

Energy Entrepreneurs 2018

Overview of independent renewable
energy generation across Great Britain

A next generation
energy company



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Independent renewable generation in 2017 (vs 2016):

6,809 projects now operating (+6.2%)

Total renewable generation reaches 13.8GW capacity (+8.2%)

Investment in renewables is now £2.98bn, up £227m in 2017 (+8.3%)

31TWh of electricity generated at a wholesale value of £1.38bn (+8.3%)

Enough to power 8.38m households (+8.3%)

Foreword

The energy revolution is happening now in the UK. The outdated and unsustainable energy system which has existed for decades is giving way to a decentralised, decarbonised and digitised one.

Decarbonisation efforts have already made the UK's power system one of the cleanest in the world, with renewable sources producing more than three times the amount of electricity than coal last year.

The shift from a system dominated by large, fossil-fuelled power stations is also continuing at a rapid pace.

The UK Government recently confirmed a pledge to end the use of coal in power plants by 2025, a fantastic step after more than 140 years burning the fossil fuel. Only seven coal-fired power stations are still in operation in the UK and this is expected to drop quickly ahead of the 2025 deadline as they become increasingly uneconomic to run.

As these ageing power stations reach the end of their lives, a network of smaller generators is taking their place and creating a more resilient energy system.

The role played by the independent renewable generation sector is underlined by this year's Energy Entrepreneurs Report which shows there are now more than 6,800 such projects in operation.

The seismic shift in how and where power is generated is happening at the same time as the digital revolution, opening up exciting opportunities to change the energy system for the better.

Smarter, flexible technologies are enabling more precise balancing of supply and demand, which is crucial with so much intermittent renewable generation on the system. Consumers are also

gaining more control over their energy and developing the ability to use their consumption as an asset through Demand Side Response.

Renewable energy generators will have to become active participants in this new, flexible system as they look to develop new revenue streams to replace subsidies.

As we enter an era where generators will increasingly be expected to 'stand on their own two feet', projects will be seen not just as renewable energy generators but as flexible assets able to take advantage of multiple revenue streams.

SmartestEnergy is working closely with our customers to adapt to this new landscape and prepare for the changes that lie ahead. We look forward to seeing independent energy entrepreneurs continue to play a vital role as the next generation energy system takes shape.



Iain Robertson
Vice President, Renewables
SmartestEnergy

Executive Summary

The scale of change taking place across Great Britain's energy system was highlighted by the fact that 2017 saw the first full day without coal power since the 1880s when the use of fossil fuel began.

Renewable sources generated more than three times the amount of electricity than coal during a year which saw carbon emissions fall to their lowest level since the 19th century.

As well as helping provide security of supply as ageing fossil-fuel power stations reach the end of their life, renewables are at the heart of the shift to a smarter, more flexible energy system.

Independent renewable generators – those outside the big utilities – are making a growing contribution to this revolution. In the six years since the Energy Entrepreneurs Report began tracking the independent sector, almost £3bn has been invested in over 6,800 projects.

Individually most are relatively small, but together they are a significant force for good. Their combined capacity of 13.8GW is more than six times that of the Eggborough coal-fired power plant in Yorkshire which is due to close soon after almost five decades in operation.

The independent generation sector is now capable of powering almost 8.4m households, more than the controversial Hinkley Point C nuclear project when it starts generating in the middle of the next decade.

Finding routes to financial viability

This year's report shows the contribution being made by independent generators has continued to increase, but the pace of growth has slowed. The impact of subsidy cuts – a reflection of a maturing market – and reductions in embedded benefits have inevitably hit investment appetite.

The closure of the Renewables Obligation (RO) scheme to new projects during the year and reductions in Feed-in Tariffs (FIT) over recent years have meant many planned projects are no longer financially viable and have not been taken forward.

But despite the challenging environment, 400 new projects were able to proceed in 2017 and the report looks in-depth at their ownership, technology and location, along with the trends seen since 2012.

Energy entrepreneurs are already tackling the new environment by exploring alternative ways to make the financial case for their investments stack up in a subsidy-free world.

New models to meet growing demand for renewables

There is certainly a strong appetite for renewable electricity, particularly from corporate buyers who have significant influence on the energy market. Initiatives like the RE100 are seeing growing numbers of the world's largest companies commit to 100% renewables and are encouraging others to do the same.

