



Llywodraeth Cymru
Welsh Government

Energy Generation in Wales 2022



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Ministerial foreword

A smart, flexible, renewables-based energy system is fundamental to support our net zero ambitions and we want our energy transition to also deliver even more benefit through local and shared ownership, seizing supply chain opportunities and the creation of good jobs for local people.



Julie James MS
Minister for Climate
Change

We have committed to new renewable energy targets for Wales. We want to generate renewable energy which fully meets our energy needs by 2035 and to keep pace with the expected demand thereafter. In this transition we also want to maximise local ownership retaining economic and social benefits in Wales.

The Energy Generation in Wales 2022 report provides a complete and transparent picture of energy generation and a consistent measure against our Welsh Government energy targets. It also provides a time series of data, illustrating trends in the deployment of generating capacity across a range of technologies. This will also be the last year reporting against our previous targets, with the 2023 publication reporting and reflecting our commitment to a more sustainable future for Wales.

The headline figures are encouraging – we supply the equivalent of approximately 59% of our annual electricity consumption from renewables working towards our target. This represents an increase of 4 percentage points compared to 2021 levels. We have achieved 97% of our 1 GW local ownership target by 2030, an increase of 7% compared to 2021 levels. Nearly twice as many locally owned renewable energy projects were installed in 2022 compared to 2021.

However, we still have a long way to go if we are going to deliver the net zero energy system we need. Our renewable energy targets have highlighted the important role that offshore wind will have in Wales and across the whole UK. To deliver that ambition we need the UK government to deliver the support this emerging and developing industry needs. The results of the latest contracts for difference were a missed opportunity to develop offshore renewables across the UK. By failing so comprehensively to respond to changing market conditions, the UK Government has called into question its grasp of the industrial opportunities marine and offshore wind represents.

I continue to call on the UK Government to ignore the advice of those urging them to row back on renewable energy and instead show they are serious about securing the long-term future of our energy supply and review the structure and scope of the CfD package.

I am pleased, however that the tidal stream projects which did succeed in gaining subsidy support continue to take important steps forward in delivering on our commitments on green energy and reflect the hard work of the many partners working on Anglesey and across the region. This is a positive development on tidal energy, which only shows the potential for offshore developments and the jobs they can create across Wales and the UK.

Future editions of this report will provide evidence of the impact of our actions, helping to build a more resilient and sustainable future for Wales.

Introduction

The Energy Generation in Wales 2022 report sets out the energy generation capacity in Wales at the end of 2022 and analyses how it has changed over time. The aim of the report is to support the Welsh Government with the development of energy policy, helping to evidence the economic, social and environmental benefits from the development 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 value of local ownership of energy assets has been recognised by the Welsh Government and is a key part of Wales' energy strategy. The current ownership of energy generation assets in Wales is also examined in this report, providing a measure against Wales' target of 1 GW of locally owned renewable energy capacity by 2030.

This report

- Breaks down Welsh electricity and renewable heat generation and storage by technology, capacity and local authority area to the end of 2022.
- Estimates that Welsh renewable electricity generation is equivalent to 59% of Wales' electricity consumption on an annual basis.
- Estimates that 27% of total electricity generation in Wales comes from renewable sources.
- Estimates 970 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 2022, Wales generated twice as much electricity as it consumed. Wales consumed approximately 13 TWh of electricity, while electricity generators in Wales produced approximately 29 TWh. This means that Wales was a net exporter of electricity to the rest of Great Britain, Ireland and the wider European electricity network.

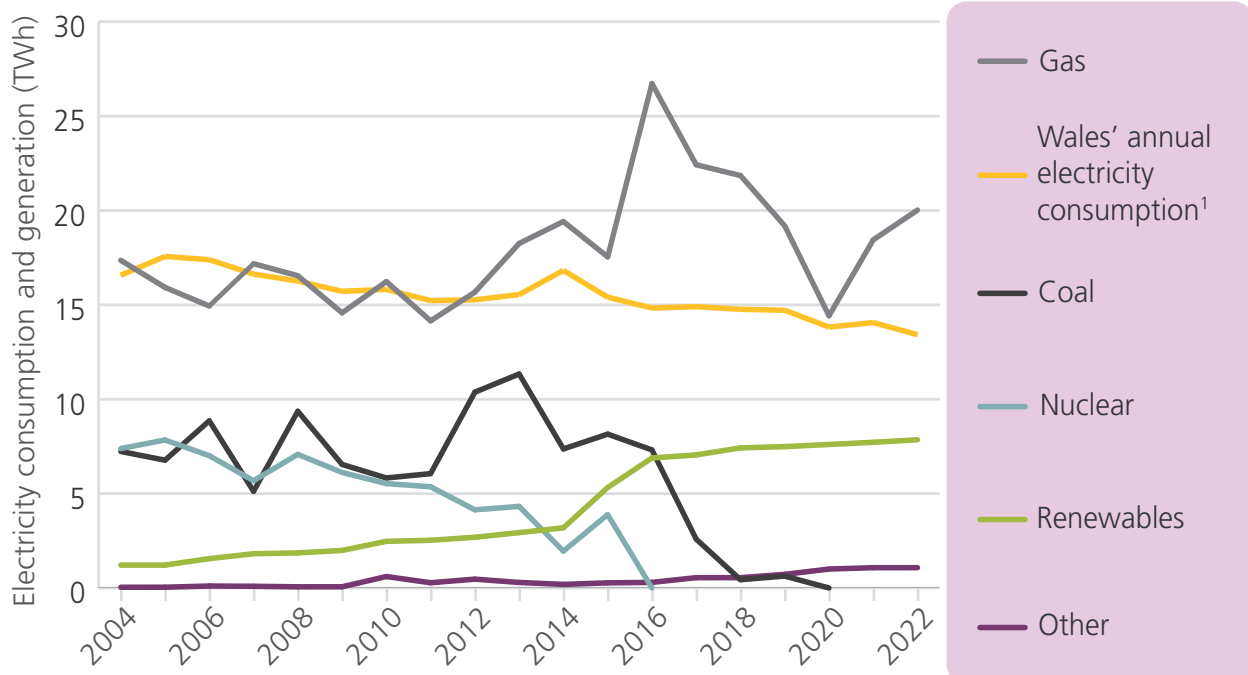
Electricity generation from gas in Wales has increased by nearly 40% since 2020, compared to a 3% increase in renewable electricity generation. Approximately 27% of all Welsh electricity generation is now from renewables, down from 33% in 2020 due to the significant increase in generation from non-renewable sources.

Wales generated a total of 29 TWh of electricity in 2022, 7.9 TWh of which came from renewables and 21.1 TWh from fossil fuels. Wales is estimated to have consumed in the order of 13.4 TWh¹ of electricity in 2022, down from 14.1 TWh¹ in 2021. Consequently, Wales remains a net exporter of electricity.

70% of all Welsh renewable electricity generation is from onshore and offshore wind, with most of the remainder from solar PV and biomass electricity generation.

Electricity generation trends versus Welsh electricity consumption

Data source: (1)



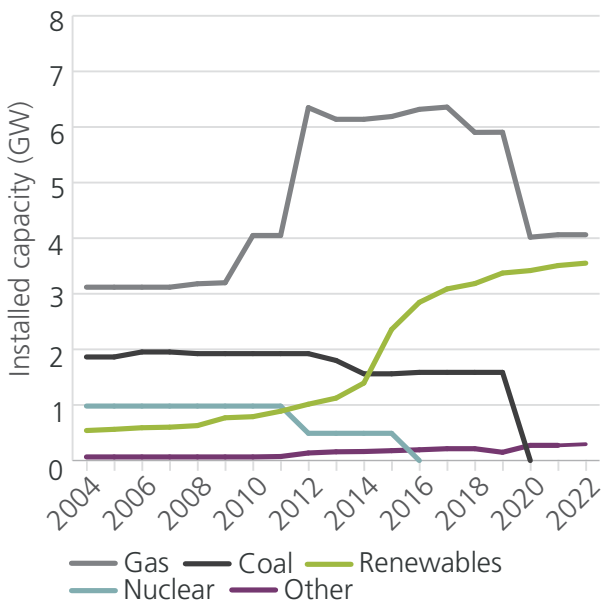
¹ Welsh electricity consumption data for 2022 has not yet been published, so an estimate for 2022 has been produced using data from DESNZ (DESNZ, 2022; Sub-national electricity consumption statistics 2005 to 2021). See methodology section for more information.

Electricity generation in Wales

- 43 MW of renewable electricity capacity was installed in 2022, down from 116 MW installed in 2021. This is part of a decline in renewable electricity capacity installation over the past decade, where at the peak in 2015, over 900 MW was installed. There is now 3,551 MW of renewable electricity capacity in Wales.
- Renewable electricity generation in Wales has tripled since 2008 and doubled since 2012, but has only increased by 11% in the last five years.
- Nearly 95% of renewable electricity generation in Wales is from large scale (>1 MW) projects.
- There has been no electricity generation from nuclear and coal in Wales since 2015 and 2019 respectively.

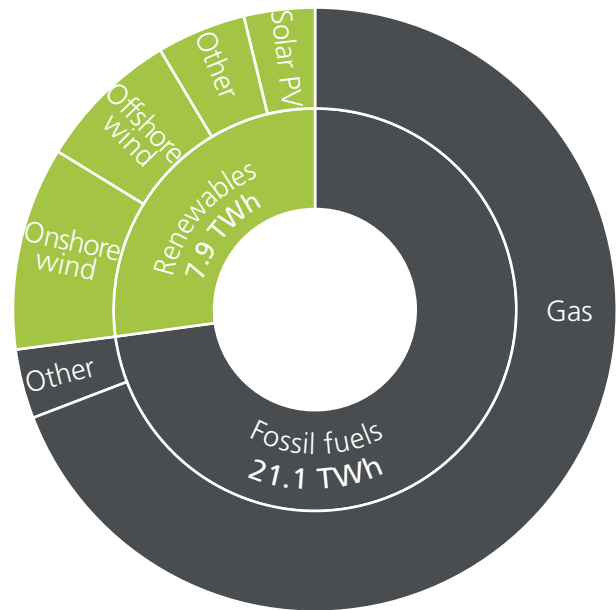
Electricity capacity trends

Data source: (1)



Electricity generation in Wales

Data source: (1)



Electricity generation in Wales key statistics

Data source: (1)

Technologies	Number of projects	Electrical capacity (MW)	Estimated annual electricity generation (GWh)
Fossil fuels	102	4,356	21,099
Coal	-	-	-
Diesel	22	269	941
Gas	78	4,062	20,023
Energy from Waste ²	2	26	135
Storage	6	2,115	n/a
Battery storage	4	27	n/a
Pumped hydropower	2	2,088	n/a
Hydrogen	-	-	n/a
Renewables	71,857	3,551	7,852

² For the purposes of this report, half Energy from Waste generation is classed as fossil fuel and half as renewable, due to the nature of the waste being incinerated.

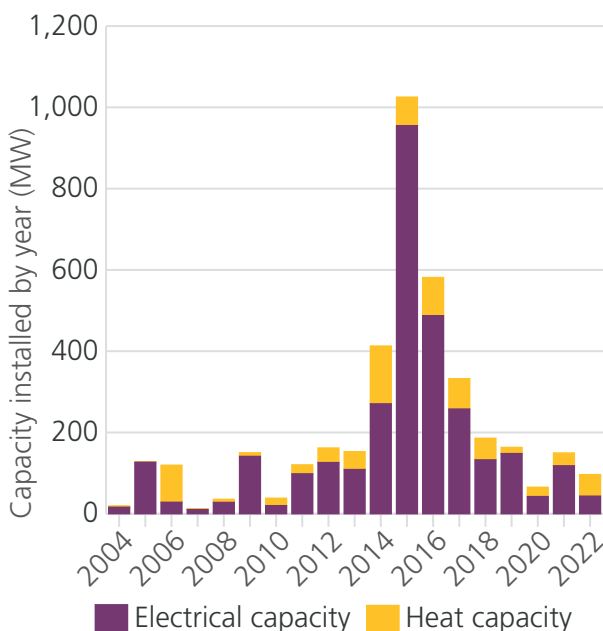
Renewable energy in Wales

In 2022, 96 MW of renewable energy was installed in Wales, 43 MW of electrical capacity and 53 MW of heat capacity. 2022's renewable energy installation rate is the second lowest in the last decade and is nearly ten times lower than the 2015 peak, when more than 1 GW of renewable energy capacity was installed.

For the first time since 2006, more renewable heat capacity was installed than renewable electricity capacity. This is largely attributable to a reduction in the amount of electrical capacity installed in 2022 and the accelerating rate of heat pump uptake. There are now estimated to be nearly 15,000 heat pumps installed across Wales. However, the vast majority of renewable energy capacity in Wales is electrical capacity – with only 18% of total installed renewable capacity providing heat. It is estimated that only 7% of Welsh demand for heat is met from renewable sources³.

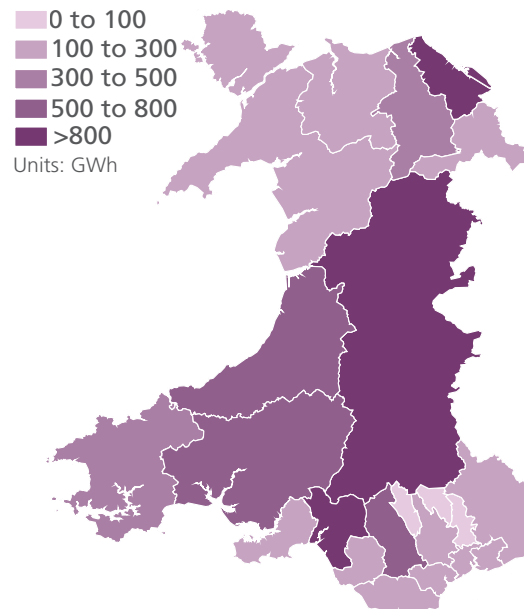
Wales' annual renewable energy installation rate

Data source: (1)



Total renewable electricity and heat generation by local authority

Data source: (1)



Renewable electricity in Wales

- 2022 saw an uplift in the rate of deployment of small-scale rooftop solar PV. 6,879 solar PV projects were commissioned in Wales in 2022, compared to 3,903 in 2021. This represents a significant step up from 2018, where less than 1,000 projects were commissioned.

³ The Welsh Government's Energy Use in Wales (second edition) report estimates that annual Welsh energy consumption for heating is nearly 37 TWh.

