nationalgrid DSO

Distribution Future Energy Scenarios 2024

South Wales Regional Review

January 2025

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Foreword by National Grid DSO

This DFES represents a very important time in our transition to net zero.

The introduction of the National Energy System Operator and a greater level of strategic direction in how network should be readied for net zero puts an onus on National Grid Distribution System Operator to plan the network of the future and explain the implications to our key stakeholders.

We have worked with Regen to help us understand what the changes that are forecast throughout the 25 years might mean for our distribution network. Our bottom-up approach is driven by the need as Distribution System Operators to map the projections to a granular level to analyse the impact on our networks and design solutions to continue to operate and maintain a safe and secure network.

One of the key messages for DFES 2024 is to understand the scale of the growth, not only in the long term but also the medium term. In 2035 we predict that our regions will have between 5 and 9 million electric vehicles and between 1 and 3 million domestic heat pumps. This will rise to between 10.8 and 12.6 million electric vehicles, between 5.2 and 8.2 million domestic heat pumps by 2050 to align to the net zero compliant pathways. This regional review focusses on our South Wales licence area.

This represents a significant challenge to design and build a distribution system that can accommodate the needs of our customers by 2050. The system will need to be smarter and utilise the flexibility our customers can provide to make the most use of our resources to deliver the additional capacity we require. DFES is the key starting point for this, giving us early insight and then driving the investment we make in our network more proactively than we ever have before.

With each annual DFES cycle we incorporate and project new technologies in our analysis. In DFES 2024 we have explored the how the electrification of aviation, maritime, rail and agricultural machinery will impact of operation of our distribution system. These are sectors with significant uncertainty on the pathway to net zero, so early insight is key to ensure that we can support these customers on their decarbonisation journey.

The cornerstone of these scenarios is the input from our stakeholders; the scenarios are simply a reflection of the expected needs of our customers. Through our DSO Strategic Engagement Officers we have established strong relationships with our local authorities. We engage extensively with stakeholders through webinars to gather feedback and bilateral discussions to discuss specific projects and data we can share with each other. This year we have incorporated Local Area Energy Planning data as well as major industry and business with nearly 8,000 local projects and plans into this year's forecasts. Thank you to all of our stakeholders for their continued input and feedback on DFES, it would not be possible without you.

We are committed to continual improvement of how we plan and develop our distribution system. We welcome any feedback on the DFES process and outputs and would like to work with our stakeholders to improve the accessibility and comprehensiveness of our DFES.

Cathy McClay
Managing Director of Distribution System Operator

The DFES process

The Distribution Future Energy Scenarios outline the range of credible pathways for the change in connections to the distribution network out to 2050.

Using the National Energy System Operator (NESO) Future Energy Scenarios (FES) framework, these projections are informed by local and regional stakeholders and encompass changes in electricity generation, storage and demand (including electrified transport and heat).

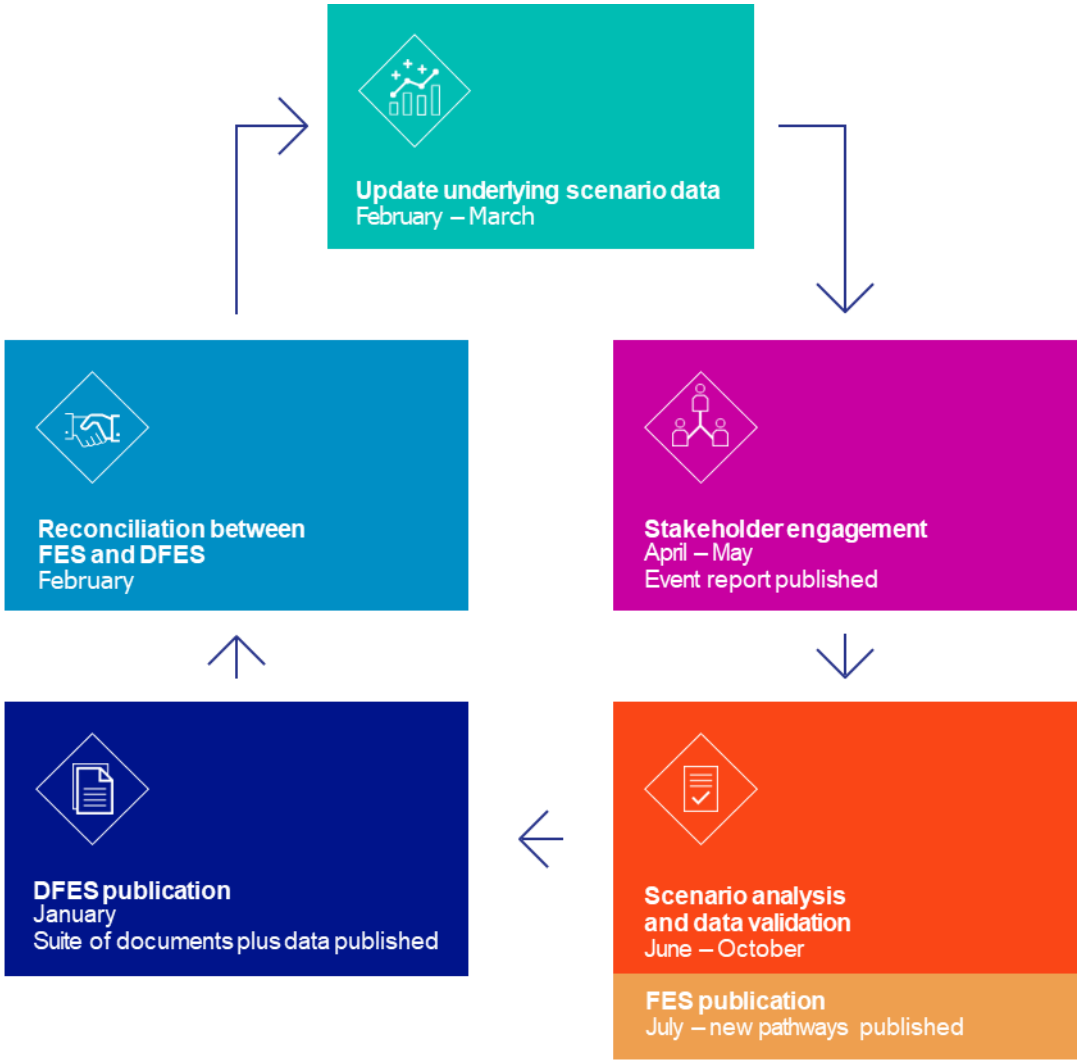
The NGED DFES is produced annually to allow for scenario projections to be regularly updated to reflect the latest information available. The DFES is published around the end of the calendar year, a few months after the release of the FES. This allows the DFES analysis to integrate the high-level scenario framework and assumptions from the latest FES as well as undertake a reconciliation between the FES and the DFES outcomes for each technology, scenario and licence area.

