WPD Distribution Future Energy Scenarios 2020

Methodology

November 2020

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Distribution Future Energy Scenarios

Methodology

Summary

- Introduction to DFES
- DFES methodology summary
- Stakeholder engagement
- Data sources and evidence gathering
- Creating the DFES projections
- How the WPD DFES is reconciled to FES 2020

Distribution Future Energy Scenarios

Methodology

The **Distribution Future Energy Scenarios** outline the range of credible futures for connections to the distribution network.

Using a scenario framework consistent with other distribution network operators and National Grid ESO – known as the Future Energy Scenarios or FES – these local stakeholder informed projections are created on an annual cycle and encompass changes in demand, storage and distributed generation, including electrified transport and heat.

WPD works with Regen to create the **Distribution Future Energy Scenarios** for all of our licence areas on an annual cycle.

Why Future Energy Scenarios?

The need for scenario based planning

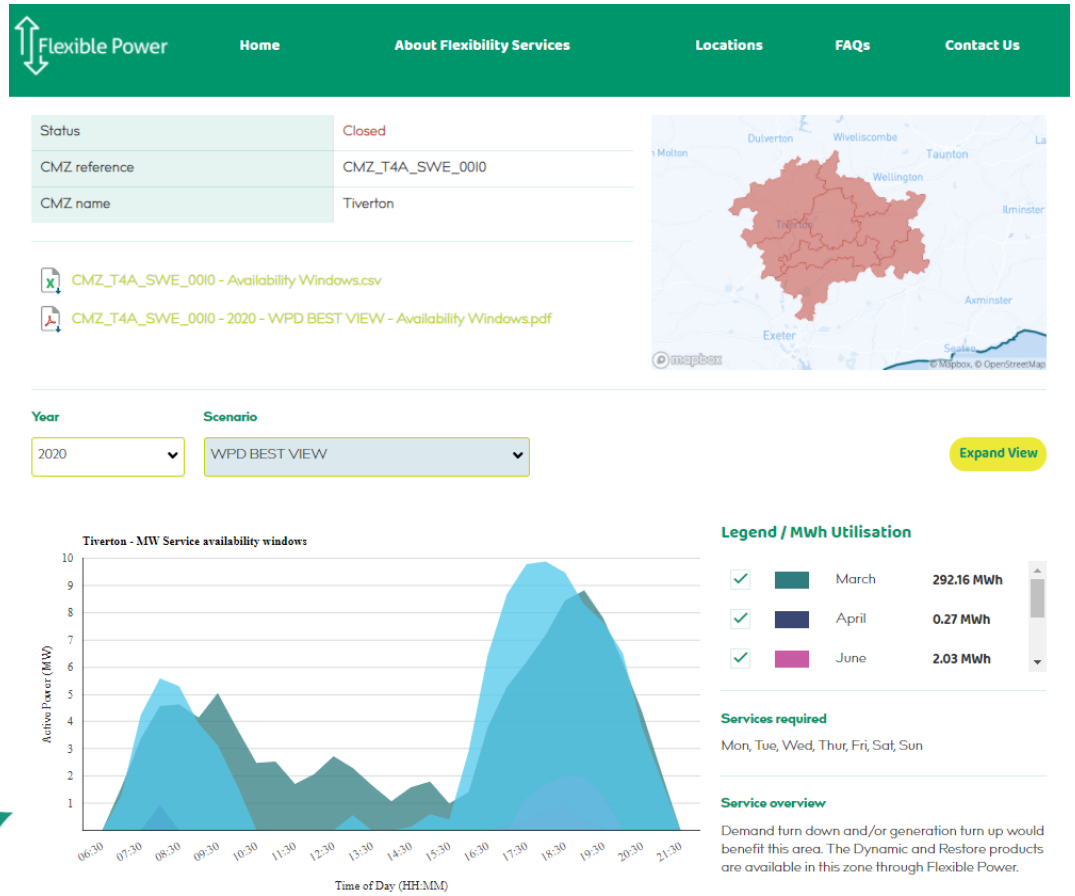
With customer requirements changing in an evolving energy system, the DFES is used to inform strategic network planning and investment for an uncertain future.

The DFES builds on historic trends, as well as analyses of the pipeline of near term projects, the local resource factors and stakeholder input to create a range of credible scenarios.

The DFES also assesses the potential growth of new technology connections, such as electric vehicles and chargers, battery storage sites and heat pumps.

The DFES is used by WPD to conduct a detailed review of its network and how it will be impacted by each scenario. This helps WPD to develop reinforcement solutions to solve anticipated network constraints in different years and under different scenarios.

The DFES is also used for RIIO-ED2 business planning, and to publicly signpost potential system flexibility needs.