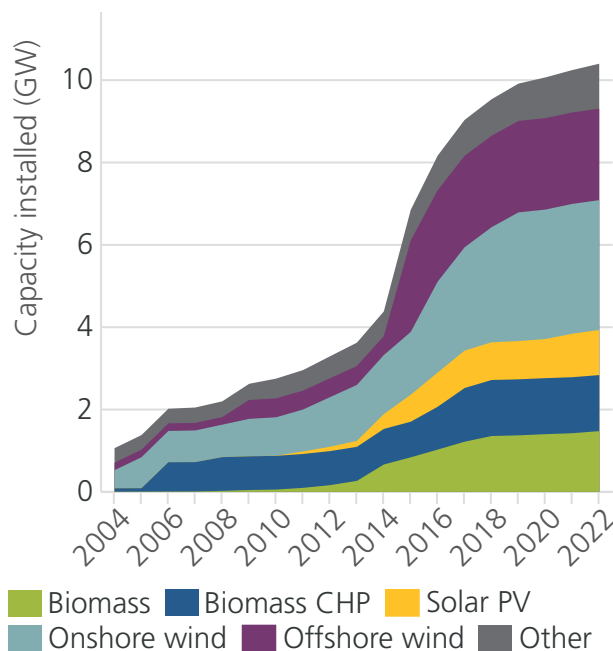
- Over 68% of renewable electricity generation in Wales is from onshore and offshore wind. However, for the first time since the 1990s, only one onshore wind project was identified as commissioning in Wales in 2022 (with a generating capacity of 6 kW).

Renewable heat in Wales

- There is now 798 MW of renewable heat in Wales, 60% of which is from biomass projects.
- Since 2020, the number of heat pump projects installed each year has increased on average by 160%.
- It is estimated that Welsh renewable heat projects produced approximately 2.5 TWh in 2022, equivalent to approximately 11% of estimated Welsh domestic heat demand. However, the majority of heat in Wales is used in non-domestic settings.

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	96	9	54
Biomass	3,652	-	-	481	1,476
Biomass electricity and CHP	52	131	698	120	663
Energy from Waste	2	26	135	-	-
Heat pump	14,717	-	-	161	262
Hydropower	379	170	350	-	-
Landfill gas	23	23	59	-	-
Offshore wind	3	726	2,222	-	-
Onshore wind	754	1,266	3,153	-	-
Sewage gas	5	12	44	14	83
Solar PV	70,587	1,179	1,096	-	-
Solar thermal	4,823	-	-	14	8
Total	95,047	3,551	7,852	798	2,547

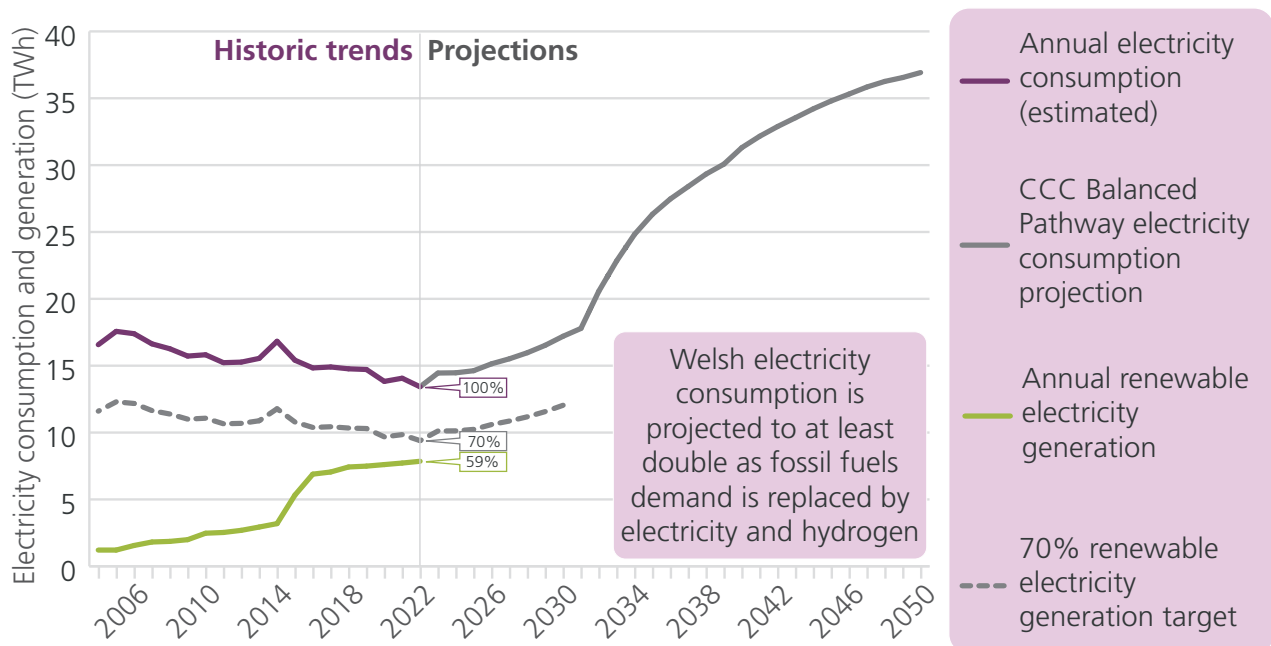
Progress towards targets

The Welsh Government has a target for Wales to meet the equivalent of 70% of its annual electricity consumption from Welsh renewable electricity generation by 2030, and 100% by 2035. In 2022, this figure stood at an estimated 59%, up from 55% in 2021 and 19% a decade ago.

Progress towards Wales’s target is impacted by changes to both electricity consumption and electricity generation. Between 2021 and 2022, Welsh electricity consumption is estimated to have fallen by almost 650 GWh while renewable electricity generation increased by over 130 GWh. Therefore, progress towards the target in 2022 was predominantly due to a fall in electricity consumption.

Although electricity consumption in Wales has reduced over the last two decades, it is projected to increase in the future. Fossil fuel consumption in the heat and transport sectors is projected to transition to electricity and hydrogen as Wales decarbonises, which could result in electricity consumption more than doubling by 2050^{4,5}. This increasing electricity demand will need to be met by increasing renewable generation to meet and maintain Wales’ progress towards targets.

Comparison of annual Welsh electricity consumption and generation trends against 70% target^{1,6} Data source: (1)



⁴ Climate Change Committee, 2020; 6th Carbon Budget

⁵ Welsh Government, 2023; Future Energy Grids for Wales: Insights Report Issue 1.1

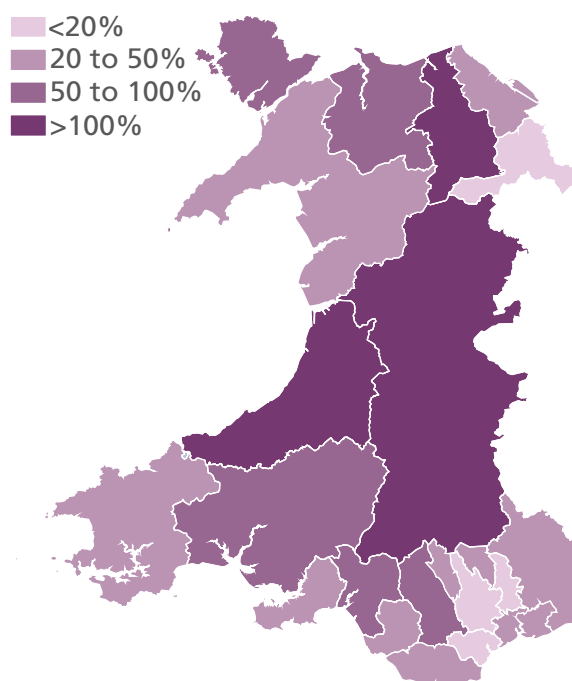
⁶ Energy Generation in Wales 2022 reports against progress to the Welsh Renewable Energy Targets set in 2017. Energy Generation in Wales 2023 will report on the updated Welsh Renewable Energy Targets adopted in 2023.

Three local authority areas generated more local renewable electricity than their total annual electricity consumption in 2022: Denbighshire, Ceredigion and Powys.

While Neath Port Talbot hosted the most renewable electricity generation of all local authority areas in Wales, it is also the second-highest consumer of electricity. In total, the area generates the equivalent of 70% of the electricity it consumes.

Denbighshire’s high renewable electricity generation and relatively low electricity consumption mean the area has the highest equivalent percentage of its electricity consumption delivered by local renewable electricity generation.

Equivalent percentage of electricity consumption delivered by local renewable generation¹ Data source: (1)



Top five local authority areas by percentage of electricity consumption met by renewables¹ Data source: (1)

Local Authority Area	Equivalent percentage of local electricity consumption met by local renewable electricity generation
Denbighshire	120%
Ceredigion	118%
Powys	106%
Rhondda Cynon Taf	84%
Neath Port Talbot	70%

Consultation on Wales’ Renewable Energy Targets

The 70% renewable electricity target for 2030 represents an initial step in the development of renewable energy in Wales, as Wales’ energy systems transition to net zero. In July 2023, following a consultation period in which broad support was received for the Welsh Government’s renewable energy ambitions, the Welsh Government adopted new energy targets for 2035. These include:

- Generating the equivalent of 100% of Wales’ annual electricity consumption from renewable sources by 2035.
- Installing 580,000 heat pumps across Wales by 2035.
- 1.5 GW of renewable energy capacity to be locally owned by 2035.

Written Statement: Publication of Summary of Responses to the Consultation on Wales’ Renewable Energy Targets. 14 July 2023.

Locally owned renewable energy

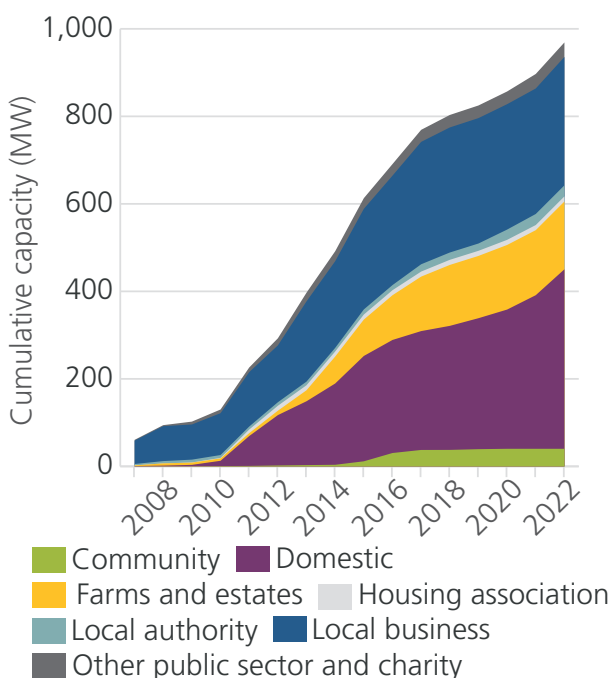
Wales has achieved 97% of its target for at least 1 GW of renewable electricity and heat capacity to be locally owned by 2030. Nearly twice as many locally-owned renewable energy projects were installed in 2022 compared to 2021, thanks to the accelerating uptake of domestic solar PV and heat pumps.

There is now 970 MW of locally owned renewable capacity, of which 72 MW commissioned in 2022. This additional capacity consists of 43 MW heat capacity and 29 MW electrical capacity. Nearly half of all locally owned capacity commissioned in 2022 is estimated to have come from heat pumps, while much of the remainder is rooftop solar PV. Nearly two-thirds of total locally owned capacity in Wales is from electricity generation such as solar PV and onshore wind.

There are now estimated to be approximately 88,700 locally owned renewable electricity and heat projects in Wales, up from around 78,500 in 2021. Although 90% of locally owned projects are domestic, these represent only 40% of the locally owned renewable energy capacity in Wales. Domestic projects tend to be small-scale heat pumps and rooftop solar PV, while projects owned by local businesses can be very large, such as Pennant Walters' 27.5 MW Fforch Nest wind farm.

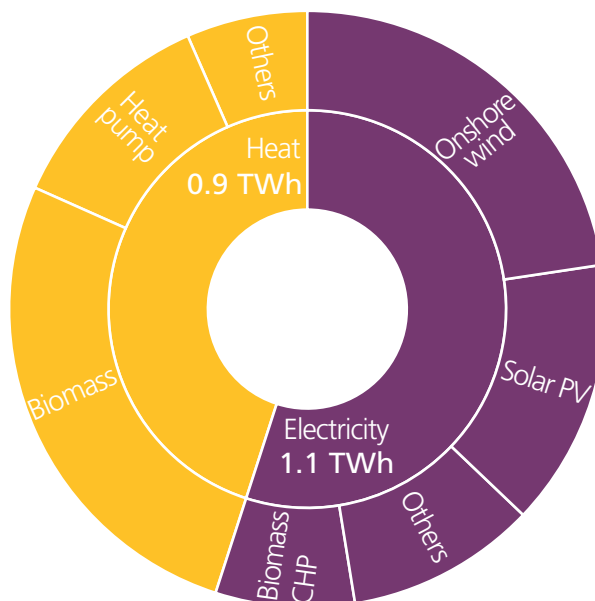
Locally owned renewable capacity by ownership type

Data source: (1)



Locally owned renewable energy generation by technology (TWh)

Data source: (1)

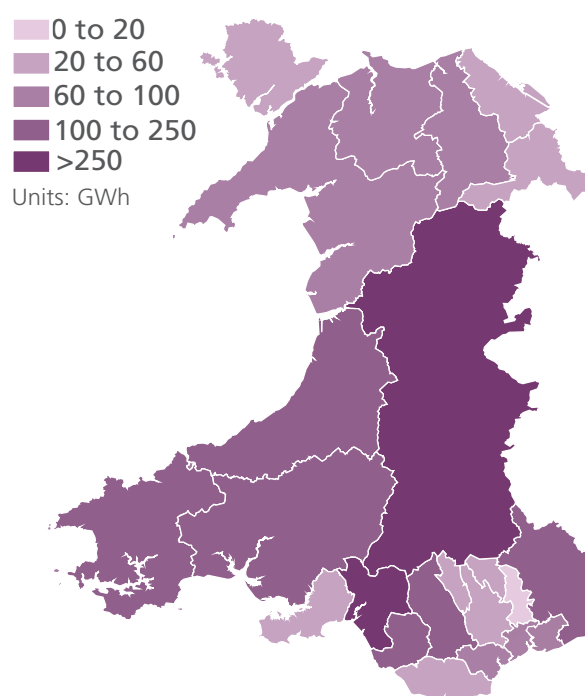


Definition of ownership

The definition of 'locally owned' is set out in the Welsh Government's policy statement detailing local ownership of energy generation in Wales⁷. 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. The figures are likely to be underestimated due to source data limitations.