Of the four FES pathways, three are compliant with the UK's target to reduce carbon emissions by 100% and achieve 'net zero' by 2050. A fourth non-compliant scenario is also modelled.

The factors used to project deployment at a local level are the result of an extensive programme of stakeholder engagement which includes consultation with developers, local authorities, technology companies, major energy users and community energy groups. This is supplemented by an additional analysis of existing trends, spatial data and future technology innovation.

These factors are then combined with the national FES framework and overarching assumptions to produce the DFES scenario analysis.

Distribution future energy scenarios regional information



The South Wales licence area

The NGED South Wales licence area is home to over 80% of the Welsh population, with around 1 million households and urban areas of Cardiff, Newport, and Swansea. However, the majority of the land in the licence area is highly rural across Mid Wales and the Brecon Beacons National Park.

As of September 2024, there were around 800 distributed electricity generation sites operating in the South Wales licence area, totalling around 2.4 GW.

Distributed generation in the area has changed significantly in recent years, with over 50% of current capacity connecting since 2016.

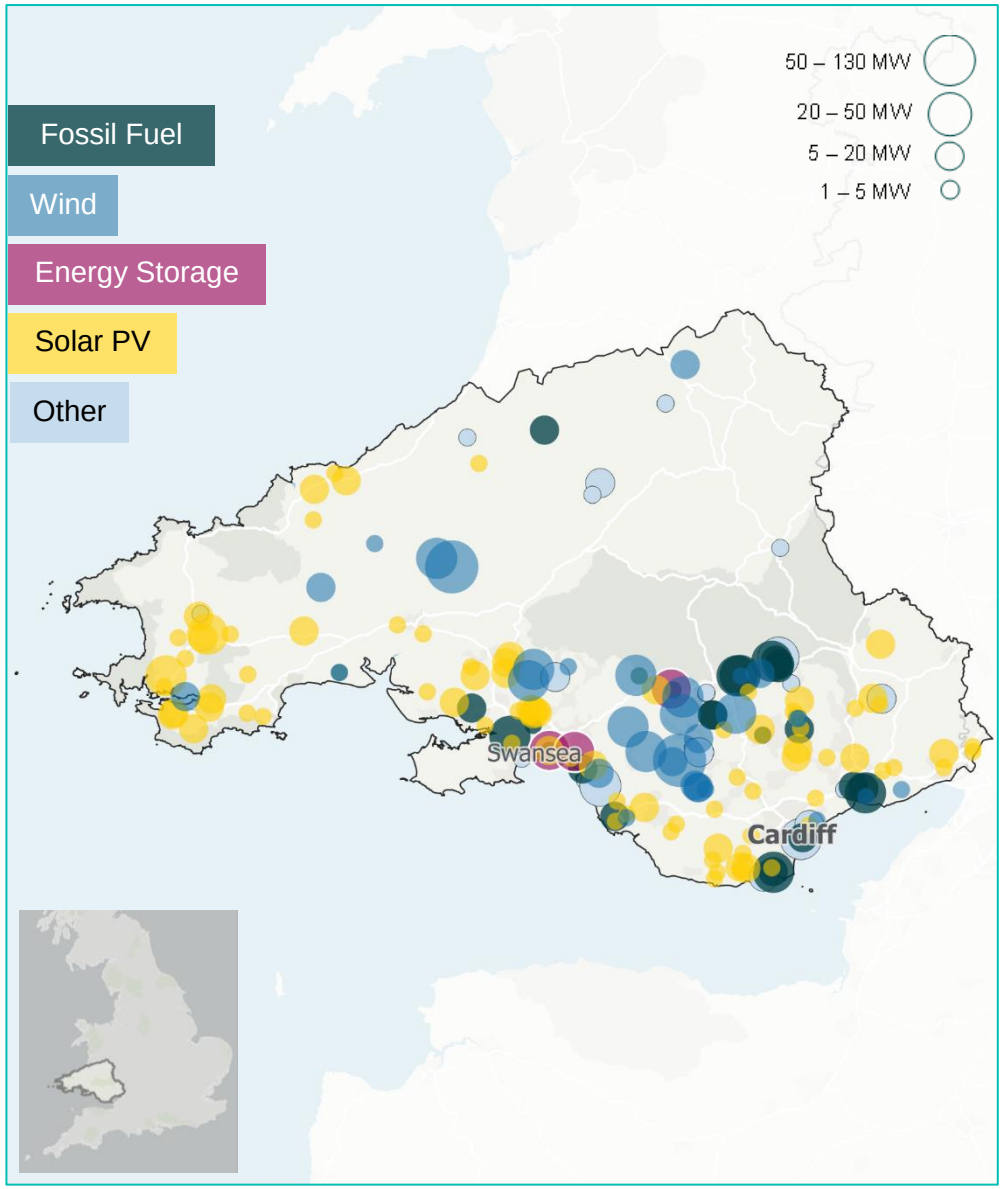
Due to good levels of resource and a supportive planning policy environment, a lot of the distributed generation capacity in South Wales is comprised of onshore wind and solar PV. There is comparatively less battery storage capacity operating in the licence area compared to other parts of the UK. This is in part due to historic network constraints previously preventing the connection of new thermal generation and storage projects.

Electricity demand has continued to evolve more slowly, with only around 2% of vehicles in South Wales being EVs and less than 1% of households having an electric heat pump to date.

South Wales is a UK industrial hub, home to the South Wales Industrial Cluster and several large-scale energy consuming customers, such as Valero, Solutia and the Port Talbot Steelworks. Recent announcements confirmed that the steelworks is planning to move away from its current production route to recycled steel, using electric arc furnaces. This will require significantly more electricity, likely to connect at transmission level.

Several other businesses in South Wales are also looking at low carbon technologies, renewable energy and decarbonisation strategies that will impact the electricity network.

South Wales licence area – baseline connections



Distributed electricity generation in South Wales

As of September 2024, there was 2.4 GW of distributed electricity generation in the South Wales licence area.

Renewable energy accounts for around 70% of this connected capacity, with the majority coming from onshore wind and large-scale solar.