Demand for renewables from businesses could lead to further growth in Corporate Power Purchase Agreements (PPAs) between generators and buyers. These provide the generator with long-term revenue to secure finance and the corporate buyer with cost certainty and sustainability benefits.

There is growing focus on the opportunities from co-location of storage with renewable generation (both existing or new projects), and the sharing of infrastructure costs, to access additional revenue streams.

Generators are also considering new ways to structure commercial agreements to access new revenues.

This year's report shows that the independent sector is continuing to make a growing contribution to the shift to a smarter energy system as it starts preparing for a subsidy-free future.



Renewables power greenest-ever year

Renewables have made a significant contribution to Great Britain's energy mix in recent years, with the sector's achievements hitting home in 2017.

Coal power generated just 7% of electricity in the UK last year, down from 36% in 2000, a milestone that may have seemed implausible just a decade ago. 2017 also saw 13 different renewable energy records set during a year described as the "greenest year ever" for electricity production.

The peak renewable energy generation was 19.2GW, the most wind power in a day was 285GWh and the highest proportion of solar in the energy mix was 26.8%.

Greater renewable generation has contributed to the UK halving its carbon emissions over the past five years, with levels at their lowest since the 19th century and the country is now ranked as having the seventh cleanest power system in the world.

But growth of intermittent renewable generation has impacted the energy market as balancing the system becomes more difficult. Electricity prices, particularly on the intraday markets, are volatile as new low-cost renewables force existing predictable baseload assets off the system.

This was highlighted last year when a period of high winds and low demand in June created negative system prices for five consecutive hours, and on the 17th May when low output from solar caused prices to spike to £1510/MWh.

With renewables here to stay, steps are being taken to adapt to this new normal. Schemes such as the Capacity Market incentivises quick-response flexible assets and battery storage technology has recently received investment and policy support.

Increasingly significant part of energy mix

The renewables sector is unquestionably now a mainstream player in energy generation, although the rate of growth has slowed markedly. Investment in new renewable projects in the UK fell for the second year in a row in 2017 after five years of growth under the coalition government (2010-2015).

The independent sector also slowed, with the £227m invested in 2017 down from £281m in 2016 and the peak of £418m seen in 2014.

However, the new projects developed during 2017 brings total investment in the independent sector to just under £3bn since 2012. With 6,809 projects now online, independent generators make up 9.2% of the GB energy mix - double their contribution just five years ago.

The number of households which independent renewable capacity can power has more than doubled from 3.87m in 2012 to 8.38m in 2017.

These projects make up about a third of Britain's overall renewable generation capacity, although that share has now fallen for two years in a row as major utility-owned offshore wind projects come on stream.

Ownership and technology trends continue

Specialist developers have always played an important role in renewables, but as the sector has matured they have increasingly dominated new project ownership.

Since the Energy Entrepreneurs Report began, the number of developer-led projects has more than trebled

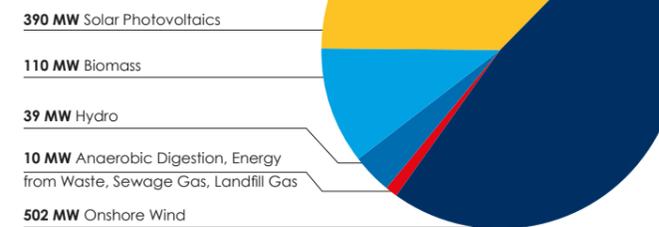
to now account for just under 2,700 independent projects, some 40% of the total.

The number of farm schemes – the second largest ownership category – has risen by more than four-fold to 1,378 in the same period and onsite generation projects developed by businesses is up by 117% to 905.

