

Distribution Future Energy Scenarios: Regional Review

South West licence area



Foreword by WPD

The electricity distribution network across the four Western Power Distribution (WPD) licence areas has changed dramatically in the last 10 years.

Primarily designed to operate as a passive network, WPD has connected 10GW of distributed energy resources and transitioned to operating a more active distribution system. In addition, annual electricity demand has decreased during this time as we continue to use more energy efficient devices in everyday life.

The next decade will see even more far-reaching changes. That is why we have worked with Regen to help us understand what these changes might mean for our distribution network and the investment that may be needed to meet customers' changing needs.

This report summarises the 2021 Distribution Future Energy Scenarios (DFES) study for the South West licence area. During the next 30 years, we are predicting to see a large increase in distributed generation connected to the network, particularly from renewable sources.

The network will also see electricity storage technologies and high levels of new low carbon technologies, such as electric vehicles and heat pumps, increasing household demand for electricity.

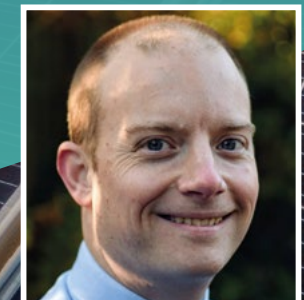
Our annual DFES cycle allows incorporation of newly developed and projected technologies to the analysis. In DFES 2021, we have included hydrogen electrolysis, hydrogen-fuelled generation and further granularity to electrified heating technology demand profiles.

The scenario framework used in this study is heavily influenced by the UK government targets to reach net zero greenhouse gas emissions by 2050, our projections out to 2050 provide a granular breakdown of the customers connected to the distribution network in a net zero compliant future.

This regional review is part of a wider suite of DFES documents hosted on our website alongside our interactive map, which has been updated this year to provide increased insight into local authority energy mix.



Ben Godfrey
Network Strategy Manager



The DFES process

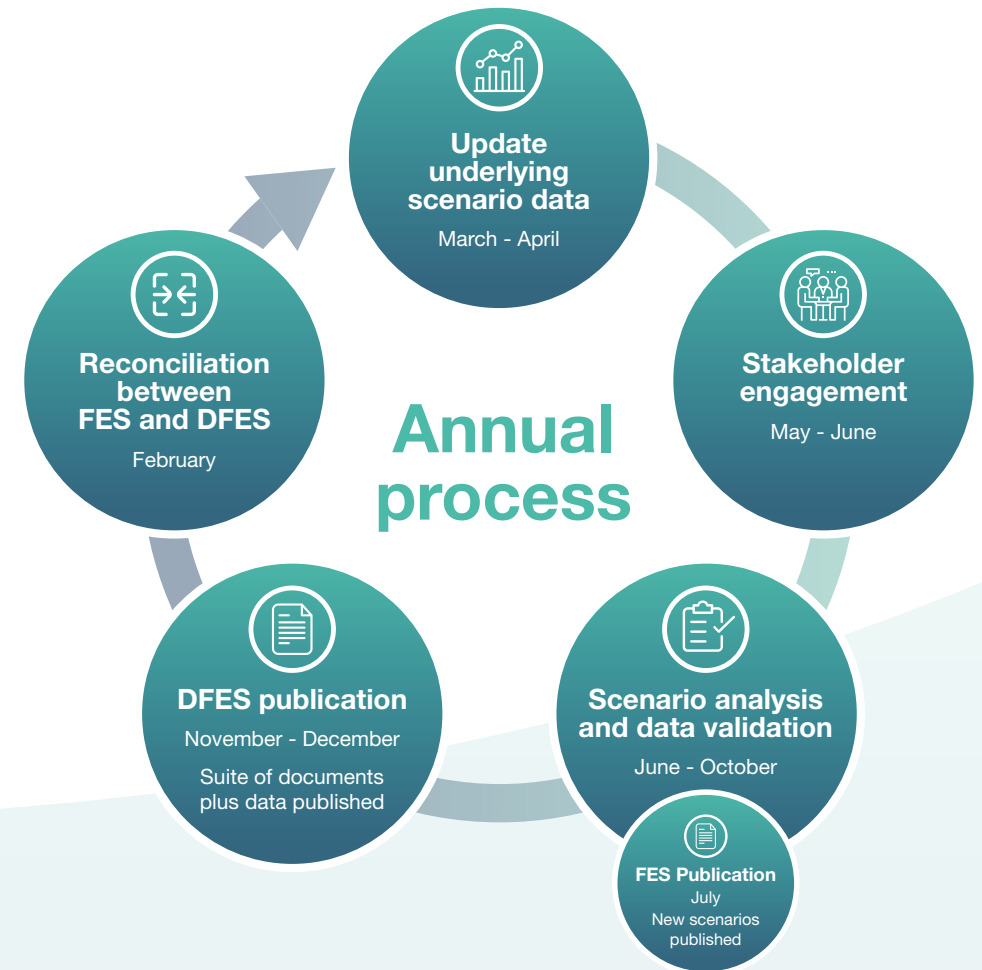


The Distribution Future Energy Scenarios outline the range of credible pathways to 2050 for the change in connections to the distribution network.