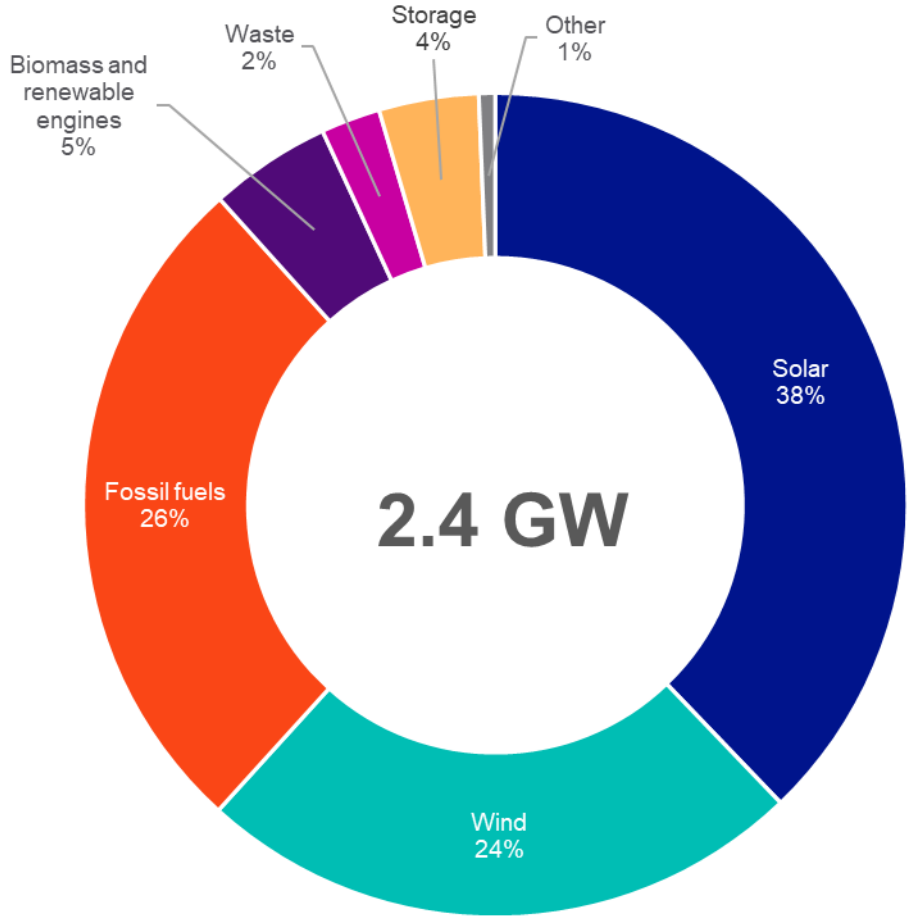
Fossil fuel generation accounts for around 25% of this capacity, including over 500 MW of gas fired generation and over 100 MW of diesel engines.

The majority of electricity generation is concentrated in the more populated and infrastructure dense areas to the south of the licence area. Mid-Wales is highly rural and hosts few large-scale electricity generation projects.

There is a significant deployment of onshore wind in the licence area, with a concentration of sites in the South Wales Valleys south of the Brecon Beacons. Solar PV has also been deployed across the south and has seen growth in recent years.

The largest power generation site in the licence area is the 80 MW Bryngolwg Solar Farm near Aberdare, which came online in 2023.

Regions around the population centres of Cardiff and Swansea host most of the licence area's existing fossil fuel generation capacity, alongside the first large-scale battery storage projects to connect in the licence area. Other generation technologies such as waste incineration, landfill, sewage gas and biogas engines, are also found in these more industrial areas.



Near-term pipeline in South Wales

There are currently over 278 electricity generation and storage projects in the pipeline, totalling around 6 GW, that hold accepted connection agreements to potentially connect to the distribution network in South Wales.

This pipeline is heavily dominated by prospective new large-scale solar farms, onshore wind farms and standalone grid-scale battery storage projects, located across the licence area.

The development potential of each pipeline site has been assessed through analysing spatial planning databases and capacity market auctions and augmented by direct engagement with project developers.

There is currently 101 MW of solar capacity that has secured a Contract for Difference agreement and just under 400 MW that has secured planning approval.

The 14 MW Hendy Wind Farm is currently under construction in Powys, and a further 100 MW of onshore wind capacity has secured planning approval.

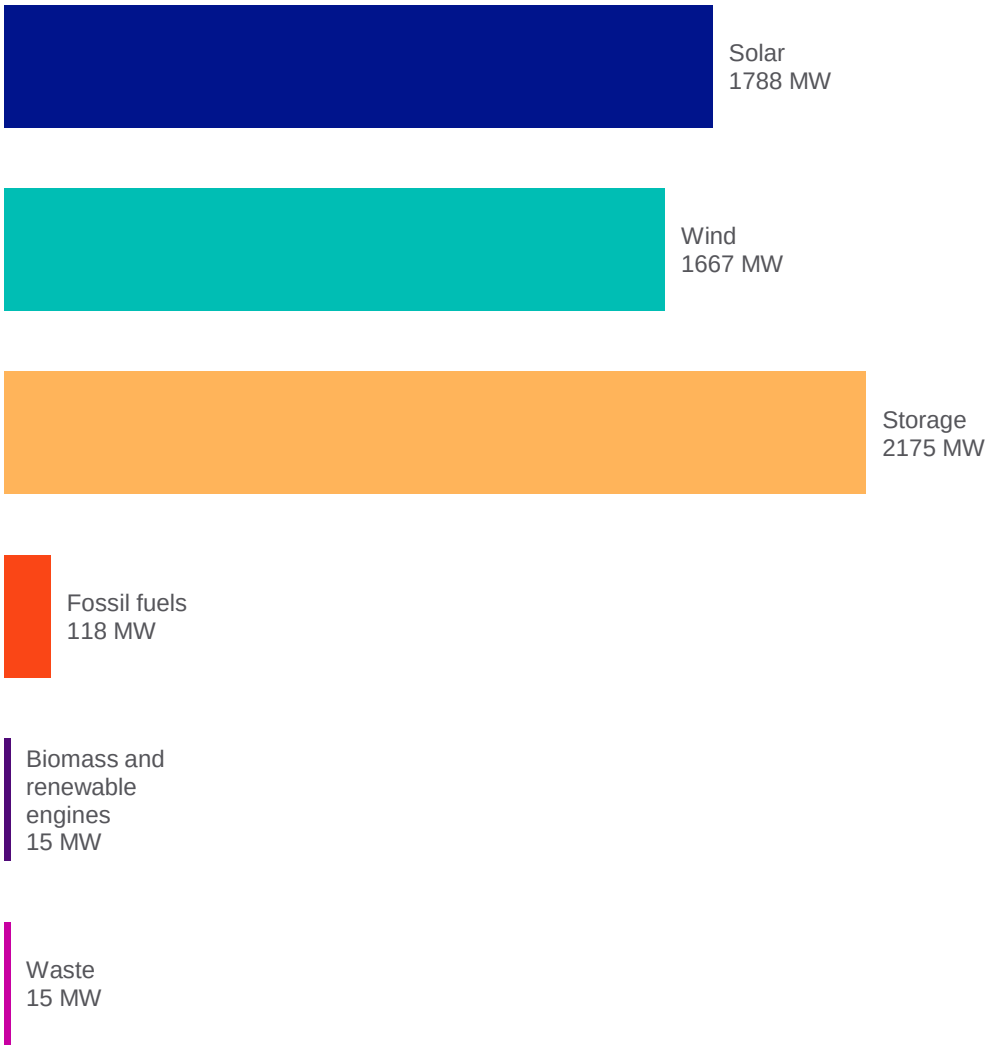
A relatively small proportion of the large 2.2 GW pipeline of battery storage projects in the licence area have entered the planning system, with 394 MW obtaining planning permission and a further 282 MW either securing pre-planning screening opinions or submitting full applications.