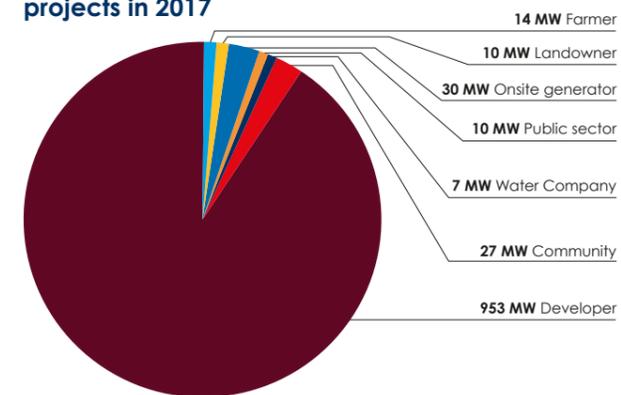
Although onshore wind accounted for the lion's share of capacity in the first Energy Entrepreneurs Report, solar PV has been the dominant technology by project for the past three years thanks to falling costs and technological advancements.

The scale of solar PV growth is highlighted by the fact that it now accounts for more than 43% of all independent generation capacity compared to just under 7% in 2012.

Technology mix of new projects in 2017



Ownership split of new projects in 2017



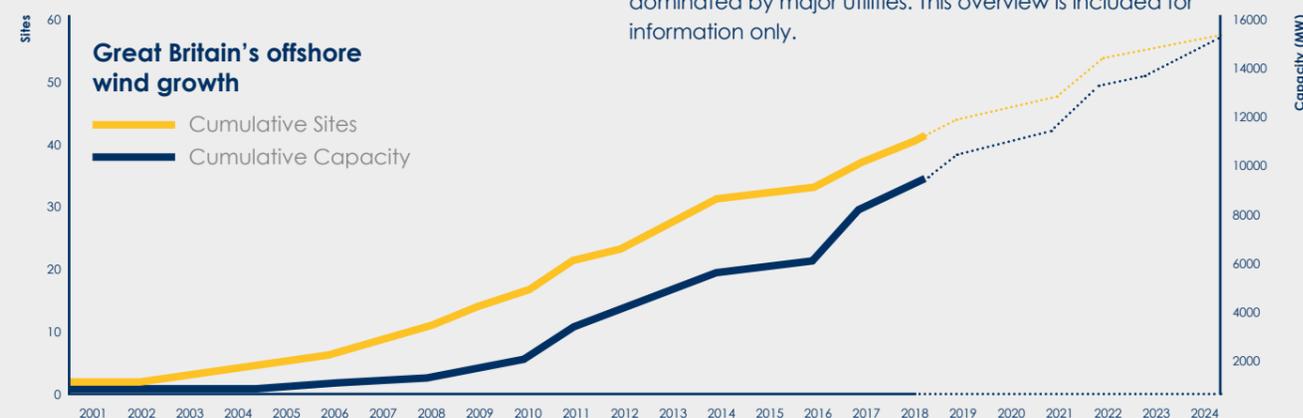
The offshore wind phenomenon

Offshore wind's dramatic progress in a relatively short period of time has been a major success story both for the renewables sector and the UK economy.

The UK now generates more electricity through offshore wind than any other country and in the first two months of 2018 it contributed 10% of total GB power output. A report suggests offshore wind capacity on the GB system could rise to approximately 30GW by the 2030s, up from 6GW currently.

The sector has made huge advances in reducing costs. Two projects secured a strike price of £57.50/MWh in the 2017 Contracts for Difference (CfD) auction, 47% lower than the average seen in 2015, and projects across Europe are achieving subsidy-free contracts, although not on a like-for-like basis with the GB market.

Offshore wind is making a significant contribution to the growth of the renewables industry. However, project data is not included in the Energy Entrepreneurs Report as transmission-connected projects to date have been dominated by major utilities. This overview is included for information only.



Investment continues but growth slows

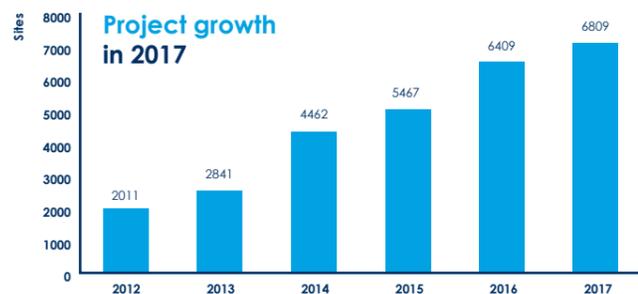
The pace of expansion in independent renewable generation last year slowed to its lowest level since the Energy Entrepreneurs Report was launched in 2012, but the sector is still in growth mode.

