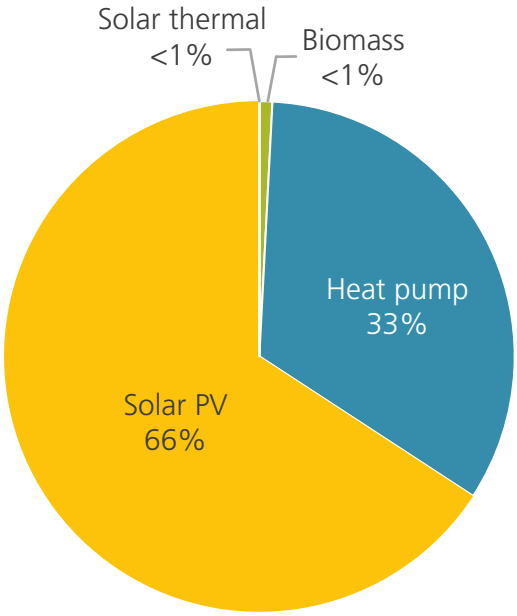


Solar PV accounted for 66% of Swansea Bay City Region's total new capacity, with 34 MW commissioned, almost double the new capacity in 2022; 10 MW of this comes from the Carn Nicholas Solar project.

Onshore wind generates approximately 47% of the region's total generation, generating an estimated 1 TWh. Solar PV (18%), biomass heat (15%) and biomass electricity and CHP (13%) are the next highest-generating technologies.

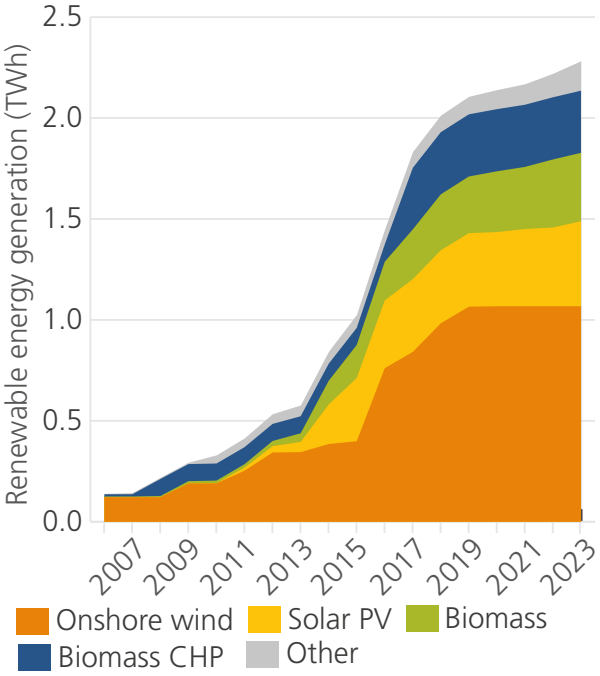
Percentage of renewable capacity commissioned in 2023, by technology

Data source: (1)



Renewable energy generation in the Swansea Bay City Region

Data source: (1)



Diesel-to-battery conversion programme

At the end of 2023, soft drinks manufacturer Radnor Hills installed a new £1.8 million solar farm at its Heartsease Farm facility near Knighton.

This 2 MW solar farm, covering roughly 1.2 hectares, is designed to produce c.2 MWh of energy annually. Combined with the company's existing rooftop solar panels, the investment enables Radnor Hills to meet 25% of its electricity needs through solar power.

Radnor Hills also operates a zero-to-landfill scheme and an on-site recycling facility. Their approach to sustainability earned Radnor Hills the Sustainable Business of the Year Award at the 2024 Wales Food and Drink Awards, a recognition of its commitment to being an environmentally conscious business.

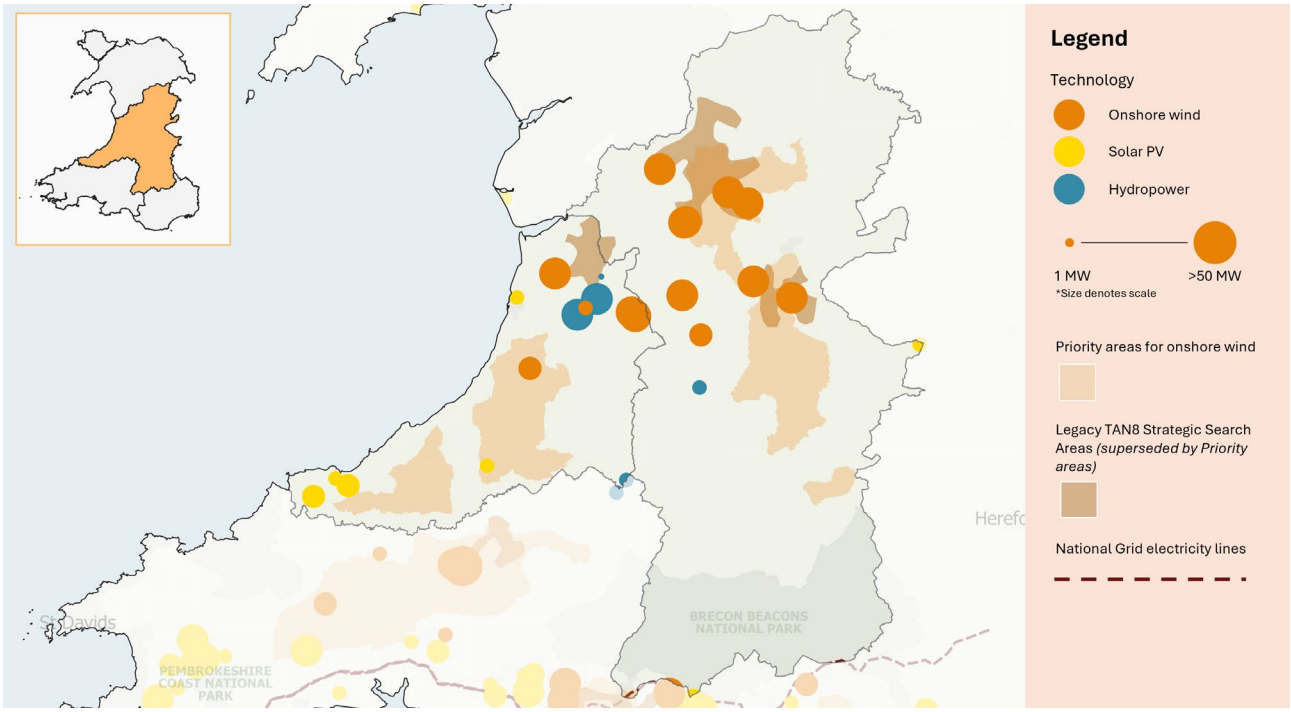
Mid Wales

In 2023, a total of 4,611 new projects were commissioned in Mid Wales, totalling 35 MW of new capacity. The majority of these projects are small-scale installations. Almost double the number of projects were commissioned in 2023 than in 2022.

Data source: (1)

Mid Wales technology	Total renewable heat and electricity			Commissioned in 2023	
	Number of projects	Total capacity (MW)	Estimated generation (GWh)	Number of projects	Total capacity (MW)
Anaerobic digestion	20	9	49	-	-
Biomass electricity and CHP	15	24	129	1	0.18
Biomass heat	1,281	177	544	5	0.12
Energy from Waste	-	-	-	-	-
Heat pump	5,939	64	110	1,855	18
Hydropower	107	64	119	-	-
Landfill gas	1	2	5	-	-
Onshore wind	197	285	700	-	-
Sewage gas	-	-	-	-	-
Solar PV	10,908	83	76	2,748	17
Solar thermal	1,057	3	2	2	0.004
Total	19,525	711	1,734	4,611	35

Mid Wales electricity generation landscape Data source: (1)

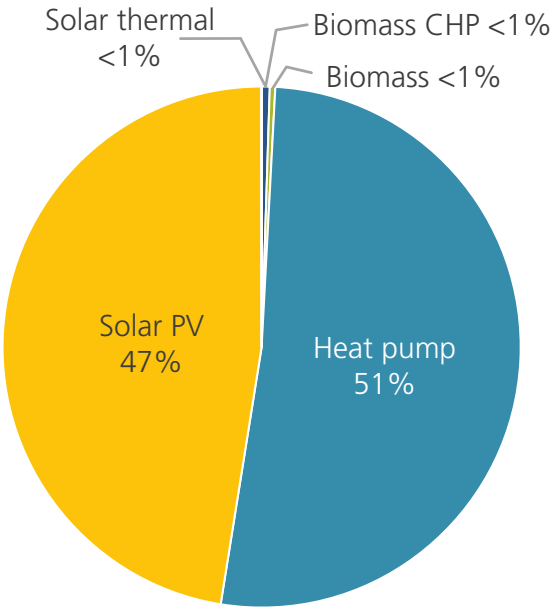


In 2023, annual solar PV installations almost tripled and heat pump installations almost doubled in Mid Wales. Solar PV accounted for 47% of all renewable energy installed in 2023, with heat pumps accounting for 52%.