Using the National Grid Energy System Operator (ESO) Future Energy Scenarios (FES) framework, these local stakeholder informed projections are created on an annual cycle and encompass changes in demand, electricity storage and distributed generation, including electrified transport and heat.

The four scenarios include three compliant with the UK's target to reduce carbon emissions by 100%, achieving 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 consultation with developers, local authorities, technology companies and community energy groups, as well as analysis of existing trends, spatial data and future innovations in technology.



South West story to date



As of April 2021, there is 2.7GW of generation connected to the distribution network in the South West licence area, including 2GW of low carbon or renewable generation.

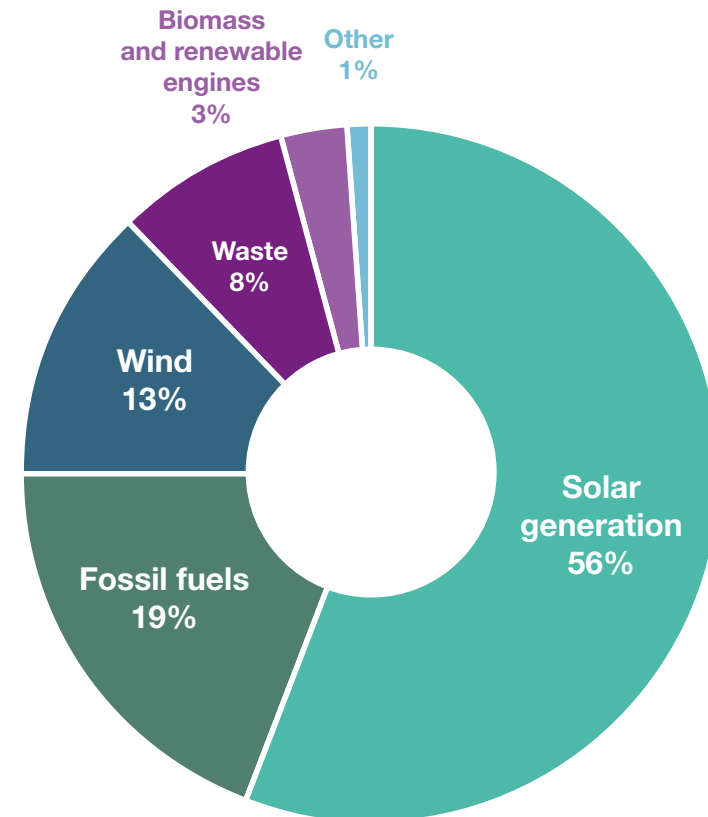
This distributed renewable generation capacity accounts for around 5% of the total renewable energy capacity in GB, enough to power around a million homes.

Distributed electricity generation capacity in the licence area has increased significantly in recent years, with over 50% of capacity having connected since 2014. However, some sites have been connected for decades, such as legacy hydropower sites on Dartmoor.

The South West licence area has some of the best solar irradiance in the UK and resultantly saw a very high deployment of solar PV from 2012. Around half of all distribution connected generation capacity in the South West licence area is solar PV, ranging from single rooftop arrays to large scale ground-mounted solar farms.

Electricity demand has changed more slowly. Only 1.3% of South West homes currently have a heat pump and just 0.6% of vehicles are battery electric. However, widespread change is expected as new policies encourage the electrification of heat and transport.