Grid connections reform

To try and tackle the significant queue of projects seeking to connect to the network, a range of grid connections reforms have been explored by the industry in the last 12 months.

As part of the ENA's 3-step Action Plan for reforming grid connections, NGED DSO launched a Technical Limits initiative, giving DNOs the ability to accelerate the connection of generators subject to wider Transmission Reinforcement Works. Technical Limit Offers provide distribution customers with the option of an interim non-firm connection arrangement, enabling more agile and 'shovel-ready' customers to connect earlier.

NESO has consulted on a number of significant changes to help accelerate the connection queue, and is now in the implementation phase. The revised approach requires projects to meet certain criteria related to land rights and planning permission to be given a queue position. This could result in effective fast-tracking for projects that are 'shovel ready' and could have a significant impact on future project pipelines seeking to connect to the distribution network.



Stakeholder engagement

Insights and evidence from stakeholders is a crucial input to the DFES process. Engaging with a diverse range of stakeholders ensures that the scenario projections are accurate, up to date and regionally relevant.

The DFES undertakes a range of stakeholder engagement activities to inform the analysis, this includes:

- A series of consultation webinars, one per licence area, gathering views from regional stakeholders on a range of technology sectors
- Every local authority in NGED's licence areas was proactively contacted, seeking feedback on local decarbonisation initiatives, new property developments and local area energy plans (LAEPs)
- Direct engagement with project developers, including many of those who hold accepted connection offers with NGED
- A questionnaire to a selection of major energy users in the licence area, seeking information around their decarbonisation strategies and future electricity demand requirements.

The four consultation webinars were held in June 2024, with 239 attendees across the four licence areas. Attendees were asked their views on:

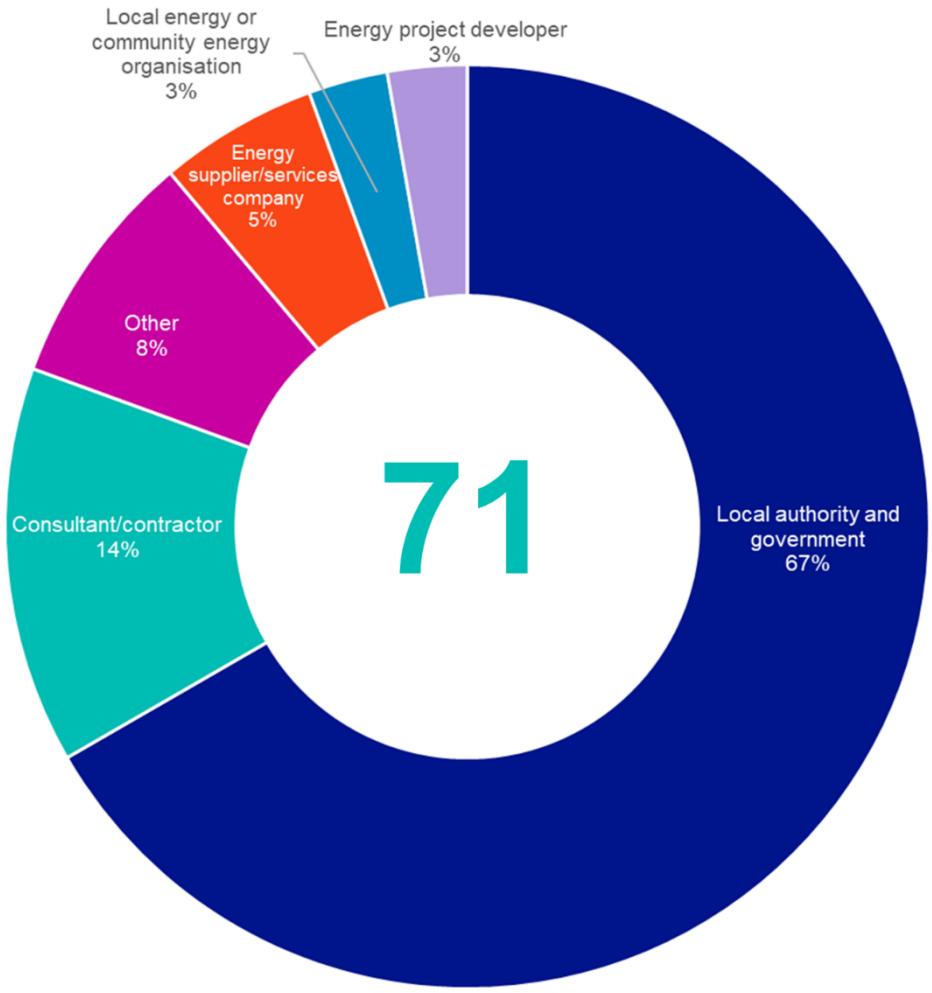
- Their level of engagement with NGED and with the DFES process
- Welsh Government energy policies and could impact the uptake of low carbon and renewable energy technologies in South Wales.
- The potential near-term development of new large-scale solar PV
- Factors that could impact households installing rooftop solar PV
- Factors driving the deployment of grid-scale battery storage
- The planning landscape for new fossil fuel generation projects
- The future focus for the adoption of en-route EV charging
- Factors that will drive on-gas households to switch to a heat pump
- The role of low carbon hydrogen for space heating in South Wales

Stakeholders also provided views on several open-form questions and shared relevant policies, initiatives and projects relevant to the region.

Several hundred stakeholders were engaged to inform DFES 2024, across the webinars, local authority teams, LAEP teams, major energy users, Welsh government and technology sector representatives.

These results, specific views and information shared were analysed and incorporated into the analysis for DFES 2024. The feedback provided refined regional spatial factors and uptake factors for specific technologies, as well as informing and sense-checking the assumptions applied in the modelling.

South Wales webinar attendees – by sector



Working with local authorities

Local authorities have historically been crucial stakeholders and key sources of data and insight to both the DFES process and wider network planning. From new housing data, regional strategies for renewable energy, transport and heat decarbonisation, insights from local authorities remains a core input to the analysis, spatial modelling and assumptions.

New homes and new industrial and commercial properties can have a significant impact on local electricity demand. In addition to representing new points of conventional electricity demand, these properties typically have higher building standards and could be hotspots for low carbon technologies such as heat pumps, EV chargers and rooftop solar PV. The DFES models new homes and commercial and industrial developments out to 2050 and is based on a data exchange and direct engagement with relevant local authority housing and planning departments.

This year, over 10,000 individual data records were provided and assessed to model the potential future impact of new property developments across the NGED licence areas.

High and low buildout scenarios were produced to model the variable building rates of these developments out to 2050. As a result, between 104,000 and 140,000 new homes were projected to be built in the South Wales licence area by 2050.