Despite no new wind projects commissioning, onshore wind continues to dominate Mid Wales' overall renewable generation for 2023 at 40% (700 GWh). This is followed by biomass heat at 31% (544 GWh). Hydropower, and biomass electricity and CHP both contribute 7% (119 GWh and 129 GWh respectively).

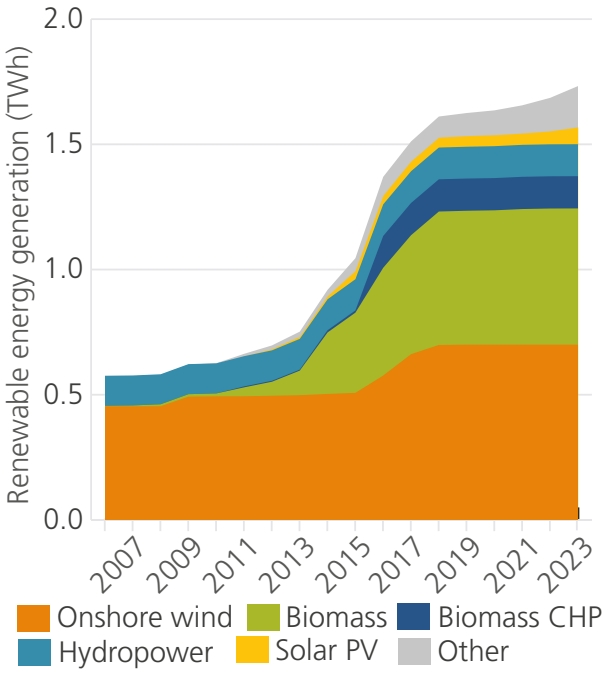
Percentage of renewable capacity commissioned in 2023, by technology

Data source: (1)



Renewable energy generation in the Mid Wales Region

Data source: (1)



Radnor Hills solar farm

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This 2 MW solar farm, covering roughly 1.2 hectares, is designed to produce c.2 MWh of energy annually. Combined with the company's existing rooftop solar panels, the investment enables Radnor Hills to meet 25% of its electricity needs through solar power.

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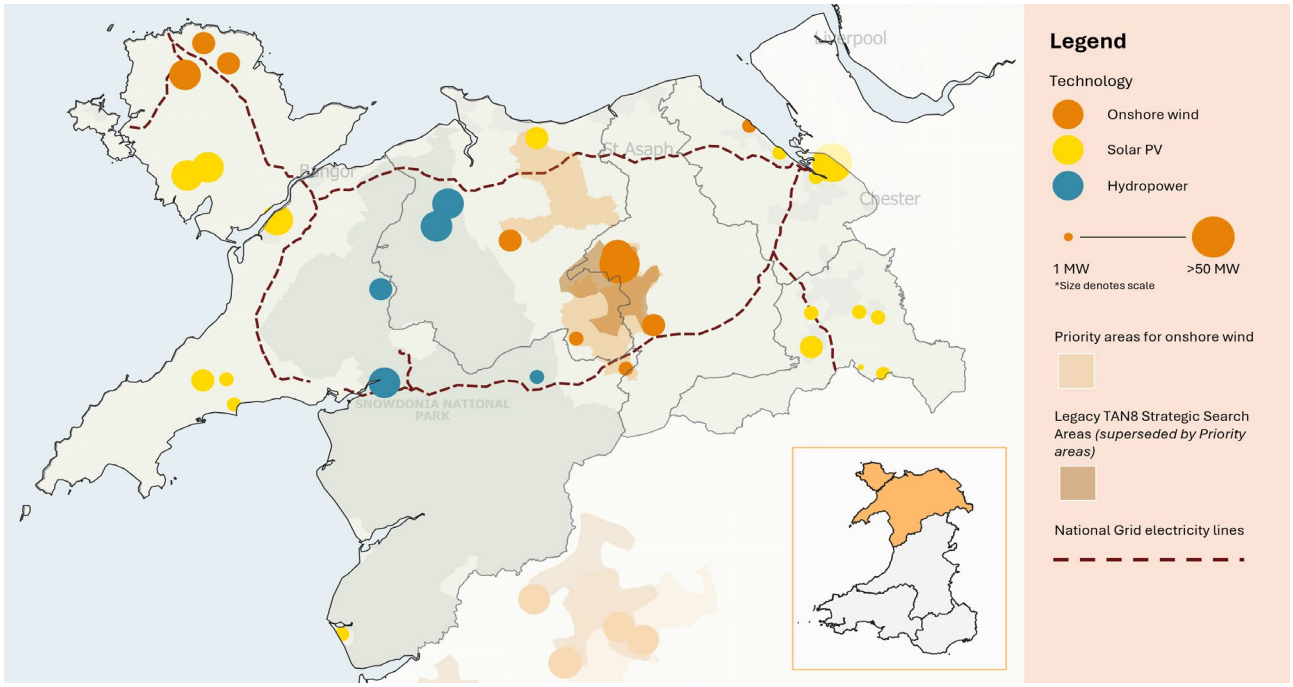
North Wales

In 2023, a total of 7,594 new projects were commissioned in North Wales, totalling 49 MW of new capacity. This is the highest number of new projects of any Welsh region in 2023. The majority of these projects are small-scale installations. North Wales saw 2.5 times more projects commissioned in 2023 than in 2022.

Data source: (1)

North Wales Technology	Total renewable heat and electricity			Commissioned in 2023	
	Number of projects	Total capacity (MW)	Estimated generation (GWh)	Number of projects	Total capacity (MW)
Anaerobic digestion	16	7	39	-	-
Biomass electricity and CHP	15	120	655	-	-
Biomass heat	833	93	286	10	0.19
Energy from Waste	1	11	55	-	-
Heat pump	7,663	77	132	2,741	25
Hydropower	205	97	195	1	0.1
Landfill gas	8	5	12	-	-
Onshore wind	181	235	576	-	-
Sewage gas	1	2	11	-	-
Solar PV	24,272	294	269	4,842	23
Solar thermal	973	3	2	-	-
Total	34,168	944	2,232	7,594	49

North Wales electricity generation landscape Data source: (1)

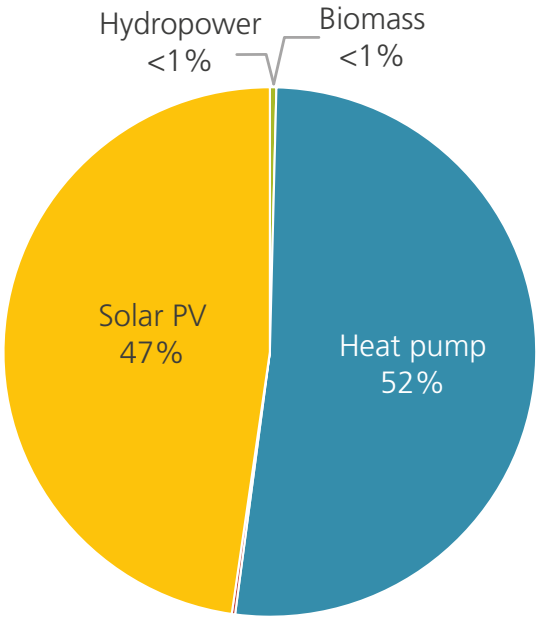


Heat pumps and solar PV represent 99% of all new renewable capacity commissioned in North Wales in 2023, at 25 MW and 23 MW respectively. The remaining 1% comprises 11 small-scale projects (10 biomass heat and one hydropower).