Total locally owned renewable electricity and heat generation by local authority¹

Data source: (1)



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	1	56
Domestic	79,697	233	178	562
Farms and Estates	807	23	132	495
Housing Association	5,687	7	5	11
Local Authority	303	22	3	37
Local Business	1,593	277	17	826
Other public sector and charity	418	9	24	85
Total	88,703	611	359	2,072

⁷ Welsh Government, 2020; Policy Statement: local ownership of energy generation in Wales – benefitting Wales today and for future generation

Renewable energy trends

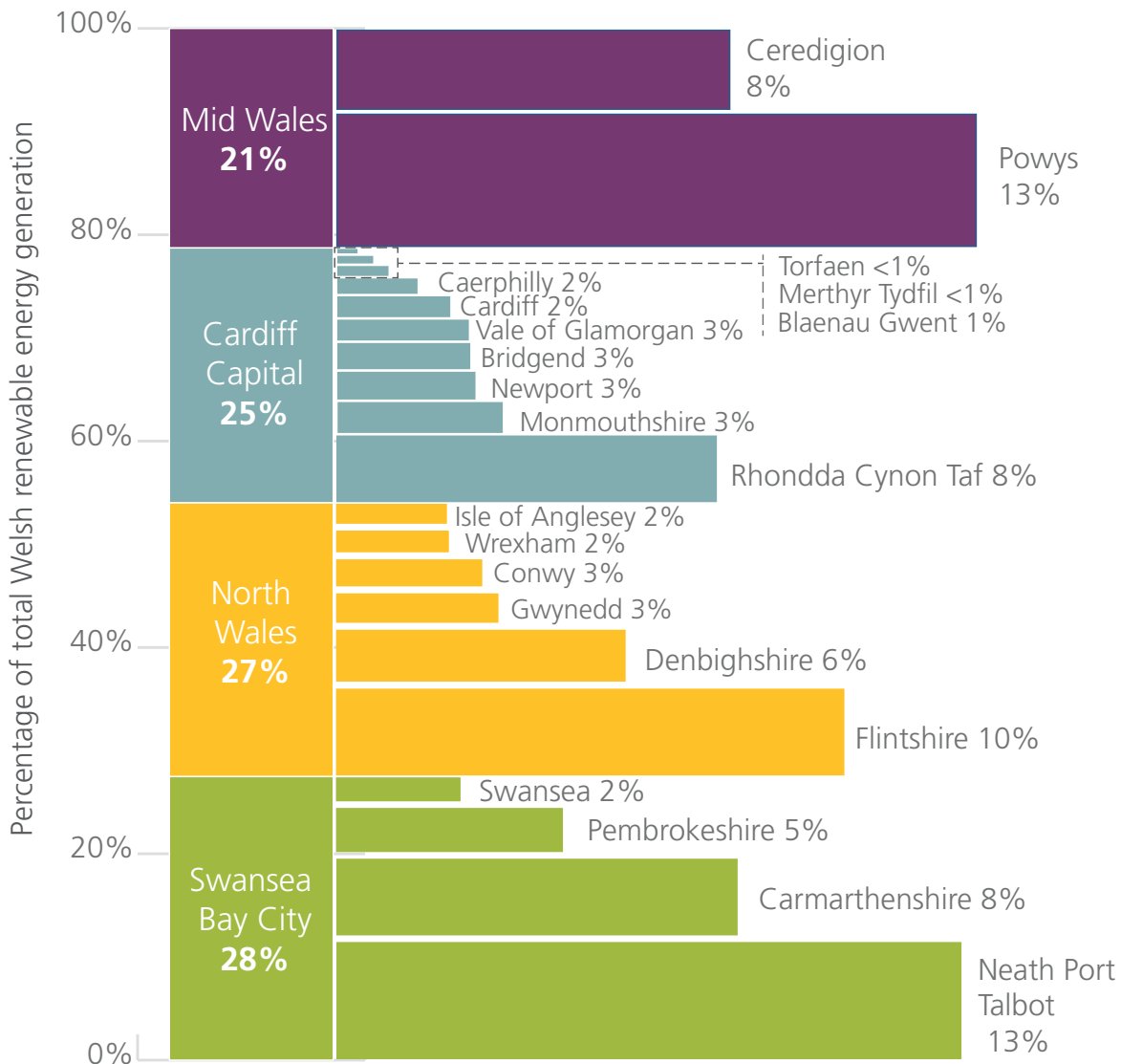
Regional context

In 2022, each of the four Welsh regions contributed a similar proportion of Wales' total renewable energy generation. However, within each region, renewable energy generation is often concentrated within a small number of local authorities. Over half of Wales' total onshore renewable electricity generation is concentrated in just five local authority areas.



Estimated annual renewable energy generation by region and local authority, 2022

Data source: (1)



Local authority areas with the highest increase in renewable energy capacity in 2022

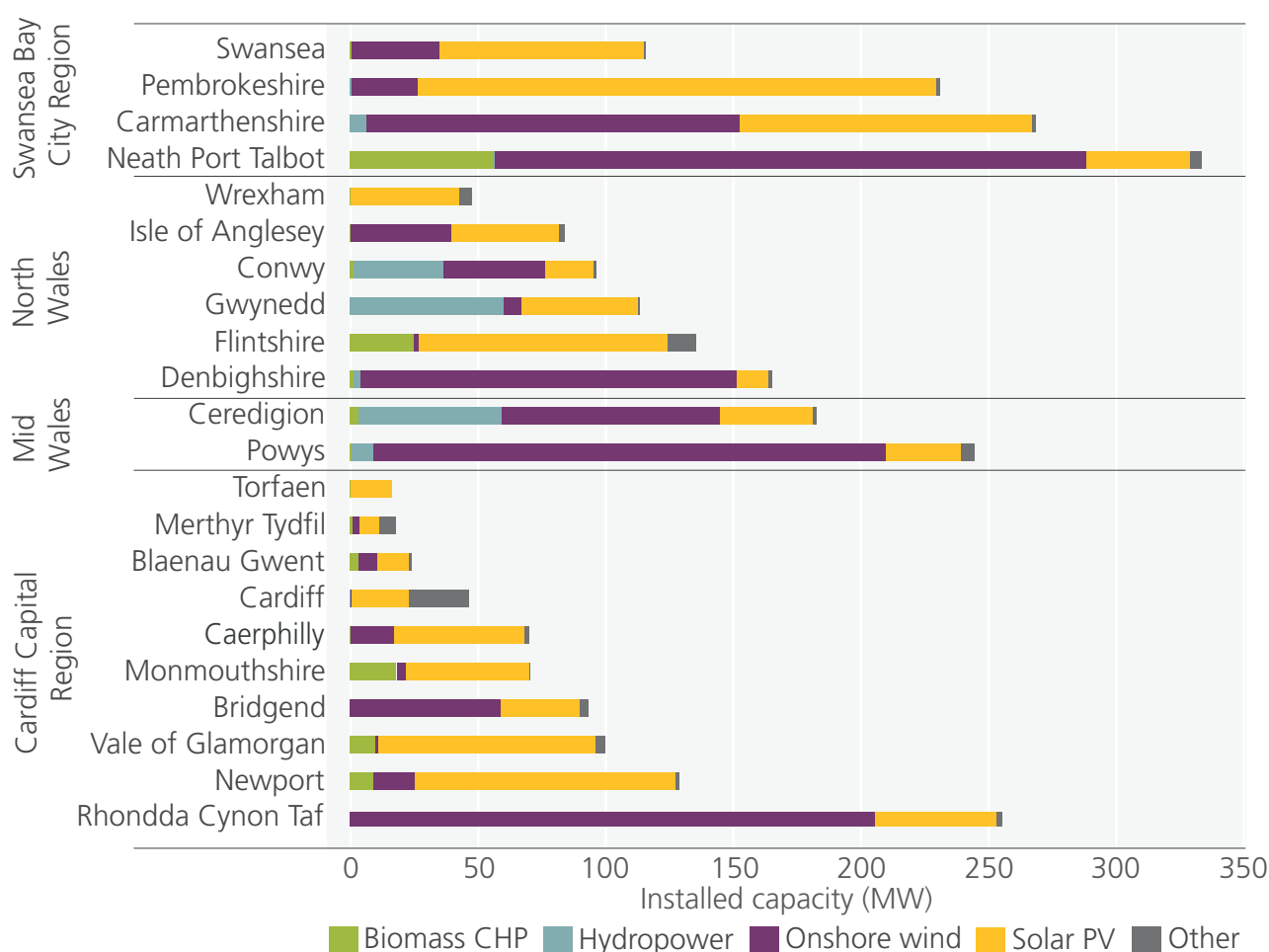
Data source: (1)

Local authority area	Region	Increase in renewable energy capacity (%)	Increase in renewable energy capacity (MW)
Swansea	Swansea Bay City	11%	13.0
Powys	Mid Wales	6%	9.7
Swansea	Swansea Bay City	5%	9.7

All 22 Welsh local authority areas saw an increase in their total renewable energy capacity in 2022, when compared to the previous year. However, only three local authorities saw an increase in renewable energy capacity greater than 5%. On average the remaining local authority areas saw an increase of approximately 3%. Swansea saw the largest growth in its total renewable energy capacity with an increase of 11% (13 MW), which can be attributed to new solar PV projects.

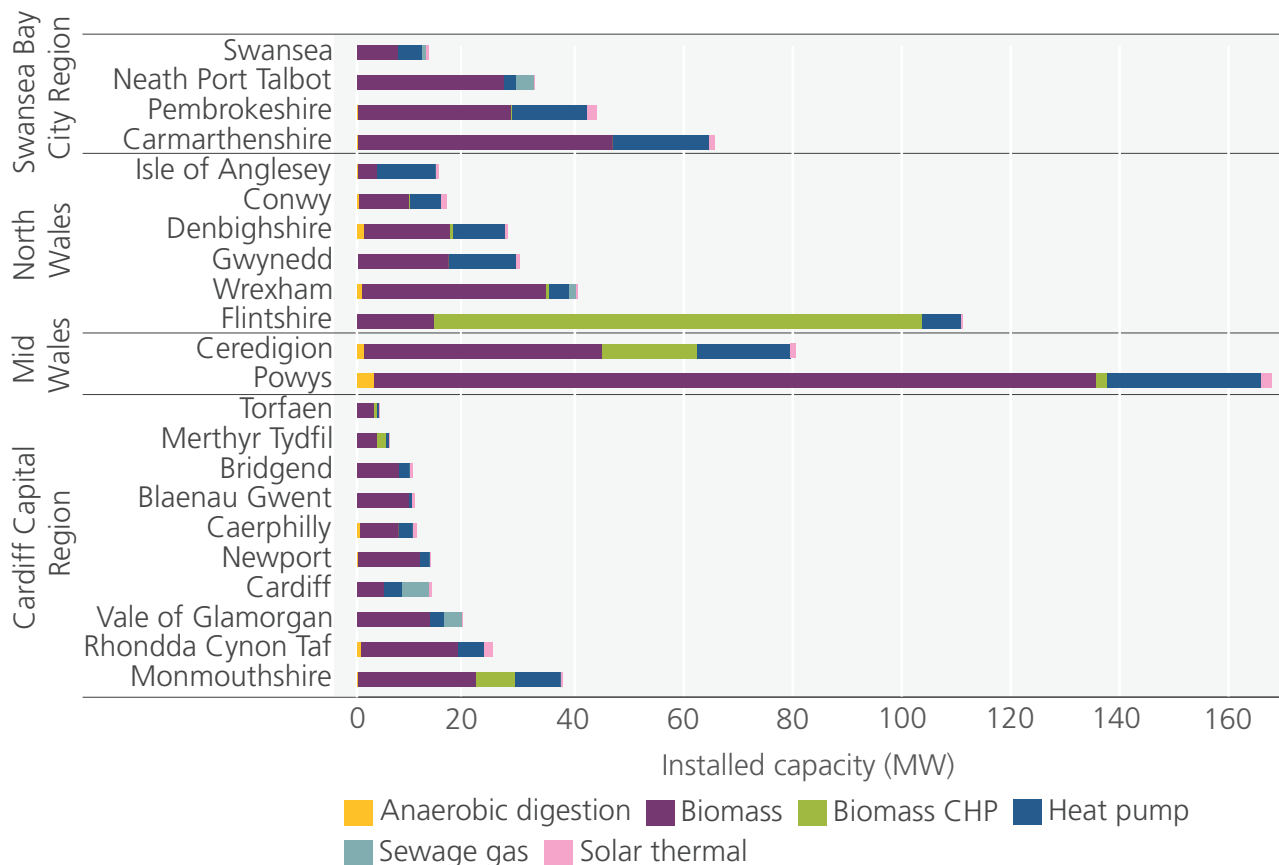
Onshore renewable electricity capacity by local authority area

Data source: (1)



The Swansea Bay City Region and the Cardiff Capital Regions represent approximately a quarter of the onshore renewable electricity capacity of Wales, with 33% and 29% respectively. North Wales accounts for 23% of the total electrical capacity, followed by Mid Wales with 15%. The definition of TAN8 SSAs and Priority Areas for Onshore Wind has aided the development of large-scale onshore wind across Wales. Among the 22 Welsh local authority areas, Neath Port Talbot and Carmarthenshire possess the highest renewable electrical capacity, representing 12% and 9% respectively.

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



Mid Wales is the region with the highest renewable heat capacity, with 31% of Wales’ total renewable heat capacity. This is followed closely by North Wales, which hosts 30%. In both regions, much of this capacity is ascribed to biomass heat, biomass CHP and heat pump projects. The Swansea Bay City Region and the Cardiff Capital Region represent 20% and 19% of Welsh renewable heat capacity respectively. The uptake of renewable heat closely correlates with the number of off-gas homes and businesses in each region. Of the 22 Welsh local authority areas, Powys and Flintshire hold the most renewable heat capacity, representing 21% and 14%.