Local authorities were also asked about plans, strategies, targets and policies for low carbon transport, heat, renewable generation, waste, hydrogen and climate declarations in their area. The information provided was used to inform the analysis of the potential uptake and evolution of the various technologies in relevant local areas

Local Area Energy Plans – reconciling targets to DFES results

Local authorities are continuing to develop Local Area Energy Plans (LAEPs), with more commissioned reports being published each year. Through wider engagement with NGED's Strategic Engagement Officers and through the DFES local authority survey process, published LAEPs have been collected, technology specific targets reviewed and compared to the four DFES scenario projections for equivalent areas.

Any variances identified between LAEP targets and DFES results have been assessed between Regen and NGED. Some adjustments to the upper envelope of the scenario projections have been resultantly applied where local authorities have a high, or very high, level of ambition e.g. for rooftop solar deployment, heat pump adoption or EV charger installations.

Welsh Government energy strategy

The South Wales licence area has unique drivers and factors for the uptake and deployment of distributed generation, electricity storage and demand, due to specific Welsh Government policies, targets and ambitions.

The Welsh Government has several devolved energy policy responsibilities and has recently announced plans to reform and streamline the planning system for renewable energy projects. Under these new plans, decisions on renewable energy projects up to 50 MW will be made by Planning and Environment Decisions Wales (PEDW). Meanwhile, planning policy for Developments of National Significance (NDS) will remain with the Welsh Government, including all onshore wind of more than 50 MW capacity, and any other generation between 50 MW and 350 MW.

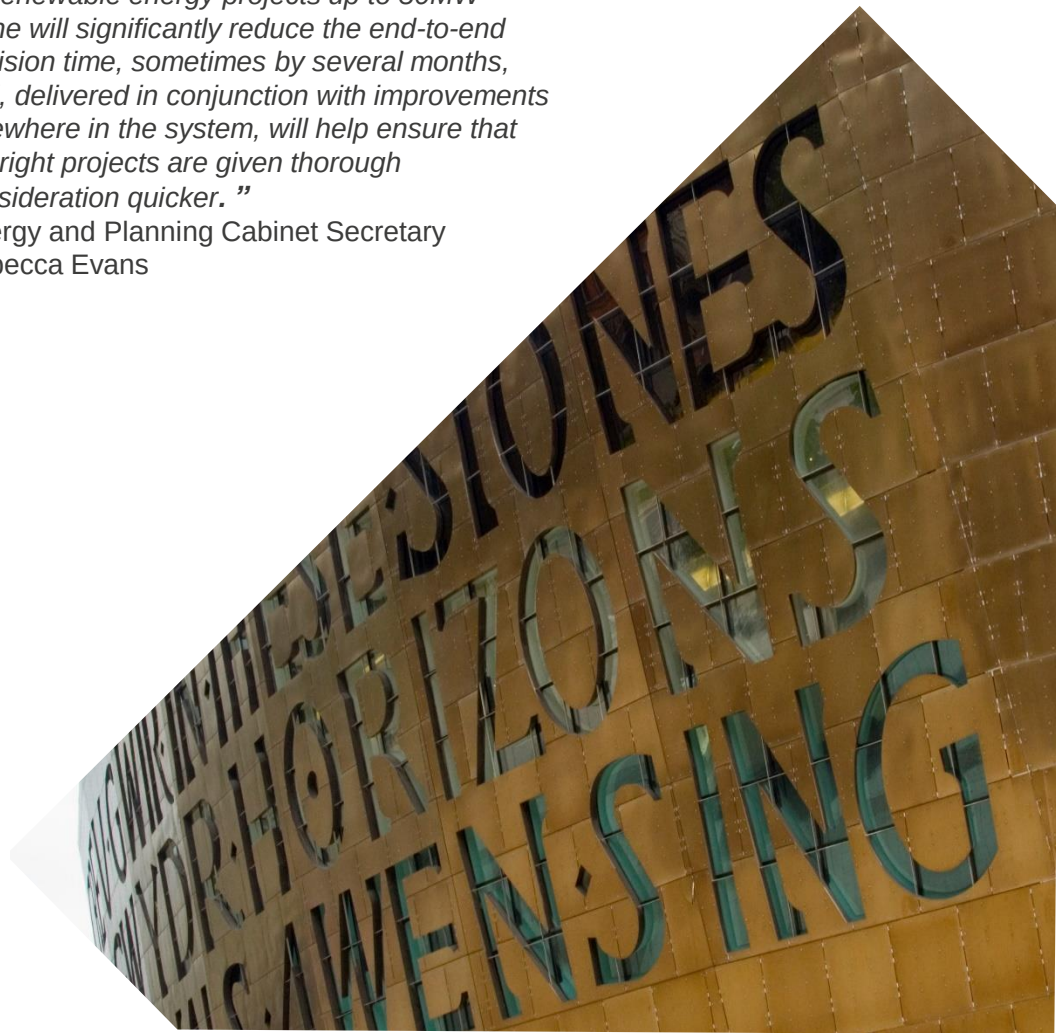
The impact of these devolved policies and responsibilities can be seen in the pipeline, with a record number of NDS applications determined in 2024, and a total pipeline of 3.5 GW of potential distributed renewable energy projects in South Wales. In contrast, NGED's other licence areas in England are anticipated to have little to no onshore wind development in the near term.

In July 2024, the Welsh Government launched a publicly owned renewable energy developer, focusing on accelerating the developing of onshore wind projects. Trydan Gwrdd Cymru works alongside Natural Resources Wales to develop large-scale onshore wind projects on public land

Welsh Government has several ambitions for low carbon energy development in Wales, including several 2035 energy targets such as 1.5 GW of locally owned renewable energy capacity (excluding heat pumps), 580,000 installed heat pumps, and the equivalent of 100% of annual electricity consumption generated by renewables. The Future Wales national plan sets out specific pre-assessed areas for wind and solar energy, which are directly reflected in the projections for these technologies.

Further Wales-specific policies, such as designated areas for renewable projects, changes to building regulations and a memorandum on new energy from waste projects are also considered in the DFES analysis. Furthermore, Welsh Government actions to address the recommendations by National Infrastructure Commission for Wales' Preparing Wales for a Renewable Energy 2050 report could play a significant role in energy infrastructure, planning and regulation in Wales, and will be considered in DFES analysis.

"Delegating decision making powers to PEDW on renewable energy projects up to 50MW alone will significantly reduce the end-to-end decision time, sometimes by several months, and, delivered in conjunction with improvements elsewhere in the system, will help ensure that the right projects are given thorough consideration quicker."
Energy and Planning Cabinet Secretary
Rebecca Evans



Summary of results in 2030 and 2035

In line with the UK government's Clean Power 2030 and net zero 2050 ambitions, the DFES results in both 2030 and 2035 show how distributed electricity generation, storage and demand could change in the South Wales licence area in the near and medium term.