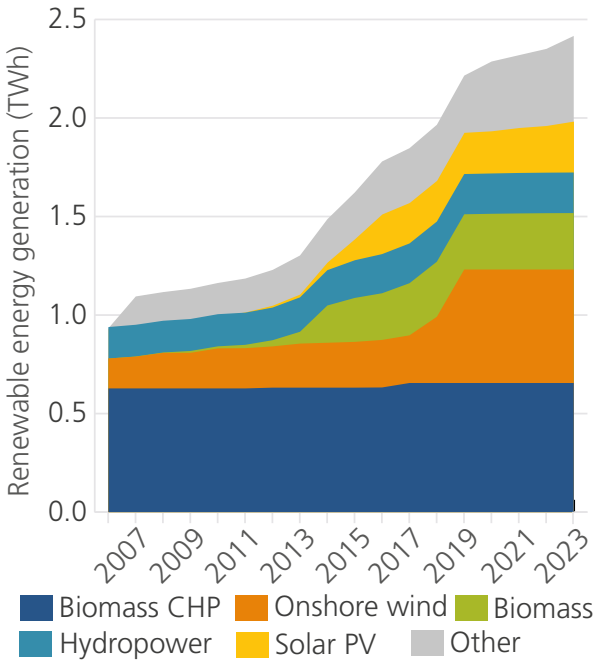
Biomass electricity and CHP, and biomass heat together remain the highest proportion of overall generation in North Wales, at approximately 42%. This is followed by onshore wind at 26%, while solar PV and hydropower contributed 12% and 9% respectively.

Percentage of renewable capacity commissioned in 2023, by technology

Data source: (1)



Renewable energy generation in the North Wales Region Data source: (1)



Bonwm Hydro

Bonwm Hydro is a 100 kW hydropower project near Corwen that uses water from the Nant Llechog stream to generate electricity. Developed by the Corwen Electricity Co-operative in 2018, the project was funded through community-raised shares and follows their initial 55 kW hydropower scheme at Nant y Pigyn, which has generated electricity since 2016.

Bonwm Hydro expects to generate enough electricity to supply 130 homes and displace almost 1,000 tonnes of CO2e over 26 years. The project is also expected to generate £220,000 for a local community benefit fund.

Low carbon technologies

Hydropower

In 2023, one new hydropower project was commissioned in Wales: a 0.1 MW community-owned project in North Wales. Wales' total hydropower capacity is now 170 MW across 380 sites, generating an estimated 332 GWh.

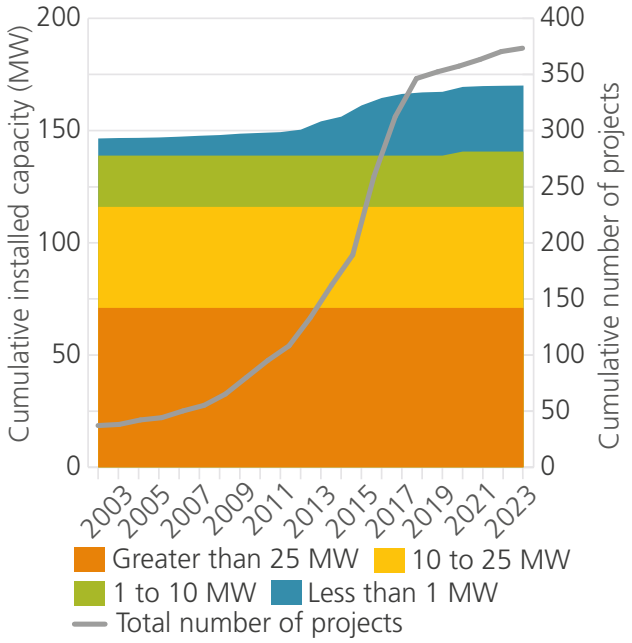
Three-quarters of Wales' total hydropower capacity comes from just six large-scale projects, all located in North and Mid Wales. These large-scale projects, ranging from 10 MW to 41 MW, were all commissioned between 1924 and 1989. Since 2000, only one megawatt-scale project has been commissioned, the 1.8 MW Ystradffin Hydro site in Carmarthenshire. The introduction of the Feed-in-Tariff in 2010 saw hundreds of small-scale hydropower projects installed in Wales, totalling 18 MW.

The local authority areas containing the most hydropower capacity are Gwynedd (59.8 MW) and Ceredigion (55.9 MW). These areas, encompassing Eryri National Park and the Cambrian Mountains, provide ample resource opportunities for hydropower.

The only hydropower project developed in 2023 was the community-owned 0.1 MW Bonwm Hydro in Denbighshire, North Wales. Developed by Corwen Electricity Co-operative and with support from the Welsh Government Energy Service, it aims to power over 130 local homes and generate an estimated £220,000 in community surplus over 26 years.[10]

Deployment of hydropower in Wales by scale

Data source: (1)



[10] Welsh Government Energy Service, 2023. Annual report: 2022-23

Offshore wind

With a total capacity of 726 MW, offshore wind accounted for approximately 28% of renewable electricity generation in Wales in 2023. The UK's offshore wind target of 55 GW by 2030, including 5 GW from floating offshore wind, will see offshore wind continue to develop off the Welsh coastline.

Since the Gwynt Y Môr offshore wind farm began operating in 2015, Welsh offshore wind capacity has remained unchanged. However, new offshore wind farms, including new fixed and floating projects and extensions to existing projects, are in development.

In 2023, Awel y Môr – a 576 MW extension to Gwynt y Môr – was awarded development consent and is now preparing for its final investment decision, including future applications to the UK Government's Contracts for Difference (CfD) scheme. At the same time, the 1.5 GW Mona project is currently undergoing examination for its development consent, having concluded the second consultation on the latest project design in June 2023.

Existing or in development offshore wind projects that could contribute to Welsh renewable electricity generation[8]

Wind farm	Foundation	Status	Actual or expected commissioning date	Installed or expected capacity (MW)
North Hoyle	Fixed	Commissioned	2003	60
Rhyl Flats	Fixed	Commissioned	2009	90
Gwynt y Môr	Fixed	Commissioned	2015	576
Mona	Fixed	Pre-planning	2029	1,500
Awel y Môr	Fixed	Consented	TBC	576
Erebus	Floating	Consented	TBC	100
Llŷr 1	Floating	Pre-planning	TBC	100
Llŷr 2	Floating	Pre-planning	TBC	100

Floating offshore wind is set to play a growing role in the future electricity mix for Wales and the UK, contributing £11.6 million to the Welsh economy in 2022-2023.[11] The Celtic Sea has a pipeline of approximately 400 MW in floating wind test projects, with about 300 MW expected to connect to the electricity network in Wales by the end of the decade. At the time of writing, the most advanced project is Erebus, a 100 MW scheme by Blue Gem Wind located 40km off Pembrokeshire, which has secured the necessary licenses and is awaiting further development, such as securing a CfD.[12]