The four WPD DFES scenarios

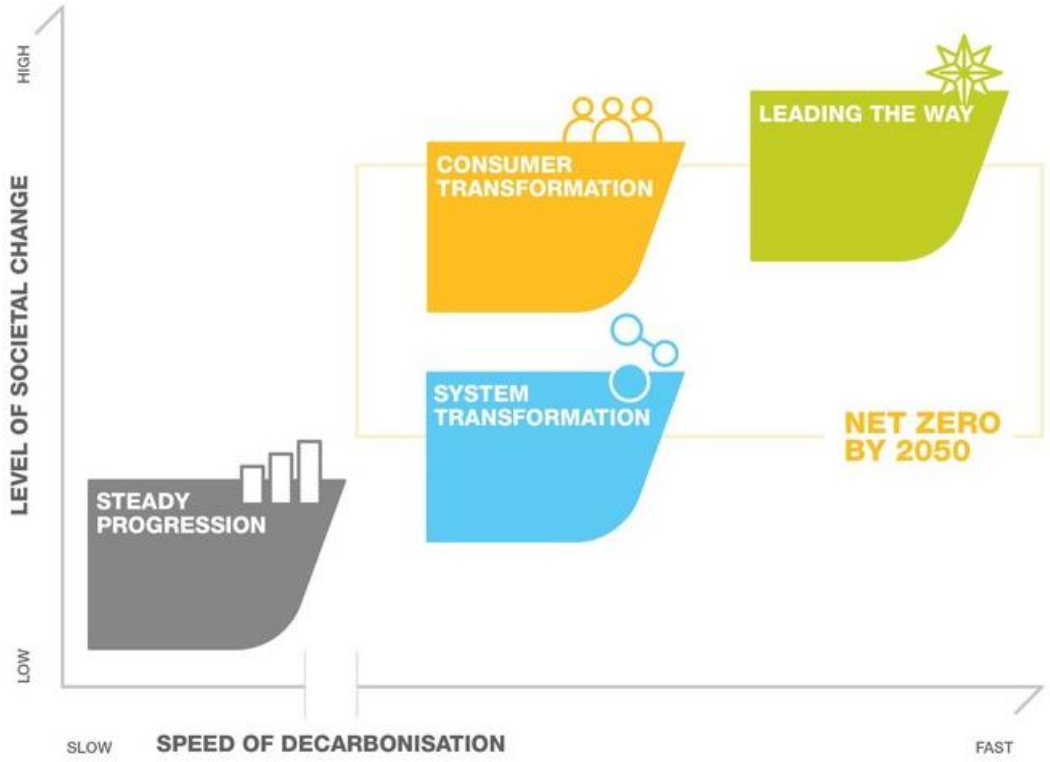
Incorporating the FES 2020 scenarios

The National Grid ESO FES 2020 scenarios are used in the WPD DFES 2020. The 2020 scenarios are significantly different from those used in previous WPD DFES studies due to the introduction of three new net zero compliant scenarios by National Grid.

Key assumptions are published by National Grid ESO for each of the four scenarios. These are incorporated in the WPD DFES 2020. The four FES 2020 scenarios are defined by different ‘speeds of decarbonisation’ and ‘level of societal change’.

Additional local assumptions are made by Regen and the WPD DFES team. For example, about the deployment of projects in the pipeline, the lifetime of existing projects, and the weighting of spatial factors such as affluence and agricultural land grade.

Three of the scenarios are compliant with the UK government net zero emissions target for 2050. Each of these scenarios achieves emissions reductions in a different way.



A whole system approach

Building on the Net Zero South Wales innovation study

The Net Zero South Wales 2050 innovation project was undertaken as a partnership between Regen, WPD and WWU with funding from the Network Innovation Allowance programme.

This innovation project brought two networks together, developing insights and value from an integrated approach to gas and electricity scenario planning and exploring an increasingly flexible and cross-vector system.

Learnings have been taken forward in the WPD DFES 2020. In WPD DFES 2020 over 3,000 small areas were assessed, incorporating a key recommendation from the innovation study for greater spatial granularity.

The WPD DFES results can be directly aggregated up to local authority areas, so that stakeholders or other networks can view results most relevant to them.

The number of technologies assessed was expanded based on learnings from the innovation study. Multiple low carbon heating technologies were assessed, as well as a full picture of waste treatment processes, including the potential for biomethane development.

WPD DFES Methodology

Methodology in brief

Overview

Local factors are used, with assumptions from National Grid FES, to project the deployment of each technology type for four scenarios at a granular level.

1. Baseline:

Data is collected on the current installed capacity, or number of installed units, for each individual technology type.

2. Pipeline

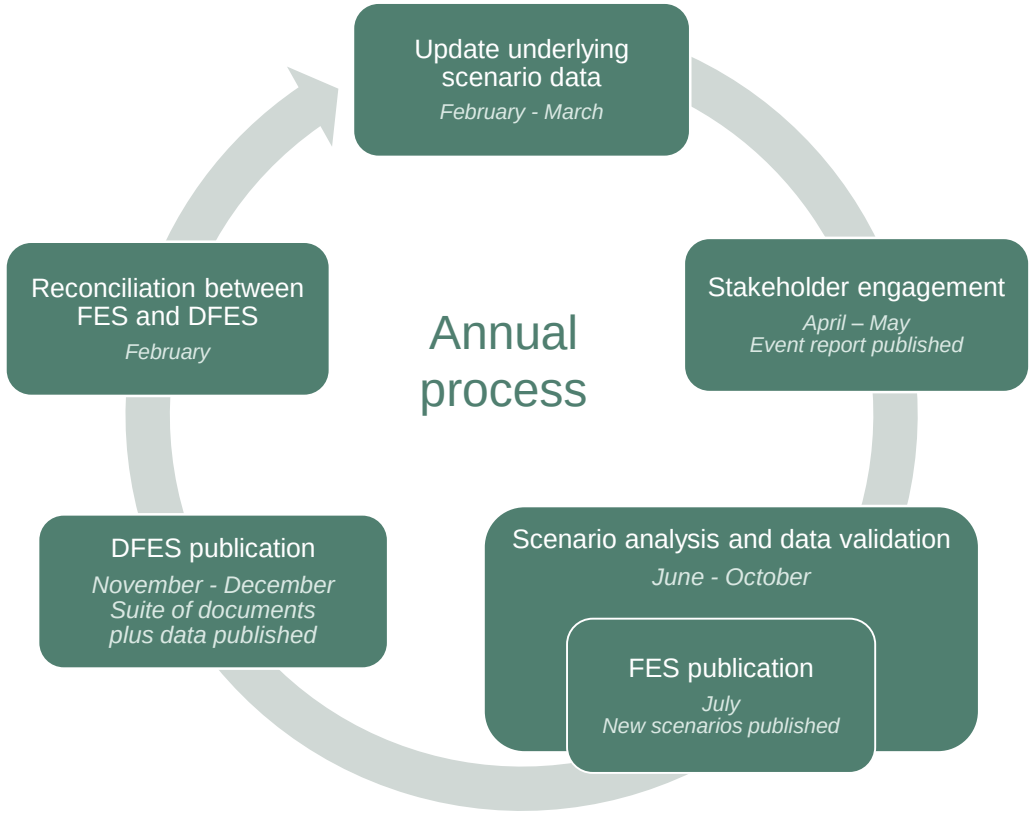
Proposed sites that may connect in the near term are individually assessed and developers contacted where possible.