Total distributed energy generation in the South West licence area



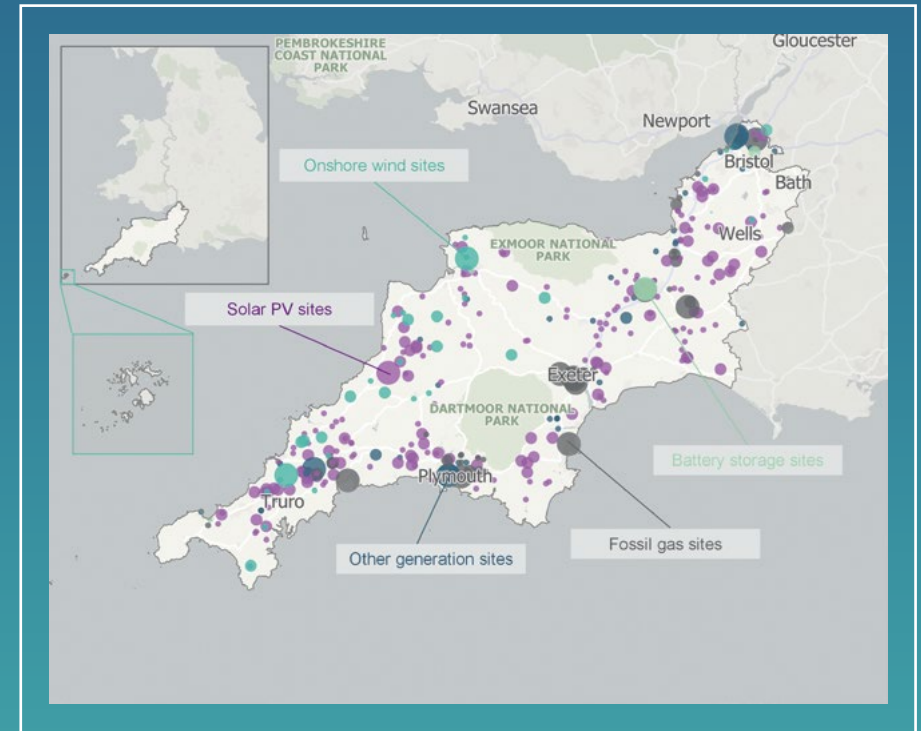
Distributed energy generation in the South West licence area

Representing over half the baseline capacity, ground-mounted solar PV is connected at various locations across the licence area.

Solar is particularly prevalent in Cornwall, and along the M5 motorway between Exeter and Bristol, situated near to distribution network infrastructure.

There is also a significant capacity of onshore wind in the licence area, mainly in Cornwall and North Devon. The largest distribution connected generation site is Fullabrook Wind Farm in North Devon, which has an installed capacity of 66MW.

There are two fossil gas power plants over 50MW in the licence area, in Exeter and South Gloucestershire. Other fossil-fuelled and waste-fuelled sites are also located near urban areas, as seen around Bristol, Plymouth and Torbay.



Near term pipeline summary



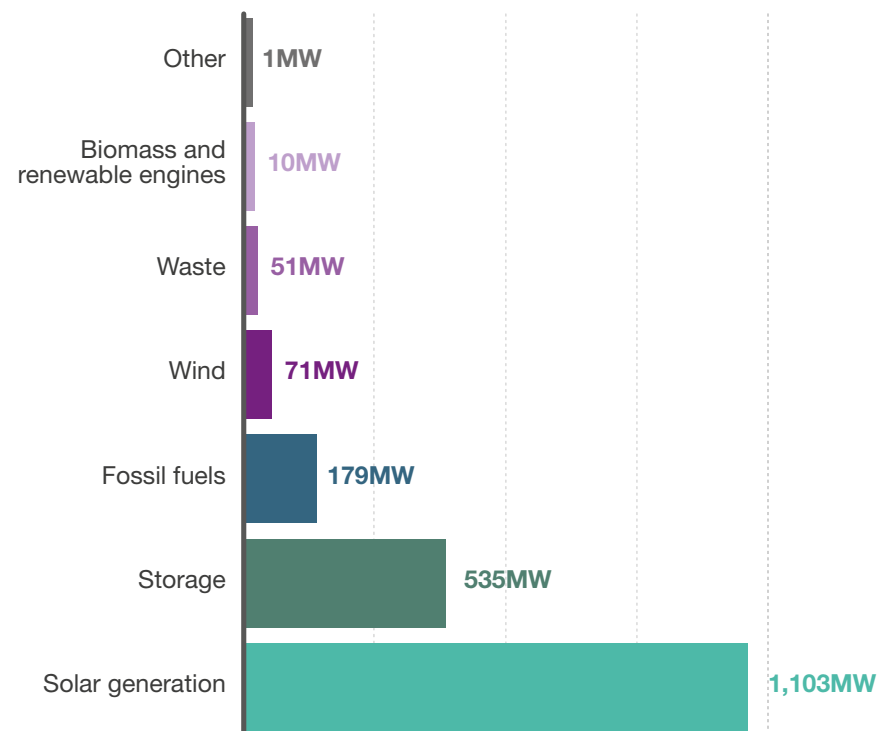
There are over 220 generation and storage projects totalling 2GW that could connect to the South West distribution network in the near future. These pipeline projects were assessed for planning status, participation in auctions, and via direct discussions with developers.