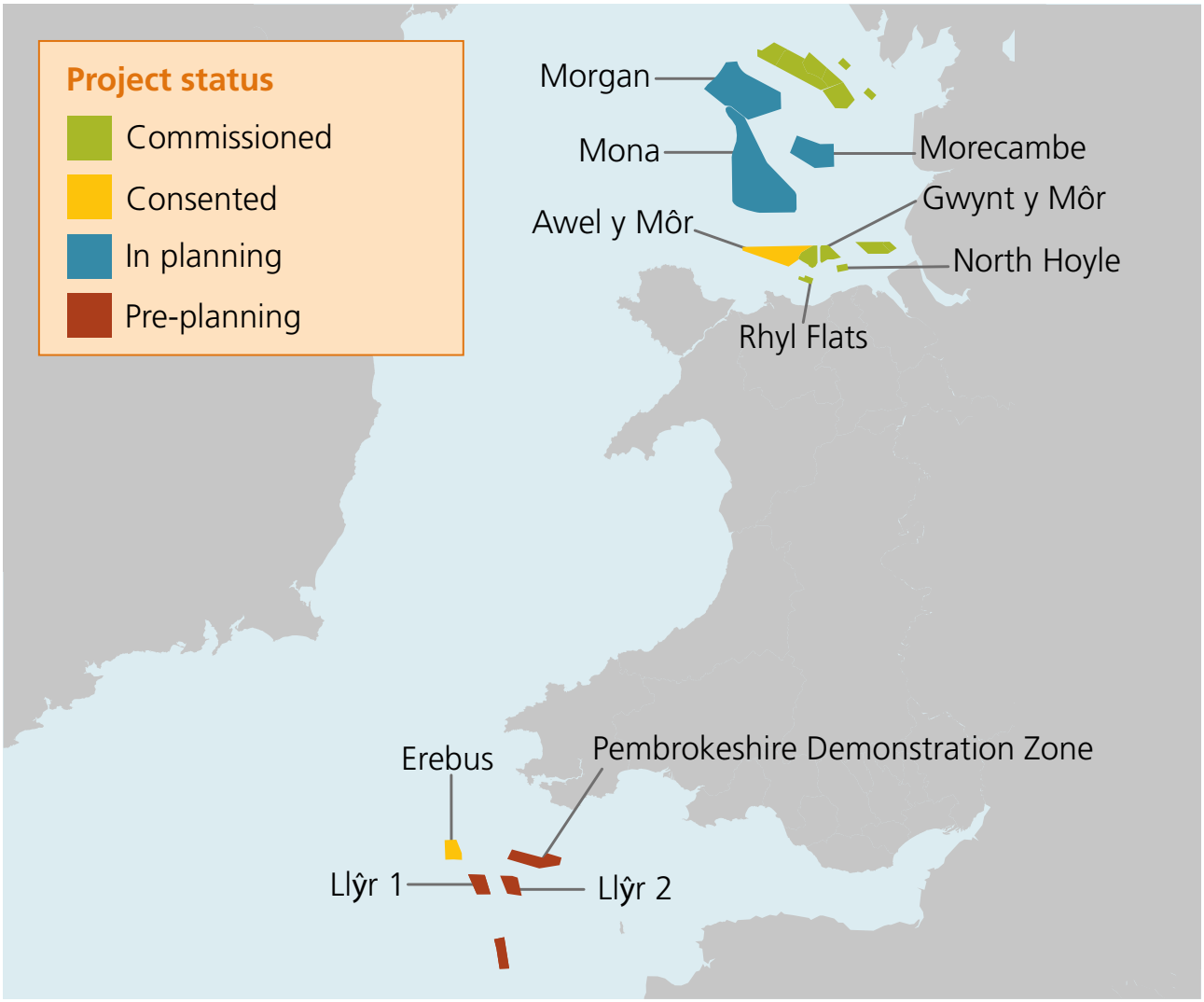
[11] Marine Energy Wales, 2023. State of the sector 2023

[12] Blue Gem Wind, 2021. Erebus floating offshore wind farm - non-technical summary

Additionally, The Crown Estate's fifth leasing round for offshore wind will award leases for three projects in the Celtic Sea, adding 4.5 GW of capacity and marking the start of commercial floating offshore wind in South Wales. The fifth round emphasises social value commitments, with estimates suggesting the creation of 10,000 jobs in Wales.[13] The Crown Estate's £50 million Supply Chain Accelerator fund – the first £10 million of which was earmarked specifically for floating offshore wind in the Celtic Sea – also presents a significant opportunity for economic investment and development of supply chains and skills in Wales.[14]

Welsh ports, particularly Port Talbot and the Port of Milford Haven, will be crucial in assembling and deploying floating offshore wind in the Celtic Sea. Designated as the Celtic Freeport in March 2023, this area will focus on technologies like floating offshore wind, attracting significant investment and job opportunities. Port Talbot has secured UK government funding and Associated British Ports (ABP) investment, potentially unlocking £1 billion for the port and surrounding area.

Location of offshore wind projects



[13] BBC, 2022. Floating wind farms at sea to create 29,000 jobs
[14] The Crown Estate, 2024. Supply Chain Accelerator

Marine

To date, approximately £165 million has been invested in tidal stream, tidal range and wave energy development across Wales. The Morlais tidal stream project now has 28 MW of CfDs awarded and has completed construction of its onshore substation. Meanwhile, the Welsh Government's Tidal Lagoon Challenge is exploring the barriers and benefits of tidal lagoons.

In 2023/24, the marine renewable energy sector contributed £29.9 million to the Welsh economy, down from £104.3 million the previous year due to completed projects and the end of EU funding.[15] Nonetheless, the sector remains active throughout Wales with promising growth.

In 2023, four developers were awarded CfDs for tidal stream projects, totalling over 22 MW. Adding to the c. 5.6 MW of Welsh tidal stream capacity that was awarded a CfD in 2021, this now brings Wales' total tidal stream CfD capacity to over 28 MW.[16,17] This capacity will be deployed in the Morlais tidal stream array demonstration project, with the first devices expected to be deployed in 2026.[18] Located west of Anglesey and spanning 35km^2, Morlais' lease and grid connection can support up to 240 MW of tidal stream capacity. The opening of the onshore substation in October 2023 sets up the site to allow future projects to export power to the electricity network.[19]

In March 2023, the Welsh Government opened its £750,000 Tidal Lagoon Challenge Fund to support innovative projects addressing barriers or quantifying benefits to tidal range schemes.[20] In March 2024, three projects were announced as winning funding that will research the environmental, engineering, technical, socio-economic and financial challenges of tidal range.

[15] Marine Energy Wales, 2024. State of the sector report
[16] DESNZ, 2023. Contracts for Difference Allocation Round 5 results
[17] DESNZ, 2021. Contracts for Difference Allocation Round 4 results
[18] Morlais, nd. The Morlais story
[19] Morlais, 2023. Official opening of Wales; first tidal stream energy site
[20] Welsh Government, 2024. Tidal lagoon challenge

Onshore wind

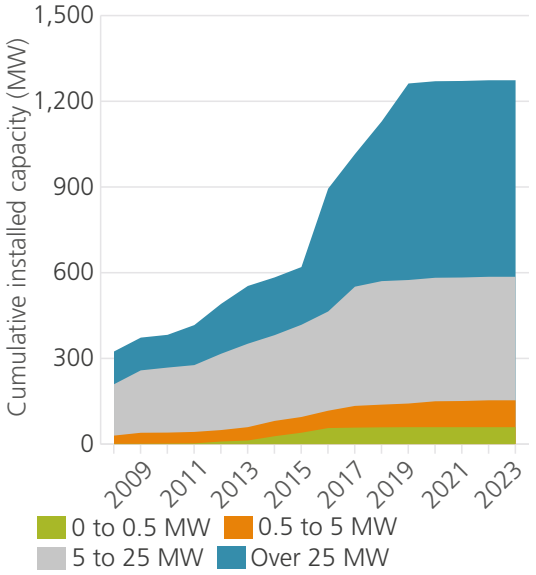
No new onshore wind sites were commissioned in Wales in 2023, marking the fourth consecutive year of decreasing deployment and the first year since 2000 without any new capacity.[21] This decline sharply contrasts with the period between 2016 and 2019, when an average of 160 MW was installed annually.

Currently, over 50% of Wales' operational onshore wind portfolio is concentrated within three local authorities: Neath Port Talbot (230 MW), Rhondda Cynon Taf (204 MW) and Powys (199 MW). In total, onshore wind capacity in Wales currently stands at 1,267 MW.

Despite low deployment rates over the last few years, several onshore wind projects are in planning and development in Wales. In 2024, a 1.5 MW turbine in Rhondda Cynon Taf began construction, and planning permission was given for a 5 MW extension to the existing 45 MW Pant Y Wal wind farm. Furthermore, 11 sites totalling 278 MW submitted applications for planning permission in 2023,[22] signalling a sizeable pipeline of future onshore wind.

In 2024, the Welsh Government launched the publicly owned Trydan Gwyrdd Cymru to support renewable energy development in Wales.[23] The company was created to speed up the development of renewable energy projects, particularly onshore wind, across the Welsh public estate and to maximise the benefits for local people. The Trydan Gwyrdd team is working with Natural Resources Wales to develop wind farms on the woodland estate.