The 400 new projects commissioned during the year represented a rise of 6.2% on total project numbers at the end of 2016. Capacity saw a greater increase, with a 1GW (8.2%) rise taking total capacity up to 13.8GW. The 31TWh of electricity generated was worth just under £1.4bn, based on £44.67/MWh.

The £227m invested during the year was almost 20% lower than the £280m spent in the previous year, although falling technology costs, particularly for solar PV, will have been a contributory factor.

There is no doubt that investment across the sector continued to be affected by the 2015 decision to close the RO scheme and the reductions of FIT rates seen in recent years.

The RO scheme closed to all new generation from March 2017, although grace periods mean the full impact on the sector has yet to feed through to the investment figures. See the timeline for a more detailed look at the impact of the RO.

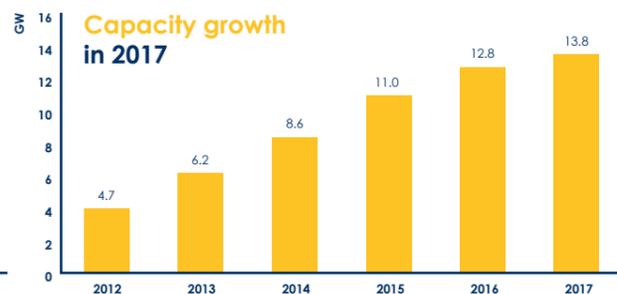


Biomass and hydro see strongest growth

In terms of technology, biomass saw the largest increase in capacity during the year, up 21.6% on 2016 with 66 new projects, including the 40MW Margam Green Energy Plant, a wood-fired power station in South Wales. Biomass still only makes up 4.4% of all independent generation capacity but due to its high load factor, contributes 11% of overall volume.

Hydro also delivered a healthy increase in project numbers and capacity. The 68 new hydro projects added 39MW of hydro capacity, an increase of 19% compared to 2016. Hydro now accounts for 1.8% of overall independent generation capacity and 3% of volume.

The 62 new onshore wind projects that went live during the year represented a rise of 3% in project numbers although several large sites helped boost capacity by 11.9%. Onshore wind now accounts for just over a third (34.2%) of independent generation capacity and 36% of overall volume.