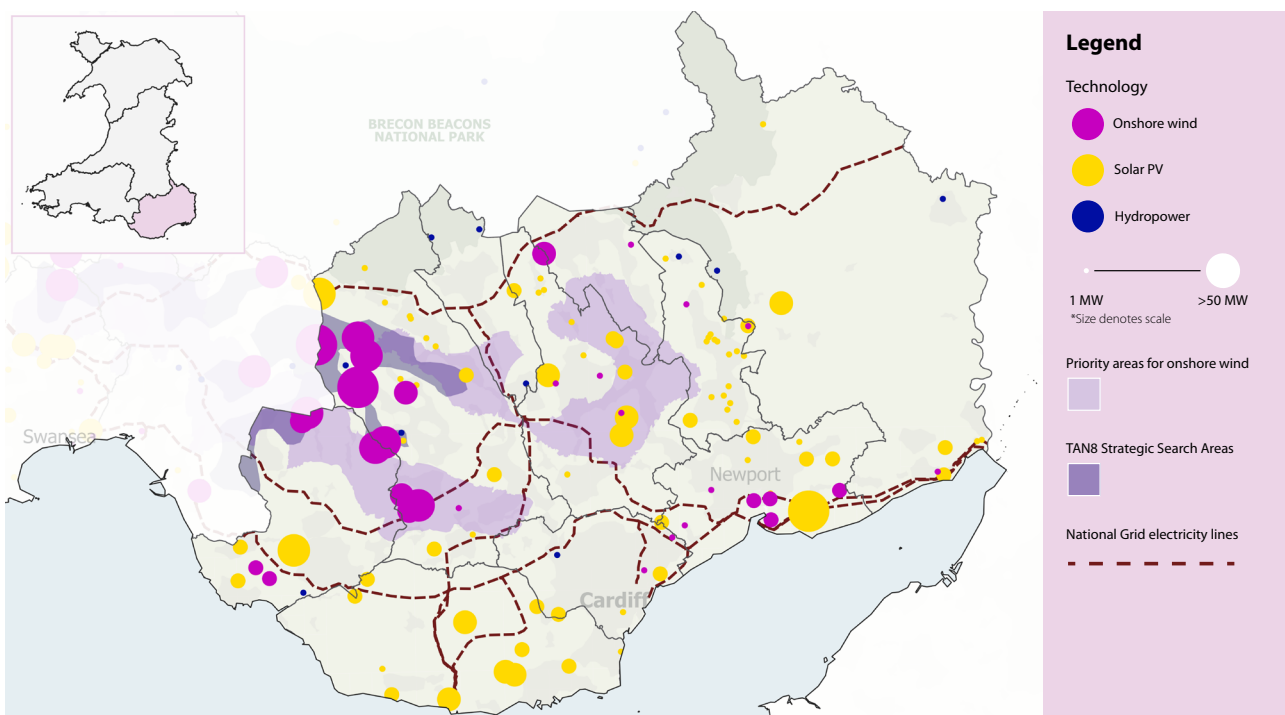
Cardiff Capital Region

In 2022, a total of 2,929 new renewable projects were commissioned in the Cardiff Capital Region, representing 23 MW of new capacity. Small-scale installations comprise the majority of these projects, with only three projects with a capacity greater than 1 MW commissioning in 2022.

Data source: (1)

Cardiff Capital Region Technology	Total Renewable heat and electricity			Commissioned in 2022	
	Number of projects	Total capacity (MW)	Estimated generation (GWh)	Number of projects	Total capacity (MW)
Anaerobic digestion	10	10	56	-	-
Biomass electricity and CHP	16	51	275	2	0.002
Biomass heat	528	101	310	12	6
Energy from Waste	1	15	80	-	-
Heat pump	2,477	27	44	620	6
Hydropower	26	1	3	1	0.05
Landfill gas	9	12	31	-	-
Onshore wind	97	311	775	-	-
Sewage gas	2	15	77	-	-
Solar PV	27,340	421	392	2,290	10
Solar thermal	1,707	4	3	4	0.01
Total	32,213	970	2,045	2,929	23

Cardiff Capital Region energy landscape Data source: (1)



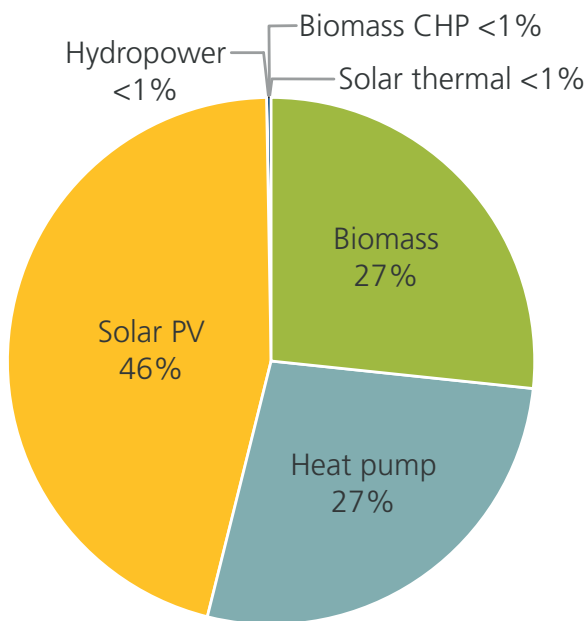
An estimated 46% of the Cardiff Capital Region’s renewable energy capacity installed in 2022 is attributed to solar PV, totalling 10.5 MW. This is a substantial decrease in the installed capacity of solar PV generation when compared to the previous year. 81 MW of solar PV was commissioned in 2021, with the majority of this due to the 75 MW Llanwern Solar PV project.

Heat pumps and biomass each represent 27% of the Cardiff Capital Region’s 2022 new renewable energy capacity, with 6.3 MW and 6.15 MW commissioned respectively.

In 2022, the proportion of generation from each renewable technology in Cardiff Capital Region remained similar to 2021. In 2022, an estimated 38% of the Cardiff Capital Region’s total renewable energy generation is attributed to onshore wind. Solar PV accounted for approximately 19% of the overall generation, with biomass and biomass CHP representing 15% and 13% respectively.

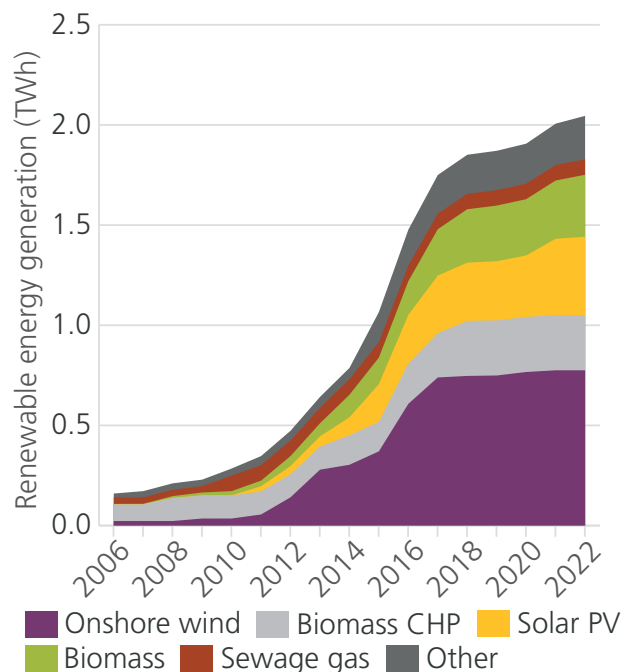
Percentage of renewable capacity commissioned in 2022, by technology

Data source: (1)



Renewable energy generation in the Cardiff Capital Region

Data source: (1)



Community-owned renewable energy

As part of the Welsh Government’s initiative to promote community owned renewable energy in Wales, Egni Coop are set to install 2 MW of rooftop solar panels at three schools, a care home and a crematorium in Newport. Egni Coop are set to be some of the first to receive Welsh Government funding for community owned renewable energy and are representative of the increasing interest in solar PV deployment on non-domestic buildings.

In total, this project is expected to save an estimated 3,200 tonnes of carbon emissions and achieve significant savings on electricity bills.

The Welsh Government is committed to expanding renewable energy capacity owned by public bodies and community groups in Wales by over 100 MW by 2026.

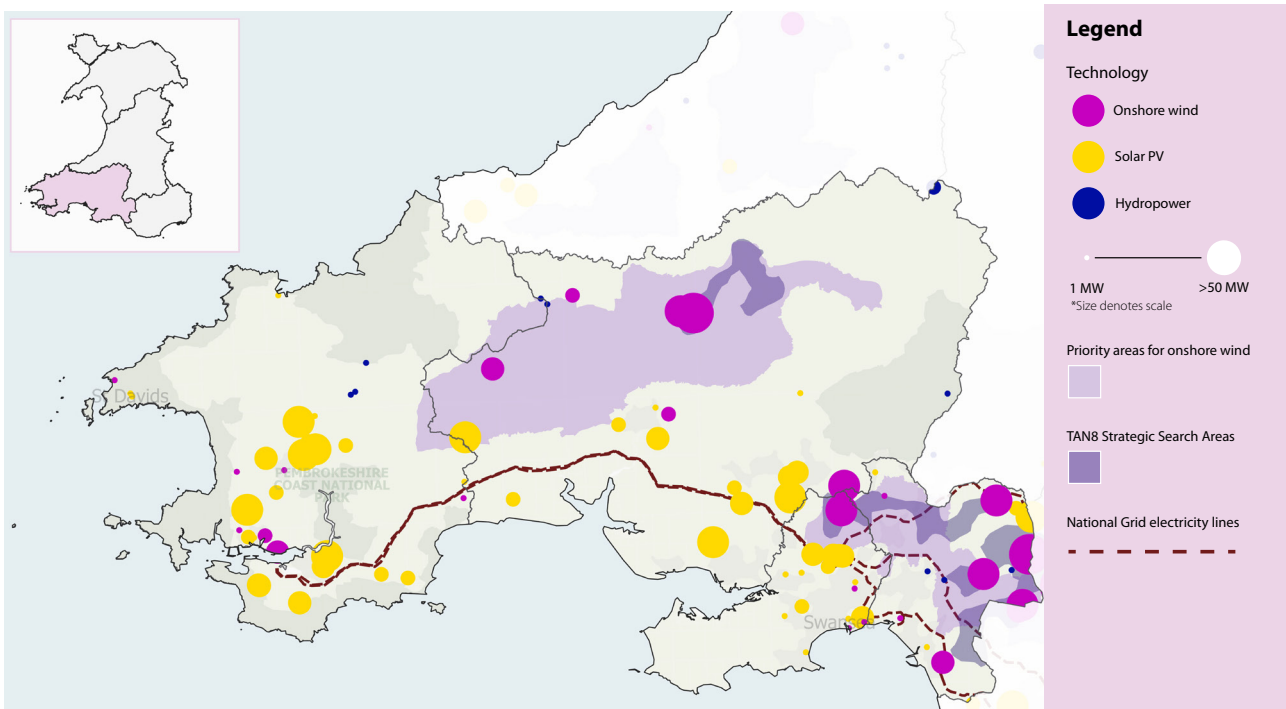
Swansea Bay City Region

In 2022, a total of 2,742 new renewable energy projects were commissioned in the Swansea Bay City Region, representing 36 MW of new capacity. While the majority of this new capacity is attributed to small-scale installations, 10 MW is attributable to the Carn Nicholas Solar project.

Data source: (1)

Swansea Bay City Region Technology	Total Renewable heat and electricity			Commissioned in 2022	
	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	301	-	-
Biomass heat	1,029	110	337	53	10
Energy from Waste	-	-	-	-	-
Heat pump	3,440	38	62	782	8
Hydropower	40	8	16	-	-
Landfill gas	5	4	10	-	-
Onshore wind	280	435	1,085	-	-
Sewage gas	2	8	38	-	-
Solar PV	16,067	435	404	1,894	18
Solar thermal	1,089	3	2	13	0.04
Total	21,961	1,099	2,260	2,742	36

Swansea Bay City Region energy landscape Data source: (1)

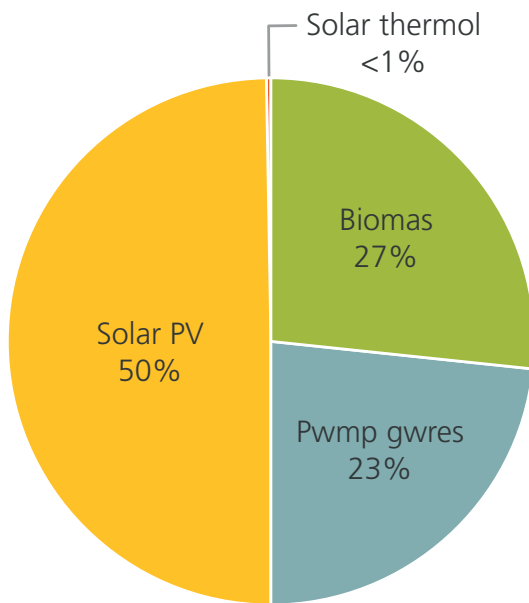


Solar PV accounted for half of the Swansea Bay City Region’s total new capacity in 2022, with 18 MW commissioned. This includes the largest renewable energy project that commissioned in Wales in 2022: the 10 MW Carn Nicholas Solar project. Biomass and heat pump capacity accounted for the remainder.

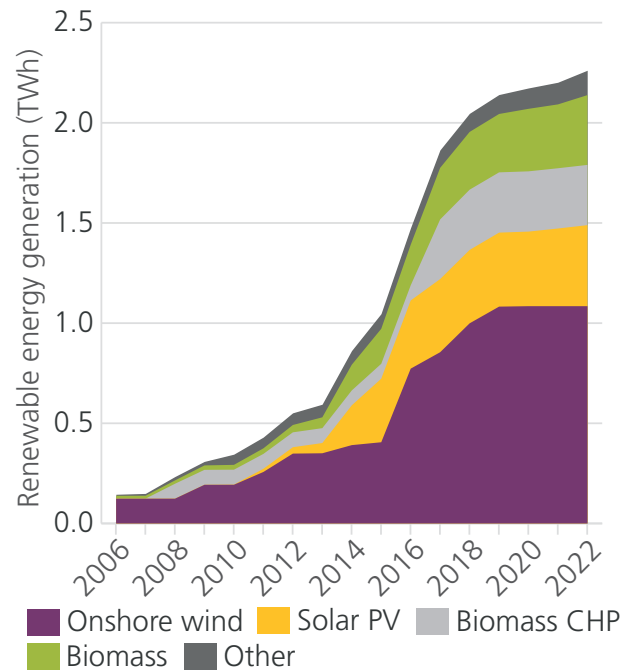
Similar to 2021, onshore wind generated an estimated 48% of the Swansea Bay City Region’s overall renewable energy generation for 2022. Solar PV (18%), biomass heat (15%) and biomass CHP (13%) make up the next three highest generating technologies.

Percentage of renewable capacity commissioned in 2022, by technology

Data source: (1)



Renewable energy generation in the Swansea Bay City Region Data source: (1)



Hwb y Gors

Hwb y Gors is a retrofit zero-carbon Arts, Education and Enterprise Centre located in Ammanford, Carmarthenshire. The building, originally a primary school, was acquired by the community energy charity Awel Aman Tawe to repurpose it into a new hub for the local community. It is currently in the final stages of refurbishing.

Capital of over £1.6 million was successfully raised to purchase the building and fund refurbishment, with proceeds raised from a community windfarm. The zero-carbon centre will encompass various amenities, including a community café, co-working studios, enterprise spaces, a community electric transport scheme, a hall and education facilities and community gardens.

Hwb y Gors will incorporate 90 kW of rooftop solar and a 50 KW ground source heat pump. These renewable technologies are projected to produce at least 75% of the centre’s electricity needs and 100% of its heating requirements on-site.