3. Stakeholder engagement

Local information is collected from consultation with developers and a survey of local authorities, this is combined with analysis of existing trends and spatial data.

4. Scenario projections (2020-2050)

Near term technology deployment is extrapolated to create the projections at the ESA level in the medium and long term, incorporating local resource factors.



Electricity Supply Areas

Spatial granularity

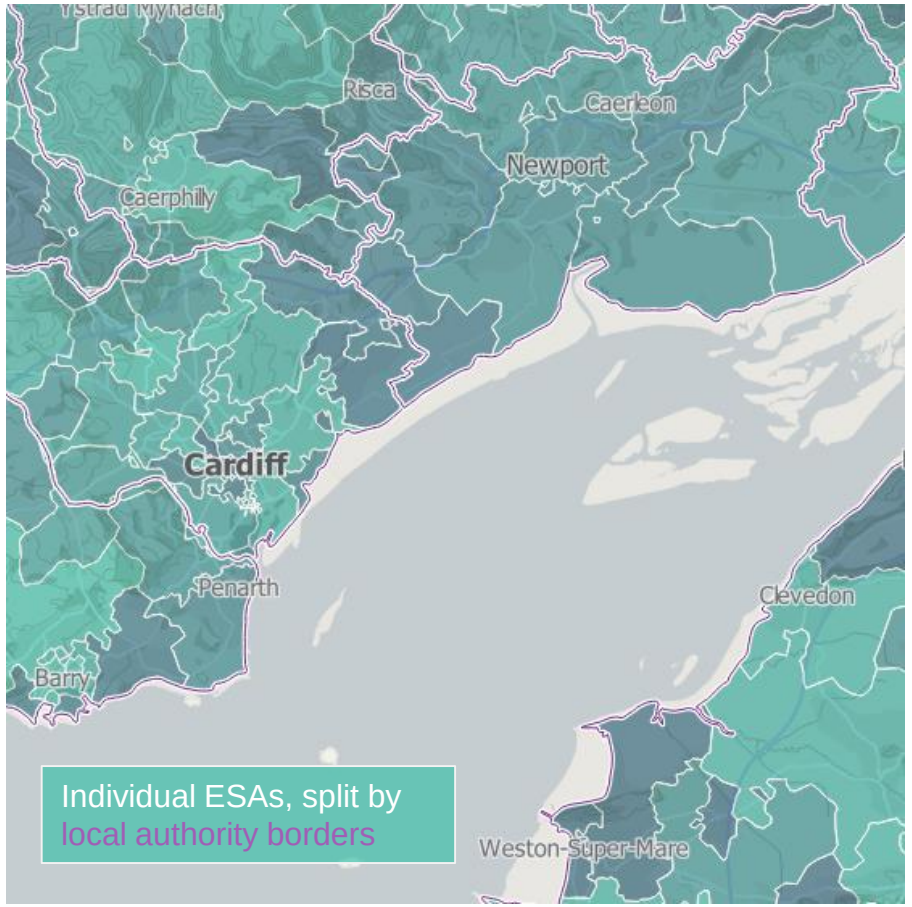
DFES analysis is produced from the bottom up, using small geographic cells called ‘Electricity Supply Areas’ (ESAs).

Each ESA represents a block of demand and generation as visible from the distribution network. This way, projected new connections by scenario are linked to specific parts of the network, allowing for detailed network analysis.

The attributes of the ESA informs the deployment of each individual technology type, for instance local windspeed or number of houses.

An ESA is: *The geographical area supplied by a Primary Substation (which contains WPD owned distribution substations) providing supplies at a voltage below 33 kV; or a customer directly supplied at 132, 66 or 33 kV or by a dedicated Primary Substation*.

These network-informed spatial areas are also split by local authority borders. This means the WPD DFES 2020 results may be directly aggregated up to local authority areas.