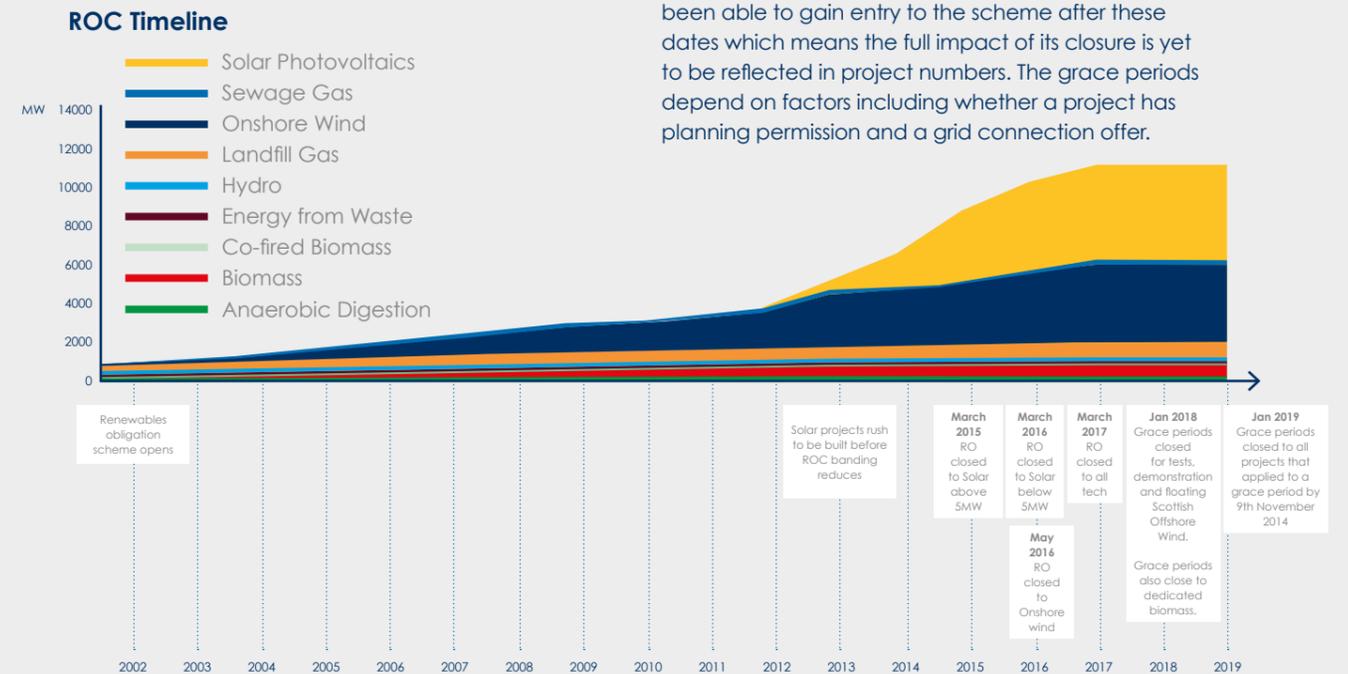


Renewables Obligation timeline

The Renewables Obligation (RO), introduced in 2002, was the UK's main support mechanism for large-scale renewable energy projects. The timeline below shows the impact of the scheme on the growth of the independent generation sector.

The scheme was closed to all new generating capacity from 31 March 2017. It had already closed to large-scale solar PV from 1 April 2015 and to onshore wind from 12 May 2016.

Under a grace period system, generators have still been able to gain entry to the scheme after these dates which means the full impact of its closure is yet to be reflected in project numbers. The grace periods depend on factors including whether a project has planning permission and a grid connection offer.



Developers behind majority of projects

With the sector changing, smaller generators such as farmers and landowners who used renewable projects to diversify their businesses are facing difficulties building a strong economic case for further projects. Farmer-owned capacity increased by just 3% during the year and that of landowners by 5%.

Developers, with their specialist knowledge and ability to spread cost and risk across a portfolio, were behind more than 90% of overall new capacity during 2017. The 223 new developer-owned projects represented an increase of 9% in 2017 and added 953.3MW of new capacity.

Although the rate of growth in onsite generation was the slowest since 2012, 69 new projects went ahead during the year, a rise of 8% on 2016's figure. Businesses are continuing to invest in onsite generation, but after several years of very strong growth they are now also likely to be looking at alternatives such as demand response to reduce energy costs.

The year saw 17 new community schemes, a rise of 13% on 2016 which saw the addition of 26.8MW of capacity, a 9% increase.

Regional divergence continues

Although England accounts for more than two-thirds of independent generation projects, Scotland and Wales are continuing to close the gap.

The devolved administrations each have their own long-term renewable targets which are more ambitious than the overall UK aim to deliver 15% of energy consumption from renewable sources by 2020.

Although the main support mechanisms for renewable energy are UK-wide, both Scotland and Wales have policy measures and funding schemes in place to drive increased renewable capacity. As renewables subsidies decline in the years ahead, further geographic divergence could develop as the sector grows.

Solar dominates in England

The 224 new projects in England during 2017, which took total numbers up to 4,923, represented growth of 4.8% on the previous year. England now accounts for 69% of all projects after investment of some £2bn.

The huge investments made in solar PV in recent years means the South West and South East of England now account for 29.4% of all GB independent generation capacity.

However, with suitable sites likely being harder to find in the solar PV hotspots in the south of England, developers have been more active elsewhere.

Scotland sees highest growth in projects

Scotland saw the highest percentage growth in overall project numbers across Great Britain, with a rise of 10.7% from 117 additional projects. Scotland's 21.7% share of total GB independent renewable generation capacity means it continues to punch significantly above its weight given its relative population size.

Onshore wind (84.3% of total capacity) remains by far the most significant technology in Scotland but hydro had a strong year, with 51 of the 68 new GB schemes located north of the border.

Overall, the volume of Scottish electricity generated from renewable sources has increased almost fourfold since 2000.

Wales gains ground

Wales has continued its impressive gains in project numbers and capacity, although from a relatively low base. It saw the biggest increase in capacity of independent renewable anywhere in the UK. The 59 new projects during the year – a rise of 9.6% - added just over 200MW to take capacity up to more than 1.25GW.