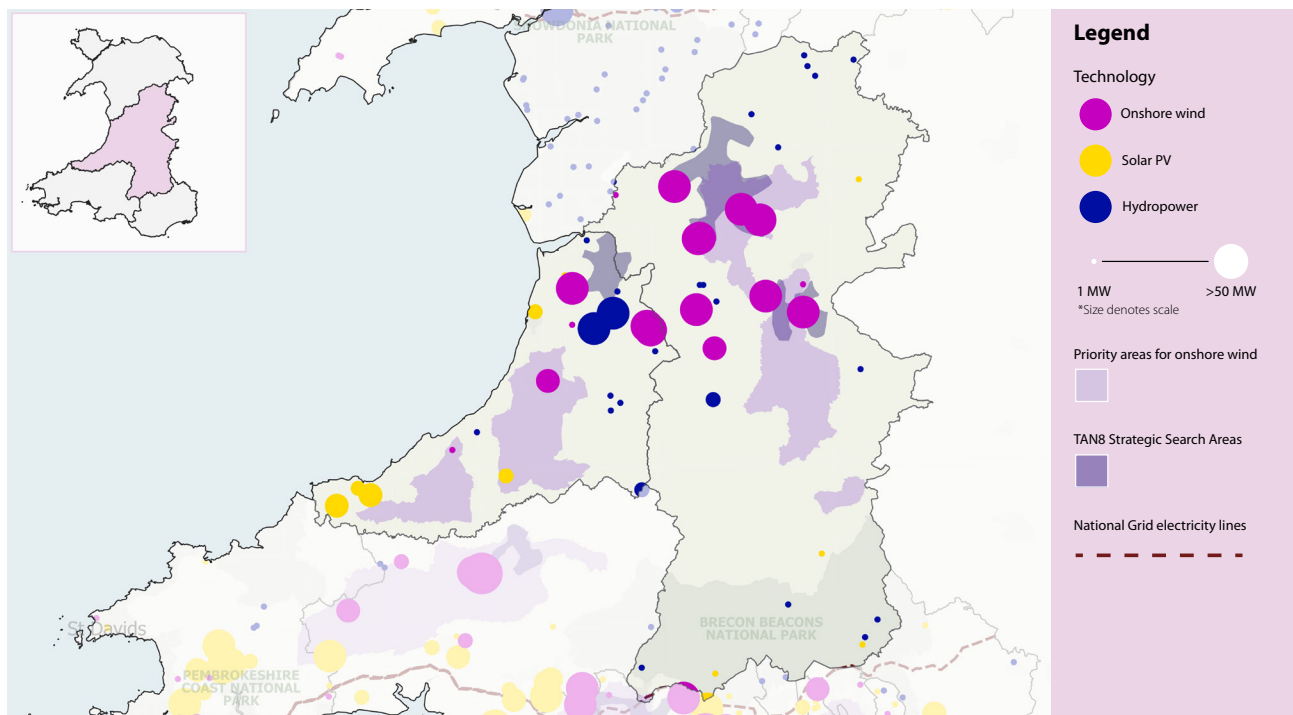
Mid Wales

In 2022, a total of 1,939 new renewable projects were commissioned in the Mid Wales region, representing 18 MW of new capacity. The majority of these projects are small-scale installations.

Data source: (1)

Mid Wales Technology	Total Renewable heat and electricity			Commissioned in 2022	
	Number of projects	Total capacity (MW)	Estimated generation (GWh)	Number of projects	Total capacity (MW)
Anaerobic digestion	20	9	49	3	1
Biomass electricity and CHP	14	24	129	-	-
Biomass heat	1,275	177	544	26	1
Energy from Waste	-	-	-	-	-
Heat pump	4,093	46	75	934	10
Hydropower	107	64	126	-	-
Landfill gas	1	2	5	-	-
Onshore wind	197	284	708	1	0.01
Sewage gas	-	-	-	-	-
Solar PV	8,108	66	61	965	7
Solar thermal	1,055	3	2	10	0.03
Total	14,870	674	1,699	1,939	18

Mid Wales energy landscape Data source: (1)

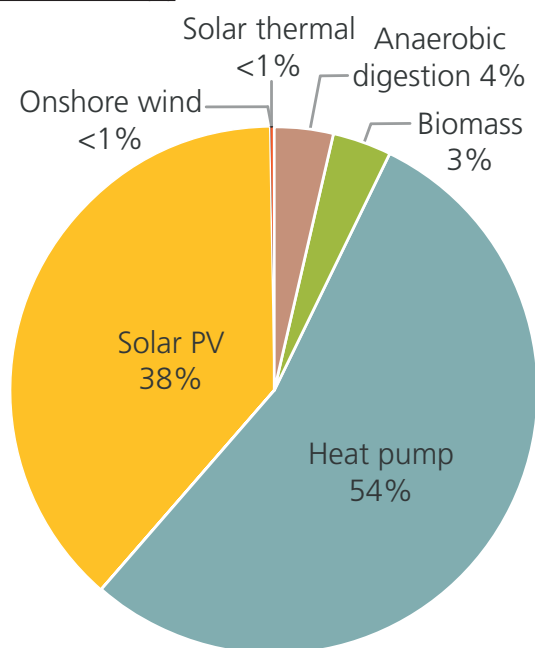


The majority of the Mid Wales region's total new renewable energy capacity for 2022 is associated with heat projects, specifically heat pumps (54%), anaerobic digestion (4%) and biomass (3%). Solar PV represents the second highest capacity commissioned in 2022, with 7 MW of new capacity.

Onshore wind accounted for 42% of the Mid Wales region's overall renewable energy generation for 2022, contributing an estimated 708 GWh. This is closely followed by biomass heat, which represents 32% of renewable energy generation, contributing 544 GWh.

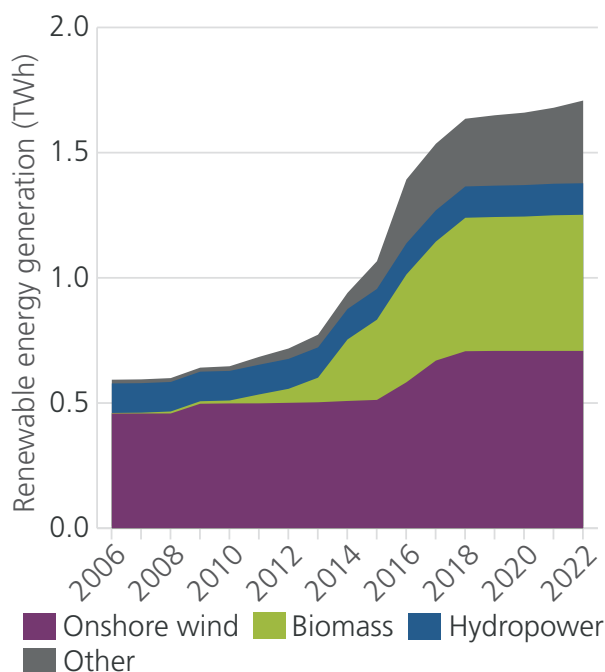
Percentage of renewable capacity commissioned in 2022, by technology

Data source: (1)



Renewable energy generation in the Mid Wales Region

Data source: (1)



Large-scale ground source heat pump

There was a significant increase in the number of heat pumps installed in Wales in 2022. While the vast majority of these were in homes, there were also several heat pump installations in public buildings and commercial premises.

One of the most noteworthy installations was a 2.4 MWth heat pump installed in Powys, Mid Wales. This heat pump provides heating for a new build agricultural grain storage building, highlighting that low carbon development is possible in the agricultural sector as well as the building sector. This heat pump is one of the largest in the UK and is over 200 times the size of a typical domestic heat pump.

In addition to the heat pump, in accordance with Welsh Government policy, the installation also incorporated biodiversity enhancements in the form of bat boxes and hedge row planting.

North Wales

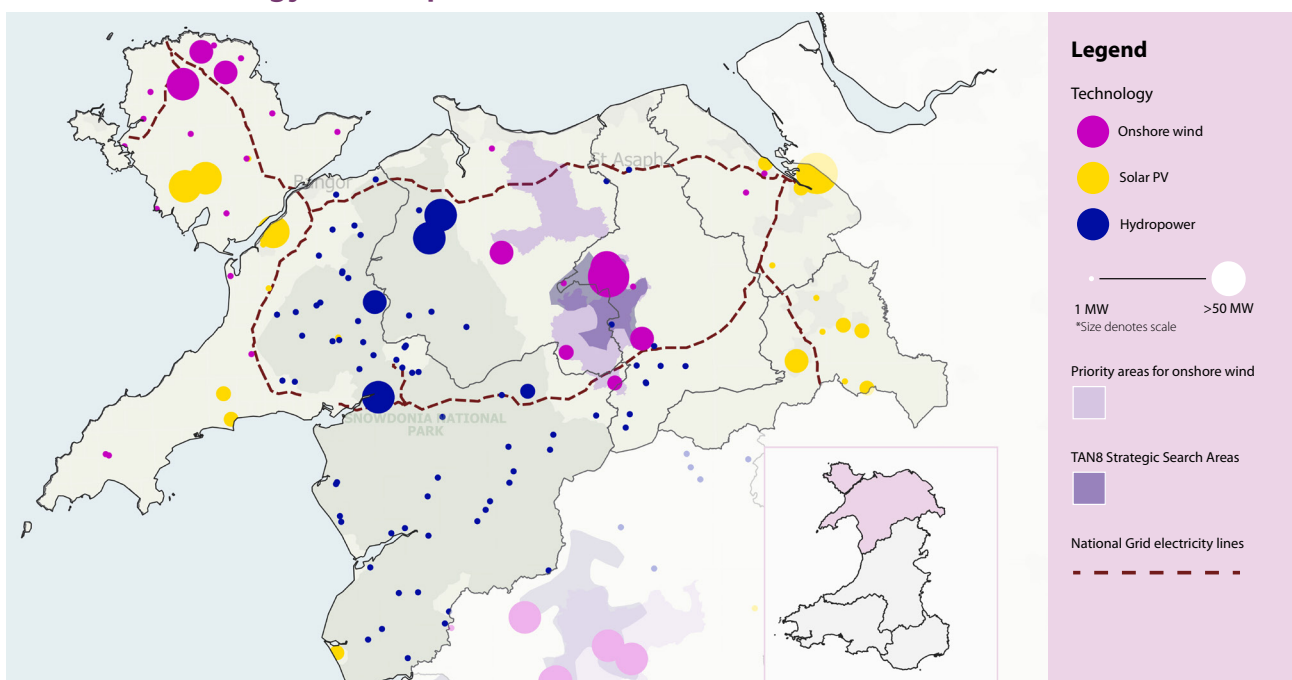
In 2022, a total of 2,899 new renewable projects were commissioned in the North Wales region, representing 19 MW of new capacity. The majority of these projects are small-scale installations. The largest project identified as commissioning in North Wales in 2022 was the 50 kW Colwydr Hydro project.

Data source: (1)

North Wales Technology	Total Renewable heat and electricity			Commissioned in 2022	
	Number of projects	Total capacity (MW)	Estimated generation (GWh)	Number of projects	Total capacity (MW)
Anaerobic digestion	16	7	40	-	-
Biomass electricity and CHP	15	120	655	-	-
Biomass heat	820	93	285	11	0.31
Energy from waste	1	11	56	-	-
Heat pump	4,707	50	82	1,150	11
Hydropower	203	97	204	2	0.08
Landfill gas	8	5	13	-	-
Onshore wind	181	235	585	-	-
Sewage gas	1	2	11	-	-
Solar PV	19,049	257	239	1,730	8
Solar thermal	972	3	2	6	0.02
Total	25,973	880	2,172	2,899	19

NB: offshore wind has been classified as a national asset in Wales and, therefore, any generation associated with this technology has not been grouped by region.

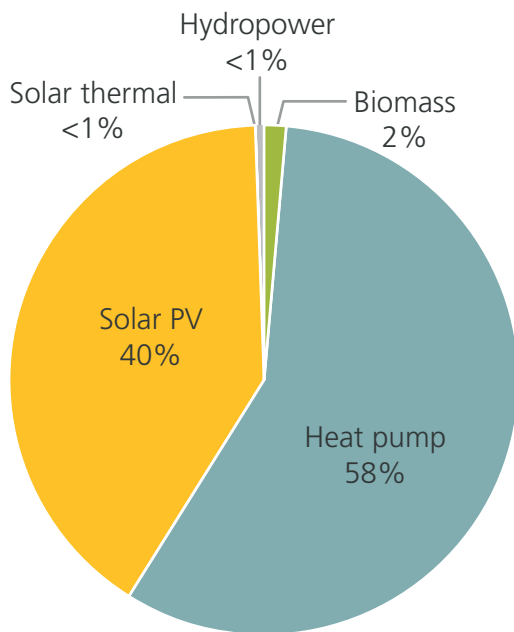
North Wales energy landscape Data source: (1)



Heat pumps and solar PV projects together represent 98% of North Wales’s new renewable energy capacity in 2022, at 11 MW and 9 MW respectively. However, in total, biomass CHP and biomass heat together represent the greatest proportion of renewable energy generation in the North Wales region, totalling 43%. This is closely followed by onshore wind, which generated 27% of overall renewable energy output, while solar PV and hydropower contributed 11% and 9% respectively.

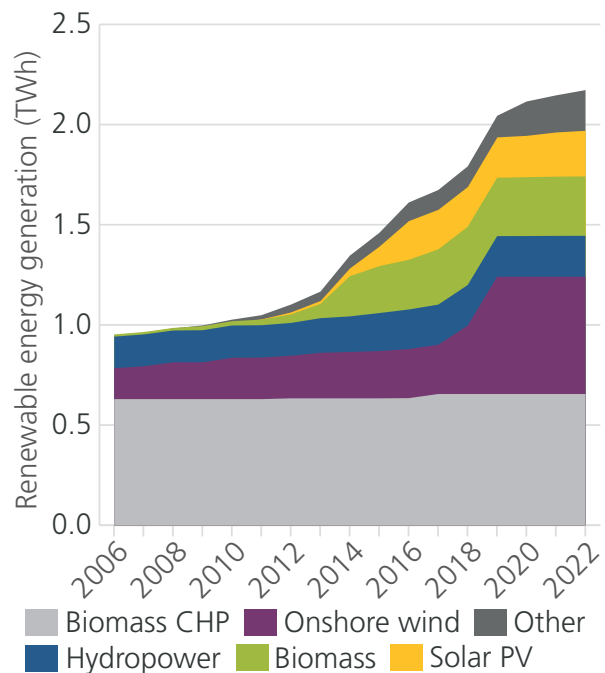
Percentage of renewable capacity commissioned in 2022, by technology

Data source: (1)



Renewable energy generation in the North Wales Region

Data source: (1)



Morlais tidal energy project

The Morlais project is a prospective tidal energy area off the coast of Holy Island, Anglesey, delivered by Menter Môn, a social enterprise delivering projects for the benefit of local communities in North Wales. In July 2022, the developer won a Contract for Difference for a 5.6 MW commercial tidal energy deployment, as part of the Morlais project. More recently, in September 2023, four further projects successfully won Contracts for Difference at the Morlais site and are due to be deployed between 2026 and 2028, bringing the total to 28 MW.