Stakeholder engagement

Overview

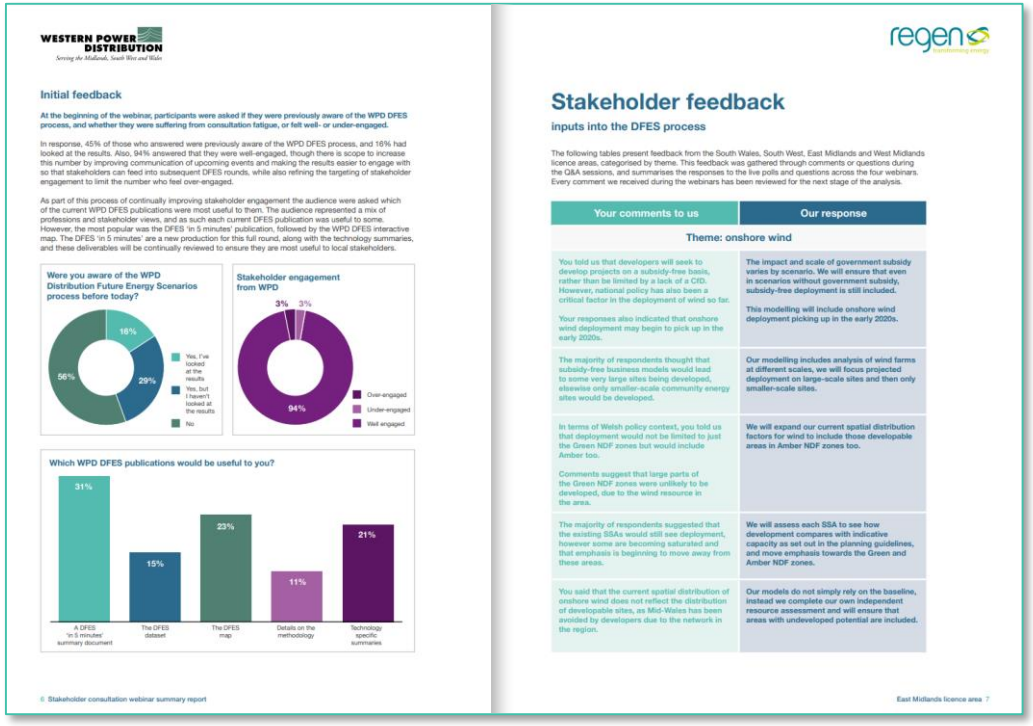
WPD and Regen ran four consultation events in May 2020, engaging with 266 attendees in webinars across the four licence areas.

Regen also contacted every local authority in the WPD licence areas to collate data on new developments

As part of the discussion with local authorities, local authorities were surveyed for plans or policies supporting low carbon infrastructure.

Developers of sites in the pipeline were contacted where possible, including sites with planning applications.

Wider industry consultation is also completed for each technology where possible. Information is gathered predominantly through direct conversations as well as through existing industry networks and events.



A report summarising the consultation webinars and the feedback received are available on the WPD website:
westernpower.co.uk/distribution-future-energy-scenarios-regional-information

Stakeholder engagement

Stakeholder consultation events

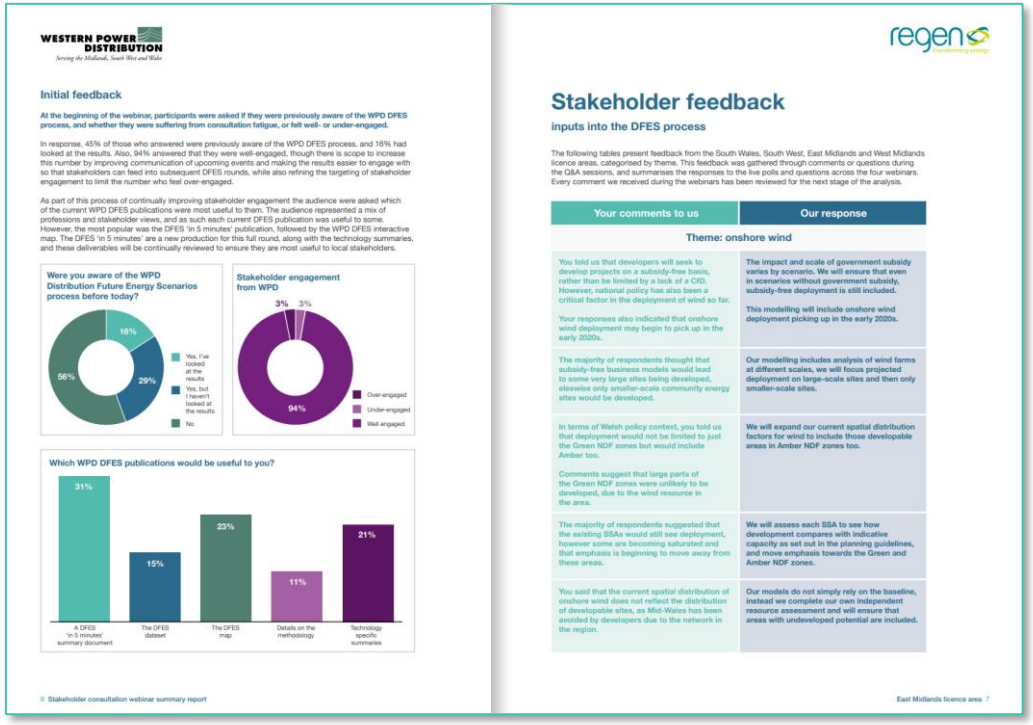
The consultation events were held online in May 2020, with 266 participants across the four webinars.

The webinars participants had the opportunity to answer live polls regarding detailed assumptions made in the DFES analysis.

The participants were also able to raise questions and critiques during and after these sessions.

After the events, a summary report was published, detailing the content covered, as well as how the comments raised would be incorporated into the DFES analysis.

For example, participants suggested that the large number of potential solar projects could begin to connect from 2022, and that battery storage would be superseded by other energy storage technologies in the future.



Initial feedback

At the beginning of the webinar, participants were asked if they were previously aware of the WPD DFES process, and whether they were suffering from consultation fatigue, or felt well- or under-engaged.

In response, 45% of those who answered were previously aware of the WPD DFES process, and 16% had looked at the results. Also, 94% answered that they were well-engaged, though there is scope to increase this number by improving communication of upcoming events and making the results easier to engage with so that stakeholders can feed into subsequent DFES rounds, while also refining the targeting of stakeholder engagement to limit the number who feel over-engaged.