Deployment of onshore wind in Wales by scale Data source: (1)



[21] According to the total embedded capacity registers covering NGED and SPEN.
[22] Sourced from the Renewable Energy Planning Database: July 2024
[23] Welsh Government, 2024. Securing Wales' green future: Trydan Gwyrdd Cymru is launched

Renewable heat

In 2023, approximately 6,900 new heat pumps were installed in Wales – the highest annual installations to date – bringing the total number of heat pumps in Wales to 22,000. In total, 67.5 MW of renewable heat capacity was installed in 2023, contributing to an estimated total of 2.6 TWh Welsh renewable heat generation.

Heat pumps

Both the Boiler Upgrade Scheme and Energy Company Obligation grant scheme are key factors in the significant increase in heat pumps across 2023. Both schemes provide grant funding to households to upgrade their heating systems to low-carbon systems, such as heat pumps or biomass boilers. Furthermore, changes to the Welsh Housing Quality Standards encourage heat pump uptake, with all new social housing in Wales requiring a low-carbon heat source.

Backed by its energy targets[24] and the Heat Strategy for Wales,[25] the Welsh Government has set an ambition to install 580,000 heat pumps by 2035, recognising that "they provide the most efficient, integrated and affordable solution in Wales' decarbonised future for most use cases".

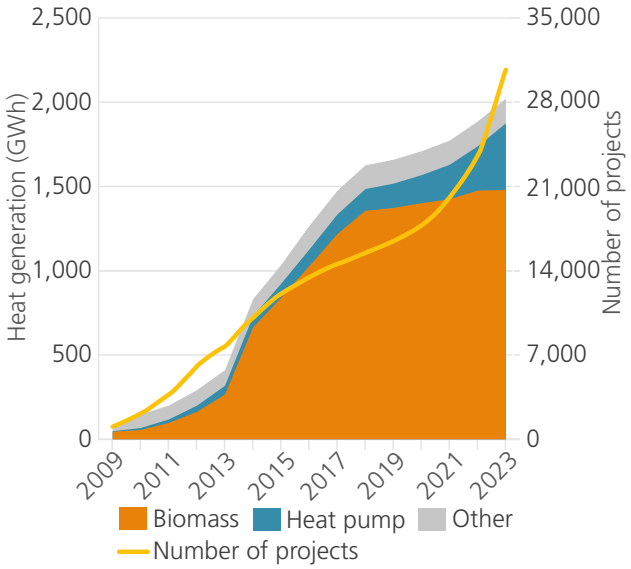
Biomass

In 2023, 35 installations in Wales accounted for an additional 0.8 MW of new biomass boiler capacity. Domestic installations constituted 86% of these, with only 0.18 MW of non-domestic installations – a notable drop compared to 2022, when non-domestic biomass boilers accounted for 14 MW.

Despite this, biomass still represents Wales' largest proportion of renewable heat, accounting for 55% of total renewable heat capacity.

Deployment of renewable heat over time

Data source: (1)



[24] Welsh Government, 2023. Wales' renewable energy targets
[25] Welsh Government, 2024. Heat Strategy for Wales

Solar PV

In 2023, 108 MW of new solar PV capacity was installed in Wales – more than double the amount installed in 2022. Very small-scale (<10 kW) projects accounted for approximately 64% of this new capacity. The total solar PV capacity across Wales is now 1.3 GW across more than 86,000 projects.

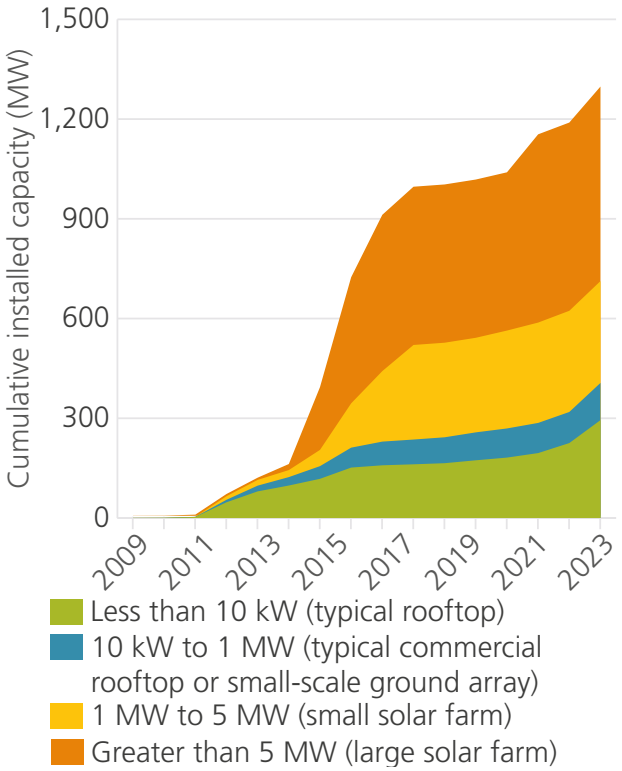
In 2023, more than 15,300 new solar PV projects were commissioned – the highest annual figure since 2011 and more than double 2022's total. This marks the third consecutive year of more than doubling installations, likely driven by various factors including the energy price crisis, the introduction of the Smart Export Guarantee, and increasing consumer confidence.

The 10 MW Carn Nicholas Solar Farm in Swansea was the largest solar project commissioned in 2023, closely followed by the 9 MW Bryngolwg solar farm in Rhondda Cynon Taf. However, approximately 97% solar PV installations commissioned in 2023 were under 10 kW, equating to 69 MW in total.

Most solar PV capacity is located in south Wales, with both Cardiff City Region and Swansea Bay City Region hosting over 450 MW each. This is likely due to the greater availability of grid connections, higher irradiance and a more developed supply chain. The local authority area that hosts the largest amount of solar PV capacity is Pembrokeshire, with 209 MW installed.

Solar PV deployment in Wales by scale

Data source: (1)



Waste technologies

No new waste projects were commissioned in 2023. Consequently, the total heat and power capacity from waste incineration, anaerobic digestion, sewage and landfill gas technologies remains at 123 MW.

Energy from Waste (EfW)

Wales has two operational Energy from Waste (EfW) sites: Trident Park in Cardiff (30 MW) and Parc Adfer in Flintshire (21 MW), generating approximately 270 GWh of electricity combined. For the purpose of this report, half of the electricity generated from these EfW projects is assumed to be renewable, due to the nature of non-biogenic waste being incinerated.

Since the Welsh Government's 2021 moratorium on large (>10 MW) EfW plants, no new facilities have been developed in Wales. Small-scale (<10 MW) plants are only permitted if regionally necessary,[26] aligning with Wales' zero waste strategy focused on reducing and recycling waste, and rendering new large EfW facilities unnecessary.

Despite no new developments in recent years, plans for a £200 million Carbon Capture and Storage (CCS) investment at the Parc Adfer EfW facility were announced in 2024. This project could capture up to 235,000t of CO2 each year, aligning with the Welsh Government's Carbon Budget to implement carbon removal solutions.[27]

Anaerobic digestion

Wales has 50 anaerobic digestion sites totalling 26.9 MW, with rapid growth in the early 2010s largely due to Feed-in Tariffs (FiT) and Renewable Heat Incentive (RHI) support. Anaerobic digestion sites make up 65% of Welsh waste technology projects and have the second-largest installed capacity of Welsh waste technology sites.

Sewage and landfill gas

Across Wales there are 21 landfill gas sites and four sewage gas sites. Together, they have an installed capacity of 46 MW which is almost evenly split between the two technology types. No new sewage gas sites have been developed since 2012 and only one new landfill gas site has been developed since 2009.

[26] Welsh Government, 2021. Strategic assessment for the future need for energy from waste capacity in the three economic regions of Wales

[27] Welsh Government, 2021. Net Zero Wales Carbon Budget 2 (2021-25)

Fossil fuels

Fossil fuel electricity generation

As of 2023, the total capacity of fossil fuel electricity generation in Wales is 4.3 GW. Collectively, fossil fuels generated 15.4 TWh of electricity in 2023, representing 66% of Wales' total electricity generation and the equivalent of 116% of Wales' annual electricity consumption.