Over half of the current pipeline capacity is solar, totalling 1.1GW. There are nine solar sites of 40MW or larger in the pipeline, including a potential 150MW site near Bath. Over half of the solar pipeline has accepted a network connection since January 2020.

Although deployment has slowed in recent years, the DFES analysis shows that there is an increasing interest to deploy new solar capacity in the licence area.

With a recent commitment to a zero carbon electricity system by 2035, energy storage could play a more significant role to keep the system in balance. There are 47 battery sites totalling 535MW with an accepted connection offer in the licence area. This pipeline is over 10 times the current installed capacity and many sites could potentially move forward to connect over the next three to five years. Around 80% of this capacity has accepted a network connection since January 2020.

Generation and storage sites with an accepted connection offer in the South West licence area



Stakeholder engagement



Stakeholder insight is critical to informing and shaping the DFES projections and ensuring they are accurate, up to date and regionally relevant.

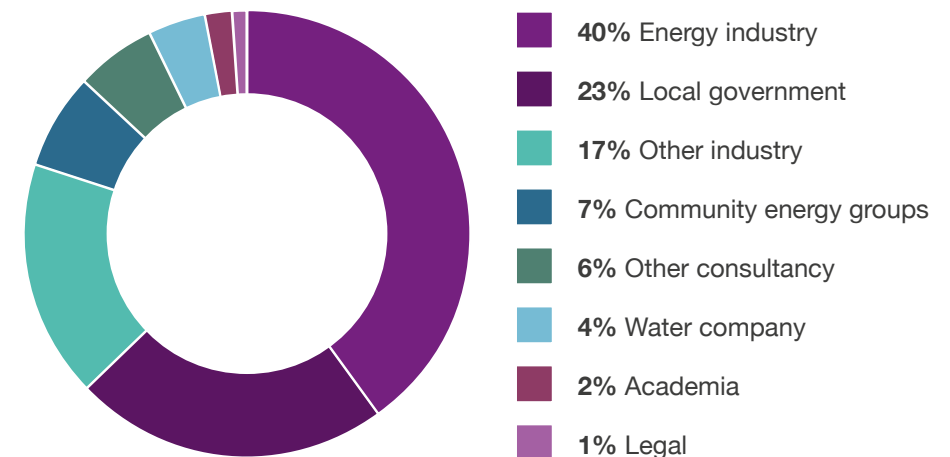
Four consultation events were held in June and July 2021 with 226 attendees across the four licence areas. Each local authority in WPD's licence areas was also contacted as part of the analysis of planned new housing and non-domestic developments.

In the South West consultation webinar, 71% of respondents were already aware of the WPD DFES process. This is up from 57% in the 2020 event. Stakeholders identified that they mainly wanted to learn more about the deployment of renewables and low carbon technologies in the South West, and understand more about the DFES process.

Attendees were asked for views around the potential deployment of renewable generation, the evolution and future use of flexible generation and storage, and the uptake of electric vehicles and heat pumps. The results, alongside comments and insights around the DFES process and modelling, were incorporated into the analysis to reflect regional factors and variation across each licence area.

The South West licence area has a large proportion of rural land and a high proportion of off-gas homes. As a result, views were sought on the role of bioenergy and resistive electric heating in a decarbonised future, as these are particularly impactful in the South West licence area projections.

South Wales webinar






Summary of results in 2035

As the midpoint between the baseline and the UK government’s 2050 net zero ambitions, the scenario results in 2035 show how distributed electricity generation, storage and demand could change in the near and medium term.

DFES scenario	Description of scenario	Baseline Renewable energy capacity	2035 Renewable energy capacity	Baseline Energy storage capacity	2035 Energy storage capacity		
Steady Progression Not net zero compliant	Not compliant with the net zero emissions target.	2GW Including: 1.5GW of solar 0.3GW of wind.	2.8GW	50MW Around 4% of the GB total installed battery storage capacity.	114MW		
	Low levels of decarbonisation and societal change.						
System Transformation Net zero compliant	High level of decarbonisation with lower societal change. Larger, more centralised solutions are developed. This scenario has the highest levels of hydrogen deployment.					3.8GW	244MW
Consumer Transformation Net zero compliant	High levels of decarbonisation and societal change. Consumers adopt new technologies rapidly, and more decentralised solutions are developed. This scenario has significant electrification of domestic heat.					4.9GW	403MW
Leading the Way Net zero compliant	Very high levels of decarbonisation and societal change. Consumers adopt new technologies rapidly, and a mix of solutions are developed. This scenario aims for the “fastest credible” decarbonisation pathway.		5.5GW		521MW		