As part of this process of continually improving stakeholder engagement the audience were asked which of the current WPD DFES publications were most useful to them. The audience represented a mix of professions and stakeholder views, and as such each current DFES publication was useful to some. However, the most popular was the DFES 'in 5 minutes' publication, followed by the WPD DFES interactive map. The DFES 'in 5 minutes' are a new production for this full round, along with the technology summaries, and these deliverables will be continually reviewed to ensure they are most useful to local stakeholders.

Were you aware of the WPD Distribution Future Energy Scenarios process before today?

16%
29%
56%
Yes, I've looked at the results
Yes, but I haven't looked at the results
No

Stakeholder engagement from WPD

3%
3%
94%
Over-engaged
Under-engaged
Well-engaged

Which WPD DFES publications would be useful to you?

31%
15%
23%
11%
21%
A DFES 'in 5 minutes' summary document
The DFES dataset
The DFES map
Details on the methodology
Technology specific summaries

6 Stakeholder consultation webinar summary report

Stakeholder feedback

inputs into the DFES process

The following tables present feedback from the South Wales, South West, East Midlands and West Midlands licence areas, categorised by theme. This feedback was gathered through comments or questions during the Q&A sessions, and summarises the responses to the live polls and questions across the four webinars. Every comment we received during the webinars has been reviewed for the next stage of the analysis.

Your comments to us	Our response
Theme: onshore wind	
You told us that developers will seek to develop projects on a subsidy-free basis, rather than be limited by a lack of a CfD. However, national policy has also been a critical factor in the deployment of wind so far. Your responses also indicated that onshore wind deployment may begin to pick up in the early 2020s.	The impact and scale of government subsidy varies by scenario. We will ensure that even in scenarios without government subsidy, subsidy-free deployment is still included. This modelling will include onshore wind deployment picking up in the early 2020s.
The majority of respondents thought that subsidy-free business models would lead to some very large sites being developed, elsewise only smaller-scale community energy sites would be developed.	Our modelling includes analysis of wind farms at different scales, we will focus projected deployment on large-scale sites and then only smaller-scale sites.
In terms of Welsh policy context, you told us that deployment would not be limited to just the Green NDF zones but would include Amber too. Comments suggest that large parts of the Green NDF zones were unlikely to be developed, due to the wind resource in the area.	We will expand our current spatial distribution factors for wind to include those developable areas in Amber NDF zones too.
The majority of respondents suggested that the existing SSAs would still see deployment, however some are becoming saturated and that emphasis is beginning to move away from these areas.	We will assess each SSA to see how development compares with indicative capacity as set out in the planning guidelines, and move emphasis towards the Green and Amber NDF zones.
You said that the current spatial distribution of onshore wind does not reflect the distribution of developable sites, as Mid-Wales has been avoided by developers due to the network in the region.	Our models do not simply rely on the baseline, instead we complete our own independent resource assessment and will ensure that areas with undeveloped potential are included.

East Midlands licence area 7

A report summarising the consultation webinars and the feedback received are available on the WPD website:
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Engagement with local authorities

Using local authority plans in DFES

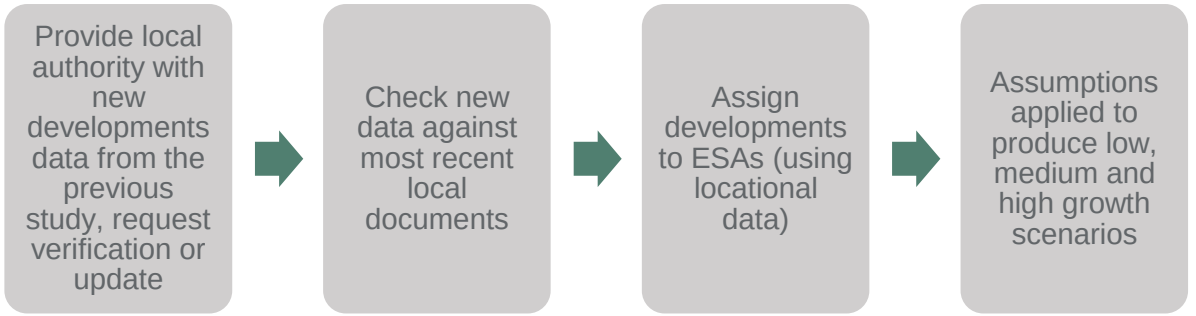
New housing and non-domestic developments are sources of new demand on the electricity network. Local authority development plans are incorporated into DFES to include the localised impact on the distribution network.

Data collection

Regen created an online database of all new development data collected during earlier DFES studies. This was then shared with the local authority planners. Updated data provided by the local authorities is verified against most recent local documents, and classified by:

- Development type:
- Domestic or non-domestic by individual use classes
- Location
- Total number of homes or floorspace
- Development stage
- Plan period
- Land type

New developments process overview



> “Over 10,000 new development records were processed as part of WPD DFES 2020”

Engagement with local authorities

Assessing local authority local plans

Creating deployment rates for the four scenarios

Once processed and verified, the individual developments are projected to be built at a schedule based on the source data.

A delay in this schedule is applied to sites in the medium and long term – which varied by scenario to capture the envelope of uncertainty. Stakeholder feedback also suggested some delays in the near term due to COVID-19.

The delay methodology means that the precise spatial data and scale of development is maintained, but the period over which the sites are built varies.