Low carbon technologies

Hydropower

Three new hydro projects were commissioned across Wales in 2022, with a total capacity of 0.1 MW. These sites, located in Gwynedd and Monmouthshire, each have an electrical capacity of 50 kW or less. Hydropower in Wales generated an estimated 350 GWh of renewable electricity in 2022, from a total installed capacity of 170 MW across 379 projects.

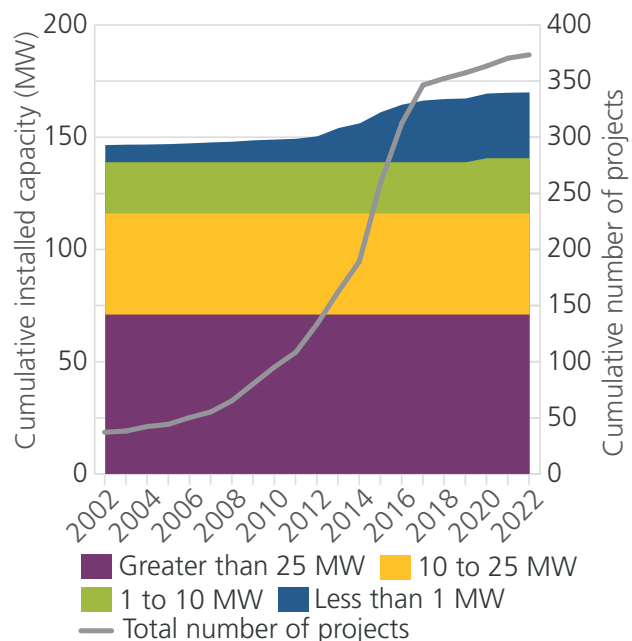
95% of hydropower in Wales is located in the North Wales and Mid Wales regions, where the mountainous and hilly topography results in high levels of hydropower resource. Over half of this capacity is in Gwynedd and Ceredigion, which host the Eryri National Park and Cambrian Mountains respectively.

Three-quarters of hydropower capacity in Wales, totalling 126 MW, comes from six large-scale projects which were commissioned between 1924 and 1989, ranging from 10 to 41 MW in capacity. These projects are located in Gwynedd, Ceredigion and Conwy.

No projects bigger than 2 MW have been developed since the start of the 21st century, and only two projects larger than 1 MW: the 1.8 MW Ystradffin Hydro site in Carmarthenshire commissioned in 2020, and a 1.4 MW site commissioned in Gwynedd in 2013.

Small-scale hydropower saw significant development during the 2010s. From 2012 to 2018, 16 MW of hydropower projects of less than 1 MW were deployed in Wales as a result of Feed-in Tariff (FiT) support. Following the closure of the FiT in 2019, less than 1 MW has been deployed, with just 0.1 MW of capacity installed in 2022.

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



Offshore wind

In 2022, offshore wind accounts for over 28% of Welsh electricity generation, remaining a key contributor to the Welsh renewable generation mix. The 2022 revision of the UK's offshore wind target to 50 GW of offshore wind, including 5 GW of floating offshore wind, indicates a vital area of future growth in renewable electricity generation for Wales.

Welsh offshore wind capacity has remained constant since the Gwynt Y Môr fixed offshore wind farm was commissioned in 2015. However, a number of extensions and new offshore wind projects near Wales are in development. Awel y Môr, an extension to Gwynt y Môr estimated to generate in excess of 500 MW, has been approved through the Development Consent Order process. Three other fixed offshore wind farms (Mona, Morecambe and Morgan) are also in pre-planning stages and are expected to generate a combined capacity of approximately 3.5 GW. Consultations for these windfarms concluded in 2022 and 2023, with the Mona project currently working towards a Development Consent Order application.

Existing or in development offshore wind projects that could contribute to Welsh renewable electricity generation⁸

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
Morecambe	Fixed	Pre-planning	2028/9	480
Morgan	Fixed	Pre-planning	2029	1,500
Awel y Môr	Fixed	Consented	TBC	576
Erebus	Floating	Consented	TBC	99
Llŷr 1	Floating	Pre-planning	TBC	100
Llŷr 2	Floating	Pre-planning	TBC	100

Floating offshore wind technology is likely to be a growing part of Wales' and the UK's future electricity generation mix, having contributed £2.7 million⁹ to the Welsh economy by 2022. There are more than 400 MW of test and demonstration floating offshore wind projects in the pipeline off the south Pembroke coast, which are anticipated to be operational near the end of

⁸ The Crown Estate, 2023; Project listings

⁹ Marine Energy Wales, 2023; State of the Sector 2022

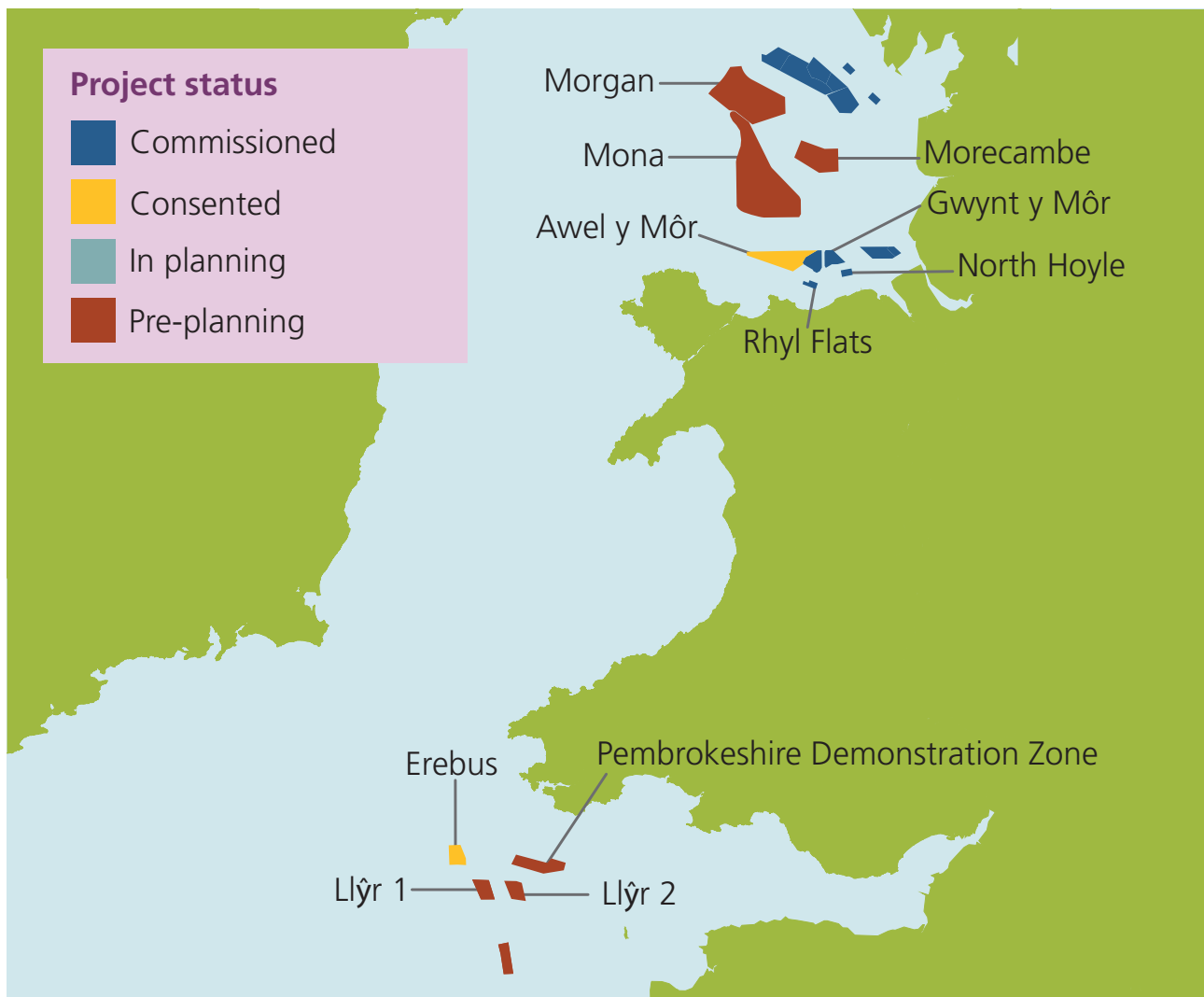
the decade. Included within this capacity is Erebus, a 99 MW project by Blue Gem Wind.

The Erebus project has obtained the necessary licenses and seabed lease in 2023, and is awaiting the next stages, including future applications to the UK Contracts for Difference.

In addition to the test and demonstration projects, The Crown Estate has announced in October 2023 three 'Project Development Areas' that would help unlock a further 4.5 GW of floating offshore wind in the Celtic Sea. Alongside this, studies predict that the first gigawatt of floating offshore wind could deliver around 3,000 full time equivalent jobs and £682 million in supply chain opportunities for Wales and the south west of England. As further search areas progress and the Celtic Seas contributes to the wider UK ambition, this could increase to around 10,000 full time equivalent Welsh jobs by 2045¹⁰.

Port Talbot and the Port of Milford Haven, both in South Wales, have been identified as two early sites that could support the integration of floating offshore wind¹¹, with both ports having already signed Memorandum of Understandings with power producer RWE and with Gwynt Glas – a joint venture between EDF Renewables UK and DP Energy.

Location of offshore wind projects



¹⁰ BBC, 2022; [Floating wind farms at sea to create 29,000 jobs](#)

¹¹ House of Commons Welsh Affairs Committee, 2023; [Floating Offshore Wind in Wales](#)

Work is now underway to develop the onshore grid infrastructure and connection requirements for the Morlais Tidal Demonstration Zone in North Wales. This work was enabled by investment of over £32 million from EU regional development funding and The Crown Estate¹². Morlais is aiming to connect up to 240 MW of tidal stream electricity to the Welsh electricity network, towards which projects totalling 28 MW have now won a Contracts for Difference.

Across all marine renewable energy technologies (including floating offshore wind), tidal stream was the largest contributor to the Welsh economy in 2022, contributing over £45.1 million¹³. This is an increase of £41.3 million from the level of investment in 2021. Wave energy developments contributed £2 million to the Welsh economy and a £750,000 fund for tidal lagoon research was announced by the First Minister¹⁴.

While there are no large-scale operational wave energy devices in Wales, wave technology continues to be developed in Wales. Bombora is conducting final tests of their 1.5 MW wave demonstrator at the Pembrokeshire Demonstration site, in preparation for deployment in the Marine Energy Testing Area, where the device will be validated in the open ocean. Bombora has successfully completed tank testing of a floating platform co-locating wave technology and floating offshore wind. Co-locating wave energy with other infrastructure has the capability to provide whole-system benefits alongside improving projects' financial viability.

Welsh marine energy projects with a Contract for Difference

Marine energy site	Technology	Status*	Expected installed capacity (MW)
Magallanes	Tidal stream	Won AR4 and AR5 CfD	8.6
Hydrowing	Tidal stream	Won AR5 CfD	10
Mor Energy	Tidal stream	Won AR5 CfD	4.5
Verdant Isles	Tidal stream	Won AR5 CfD	4.9

* Contracts for Difference (CfD), Allocation Round 4 (AR4), Allocation Round 5 (AR5)

¹² The Crown Estate, 2022; [The Crown Estate to invest £1.2million in Welsh tidal stream energy innovation](#)

¹³ Marine Energy Wales, 2023; [State of the sector report 2023](#)

¹⁴ Welsh Government, 2023; [First Minister announces £750,000 fund for tidal lagoon research](#)

Onshore wind

2022 saw only a single, micro-scale onshore wind site installed. This is the third consecutive year of decreasing deployment and a marked difference to the preceding period from 2016 to 2019, during which an average of 160 MW per year were installed. Onshore wind capacity now stands at 1,266 MW in Wales, with just over half of this capacity located in three local authorities: Rhondda Cynon Taf, Powys, and Neath Port Talbot.

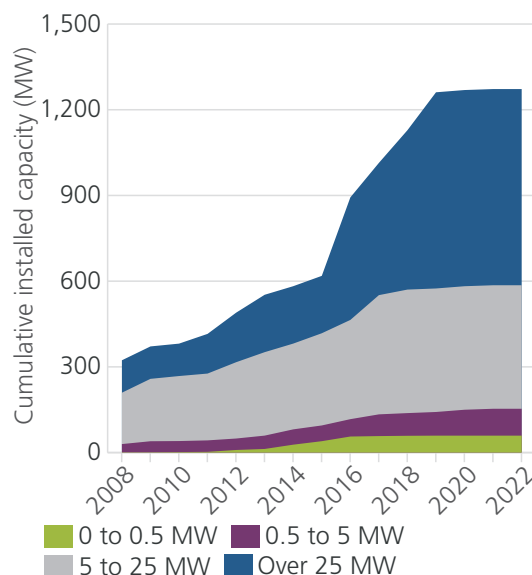
The onshore wind site installed in Wales in 2022 was a single 6 kW installation in Powys. This compares to 3.4 MW of deployment in 2021, from Ripple Energy's 2.5 MW Graig Fatha wind farm in Rhondda Cynon Taf, and a 0.9 MW turbine at the Rassau Industrial Estate in Blaenau Gwent.

Despite the low levels of current deployment, partially owing to onshore wind not being included in Contracts for Difference Allocation Rounds 2 and 3 in 2017 and 2019 respectively, there are a number of onshore wind projects in development. Three sites, totalling 27 MW, were granted planning permission in 2022, and a further two sites submitted planning applications with a combined capacity of 119 MW¹⁵.

Geographically, total onshore wind capacity in Wales is concentrated in local authorities with high levels of wind resource, such as Rhondda Cynon Taf, Powys, Neath Port Talbot and Denbighshire. There is a fairly even spread of onshore wind capacity across the four Welsh regions, from 235 MW in North Wales to 435 MW in Swansea Bay City Region.

In June 2023, Climate Change Minister Julie James introduced the Infrastructure (Wales) Bill 2023 to the Senedd, which aims to streamline and unify the current consenting processes for large infrastructure projects such as onshore wind farms¹⁶.

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



¹⁵ Sourced from the [Renewable Energy Planning Database Quarterly Extract](#), July 2023

¹⁶ Welsh Government, 2023; [Infrastructure \(Wales\) Bill 2023](#)

Renewable heat

A total of 52 MW of new renewable heat capacity was commissioned in 2022, a 68% increase compared to 2021. Over 3,500 new renewable heat sites were commissioned, 97% of which were heat pumps, with biomass boilers accounting for most of the remainder. In total, Welsh renewable heat is estimated to have produced over 1,700 GWh in 2022, more than 100 GWh higher than in 2021.