Summary of results in 2035

DFES scenario	Description of scenario	Baseline Battery electric vehicles (000s)	2035 Battery electric vehicles (000s)	Baseline Domestic heat pumps (000s)	2035 Domestic heat pumps (000s)	
Steady Progression Not net zero compliant	Not compliant with the net zero emissions target.	12 Equivalent to: 0.9% of total vehicles.	734 33% of total vehicles.	5 Heat pumps 0.5% of homes.	279 17% of homes.	
	Low levels of decarbonisation and societal change.					
System Transformation Net zero compliant 	High level of decarbonisation with lower societal change. Larger, more centralised solutions are developed. This scenario has the highest levels of hydrogen deployment.				1,154 51% of total vehicles.	221 13% of homes.
	Consumer Transformation Net zero compliant 				High levels of decarbonisation and societal change. Consumers adopt new technologies rapidly, and more decentralised solutions are developed. This scenario has significant electrification of domestic heat.	1,646 74% of total vehicles.
Leading the Way Net zero compliant 		Very high levels of decarbonisation and societal change. Consumers adopt new technologies rapidly, and a mix of solutions are developed. This scenario aims for the “fastest credible” decarbonisation pathway.	1,778 80% of total vehicles.	908 53% of homes.		

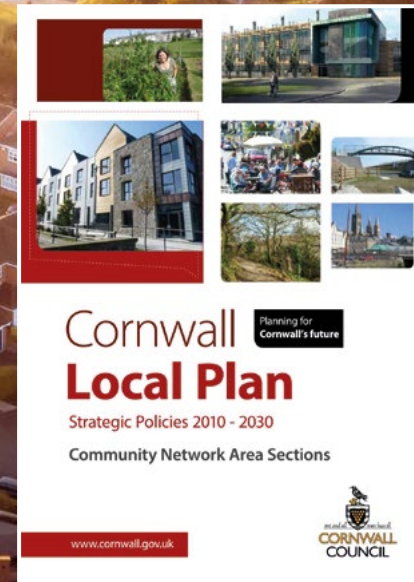
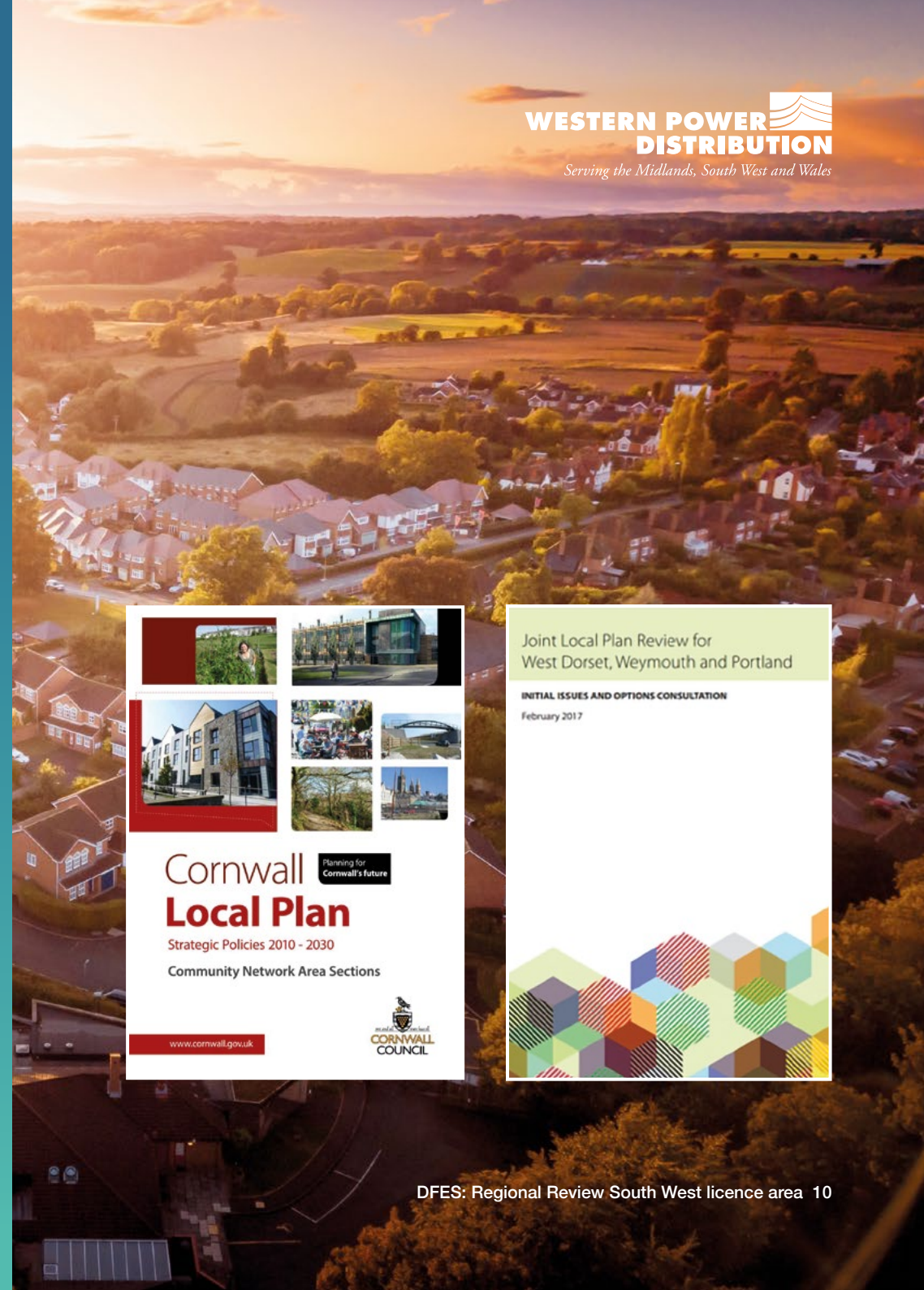
Working with local authorities