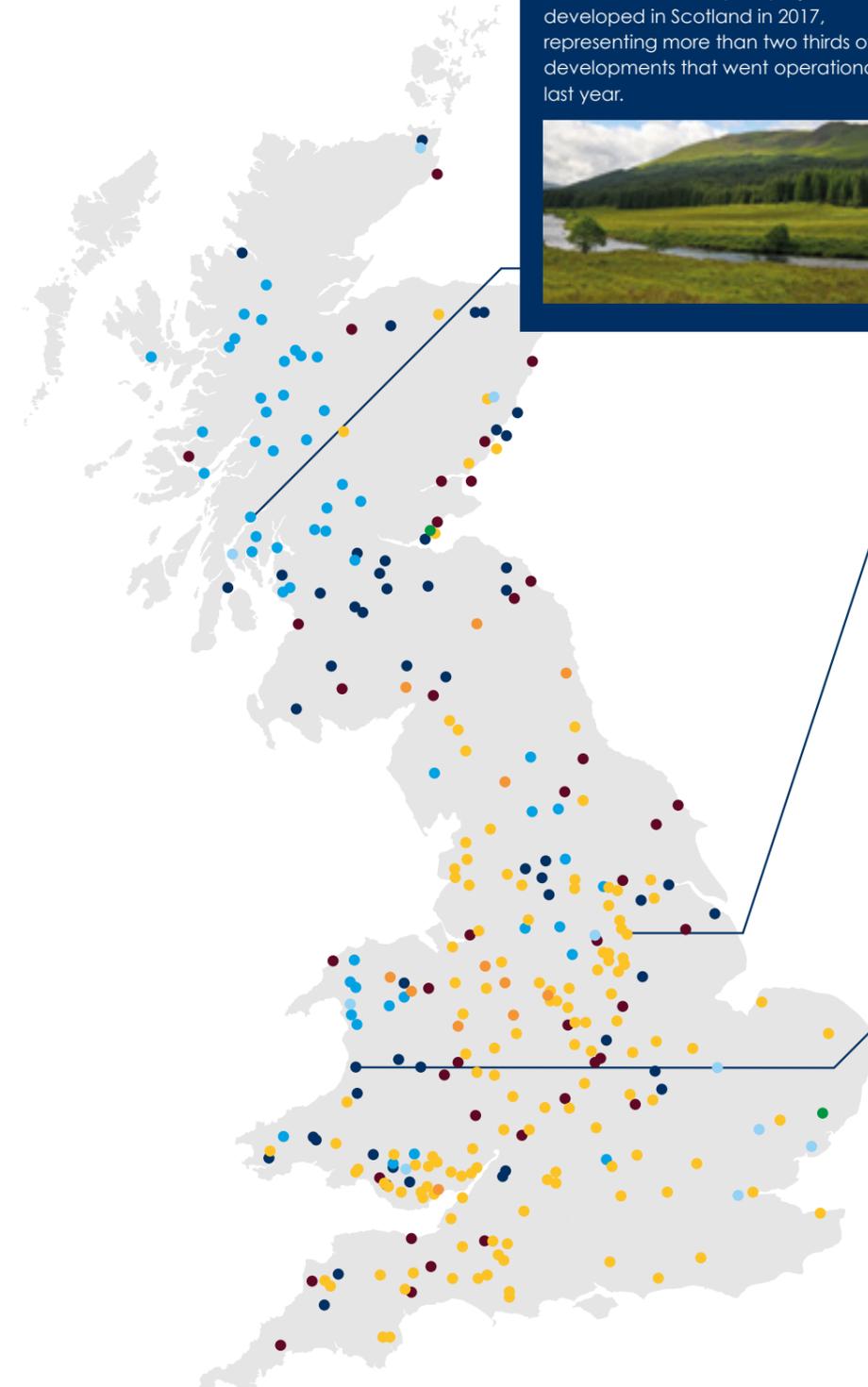
Onshore wind – which was overtaken by solar PV as the dominant technology in Wales in 2016 – jumped back into top spot after 15 new projects came on stream.

Overall renewable energy capacity in Wales has increased by 47% since 2014, making up 18% of the nation's total electricity generation.