Historic trends in new developments are also used to provide estimates for a low, medium, and high level of deployment. These are then assigned to the FES 2020 scenarios for the near and medium term as detailed below:

Steady Progression
Low deployment

Consumer Transformation
Medium deployment

System Transformation
Medium deployment

Leading the Way
High deployment

Engagement with local authorities

Assessment of local authority local plans

Not all local authority plans extend out to 2030 or later, and as a result there is a natural reduction in the data available for the analysis of planned developments.

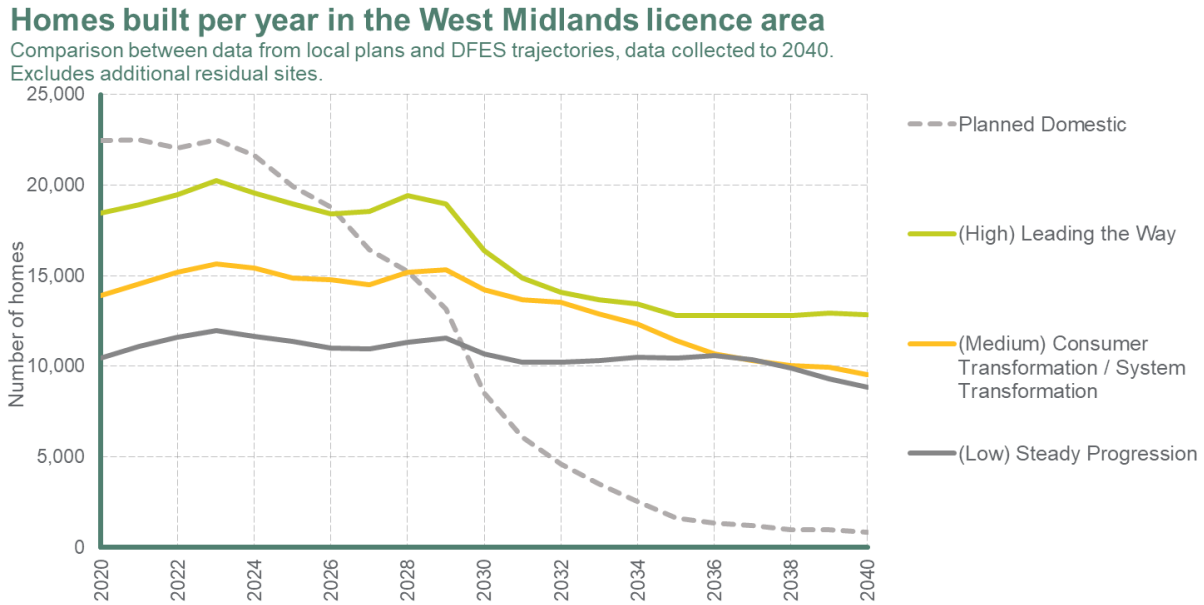
To compensate for this reduction, additional dwellings and commercial floorspace were modelled, with locations weighted towards areas of similar characteristics to those that have seen recent deployment of new developments.

Each individual development is also assigned to an ESA, the part of the network to which it is most likely to connect.

Though some of these sites are already visible to WPD through accepted demand connection offers, many are not.

New build deployment also feeds into the other DFES models for heat pumps, rooftop solar PV, and electric vehicle charger uptake, among others.

Example of source data trajectory build rates



Engagement with local authorities

Survey of local policies

Local authorities in the WPD area were surveyed for local plans and policies which may affect the uptake of new low carbon technologies included in the DFES analysis.

This included waste treatment policies, electric vehicle charging infrastructure or clean air zones, or specific policies supporting renewable energy deployment.

The surveys provided valuable insight into multiple factors which fed into the uptake modelling.

Local policies are expected to change significantly year on year. Through an annual iteration of the DFES this process will be expanded to make the surveys more comprehensive over time.

The local factors and policies will therefore be updated and verified annually with relevant local authorities.

Clean air zones are assumed to contribute to an increased use of electric vehicles in the local area

Creating the DFES projections

Overview and process

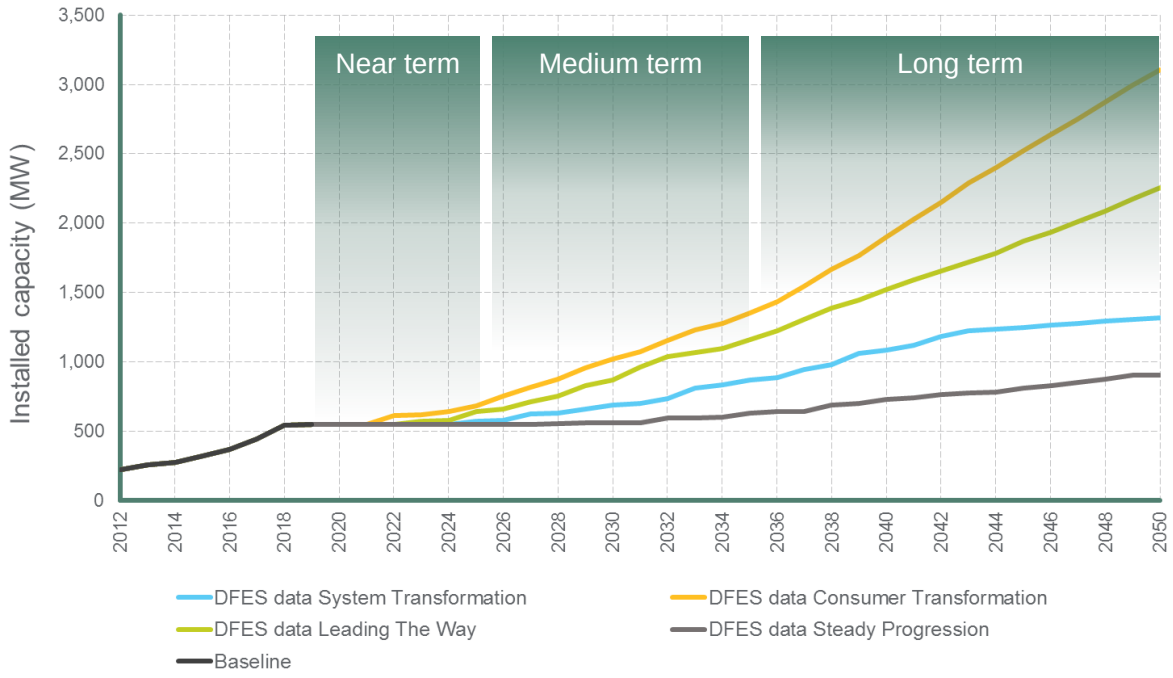
Baseline
The baseline process establishes the deployment of each technology to date and identifies historic growth trends and local factors.