Since the late 1990s, natural gas has been the primary fossil fuel for electricity generation in Wales. With coal phased out since 2020, natural gas now represents 94% of Wales' fossil fuel-based electricity generation.

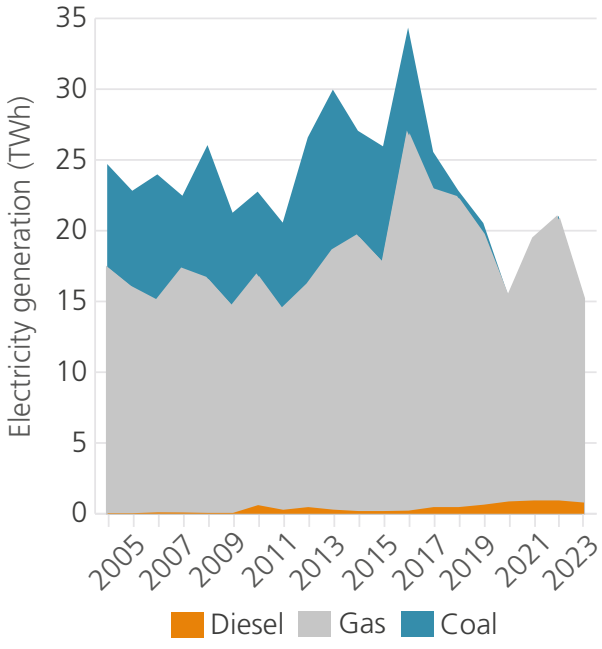
The installed capacity of natural gas fell significantly between 2017 and 2023 – dropping from over 6.3 GW to nearly 4.1 GW – as several power stations ceased operations. Nearly 88% of 2023's capacity is attributed to the two large-scale power stations at Pembroke (2,199 MW) and Connah's Quay (1,380 MW), with the remaining capacity arising from smaller-scale gas generators, which operate principally as flexible 'peaking' plants or combined heat and power (CHP) plants.

Natural gas electricity generation fell significantly in 2023 to just under 14.5 TWh, the second lowest natural gas electricity generation since 2012, with 2020 only slightly lower at 14.1 TWh. This is primarily driven by reduced output from Pembroke and Connah's Quay power stations, with other gas generators also decreasing output.

Most of the remaining fossil fuel generation capacity comes from small-scale diesel generation, typically deployed as short-term operating reserve and backup generators. Diesel generation currently represents 226 MW of capacity, a decrease from 2022. This reduction is due to the decommissioning of two diesel plants in Swansea: Tir John (22.4 MW) and Briton Ferry (20.2 MW) as part of an innovative diesel-to-battery conversion programme.[28]

Fossil fuel generation over time

Data source: (1)



[28] Pulse Clean Energy, 2023. Pulse Clean Energy and Habitat Energy activate 100MWh of battery storage in diesel-to-battery conversion programme

It is assumed that half of the EfW generation is non-renewable, with capacity totalling 26 MW across two projects in Cardiff and Flintshire. This accounts for less than 1% of fossil fuel generation in Wales.[29]

Regional context

The Swansea Bay City Region hosts over half of Wales' fossil fuel capacity, totalling 2.4 GW, with the Pembroke gas-fired power station contributing over 90% of this capacity. Despite the Swansea Bay City Region holding the greatest capacity, the Cardiff Capital City Region hosts the greatest number of fossil fuel sites – 55 of the 98 in Wales. However, these sites are small-scale, totalling only 406 MW, with none exceeding 30 MW individually. In contrast, North Wales hosts just 17 fossil fuel sites, but these total over 1.5 GW in capacity, primarily due to the 1.38 GW gas-fired Connah's Quay power station in Flintshire.

Mid Wales has limited electricity generation from fossil fuels, totalling just over 11 MW from five projects. Unlike other regions, the installed capacity of diesel generators in Mid Wales surpasses that of fossil gas generators, with 10 MW of diesel and 1.5 MW of gas generation. The fossil gas grid is less extensive in Mid Wales than in other regions, so diesel tends to be used instead of fossil gas when additional electricity is needed to meet peak demand. As such, over 85% of Mid Wales' fossil fuel generation can be attributed to a single diesel plant in Ceredigion.

Future

The reduction in fossil fuel generation reflects Wales' continued focus on decarbonisation and the growing recognition of fossil fuels' evolving role in the future energy mix.

Fossil fuels, particularly gas, are increasingly used flexibly rather than as a baseload. In the short to medium-term, gas power stations will play a key role in maintaining system stability when wind and solar output is low. However, under the UK Government's net zero commitment, unabated fossil fuel generation will have no role in the future. Instead, system operability will rely on batteries; flexibility; gas with Carbon Capture, Utilisation and Storage (CCUS); Bioenergy with Carbon Capture and Storage (BECCS); and other technologies. Plans such as proposed carbon capture at Connah's Quay power station, are already in development.

[29] Data on fossil fuel projects come from sources including DUKES power station data and Wales' two distribution network operators. Small backup and on-site generators, often located on farms or industrial and commercial sites, are likely underestimated. While these generators may increase project numbers, their impact on total capacity and generation trends is minimal due to their size and infrequent use.

Storage and flexible technologies

Battery storage

Two new commercial-scale battery storage sites were commissioned in 2023, both part of an innovative diesel-to-battery conversion programme by Habitat and Pulse Clean Energy. The programme is designed to decommission and repurpose diesel sites as grid-scale battery storage and energy optimisation assets. Wales now has 73 MW of battery storage capacity.

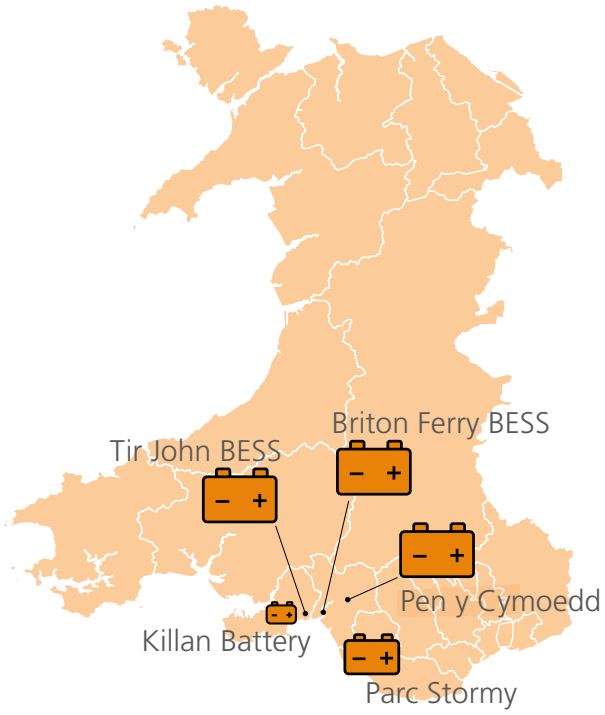
More than 93% of Wales' battery storage capacity is concentrated in three major projects: the 25 MW Tir John Battery Energy Storage System (BESS) project in Swansea, the 22 MW Pen y Cymoedd project in Neath Port Talbot – co-located with the Pen Y Cymoedd windfarm – and the 22 MW Briton Ferry BESS project, also in Neath Port Talbot. The remaining capacity comes from smaller battery installations and projects co-located with renewable energy installations.

In both Wales and the wider UK, there is a growing trend towards the installation of large-scale battery projects, typically above 50 MW, but often exceeding 100 MW. In Wales, 23 BESS projects have received planning permission (six were awarded planning permission in 2023), and two are currently under construction, amounting to more than 1 GW of BESS capacity.[30] Just under half of these sites are co-located with renewable or fossil-fuelled electricity generation. In addition, eight sites have submitted a planning application, totalling over 150 MW of capacity.

As Wales and the rest of the UK aim to achieve a net-zero electricity system by 2030, battery storage is a critical technology type that delivers low-carbon flexibility and replaces high-carbon alternatives. Battery storage operators help maintain network security by providing sub-second response services and wider balancing services to support the operation of the UK's electricity grid and enable further integration of renewables.