Projects commissioned in 2017

Technology	Projects	Capacity (MW)
Anaerobic Digestion	13	3.0
Biomass	66	109.5
Energy from Waste	2	3.0
Hydro	68	39.0
Landfill Gas	11	1.1
Onshore Wind	62	502.1
Sewage Gas	2	2.9
Solar Photovoltaics	176	390.5

Projects commissioned in 2017 across Great Britain



Balliemanoach Hydro

Developer Wemyss Renewables

Installed Capacity 415kW

Balliemanoach is an ambitious project developed by Wemyss Renewables, consisting of two small "run of the river" hydro projects within 10 miles of each other, situated on the West Coast of Scotland. This was one of 46 hydro projects developed in Scotland in 2017, representing more than two thirds of developments that went operational last year.



Littlewood solar farm

Developer Foresight

Installed Capacity 3800kW

Littlewood solar farm has been developed by Foresight, located in Nottinghamshire, and costing significantly less than previous years due to component costs and design processes becoming more efficient. The project was one of the 130 solar projects developed over the course of the year in England representing 308MW of capacity.



Penbrymoelddu wind

Developer SternWind

Installed Capacity 500kW

Penbrymoelddu is one of the largest projects that SternWind have developed located south of Snowdonia National Park in Mid Wales. The project was one of 15 onshore wind projects in Wales, representing 93MW capacity developed in Wales in 2017, more capacity than the 85MW built in England.



Towards a subsidy-free landscape

Renewable energy projects capable of operating subsidy-free will be the exception rather than the norm for some time to come – particularly for less mature technologies - but it is seen as the long-term direction of travel for the sector.

A recent report¹⁰ showed that onshore wind and solar PV in the UK could both be viable without subsidies by 2025, unlocking some £20bn of investment by 2030. The beginning of that trend was highlighted during 2017 with the UK's first unsubsidised solar PV farm opening during the year¹¹, and several others currently in the pipeline.

In response to reducing subsidies, market participants are actively exploring creative solutions to fill the gap. Instead of looking at their asset as a single-technology renewable energy project, they are increasingly focusing on its potential as a power station with access to a number of different revenue streams in a dynamic market.

The key areas of focus are options around the co-location of assets, Corporate PPAs and new commercial approaches to maximising power revenues. The potential role of each of these areas is explored below.

The extent to which they might complement each other to build a business case will depend on the individual circumstances of a particular project.

Extending the concept of co-location

Co-location refers to increasing the generation intensity of a site by incorporating multiple assets, maximising generation output and grid connection capacity to benefit from higher prices and access new revenue streams.

While recent discussion on the topic of co-location has focused on adding battery storage to wind or solar projects, it could also include building multiple generation assets on the same site to share infrastructure.

Innovative developments are showcasing the different options available, such as the Levenmouth Community Energy Project in Scotland which features a wind turbine and solar PV connected to a hydrogen storage facility.

The co-location of batteries with renewable energy projects offers the ability to charge the battery at peak generation times - when all other projects are also generating, and prices are therefore lower – then release the electricity to the grid later when prices may be higher.

Combining this approach with other revenue streams, such as ancillary services, is essential to create the required value to cover the cost of the battery.



Corporate PPAs provide a win-win

A Corporate PPA is an agreement between a generator and a large, investment-grade energy consumer. A typical agreement involves a business agreeing to buy the power from a generation project at a guaranteed price for a long period, often up to 15 years. This commitment can be used by the generator to secure funding from a lender to build the project.

The concept of Corporate PPAs has existed for years but the removal of subsidy support for renewables is expected to see the number of agreements accelerate. According to a report¹² by the World Business Council for Sustainable Development, the fact that onshore wind and solar PV projects have been excluded from CfD auctions, for the time being, means more developers are looking at Corporate PPAs.

These agreements are attractive to large energy consumers as they can provide long-term price certainty for part of their energy supply. They could also support the company's sustainability ambitions, demonstrating additionality by enabling a project that might not otherwise get built, or creating local community engagement.

Our estimates show that 1.6TWh were consumed through corporate PPA's last year, with the retail and banking sectors being among the most active, accounting for more than half of capacity. BT, Nationwide and Sainsbury's are among the UK companies to have Corporate PPAs in place for some of their energy needs.