Near term (2020-2025)
Sites which may connect in the near term are individually assessed for planning applications, network connection offers, and developer progress.

Medium term (2025-2035)
Key growth factors and stakeholder perspectives are used to create four scenario projections, with assumptions linked to FES 2020.

Long term (2035-2050)
Key uncertainties in technology improvements and costs are incorporated in an envelope of scenario projections. Data is reported in 5-year stages from 2035.

Example results showing range within scenario projections



Creating the DFES projections

Data sources for deployment to date

The primary source of data for the baseline of connected generation and storage sites is WPD connection agreement data. For the WPD DFES 2020 study, the cut-off data for this data is the beginning of April 2020.

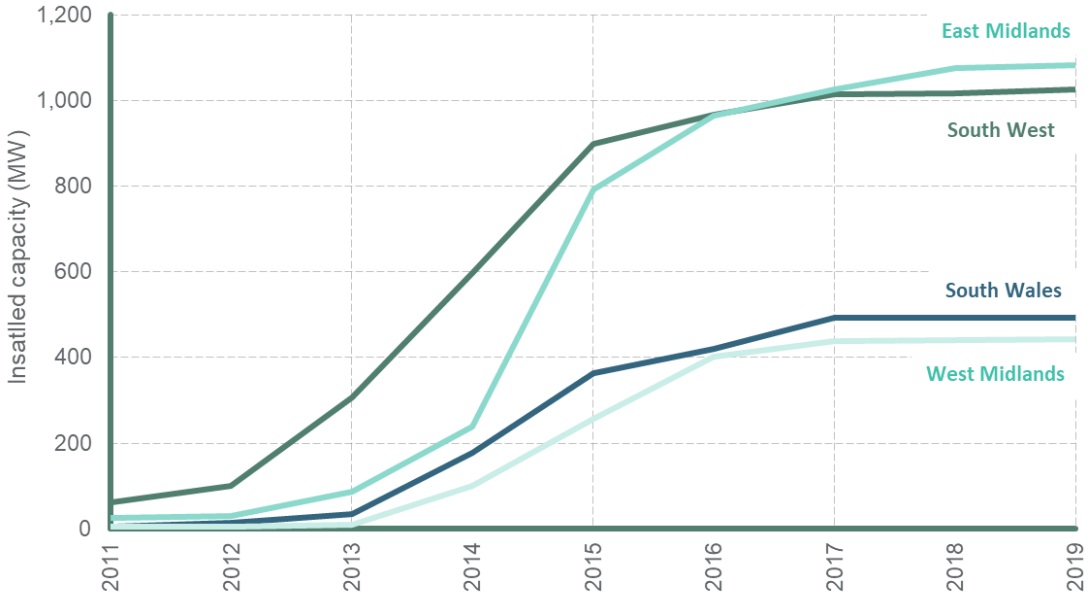
Additional data records are sourced from public subsidy records and other sources such as the Feed in Tariff, the Capacity Market, planning records and the Renewable Heat Incentive.

The baseline registrations for electric vehicles are based on Department for Transport data at local authority level. This information is then distributed to ESAs based upon demographic factors that reflect the characteristics of early adopters.

The baseline of heat pump and direct electric heating installations is based on analysis of Energy Performance Certificate data and Renewable Heat Incentive reports.

Deployment of solar PV over time

By WPD licence area, sites > 1 MW



Creating the DFES projections

The pipeline analysis process

Sites with an accepted network connection offer are individually assessed to establish when and if they will connect. Records of planning applications, network connection offers, and online information is used to assess progress.

Where possible, direct discussions are had with the developers of the pipeline sites to identify the stage of development and key factors affecting the connection year.

Factors which are specific to different technologies were also included in the pipeline research. For example Capacity Market activity is a key factor in the pipeline treatment of thermal generation and storage pipeline sites.

The planning applications of the individual pipeline sites are also assessed. The weighting given to a successful or undecided planning application varies by technology, as planning is a larger barrier for some generation technology types than others.

> “Over 350 individual pipeline sites were assessed, across a range of generation and storage technologies.”

Creating the DFES projections

Technology-specific projections are created at ESA level to create the DFES projections.