Location of battery storage projects

Data source: (1)



[30] Sourced from the Renewable Energy Planning Database Quarterly Extract, April 2024.

Pumped hydropower

Wales is home to two operational pumped hydropower energy storage sites, that together account for three-quarters of the UK's total pumped hydropower storage capacity. These two sites have a combined capacity of 2.1 GW and approximately 11 GWh of storage capacity. Additionally, a 100 MW site in Gwynedd is currently under development.

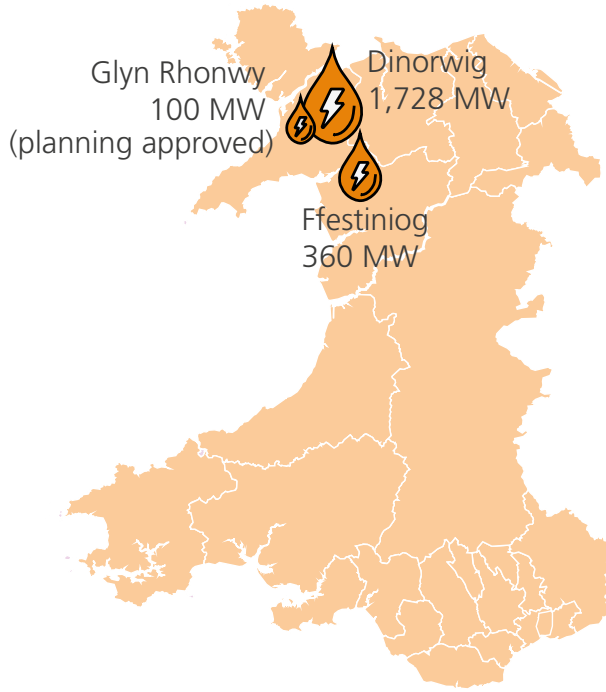
Pumped hydropower storage is one of the most established forms of energy storage, with its use dating back to the early 1900s. Wales hosts two pumped hydropower storage sites: The Ffestiniog Power Station in Gwynedd, commissioned in 1963, and the Dinorwig Power Station, also in Gwynedd, which began operation in 1984, provide approximately 11 GWh of storage capacity.

Wales' third pumped hydropower storage site, the 100 MW Glyn Rhonwy project, was granted a Development Consent Order in 2017. In November 2021, the Welsh Government granted an extension to the planning consent due to delays caused by the COVID-19 pandemic, allowing construction to commence by April 2025. In February 2024, this was amended to commencement no later than March 2026.

Pumped hydropower offers essential long-term storage flexibility to adapt to changes in generation and demand, with project lifespans typically exceeding 80 years. It will remain crucial for maintaining stability in an energy system increasingly reliant on variable renewable generation sources.

Location of pumped hydropower projects

Data source: (1)



Hydrogen

While there are no operational large-scale low-carbon hydrogen projects in Wales, hydrogen could have a range of uses in a decarbonising energy system. Hydrogen requires energy to produce, making it relevant to both supply and demand. However, in electricity generation its main role is as a storage technology.

Low-carbon hydrogen is important in decarbonising the energy system, from heavy industry and specialist vehicles to grid services and system operability. In the context of electricity generation, hydrogen primarily functions as energy storage, storing surplus electricity for later use in electricity system balancing. The National Energy System Operator's (NESOs) Clean Power 2030 plan highlights hydrogen's value as a dispatchable, low-carbon technology that can significantly ease electricity system challenges.[31]

In response to the 2021 Hydrogen in Wales consultation, the Welsh Government reaffirmed its belief that "hydrogen will have an important role to play in meeting net zero" and committed to "continue to support the hydrogen energy sector in Wales".[32] Significant public and private investment has created opportunities for Welsh workers in the hydrogen sector. Wales now hosts many projects looking to produce hydrogen for use in industry, such as commercial transport, construction and manufacturing. This includes two projects, totalling 19.4 MW, that received funding in the 2023 Hydrogen Allocation Round. Other plans to use stored hydrogen to generate electricity are still in their infancy.

The Welsh Government's Heat Strategy for Wales states that hydrogen will likely be key for high-temperature industrial processes, but confirms that electrification is preferred for most building heating.[33] The strategy also states that off-gas areas will not use hydrogen and that Local Area Energy Plans (LAEPs) will establish where, if anywhere, the gas grid could be repurposed for hydrogen.

[31] National Energy System Operator, 2024. Clean Power 2030
[32] Welsh Government, 2022. Hydrogen in Wales consultation – summary of response
[33] Welsh Government, 2024. Heat Strategy for Wales

Reference pages

Data tables

Local authority	Totals					Renewables							
	Renewables			Fossil fuels		AD			Biomass heat		Biomass electricity and CHP		
	Number of projects	Capacity (MW_e)	Capacity (MW_{th})	Number of projects	Capacity (MW_e)	Number of projects	Capacity (MW_e)	Capacity (MW_{th})	Number of projects	Capacity (MW_{th})	Number of projects	Capacity (MW_e)	Capacity (MW_{th})
Blaenau Gwent	1,615	25	11	6	107	-	-	-	15	10	1	4	-
Bridgend	3,338	95	10	5	24	1	3	-	36	8	-	-	-
Caerphilly	4,136	74	11	3	19	2	2	1	51	7	2	0	-
Cardiff	5,383	51	15	7	37	1	2	-	22	5	1	0	-
Carmarthenshire	10,103	274	73	2	10	2	1	0	565	47	-	-	-
Ceredigion	7,364	188	88	2	10	4	1	1	278	44	4	3	17
Conwy	4,146	108	19	3	2	3	-	0	123	9	5	1	0
Denbighshire	4,976	169	32	2	1	3	1	1	183	16	5	2	0
Flintshire	6,452	141	117	9	1,434	-	-	-	148	14	1	25	90
Gwynedd	6,558	117	37	3	10	2	0.5	0	226	17	1	0	-
Isle of Anglesey	6,220	89	22	1	0	2	2	0	61	3	1	0	0
Merthyr Tydfil	1,130	18	6	3	41	-	-	-	16	4	1	1	2
Monmouthshire	5,913	73	39	5	6	2	0	0	191	22	4	18	7
Neath Port Talbot	3,101	334	34	6	66	-	-	-	102	27	2	56	-
Newport	2,979	130	14	4	39	2	0	0	41	11	2	9	0
Pembrokeshire	9,318	238	52	6	2,258	2	0	0	318	28	2	0	0
Powys	12,161	255	180	4	1	16	3	3	1,003	134	11	1	2
Rhondda Cynon Taf	6,127	267	25	11	71	1	1	1	67	18	-	-	-
Swansea	5,229	120	16	5	65	-	-	-	61	8	1	1	-
Torfaen	2,719	18	4	5	0	-	-	-	21	3	1	0	1
Vale of Glamorgan	3,437	102	21	8	62	1	1	-	71	14	2	10	-
Wrexham	5,817	51	42	4	63	6	0	1	92	34	2	0	1
Offshore	3	726	-	-	-	-	-	-	-	-	-	-	-
Unknown	26	0	0	-	-	-	-	-	-	-	2	0	0
Total	118,249	3,663	869	104	4,325	50	18	9	3,691	482	51	132	120

In these backing data tables, 0 represents a value of greater than 0 and less than 1 that has been rounded down. Hyphens represent 0 values.