DFES scenario	Scenario description	Renewable energy capacity (GW)			Electricity storage capacity (GW)		
		Baseline	2030	2035	Baseline	2030	2035
Counterfactual Not UK net zero compliant	The only scenario in which net zero is missed, though some progress on decarbonisation is achieved. Significant use of gas remains across a range of sectors, particularly in power and space heating. Electric vehicle uptake is slower than other scenarios and overall lower levels of renewable energy is deployed under this scenario.	**1.6 GW** Including: 0.9 GW solar PV 0.6 GW wind 0.1 GW other RE	**2.5 GW**	**3.1 GW**	**0.1 GW** Including: 75 MW large-scale 22 MW small-scale	**0.5 GW**	**0.5 GW**
Hydrogen Evolution UK net zero compliant	Net zero is met through an accelerated adoption of hydrogen, particularly for industry and space heating. Consumer engagement is lower overall than other net zero scenarios, but electric car uptake remains high. Notable levels of renewable energy is still deployed, but hydrogen power generation and hydrogen storage provides the majority of system flexibility under this scenario.		**3.2 GW**	**3.9 GW**		**0.5 GW**	**0.6 GW**
Electric Engagement UK net zero compliant	Net zero is met through significant levels of electrification of energy demand. Highly engaged consumers adopt heat pumps, a range of smart technologies and electric vehicles. Significant levels of renewable energy generation and electricity storage are seen under this scenario.		**4 GW**	**5.1 GW**		**0.6 GW**	**0.8 GW**
Holistic Transition UK net zero compliant	Net zero is met through a mixture of electrification and low carbon hydrogen. Hydrogen is focused on decarbonising heavy industry. Consumer engagement is very high, shifting demand, adopting electric vehicles and heat pumps. The highest level of renewable energy is seen under this scenario, alongside significant levels of electricity storage to provide system flexibility.		**4.1 GW**	**5.5 GW**		**0.7 GW**	**0.9 GW**

Summary of results in 2030 and 2035

DFES scenario	Battery electric vehicles (000s)			Domestic heat pumps (000s)			Hydrogen electrolysis capacity (GW)		
	Baseline	2030	2035	Baseline	2030	2035	Baseline	2030	2035
Counterfactual Not UK net zero compliant	**18.5** 2% of all vehicles	**185** 13% of all vehicles	**501** 34% of all vehicles	**13** 1% of homes	**59** 6% of all homes	**117** 10% of all homes	**0 GW**	**0.02 GW**	**0.06 GW**
Hydrogen Evolution UK net zero compliant		**251** 17% of all vehicles	**733** 50% of vehicles		**116** 11% of all homes	**324** 27% of all homes		**0.15 GW**	**0.3 GW**
Electric Engagement UK net zero compliant		**435** 30% of all vehicles	**1,083** 74% of vehicles		**116** 11% of all homes	**348** 29% of all homes		**0.1 GW**	**0.1 GW**
Holistic Transition UK net zero compliant		**249** 17% of all vehicles	**731** 50% of vehicles		**127** 11% of all homes	**385** 31% of all homes		**0.1 GW**	**0.2 GW**

Renewable generation

There is currently 0.7 GW of large-scale solar PV, 0.6 GW of onshore wind and 0.1 GW of other renewables connected in the South Wales licence area. There is also a very large 3.5 GW pipeline of potential new solar projects that hold accepted connection offers.

South Wales has historically seen a high level of large-scale solar PV deployment. In the past year alone, 85 MW of new large-scale solar projects have connected in the licence area.

South Wales is host to a significant amount of suitable land for solar and wind development. This is combined with strong wind speeds, moderately high solar irradiance and a history of support for renewable energy projects from local planning authorities and Welsh Government. These factors mean that the installed capacity of both large-scale solar and onshore wind in the South Wales licence area is projected to increase substantially out to 2050 in all scenarios.

This is reflected in the significant 1.8 GW pipeline of new solar and 1.5 GW of new wind capacity seeking to connect to the distribution network. Of this pipeline, there are currently 26 projects in the South Wales licence area with granted planning permission, totalling over 0.5 GW. The Contracts for Difference Allocation Round 6 also supported new renewable projects in South Wales, with three large-scale solar PV projects, totalling 101 MW, being awarded contracts in Allocation Round 6.

By 2050, the capacity of large-scale solar and wind generation in South Wales ranges from 2.9 GW under the least ambitious scenario (over three times the current baseline) to 3.2 GW in the most ambitious scenario.

Fossil-fuelled generation

There is currently 0.6 GW of operational fossil-fuelled generation capacity in the licence area. This is dominated by two large-scale gas-fired plants and a number of smaller gas reciprocating engine sites and diesel generators installed at commercial and industrial premises.

The majority of the operational fossil-fuelled generation in the licence area stems from gas CCGT and CHP plants at Pembroke Refinery, totalling 61 MW and 50 MW respectively. The continued operational of these as unabated fossil fuel power generation sites is at odds with net zero.

Deployment of gas-fired generation is slowing overall as GB looks to decarbonise its electricity system. There are currently 4 fossil fuel generation projects, totalling 100 MW of capacity, with an accepted connection offer with NGED. Some of this capacity is already under construction and other sites have well advanced planning applications.

In the net zero scenarios, fossil gas generation capacity is modelled to decrease across the late 2020s and 2030s as GB moves to lower carbon forms of dispatchable generation such as batteries, hydrogen-fuelled generation and bioenergy, alongside demand-side flexibility.

By 2050, all installed fossil fuel generation capacity disconnects from the distribution network in the licence area under the net zero scenarios.

Electricity storage

There is currently just under 0.1 GW of operational battery storage capacity in the licence area. This baseline capacity is mostly accounted for by standalone large-scale battery storage projects providing grid services. There are also a few smaller battery storage assets installed in homes and businesses in the licence area.

Grid-scale battery storage has become one of the most active development sectors in the UK, with numerous developers and four listed capital investment funds seeking to develop battery storage projects at various scales across the country.

South Wales has seen a relatively small deployment of battery storage capacity coming online, this is partially related to previous network constraints preventing the connection of new thermal generation and storage.

This restriction has since been resolved and much like the rest of the UK, there is resultantly a very large, 2.2 GW pipeline of prospective new battery storage projects seeking to connect to the network in the South Wales licence area. However, with significant new reforms to grid connection policy and a challenging environment for battery storage revenues, it is likely that only a limited proportion of this pipeline will progress through to development. This is partially evidenced by only 0.4 GW being found to have planning approval to date.

There is the potential for battery storage to also co-locate with solar and wind generation projects in the licence area, as well as more behind-the-meter installations in homes and businesses.

Under the most ambitious scenario, some 1.4 GW of battery storage could be in operation by 2050, providing flexibility to the wider electricity system.