New homes and industrial and commercial properties can have a significant impact on local electricity demand. With the recent publication of the Heat and Buildings Strategy, these homes and commercial properties are also likely to be a focal point for more energy efficiency, low carbon technologies like heat pumps and solar panels, and be designed to facilitate low carbon transport.

Over 8,000 individual data records were brought together to model the potential future impact of new developments across the WPD licence areas. Where and when these buildings and new technologies are expected to connect is projected using the scenario frameworks and based on data from local authority plans, along with historic data on the number of new homes per year.

High and low scenarios were produced to model the variable building rates of these developments over the scenario period. Between 54,000 and 70,000 homes are projected to be built in the South West licence area over the next five years.

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



Renewable energy generation



There is currently c.1.5GW of solar PV capacity in the South West licence area. Ground-mounted solar accounts for around 1GW of this, with the remaining capacity comprised of rooftop solar installations.

Solar deployment was high from 2012 onwards, earlier than other parts of the UK due to the relatively high solar irradiance in the South West.

Despite this, deployment in the South West has stagnated in recent years, due to some market uncertainty after the reduction in government subsidies. This has meant few sites have been commissioned since 2017.

However, new business models for solar are becoming viable across the UK, which is shown in the pipeline of prospective new sites seen. The cost of deploying solar has also reduced dramatically over the last decade. Under the highest DFES scenario, the South West hosts over 7GW of solar capacity by 2050, across both ground-mounted and rooftop installations.

Onshore wind deployment has also stalled in recent years, due to difficulties in achieving planning. However, there is scope for renewed deployment of wind farms. The DFES scenarios project between 500MW and 1,400MW of wind capacity, both onshore and offshore, connecting to the South West licence area by 2050.

Fossil-fuelled energy generation



While at odds with net zero ambitions, fossil-fuelled power stations are prevalent in the South West licence area.

There is a total of 524MW of fossil-fuelled generation connected in the South West licence area today. This is made up of gas and diesel engines, gas CHP and large OCGT sites. There are two large OCGT sites, in Exeter and Bristol, with a total of 123MW capacity.

The annual energy output of these fossil fuel plants significantly decreases in all net zero compliant scenarios, especially in the medium term, in the late 2020s and 2030s.

The DFES analysis shows the potential for a near term increase in fossil gas-fired power in all scenarios, based on analysis of successful planning and Capacity Market applications of sites in the pipeline. In contrast, diesel power is expected to decrease in the near term due to air quality and environmental permitting regulations.

Overall, a significant reduction in fossil fuel energy output and installed capacity is projected by 2035 and out to 2050 under the net zero scenarios, as the UK looks to significantly decarbonise its electricity supply.

Hydrogen



Hydrogen has the potential to impact a number of aspects of the energy system, from decarbonising industry, heating and transport to use as a fuel for flexible, low carbon electricity generation.

Additionally, the production of hydrogen via electrolysis could result in significant electricity demand, with the distribution network potentially seeing electrolysis plants looking to connect in areas of localised hydrogen demand. Due to high levels of uncertainty around the approach to hydrogen production and the level of hydrogen demand, a wide range of outcomes are seen in the four scenarios.