Data tables

Local authority	Renewables											
	Energy from waste		Heat pumps		Hydropower		Landfill gas		Offshore wind		Onshore wind	
	Number of projects	Capacity (MW_e)	Number of projects	Capacity (MW_{th})	Number of projects	Capacity (MW_e)	Number of projects	Capacity (MW_e)	Number of projects	Capacity (MW_e)	Number of projects	Capacity (MW_e)
Blaenau Gwent	-	-	94	1	1	0	1	1	-	-	9	7
Bridgend	-	-	225	2	3	0	1	0	-	-	14	59
Caerphilly	-	-	327	3	-	-	-	-	-	-	21	17
Cardiff	1	30	448	5	1	0	2	2	-	-	3	0
Carmarthenshire	-	-	2,241	24	15	7	1	0	-	-	113	145
Ceredigion	-	-	2,589	24	26	56	-	-	-	-	78	86
Conwy	-	-	843	9	30	35	1	1	-	-	40	40
Denbighshire	-	-	1,332	14	22	3	-	-	-	-	39	147
Flintshire	1	21	1,283	12	-	-	2	0	-	-	17	2
Gwynedd	-	-	1,944	19	153	60	1	0	-	-	36	7
Isle of Anglesey	-	-	1,818	18	-	-	1	0	-	-	49	40
Merthyr Tydfil	-	-	53	1	4	0	2	6	-	-	5	2
Monmouthshire	-	-	873	10	12	0	-	-	-	-	11	4
Neath Port Talbot	-	-	339	4	10	1	1	1	-	-	12	230
Newport	-	-	179	2	-	-	1	1	-	-	11	16
Pembrokeshire	-	-	2,074	22	14	1	1	2	-	-	150	26
Powys	-	-	3,350	40	81	8	1	2	-	-	119	199
Rhondda Cynon Taf	-	-	541	5	4	0	2	1	-	-	14	204
Swansea	-	-	696	8	2	0	-	-	-	-	5	34
Torfaen	-	-	59	1	1	0	-	-	-	-	3	0
Vale of Glamorgan	-	-	316	4	-	-	-	-	-	-	6	1
Wrexham	-	-	443	5	-	-	3	3	-	-	1	0
Offshore	-	-	-	-	-	-	-	-	3	726	-	-
Unknown	-	-	-	-	1	0	-	-	-	-	-	-
Total	2	51	22,067	231	380	170	21	22	3	726	754	1,267

In these backing data tables, 0 represents a value of greater than 0 and less than 1 that has been rounded down. Hyphens represent 0 values.

Data tables

Local authority	Renewables							Fossil fuels					
	Sewage gas			Solar PV		Solar thermal		Coal		Diesel and unknown		Gas	
	Number of projects	Capacity (MW_e)	Capacity (MW_{th})	Number of projects	Capacity (MW_e)	Number of projects	Capacity (MW_{th})	Number of projects	Capacity (MW_e)	Number of projects	Capacity (MW_e)	Number of projects	Capacity (MW_e)
Blaenau Gwent	-	-	-	1,204	13	290	1	-	-	1	21	5	86
Bridgend	-	-	-	2,957	33	101	0	-	-	-	-	5	24
Caerphilly	-	-	-	3,386	55	347	1	-	-	1	18	2	1
Cardiff	1	4	5	4,806	27	97	0	-	-	1	1	5	21
Carmarthenshire	-	-	-	6,848	122	318	1	-	-	-	-	2	10
Ceredigion	-	-	-	4,022	41	363	1	-	-	1	10	1	0
Conwy	-	-	-	2,845	31	256	1	-	-	-	-	3	2
Denbighshire	-	-	-	3,248	16	144	0	-	-	-	-	2	1
Flintshire	-	-	-	4,913	103	87	0	-	-	1	14	7	1,409
Gwynedd	-	-	-	4,013	50	182	1	-	-	-	-	3	10
Isle of Anglesey	-	-	-	4,098	47	190	1	-	-	-	-	1	0
Merthyr Tydfil	-	-	-	982	8	67	0	-	-	1	20	2	21
Monmouthshire	-	-	-	4,702	51	118	0	-	-	2	6	3	0
Neath Port Talbot	1	3	3	2,595	43	39	0	-	-	3	27	3	39
Newport	-	-	-	2,709	103	34	0	-	-	1	12	3	27
Pembrokeshire	-	-	-	6,188	209	569	2	-	-	-	-	6	2,258
Powys	-	-	-	6,886	41	694	2	-	-	-	-	4	1
Rhondda Cynon Taf	-	-	-	4,951	60	547	2	-	-	1	20	10	51
Swansea	-	-	-	4,300	85	164	1	-	-	2	22	3	43
Torfaen	-	-	-	2,616	18	18	0	-	-	-	-	5	0
Vale of Glamorgan	1	3	3	2,951	87	89	0	-	-	3	19	5	42
Wrexham	1	1	1	5,155	46	114	0	-	-	2	36	2	27
Offshore	-	-	-	-	-	-	-	-	-	-	-	-	-
Unknown	-	-	-	23	0	-	-	-	-	-	-	-	-
Total	4	11	13	86,398	1,291	4,828	14			20	226	82	4,073

In these backing data tables, 0 represents a value of greater than 0 and less than 1 that has been rounded down. Hyphens represent 0 values.

Data source 1 - methodology

Regen was commissioned by the Welsh Government to produce a database of energy generation projects in Wales, to identify the extent to which projects are owned by Welsh individuals, organisations and communities, and to analyse the data to produce a report on progress. This database is used to inform much of this report's analysis and is referred to in this report as Data source 1.

The research method developed by Regen to produce a detailed picture of energy generation across Wales includes:

- Identifying, collating, cleaning and cross-referencing records from existing datasets.
- Verifying and analysing the data to ensure a robust national overview and locally specific data where it is available.
- Verifying the data with stakeholders and industry where appropriate.
- Researching ownership details, including referencing to Companies House to identify projects with local ownership.

The key sources of data used in the database compiled by Regen (Data source 1) include:

- Anaerobic Digestion & Bioresources Association data.
- Contact with utilities, installers and industry organisations.
- DESNZ Digest of UK Energy Statistics.
- EMR Capacity Market.
- Low Carbon Contracts Company Contracts for Difference data.
- MCS installations data.
- National Grid Electricity Distribution Embedded Capacity Register.
- National Grid ESO Transmission Entry Capacity register.
- National Non-Food Crops Centre data.
- Ofgem Feed-in Tariff data.
- Renewable Energy Guarantees of Origin data.
- Renewable Energy Planning Database.
- Renewable Heat Incentive and Renewable Heat Premium Payment data.
- Renewables Obligation register.
- SP Energy Networks Embedded Capacity Register.

Assumptions

	Researched by Regen through a survey of major power plants. Actual generation from plants was collected from plants representing 95% of the major electricity generating fossil fuel capacity in Wales.
	Welsh electricity consumption for 2023 has not yet been published, and so an estimate has been analysed. To estimate 2023 consumption, the 2022 DESNZ subnational electricity consumption data for Wales has been increased. This 2022 figure was adjusted based on the overall increase in UK electricity consumption from 2022 to 2023, as reported in the DESNZ UK electricity trends data.
	It is assumed that half of the electricity generated by energy from waste projects can be attributed to renewable sources, with the other half coming from fossil fuel sources.
	The proportion of electricity that is generated by fossil fuels is proportionally removed from total heat pump generation. Removing this proportion, representing approximately 11% of total heat pump heat generation, ensures the remaining heat pump generation published in this report is categorised as renewable energy. We have removed the proportion of heat pump electricity consumption that is from fossil fuels (11%) and the remainder is classified as renewable.
	Progress towards Wales' 100% target is estimated by comparing the generation figures estimated in this report against electricity demand in the CCC's Balanced Pathway 2035 with an assumed additional 9% network losses.

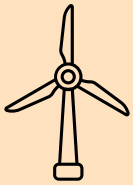
Abbreviations and definitions

	The percentage of a project's maximum theoretical output that it achieves. This is calculated by dividing the actual energy generated over a year by its theoretical maximum capacity, i.e. the amount it would have generated if it ran at full capacity, 24 hours a day, 365 days a year. For example, the capacity factor for offshore wind in Wales is evaluated to be 33%.
CCGT	Combined Cycle Gas Turbine
CCUS	Carbon Capture, Utilisation and Storage
CO2	Carbon dioxide emissions
FiT	Feed-in Tariff
	Local Area Energy Plan. These set out the changes needed to transition an area's energy system to net zero. They are commissioned and published at the discretion of local authorities.
MW	Megawatt – a unit of power (capacity). Where heat capacity is listed, it is the thermal output capacity of heat technologies.
MWh	Megawatt hour – a unit of energy (demand or generation)
RHI	Renewable Heat Incentive

Abbreviations 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
 50 watts	X	 20 hours	=	1,000 Wh or 1 kWh
 1,000,000 watts (1 MW)	X	 1 hour	=	1,000,000 Wh or 1 MWh

A note on generation and demand