The Welsh Government is currently consulting on a draft Heat Strategy for Wales, with the final version due for release in early 2024, helping to ensure that funding and effort is focused on the most appropriate solutions for decarbonising heat generation in Wales.

Heat pumps

There were 3,486 recorded heat pump installations in 2022. This is the highest number of installations in a single year to date, and a significant increase on the previous high of 2,082 heat pumps installed in 2021. Domestic installations accounted for 97% of these installations, with the remainder coming from farms and estates, commercial buildings and industrial premises.

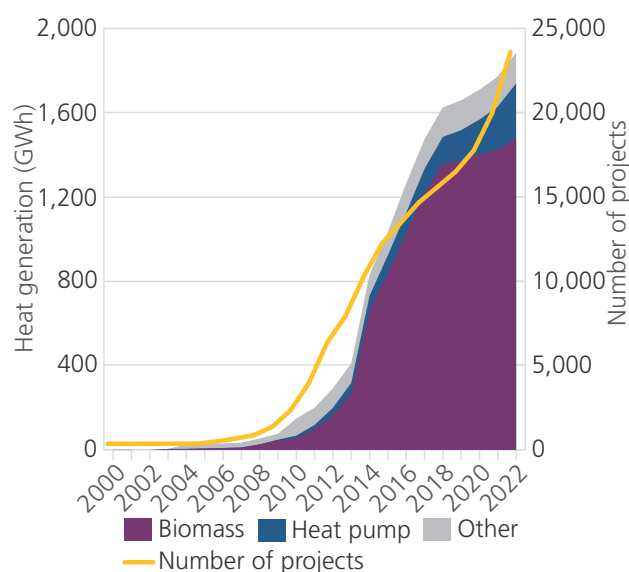
A significant factor in the uptake of heat pumps in 2022 was the closure of the domestic Renewable Heat Incentive (RHI) to new applications on 31 March 2022. This deadline resulted in a large number of installations in early 2022, as people aimed to access the support through this mechanism. This, combined with the increased prices of gas and electricity as a result of the energy price crisis, resulted in an increased level of heat pump deployment in Wales across 2022.

Biomass

New biomass boiler capacity in 2022 totalled 17 MW across 102 recorded installations, more than double the capacity recorded in 2021. This was driven by 14 non-domestic installations of 0.8 MW or more, totalling 14 MW. In terms of capacity, this represents the greatest uptake of biomass heat since 2018, when 45 MW of was installed.

Deployment of renewable heat over time

Data source: (1)



Solar PV

In 2022, 43 MW of new solar PV capacity was installed in Wales. This was dominated by domestic and commercial rooftop solar uptake, which made up over 30 MW of new capacity. In 2022, small-scale solar PV projects were installed at the fastest rate since 2015. The total solar PV capacity in Wales now totals almost 1.2 GW, across more than 70,000 individual projects.

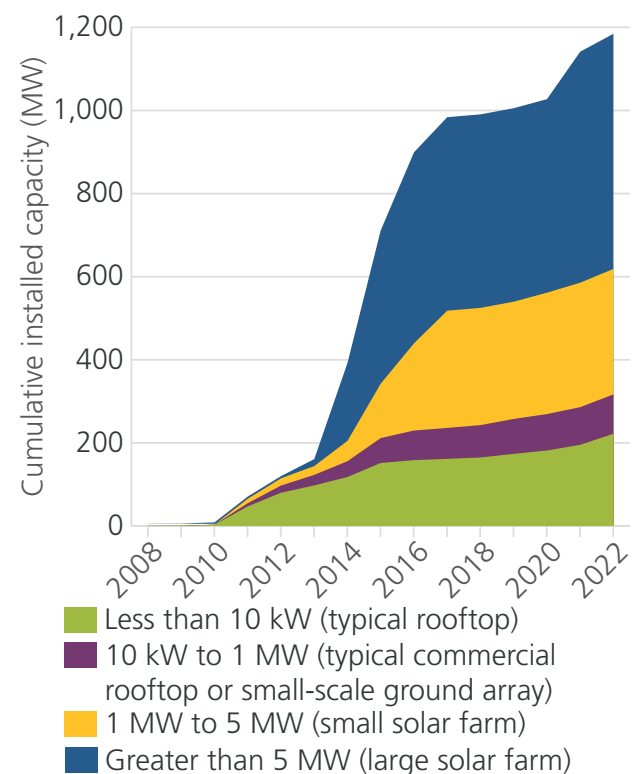
Deployment was spread across local authorities throughout Wales, with Cardiff, Powys, Isle of Anglesey and Swansea all seeing over 2 MW of capacity installed in 2022; only Blaenau Gwent, Merthyr Tydfil and Flintshire had fewer than 150 small-scale installations.

2022 marked the highest rate of small-scale solar PV deployment since the height of the Feed-in Tariff support scheme in the mid-2010s. The energy price crisis has driven high levels of solar PV deployment across homes and businesses looking to reduce their substantially increased energy bills through self-consumption, with additional support from the Smart Export Guarantee, the successor to the Feed-in Tariff.

Compared to the uptake of rooftop solar PV, deployment of solar farms in Wales in 2022 has been much slower. Only two large-scale solar PV projects were commissioned, totalling 12.5 MW: the 10 MW Carn Nicholas Solar Park in Swansea, and the 2.5 MW Fferm Penglais Solar Farm in Ceredigion. This is a substantial decrease compared to 2021, which saw 98 MW of capacity deployed across six large-scale projects, including the 75 MW Llanwern Farm Solar Park in Newport, the largest operational solar farm in the UK at time of construction.

Solar PV deployment in Wales by scale

Data source: (1)



Waste technologies

Energy generation from waste incineration, anaerobic digestion, sewage and landfill gas technologies total over 120 MW of heat and power capacity. In 2022, three new sites were commissioned, totalling 0.7 MW of anaerobic digestion capacity.

Energy from Waste (EfW)

Incineration of waste at the two Energy from Waste (EfW) plants in Wales totals 51 MW of generation capacity, producing an estimated 270 GWh of electricity. This comprises the 30 MW Trident Park site in Cardiff and the 21 MW Parc Adfer site in Flintshire. For the purposes of this report, only half of this generation is classed as renewable, due to the nature of the waste being incinerated.

It is expected that the supply of waste will reduce in line with Wales's zero waste strategy. Since 2021, there has been a moratorium on development of large-scale waste energy plants (over 10 MW) in Wales¹⁷, while small-scale plants would only be allowed if there is a clear local need for such facilities. As a result, no new EfW plants have been developed in Wales since 2020.

Anaerobic digestion

There are 50 anaerobic digestion sites across Wales, predominantly developed in the mid-2010s thanks to support from the FIT and Renewable Heat Incentive. These are small-scale sites, ranging from 0.013 MW to 2.8 MW. Of the 150 GWh of energy generated by these sites, around 60% is electricity and 40% heat.

The three anaerobic digestion sites commissioned in 2022, totalled 0.7 MW. These were all located in Powys on farms and estates, using the biogas produced by anaerobic digestion for heat.

Sewage and landfill gas

There are 6 sewage and 24 landfill gas generation sites in operation across Wales. These technologies have a combined electricity and heat generation capacity of almost 50 MW, generating nearly 190 GWh of energy in 2022. Deployment of sewage and landfill gas sites has flatlined in Wales, with only one new project since 2012, a single micro-scale landfill gas site of 0.05 MW commissioned in 2017.

¹⁷ Welsh Government, 2021; [Wales takes action on Circular Economy with funding, upcoming reforms on plastic and a moratorium on large-scale waste energy](#)

Fossil fuels

Fossil fuel electricity generation

As of 2022, the capacity of fossil fuel electricity generation in Wales totals 4.4 GW. No new fossil fuel projects were commissioned in Wales in 2022, following seven consecutive years of fossil fuel project deployment. Fossil fuel electricity generation produced 21 TWh of electricity in 2021, representing 73% of Wales' total electricity generation and the equivalent of 157% of Wales' electricity consumption.

Following the decommissioning of the coal-fired Aberthaw Power Station in 2020, over 95% of fossil fuel electricity generation in Wales is from natural gas.

The installed capacity of natural gas electricity generation in Wales fell significantly in 2019 and 2020 as the Barry, Baglan Bay and Severn power stations ceased operations, totalling 1.6 GW of electricity generation capacity between them.

In 2022, the total capacity of natural gas electricity generation in Wales was 4,062 MW. Nearly 90% of this capacity is attributed to the large-scale power stations at Pembroke (2,199 MW) and Connah's Quay (1,380 MW). There are also more than 70 other smaller gas generators in Wales, totalling 483 MW of generation capacity, which operate principally as flexible 'peaking' plants or combined heat and power (CHP) plants.

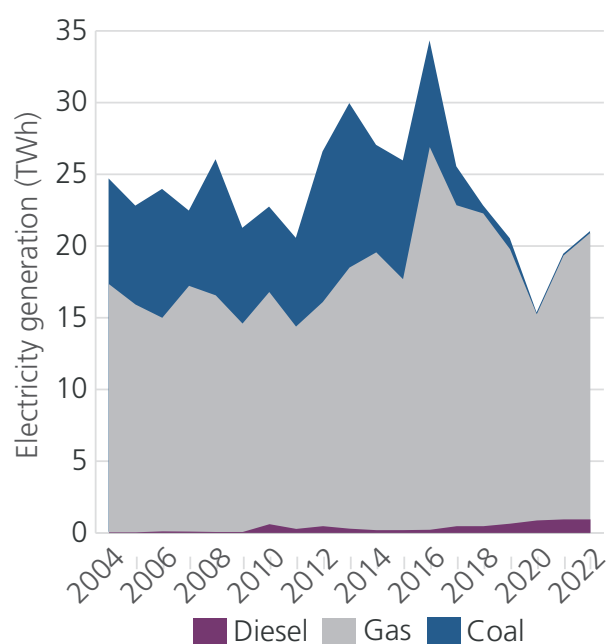
Total electricity generation from natural gas totalled over 20 TWh in 2022, the first year this level has occurred since 2018, despite falling capacity. This is an increase of 1.6 TWh compared to 2021, primarily driven by an increase in generation output at Pembroke Power Station.

The majority of the remaining fossil fuel generation capacity comes from small-scale diesel generation, representing 267 MW of capacity. The vast majority of this capacity comes from 14 sites of between 10 and 22 MW in size. This diesel generation is typically deployed as a short-term operating reserve, and as a result has relatively little electricity generation associated with it.

It is also assumed that half of the EfW generation is non-renewable, with capacity

Fossil fuel generation over time

Data source: (1)



totalling 26 MW across two projects in Cardiff and Flintshire. This accounts for less than 1% of fossil fuel electricity generation in Wales.

The lack of fossil fuel projects commissioning in 2022 reflects dwindling deployment rates over the last few years, with just eight projects deployed between 2019 and 2021 and six sites decommissioning. By contrast, 33 projects were commissioned between 2015 and 2018, including 16 in 2018 alone.

The Swansea Bay City Region hosts over half of fossil fuel capacity in Wales at 2.4 GW, over 90% of which is from the Pembroke power station. In terms of the number of fossil fuel sites, the Cardiff Capital Region has the greatest number, hosting 55 of the 98 fossil fuel electricity generation sites in Wales. However, these are all small-scale sites, totalling just 406 MW with no individual site larger than 30 MW. In contrast, North Wales hosts just 17 sites, but these sites total over 1.5 GW of generation capacity due to the presence of the Connah's Quay power station in Flintshire.

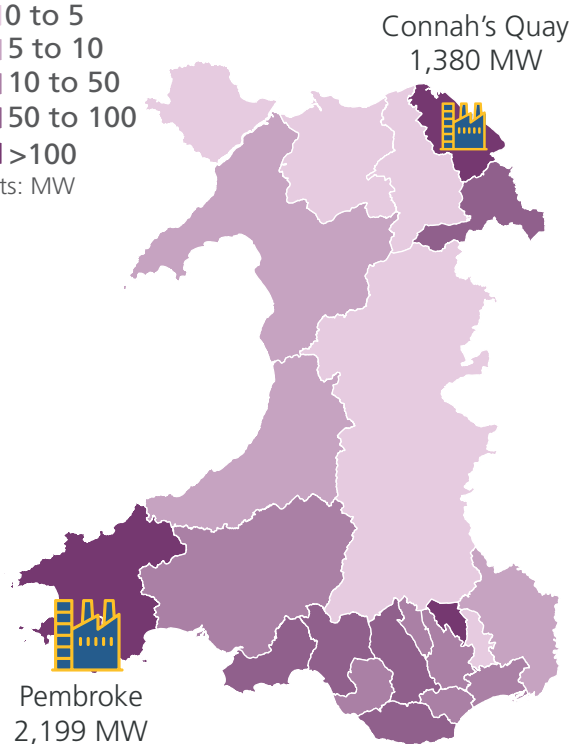
Mid Wales has a minimal amount of fossil fuel generation, totalling 11 MW from five projects, 10 MW of which comes from a single diesel plant in Ceredigion. This is likely to be due to the lack of natural gas connectivity in the Mid Wales region and rural topography of the region.

Fossil fuel electricity capacity by region

Data source: (1)

- 0 to 5
- 5 to 10
- 10 to 50
- 50 to 100
- >100

Units: MW



Storage and flexible technologies

Battery storage

There are currently four operational commercial scale battery sites identified in Wales, with a total power capacity of 27 MW.

The vast majority of battery storage capacity in Wales comes from two projects: the 22 MW Pen y Cymoedd project in Neath Port Talbot, and the 4.3 MW Parc Stormy project in Bridgend. Two further battery installations of at least 50 kW are known to exist, ranging from 50 kW to 232 kW in scale.

Battery storage deployment is seeing strong interest from project developers. There are 19 projects in the pipeline that have been granted planning permission, totalling well over 300 MW of power capacity and over 500 MWh of storage capacity. Just under half of these sites are co-located with renewable or fossil-fuelled electricity generation. In addition, there are seven further sites that have submitted a planning application, totalling over 100 MW.