The direct impacts of hydrogen on the electricity distribution networks manifest in two forms: demand for electricity for hydrogen electrolysis, and generation of electricity through hydrogen-fuelled generation.

There are already a couple of small scale hydrogen electrolysers in South West, serving hydrogen-fuelled vehicles, and a number of innovation trials underway. By 2050, distribution-connected hydrogen electrolysis capacity in the South West licence area ranges significantly from less than 0.1GW to 1.6GW, reflecting the scale of uncertainty in this technology. Hydrogen-fuelled generation could reach up to 0.5GW, slightly higher than the current fossil fuel baseline that it replaces.

Electricity storage



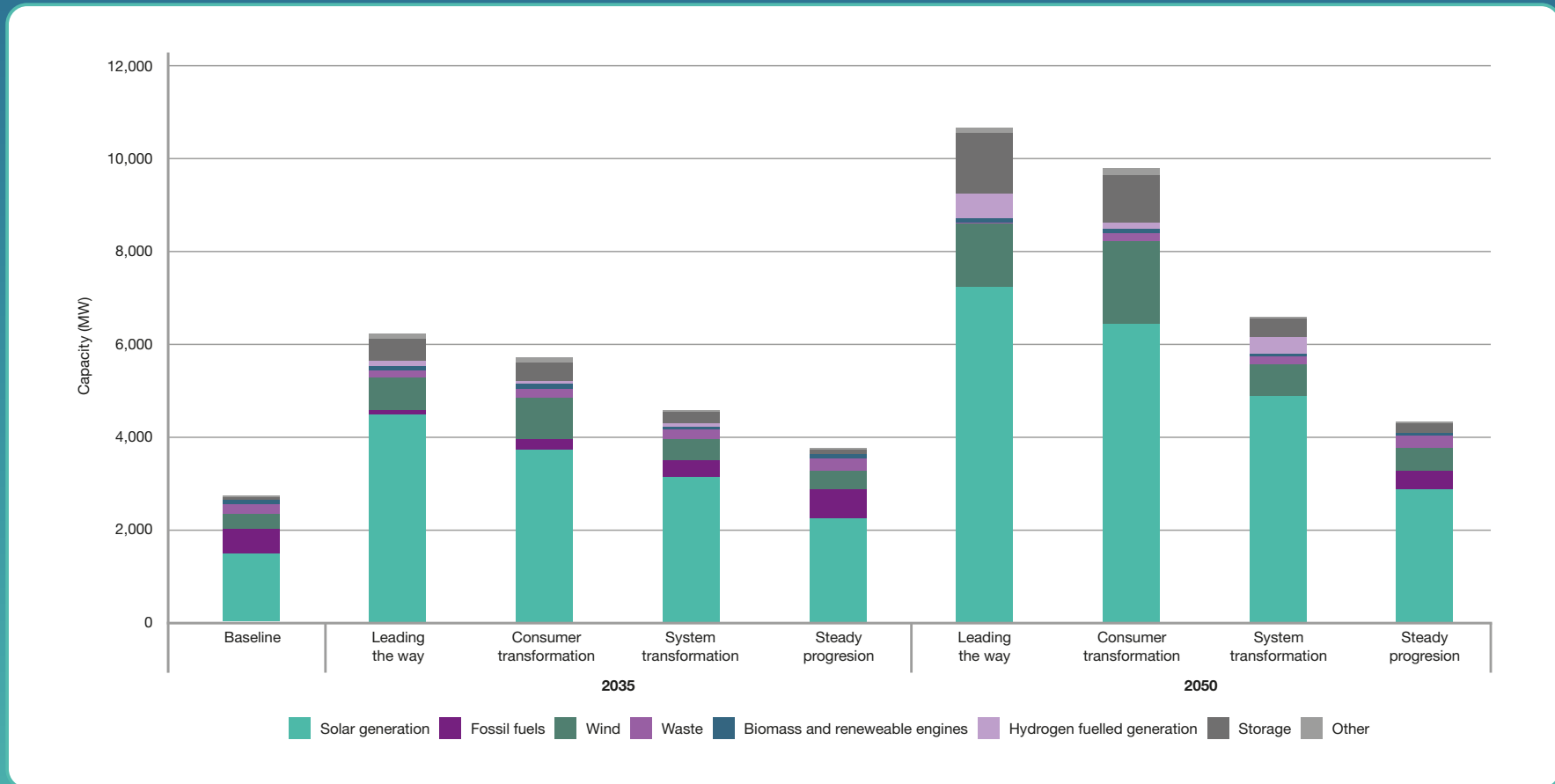
Electricity storage is expected to be critical for balancing a high renewables electricity system.