Photo credit: Next Energy Capital

Hydrogen

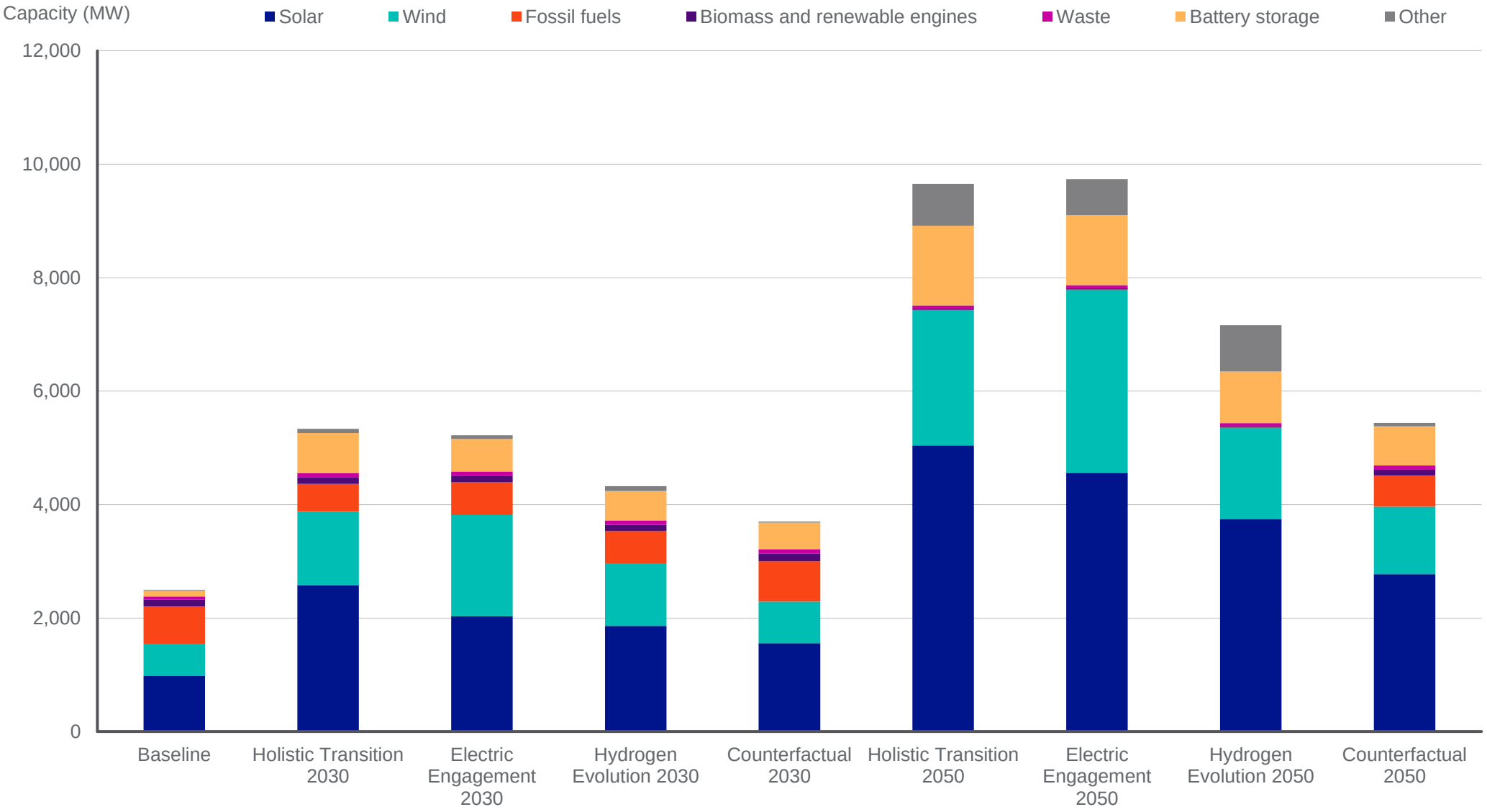
The production and use of low carbon hydrogen has the potential to impact a number of aspects of the energy system, from decarbonising heavy industry, transport and heat, as well as a potential source of flexible electricity generation to displace fossil-fuelled generators.

To date there has been very limited development of hydrogen projects in the South Wales licence area. However, the production of hydrogen through electrolysis could be a significant new source of electricity demand to provide low-carbon hydrogen to end consumers, such as industry and heavy transport hubs.

The UK government's Electrolytic Hydrogen Allocation Round incentive programme has supported several projects across the UK. Further rounds of this scheme could enable the business case for further electrolysis projects.

Four hydrogen electrolysers projects totalling 96 MW have accepted connection offers with NGED in South Wales. The largest of these being the 53 MW Magnor Net Zero project located in Monmouthshire. By 2050, under the most ambitious scenario, around 0.6 GW of hydrogen electrolysis capacity could be operational in the South Wales licence area. In addition to this, under some scenarios, up to 0.7 GW of hydrogen fuelled electricity generation could be connected in the licence area and replace existing fossil-fuelled generation sites.

Distribution-connected generation and storage scenarios – NGED South Wales licence area



Low carbon heat

The decarbonisation of heating in homes and businesses will be a core aspect of the transition to net zero. Part of this transition is going to include a significantly increased adoption rate of heat pumps to replace existing fossil fuel or lower-efficiency electric heating in many areas.

The DFES scenarios consider a range of outcomes for the decarbonisation of space heating in domestic and non-domestic properties. However, all four scenarios still show a significant increase in the adoption of heat pumps out to 2050.

In South Wales, currently over 66,000 homes are heated by a form of electric heating, including over 7,000 heat pumps.

The UK government and Welsh Government have a number of policies that will impact the uptake of heat pumps in the near-term. This includes a UK target to increase annual heat pump installations to 600,000 per year by 2028. Policy measures through the Labour Government's Warm Homes Plan also seek to provide funding support for social housing upgrades, clean heat technology solutions (such as a continuation of the Boiler Upgrade Scheme) and proposed improvements to the EPC standard. Welsh Building Regulations also require new homes to be installed with a heat pump or district heating.

As a result of these factors, an accelerated uptake of heat pumps in homes and businesses is seen in all scenarios in South Wales. Under the most ambitious scenarios, around 1-1.1 million homes are modelled to use a form of heat pump (including heat-pump-driven district heat) by 2050, accounting for the majority of homes in the region.

DFES scenario	Number of homes with domestic heat pumps	
	By 2035:	By 2050:
Counterfactual Not UK net zero compliant	**111,000** non-hybrid heat pumps **3,000** hybrid heat pumps **3,000** district heating heat pumps	**654,000** non-hybrid heat pumps **1,000** hybrid heat pumps **13,000** district heating heat pumps
Hydrogen Evolution UK net zero compliant	**309,000** non-hybrid heat pumps **11,000** hybrid heat pumps **5,000** district heating heat pumps	**727,000** non-hybrid heat pumps **192,000** hybrid heat pumps **32,000** district heating heat pumps
Electric Engagement UK net zero compliant	**332,000** non-hybrid heat pumps **11,000** hybrid heat pumps **5,000** district heating heat pumps	**1 million** non-hybrid heat pumps **10,000** hybrid heat pumps **46,000** district heating heat pumps
Holistic Transition UK net zero compliant	**370,000** non-hybrid heat pumps **11,000** hybrid heat pumps **4,000** district heating heat pumps	**1.1 million** non-hybrid heat pumps **9,000** hybrid heat pumps **42,000** district heating heat pumps

Low carbon transport

The UK government's Zero Emission Vehicle mandate and increasing availability of new electric car models has driven further adoption of EVs across the UK. In the next decade, the sale of EVs is set to significantly accelerate accompanied by an extensive rollout of charging infrastructure.