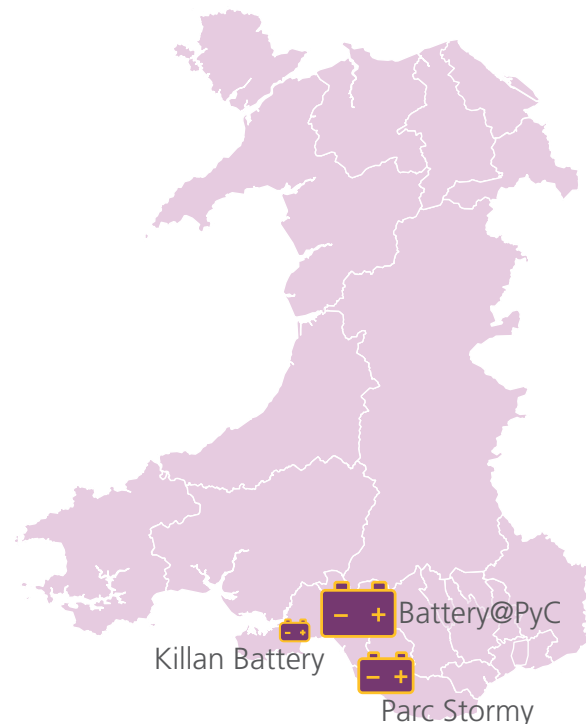
Across the UK, there is a trend towards development of very large-scale batteries of at least 50 MW, often well over 100 MW in size. In Wales, a 230 MW/460 MWh battery at Uskmouth Sustainable Energy Park on the site of the former Uskmouth coal fired power station in Newport was granted planning permission in December 2022.

Geographically, this pipeline of prospective battery storage sites are located near to demand, including major urban centres such as Cardiff, Swansea and Wrexham, or near to major industrial areas.

As Wales and the rest of the UK look to operate a net zero electricity system by 2035, the role of batteries in providing zero carbon flexibility is expected to rapidly increase. This includes battery operators looking to provide Dynamic Response Services to aid the operation of the UK's electricity system.

Location of battery storage projects

Data source: (1)



Pumped hydropower

There are two pumped hydropower energy storage sites in Wales, totalling 2.1 GW of power capacity and around 11 GWh of storage capacity. The Dinorwig and Ffestiniog pumped hydro power stations were developed in 1984 and 1963 respectively, and currently make up around one-third of the UK's total electricity storage capacity. A 100 MW/700 MWh site in Gwynedd is currently in development.

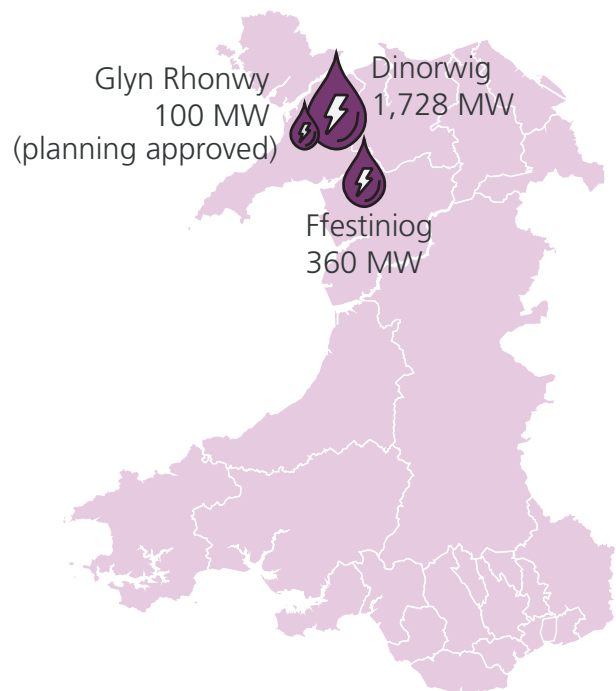
Pumped hydropower is one of the most established forms of electricity storage, having been in use since the early 1900s. The Ffestiniog Power Station in Gwynedd was commissioned in 1963, and the Dinorwig Power Station, also in Gwynedd, began operation in 1984. Pumped hydropower, totalling over 25 GWh of storage capacity across the UK, plays a vital role in the balancing and operation of the UK's electricity system.

The Glyn Rhonwy project, developed by Snowdonia Pumped Hydro, was granted a Development Consent Order in 2017 to turn two disused slate quarries in Gwynedd into a 100 MW pumped hydro energy storage site. In November 2021, the Welsh Government granted an extension to the planning consent due to delays caused by the COVID-19 pandemic, which allows construction to commence by April 2025.

Pumped hydropower provides vital long-term storage flexibility to respond to changes in demand, with project lifespans typically extending beyond 80 years. It will continue to play a key role in ensuring stability in an energy system featuring an increasing number of variable renewable generation sources.

Location of pumped hydropower projects

Data source: (1)



Hydrogen

While there were no operational projects in Wales in 2022, low carbon hydrogen could have a wide range of uses in a decarbonising energy system. This includes as a form of energy demand to produce low carbon hydrogen from electricity or natural gas, as a fuel for electricity generation, transport and industrial uses, or as a feedstock for chemical processes. Where hydrogen is produced from electricity via electrolysis it acts as a form of energy storage.

In its Hydrogen in Wales consultation response published in June 2022¹⁸, the Welsh Government stated it “remains convinced that hydrogen will have an important role to play in meeting net zero, and that Wales is well-placed to be at the forefront of this developing sector”. This was backed by support for hydrogen energy projects in Wales, such as unlocking investment for a 10 MW renewable hydrogen production facility in 2023/24, and leveraging public funding against private sector investment to development skills and opportunities for Welsh workers in the hydrogen sector.

The Welsh Government’s Draft Heat Strategy for Wales¹⁹, which was put out to consultation in August 2023, notes that hydrogen is likely to be a key low carbon fuel for industrial processes, especially those requiring high-temperature heat. However, there is “a lack of strong impartial evidence to support it as the ubiquitous heating fuel in Welsh buildings”. The draft strategy also suggests that currently off-gas areas will not use hydrogen for heating, and that Local Area Energy Plans will be used to establish where repurposing the gas grid for hydrogen heating may be feasible.

In 2022, the UK government Department for Energy Security and Net Zero established the first electrolytic hydrogen allocation round (HAR1), offering revenue and capital support to successful low carbon electrolytic hydrogen projects. The March 2023 shortlisting included three hydrogen production projects in Wales.

In addition, plans for a 15 MW green hydrogen project in Pembrokeshire were announced in October 2022. The Trecwn green Energy Hub²⁰ is being developed by Statkraft to produce low carbon hydrogen for buses, HGVs, trains and industry in Wales. This project was also awarded funding from UK government in early 2023, as part of the Net Zero Hydrogen Fund. These projects add to the previously launched FLEXIS (Flexible Integrated Energy Systems) and Pembroke Net Zero Centre (PNZC) projects led by the University of South Wales and RWE respectively.

¹⁸ Welsh Government, 2022; [Hydrogen in Wales A pathway and next steps for developing the hydrogen energy sector in Wales](#)

¹⁹ Welsh Government, 2023; [Heat strategy for Wales](#)

²⁰ Statkraft, accessed 2023; [Trecwn Green Energy Hub](#)

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	1,347	24	11	6	107	-	-	-	15	10	1	4	-
Bridgend	3,003	93	10	4	24	1	3	-	36	8	1	-	0
Caerphilly	3,643	70	11	3	19	2	2	1	51	7	2	0	-
Cardiff	4,456	46	14	7	37	1	2	-	22	5	1	0	-
Carmarthenshire	8,104	267	66	2	10	2	1	0	554	47	-	-	-
Ceredigion	5,586	181	81	2	10	4	1	1	277	44	4	3	17
Conwy	3,202	96	17	3	2	3	-	0	122	9	5	1	0
Denbighshire	3,683	164	28	2	1	3	1	1	176	16	5	1	0
Flintshire	4,714	135	112	8	1,432	-	-	-	144	14	1	25	90
Gwynedd	4,788	113	30	2	5	2	0	0	225	17	1	0	-
Isle of Anglesey	4,206	84	15	1	0	2	2	0	61	3	1	0	0
Merthyr Tydfil	1,013	18	6	3	40	-	-	-	16	4	1	1	2
Monmouthshire	5,299	70	38	4	6	2	0	0	189	22	5	18	7
Neath Port Talbot	2,450	331	33	7	86	-	-	-	102	27	2	56	-
Newport	2,647	128	13	4	39	2	0	0	41	11	2	9	0
Pembrokeshire	7,258	230	44	6	2,258	2	0	0	312	28	2	0	0
Powys	9,284	243	169	4	1	16	3	3	998	133	10	1	2
Rhondda Cynon Taf	5,497	254	25	11	71	1	1	1	66	18	-	-	-
Swansea	4,149	115	13	6	82	-	-	-	61	8	1	1	-
Torfaen	2,427	16	4	5	0	-	-	-	21	3	1	0	1
Vale of Glamorgan	2,881	99	19	8	63	1	1	-	71	14	2	10	-
Wrexham	5,381	47	41	4	63	6	0	1	92	34	2	0	1
Offshore	3	726	-	-	-	-	-	-	-	-	-	-	-
Unknown	28	0	0	-	-	-	-	-	-	-	2	0	0
Total	95,047	3,551	798	102	4,356	50	18	9	3,652	481	52	131	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	-	4	56	1	1	0	1	1	-	-	9	7
Bridgend	-	-	197	2	3	0	1	0	-	-	14	59
Caerphilly	-	0	267	3	-	-	-	-	-	-	21	17
Cardiff	2	0	298	3	1	0	2	2	-	-	3	0
Carmarthenshire	-	-	1,620	18	14	6	1	1	-	-	113	145
Ceredigion	-	3	1,868	17	26	56	-	-	-	-	78	85
Conwy	-	1	508	6	30	35	1	1	-	-	40	40
Denbighshire	-	1	892	10	21	3	-	-	-	-	39	147
Flintshire	2	25	769	7	-	-	2	0	-	-	17	2
Gwynedd	-	0	1,217	13	152	60	1	0	-	-	36	7
Isle of Anglesey	-	0	1,026	11	-	-	1	0	-	-	49	40
Merthyr Tydfil	-	1	45	1	4	0	2	6	-	-	5	2
Monmouthshire	-	18	735	8	12	0	-	-	-	-	11	4
Neath Port Talbot	-	56	201	2	10	1	2	1	-	-	12	230
Newport	-	9	142	2	-	-	1	1	-	-	11	16
Pembrokeshire	-	0	1,244	14	14	1	1	2	-	-	150	26
Powys	-	1	2,225	29	81	8	1	2	-	-	119	199
Rhondda Cynon Taf	-	-	506	5	4	0	2	1	-	-	14	204
Swansea	-	1	375	4	2	0	1	-	-	-	5	34
Torfaen	-	0	31	0	1	0	-	-	-	-	3	0
Vale of Glamorgan	-	10	200	2	-	-	-	-	-	-	6	1
Wrexham	-	0	295	4	-	-	3	3	-	-	1	0
Offshore	-	-	-	-	-	-	-	-	3	726	-	-
Unknown	-	0	-	-	3	0	-	-	-	-	-	-
Total	4	131	14,717	161	379	170	23	23	3	726	754	1,266

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	-	-	-	974	12	290	1	-	-	1	21	5	86
Bridgend	-	-	-	2,649	31	101	0	-	-	-	-	4	24
Caerphilly	-	-	-	2,953	51	347	1	-	-	1	18	2	1
Cardiff	1	4	5	4,030	23	96	0	-	-	1	1	5	21
Carmarthenshire	-	-	-	5,483	114	317	1	-	-	-	-	2	10
Ceredigion	-	-	-	2,966	36	363	1	-	-	1	10	1	0
Conwy	-	-	-	2,237	19	256	1	-	-	-	-	3	2
Denbighshire	-	-	-	2,403	12	144	0	-	-	-	-	2	1
Flintshire	-	-	-	3,694	97	86	0	-	-	1	14	6	1,407
Gwynedd	-	-	-	2,972	45	182	1	-	-	-	-	2	5
Isle of Anglesey	-	-	-	2,876	42	190	1	-	-	-	-	1	0
Merthyr Tydfil	-	-	-	873	8	67	0	-	-	1	20	2	20
Monmouthshire	-	-	-	4,227	48	118	0	-	-	2	6	2	0
Neath Port Talbot	1	3	3	2,081	41	39	0	-	-	4	47	3	39
Newport	-	-	-	2,414	102	34	0	-	-	1	12	3	27
Pembrokeshire	-	-	-	4,964	201	569	2	-	-	-	-	6	2,258
Powys	-	-	-	5,142	29	692	2	-	-	-	-	4	1
Rhondda Cynon Taf	-	-	-	4,357	47	547	2	-	-	1	20	10	51
Swansea	1	1	1	3,539	80	164	1	-	-	3	45	3	37
Torfaen	-	-	-	2,352	16	18	0	-	-	-	-	5	0
Vale of Glamorgan	1	3	3	2,511	85	89	0	-	-	3	19	5	43
Wrexham	1	1	1	4,867	42	114	0	-	-	2	36	2	27
Offshore	-	-	-	-	-	-	-	-	-	-	-	-	-
Unknown	-	-	-	23	0	-	-	-	-	-	-	-	-
Total	5	12	14	70,587	1,179	4,823	14	-	-	22	269	78	4,062

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, identify the extent to which projects are owned by Welsh individuals, organisations and communities, and analyse the data to produce a report on progress.

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.

Further data sources

- (1) Database compiled by Regen, as described above

Assumptions

Assumption	Source
Estimated Welsh domestic heat demand	Welsh Government, Energy Use in Wales, 2021.
Fossil fuel electricity generation	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.
Number of homes	StatsWales Dwelling stock estimates.
Capacity factors	Evaluated from a five-year average of DUKES regional capacity factors and other industry established values.
Energy consumption	Welsh electricity consumption for 2022 has not yet been published, and so an estimate has been analysed. Welsh electricity consumption for 2022 is estimated by increasing 2021 DESNZ subnational electricity consumption data for Wales by the increase in the UK's electricity consumption seen between 2021 and 2022 in DESNZ UK electricity trends data.
Heat pump heat generation	To calculate the renewable portion of heat pump generation, the proportion of heat generated from heat pumps that is delivered by fossil fuels through the consumption of electricity is calculated. This proportion (~15%) is then removed from total heat pump generation. The remaining 85% of heat generation from heat pumps is, therefore, categorised as renewable and is published in this report.
Progress towards targets	Progress towards the target for Wales to meet the equivalent of 70% of its electricity demand from Welsh renewable electricity sources by 2030 is estimated by using national consumption for Wales (see above), and estimated generation figures.

Abbreviations and definitions

Abbreviation	Explanation
Capacity	How much power a project can generate at maximum output.
Capacity factor	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%.
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)
MWe	Megawatt of electrical capacity
MWth	Megawatt of thermal capacity
CO ₂	Carbon dioxide emissions
CHP	Combined Heat and Power
CCGT	Combined Cycle Gas Turbine
Solar PV	Solar photovoltaic panels
<1	Less than 1
>1	Greater than 1

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

$$\text{Power (capacity)} \times \text{Time} = \text{Energy (e.g. demand and generation)}$$

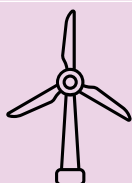


X



=

1,000 Wh or 1 kWh
(of demand)



X



=

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