Given the complexities and long-term nature of Corporate PPAs, they require generators, consumers and energy suppliers to work together to structure agreements which meet the requirements and aspirations of all parties.

The market is evolving quickly, and different commercial options are becoming available to support generators with these new opportunities.

New approaches to project commercials

As the independent sector has matured and generators have developed greater insight into how their assets perform, energy entrepreneurs are challenging the conventional approach to selling their power.

The simplest way to do this is through their PPA, adopting a more active hedging strategy to take advantage of wholesale price movements. This could include hedging across multiple decisions rather than taking the traditional 'once-a-year' price fix, or tracking the market more closely using objective market analysis or trigger-based decision-making.

For more experienced generators, an alternative may be to package power into smaller unit bundles to take advantage of different market products. For example, opting to sell power in shorter blocks when they expect demand to be higher rather than fixing prices for longer baseload time periods.

Other developers are looking to extend their project horizons, taking advantage of technology improvements which have increased asset lifespan. This could be part of a proposed plan to build subsidy-free renewables or the justification to refinance an existing project to spread the cost of repayments over a longer period.

Proven partner of independent generators

SmartestEnergy is a next generation energy company. We work with a network of independent energy entrepreneurs who are building a cleaner, more decentralised and resilient energy system in the UK.

Established in 2001, we have been on the journey alongside generators and are always innovating to find new commercial opportunities in the changing energy landscape.

Our 3GW portfolio consists of over 600 projects across the UK, from specialist developers and blue-chip companies to farmers, landowners and communities.

We work with generators across all technologies and are backed by the financial strength of the Marubeni Corporation.

As well as being the UK's leading purchaser of independent generation, we are also a renewable electricity supplier and provider of demand response services to UK businesses.

This experience across the energy landscape and our long, proud heritage in the renewables sector makes us the trusted partner of independent generators.

Connect with us

If you would like to find out more about how we could support your generation project, please contact us.

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Methodology

Renewable project figures have been compiled from publicly available project data from the Ofgem FIT Register and the Ofgem Renewables Register as at 31st December 2017. Projects commissioned before this date but not yet accredited are therefore not included and will be captured in future reports.

Battery storage figures have been compiled from a range of publicly available databases such as the National Grid Capacity Market registers for the Early Auction and T-4 Auction in addition to the Enhanced Frequency Response register. Operational storage projects have been compiled from the United States Department of Energy Global Energy Storage Database.

For the purposes of the Energy Entrepreneurs Report, commercial-scale schemes are classed as those with a capacity of 50kW or more. Independent projects are defined as those not owned by an electricity supply company.

Value of generation is based on a wholesale energy price of £44.67 per MWh (average APX Reference Price Data for 2017) and household usage of 3.70MWh a year from Energy Consumption in the UK (ECUK) 2016 by BEIS, 30 November 2016.

Load factors for different renewable technologies are estimated as: Anaerobic Digestion 62.80%; Biomass 61.70%; Co-Fired Biomass 78.6%; Energy from Waste 32.10%; Hydro 34.00%; Landfill Gas 50.40%; Ocean Energy 0.00%; Onshore Wind 27.90%; Sewage Gas 44.30%; Solar PV 11.10%. (Source: Renewable sources of energy: Chapter 6, Digest of United Kingdom Energy Statistics (DUKES) – 6.5 Load Factors for renewable electricity generation)

Investment data is based on capital investment costs from BEIS electricity generation cost report published by BEIS, 9th November 2016.

Sources

- 1 <https://www.wwf.org.uk/updates/britain-set-greenest-year-ever-clean-energy-breaks-all-records-2017>
- 2 <https://www.wwf.org.uk/updates/britain-set-greenest-year-ever-clean-energy-breaks-all-records-2017>
- 3 <https://www.carbonbrief.org/analysis-uk-cuts-carbon-record-coal-drop>
- 4 <https://about.bnef.com/clean-energy-investment/#toc-download>
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- 11 <http://anesco.co.uk/clayhill-uks-first-subsidy-free-solar-farm/>
- 12 https://www.wbcsd.org/Clusters/Climate-Energy/Resources/Corporate_Renewable_PPAs_Scaling_up_globally