Whilst not fully confirmed, it is expected that the ban on the sale of new petrol and diesel vehicles will be brought forward from 2035 to 2030 and the DFES analysis has modelled both of these outcomes. As a result of this ban, it is expected that most road vehicles will be fully electric by 2050 in every scenario and a significant capacity of EV charging will be available in homes, businesses and on major highways.

There are currently around 18,000 battery electric vehicles and 9,000 hybrid electric vehicles registered in the South Wales licence area. This equates to around 2% of all vehicles in the region. This is projected to significantly increase rapidly over the coming decade.

Where EVs may be registered can be influenced by a number of locational factors:

- The availability of off-street parking
- The level of car ownership, including second cars
- Initiatives and funding to increase the number of EV chargers
- Local policies, targets and programmes to promote EVs, such as clean air zones

DFES scenario	EV and EV charger uptake	
	By 2035:	By 2050:
Counterfactual Not UK net zero compliant	**501,000** battery electric vehicles **2,454 MW** domestic chargepoints **387 MW** non-domestic chargepoints	**1.5 million** battery electric vehicles **5,722 MW** domestic chargepoints **990 MW** non-domestic chargepoints
Hydrogen Evolution UK net zero compliant	**733,000** battery electric vehicles **3,349 MW** domestic chargepoints **603 MW** non-domestic chargepoints	**1.6 million** battery electric vehicles **5,738 MW** domestic chargepoints **1,004 MW** non-domestic chargepoints
Electric Engagement UK net zero compliant	**1.1million** battery electric vehicles **5,050 MW** domestic chargepoints **595 MW** non-domestic chargepoints	**1.4 million** battery electric vehicles **5,915 MW** domestic chargepoints **796 MW** non-domestic chargepoints
Holistic Transition UK net zero compliant	**731,000** battery electric vehicles **3,480 MW** domestic chargepoints **484 MW** non-domestic chargepoints	**1.4 million** battery electric vehicles **5,792 MW** domestic chargepoints **797 MW** non-domestic chargepoints

New sector analysis for 2024

As part of DFES 2024, we have looked at the potential demands on our network from the decarbonisation of additional commercial and industrial sectors. This includes maritime transport and ports, airports and aviation, rail electrification as well as agricultural transport and major farms. This analysis has focused on the potential for additional future electricity demand from specialised vehicles and equipment at specific site locations across the licence area.

Aviation and airports

The aviation sector is considered to be 'hard to decarbonise', due to the vast amount of energy required to fuel aircraft. There are a range of technological pathways to reduce aviation emissions, including sustainable aviation fuels, hydrogen or hydrogen derivatives, and electric aircraft. The DFES analysis has been informed by work completed by IBA and commissioned by National Grid Group. Modelling focused on electricity demand from airport vehicles, aircraft ground power, aircraft charging and on-site hydrogen liquefaction.

There is one commercial airport operational in the licence area: Cardiff International Airport. Under the net zero scenarios peak electricity demand at airports in the South Wales increases by 17 MW by 2050. This is primarily based on liquefaction and storage of low-carbon hydrogen as a sustainable aviation fuel.

Rail electrification

There are two key decarbonisation targets for the UK rail sector, both of which will see increased levels of demand from the electricity network. By 2040, all diesel-only trains will be removed from the rail network and by 2050 the railway will have net zero emissions. Network Rail have also proposed several works to implement thousands of kilometres of new overhead line electrification across the rail network. Whilst the transmission network will see a significant proportion of this new demand, in South Wales, it is estimated that an additional 3 MW of demand will be seen on the distribution network by 2050 through the battery electrification of five routes and branch lines.

Maritime transport

The International Maritime Organisation has committed to reduce global international shipping emissions by at least 50% by 2050, compared to 2008 levels.

The DFES modelling of the decarbonisation of the maritime sector includes shore power requirements, vessel charging and the electrification of other port operations. There are nine commercial ports operational in the South Wales licence area including: Fishguard, Milford Haven, Swansea and Cardiff. A range of outcomes have been considered in the DFES, some focusing on a higher degree of electrification and others favouring more direct use of hydrogen. Under the most ambitious scenarios, peak demand at key ports in South Wales increases by up to 147 MW by 2050. This is driven by shore power, where vessels temporarily connect to the local grid to power systems and charging electric ferries.

Agricultural sector

The decarbonisation of the agricultural sector was assessed as part of the Committee on Climate Change's scenario analysis. The DFES modelling has specifically considered the future electrification of agricultural vehicles and fixed machinery in place of the diesel that is currently used. Based on data from Department for Transport, the electrification of these assets is still in a very early stage, with less than 40 electric agricultural vehicles registered in the South Wales licence area to date. Deployment of these vehicles and other equipment, alongside the use of biodiesel and biomethane, has been modelled out to 2050 and results in around 85 MW of new demand from the sector in South Wales by 2050.

<table>
<tr><th rowspan="2">DFES scenario</th><th colspan="2">Aviation</th><th colspan="2">Rail</th><th colspan="2">Maritime transport</th><th colspan="2">Agriculture</th></tr>
<tr><th>By 2035:</th><th>By 2050:</th><th>By 2035:</th><th>By 2050:</th><th>By 2035:</th><th>By 2050:</th><th>By 2035:</th><th>By 2050:</th></tr>
<tr><td>Counterfactual
Not UK net zero compliant</td><td>0.6 MW</td><td>1 MW</td><td rowspan="4">0 MW</td><td>3 MW</td><td>1 MW</td><td>46 MW</td><td>4 MW</td><td>68 MW</td></tr>
<tr><td>Hydrogen Evolution
UK net zero compliant</td><td rowspan="3">0.6 MW</td><td rowspan="3">17 MW</td><td rowspan="3">3 MW</td><td>83 MW</td><td>91 MW</td><td rowspan="3">54 MW</td><td rowspan="3">85 MW</td></tr>
<tr><td>Electric Engagement
UK net zero compliant</td><td rowspan="2">116 MW</td><td rowspan="2">147 MW</td></tr>
<tr><td>Holistic Transition
UK net zero compliant</td></tr>
</table>

Next steps

The DFES is the first step of our strategic investment process. We use the DFES to identify future network constraints, and design the future network needed to facilitate net zero across our

This analysis will be directly feeding into the planning for our next RIIO-ED3. To learn more about our strategic investment process a Development Plan, click here.

NGED Distribution System Operator's (DSO) Strategic Engageme contact with local authorities to discuss the results of DFES 2024.

If you have any questions in relation to the NGED DSO System Pl please get in touch via the details below.

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