National Grid ESO announced in 2021 that it is on track to be able to operate a zero carbon electricity system by 2025. UK government recently also confirmed plans to eliminate fossil fuel generation from the electricity system by 2035. New sources of flexibility will be needed to provide services to the network to support this transition to low carbon electricity generation. The four scenarios include a number of assumptions regarding the technologies that will provide these services, including the scale of development of energy storage.

The South West licence area has 50MW of operational battery storage, made up of 13 sites. Two large scale sites, connected in 2017 and 2020 respectively, total 43MW. DFES analysis shows there to be 47 pipeline sites, totalling 535MW, which could connect in the near term. Future business models for new storage assets include co-location with renewable generators and non-domestic consumers, as well as smaller batteries in homes.

Due to the scenario-specific assumptions around the deployment of other providers of network services, there is a wide envelope of deployment between the scenarios. Overall battery storage capacity in 2050 in the South West licence area ranges from c. 0.2GW in Steady Progression to 1.3GW in Leading the Way.

Distribution connected generation and storage scenarios WPD South West licence area



Low carbon heat



As has been spotlighted by the recent UK government Heat and Buildings Strategy, a key area of change in the energy system will be the decarbonisation of heat.

The four DFES scenarios model a variety of decarbonisation pathways, all showing a large increase in domestic heat pump deployment in the medium and long term.

The South West licence area currently has 290,000 homes heated by electricity, including around 20,000 domestic heat pumps. This equates to around 1.3% of homes with a heat pump, which is well above the national average of 0.6%.

There is a dramatic shift to low carbon heating in all net zero compliant scenarios, with deployment of domestic and non-domestic heat pumps accelerating throughout the 2020s. Under Consumer Transformation, almost 90% of homes are primarily heated by a heat pump in 2050.

National policy is expected to see off-gas homes and new build homes targeted in the near term. The above-average proportion of off-gas homes in the South West, compared to the UK average, leads to higher near-term deployment of heat pumps in the licence area.

By 2050

Steady Progression



System Transformation Net zero target compliant



Consumer Transformation Net zero target compliant



Leading the Way Net zero target compliant



Low carbon transport



The UK government's ban on new petrol and diesel vehicles from 2030 is preceded by a significant increase in uptake of electric vehicles over the next 10 years. As a result of the ban, most road vehicles are expected to be electric by 2050 in every scenario.

There are around 12,000 battery electric vehicles and 8,000 plug-in hybrid electric vehicles registered in the South West licence area, totalling around 2% of all vehicles. This is projected to increase rapidly over the next decade. The projections use local factors that influence take up in the near term, including:

- The availability of off-street parking.
- The level of car and second-car ownership.
- Initiatives to increase the number of electric vehicle chargers or potential clean air zones.

For electricity networks, the key question is how and when these electric vehicles are charged. The deployment of chargers is also projected in the DFES by charger size, type and use case, such as domestic chargers, chargers at car parks and chargers at existing petrol stations.

By 2050, all road transport is projected to be decarbonised, the majority being electric vehicles. By 2035:

Steady Progression



734,000
battery electric vehicles



401,000
domestic charge points

System Transformation Net zero target compliant



1,153,000
battery electric vehicles



704,000
domestic charge points

Consumer Transformation Net zero target compliant



1,645,000
battery electric vehicles



830,000
domestic charge points

Leading the Way Net zero target compliant



1,777,000
battery electric vehicles



1,042,000
domestic charge points

Next steps

The WPD DFES 2020 suite of output documents is now available online:



Stakeholder feedback summary reports for all licence areas available here.



Data available through the map hub.



Technology results and assumptions reports for all licence areas.



Methodology walkthrough slides.



'DFES regional review' summaries for all licence areas.

The DFES is an annual process conducted by WPD and Regen; the WPD DFES 2022 process will begin in spring 2022.

WPD Distribution Managers are in contact with local authorities to discuss the results. The stakeholder engagement process for DFES 2022 runs from February to July 2022.

If you have any questions in relation to WPD's Network Strategy work, please contact WPD on the details below:

Email:

wpdnetworkstrategy@westernpower.co.uk

By post:

Network Strategy Team
Western Power Distribution
Feeder Road
Bristol
BS2 0TB

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales



Western Power Distribution (East Midlands) plc, No2366923
Western Power Distribution (West Midlands) plc, No3600574
Western Power Distribution (South West) plc, No2366894
Western Power Distribution (South Wales) plc, No2366985

Registered in England and Wales
Registered Office: Avonbank, Feeder Road, Bristol BS2 0TB

www.westernpower.co.uk