Key:

- ● Core factor
- ● Secondary factor
- ○ Unused

Projections driven by:	Wind	Solar	Hydro power	AD biogas	Fossil gas	Diesel	Heat pumps	Electric vehicles	Energy storage	Marine energy	Biomass
Analysis of pipeline sites	●	●	●	●	●	●	○	○	●	●	●
ESA-level resource availability	●	●	●	●	○	○	○	○	○	●	●
The business-case for development	●	●	●	●	●	●	●	●	●	●	●
ESA-level social factors	○	●	○	●	○	○	●	●	●	○	○
FES 2020 assumptions	● In line	● In line	● In line	● In line	● In line	● In line	● Led by	● Led by	● Led by	● In line	● In line
Local authority factors	●	●	●	●	●	○	●	●	●	●	●
National policies and regulations	●	●	●	●	●	●	●	●	●	●	●
Local stakeholder input	●	●	●	●	●	●	●	●	●	●	●

Creating the DFES projections

Demographic and social factors

Projections for household-scale technologies such as heat pumps, rooftop solar PV and battery electric cars, are most affected by demographic and social factors.

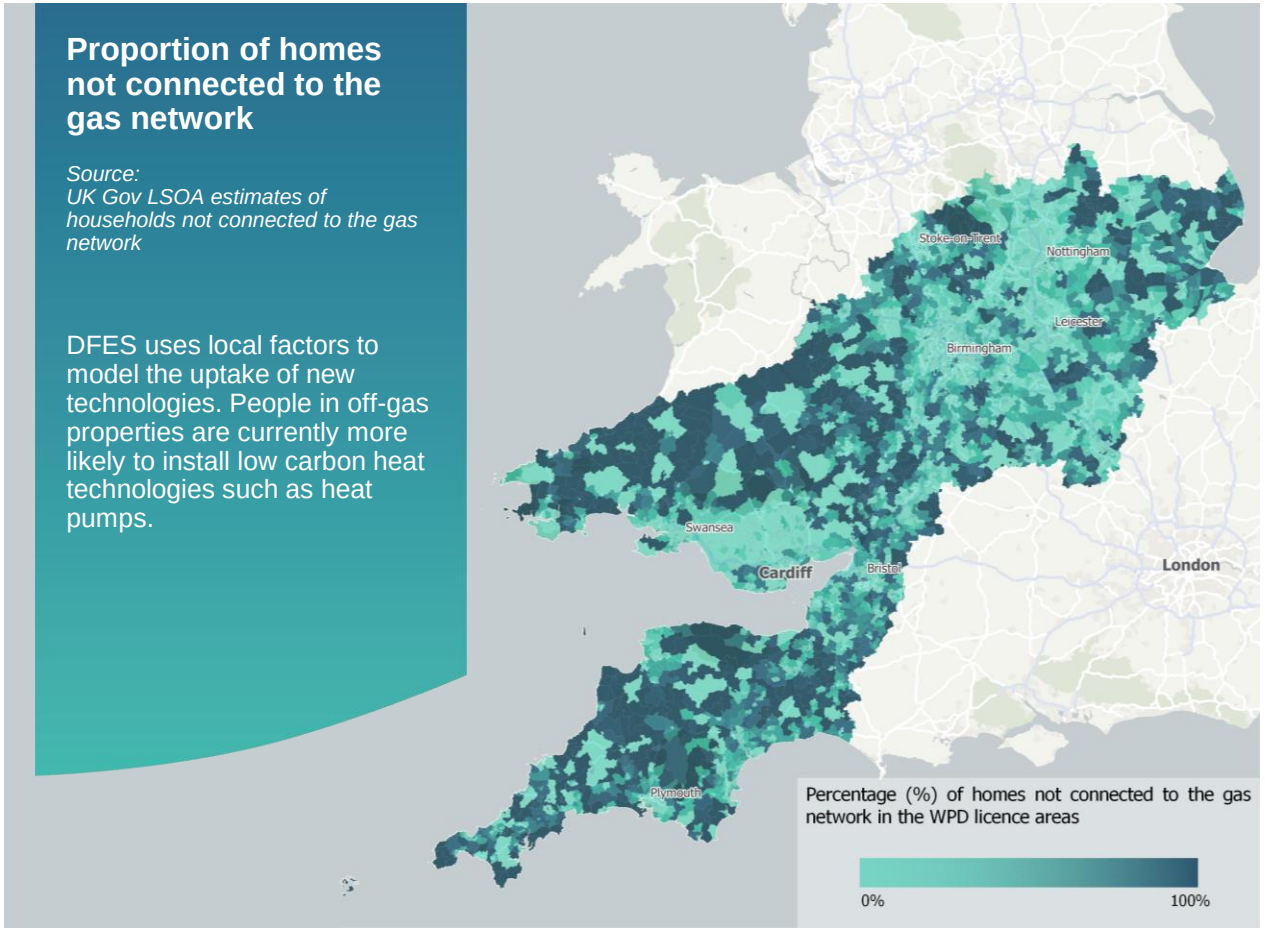
For example heat pump deployment is impacted by off-gas homes, building types, and energy efficiency ratings. These factors interact with other factors such as affluence or national policies or financial incentives.

These demographic and social factors are assumed to have a greater impact in the near term, during which low carbon technologies move from being niche to more widespread adoption. In the medium and long term therefore, uptake is much more widely distributed.

Proportion of homes not connected to the gas network

Source:
UK Gov LSOA estimates of households not connected to the gas network

DFES uses local factors to model the uptake of new technologies. People in off-gas properties are currently more likely to install low carbon heat technologies such as heat pumps.



Creating the DFES projections

Geographic resource assessments

Projections for generation technologies such as onshore wind and solar farms are weighted towards more geographical and resource factors.

Renewable generation is particularly reliant on areas of good resource, for instance high wind speed or solar irradiance.

Other key considerations are natural constraints including ground slope angle, National Parks and other protected areas.

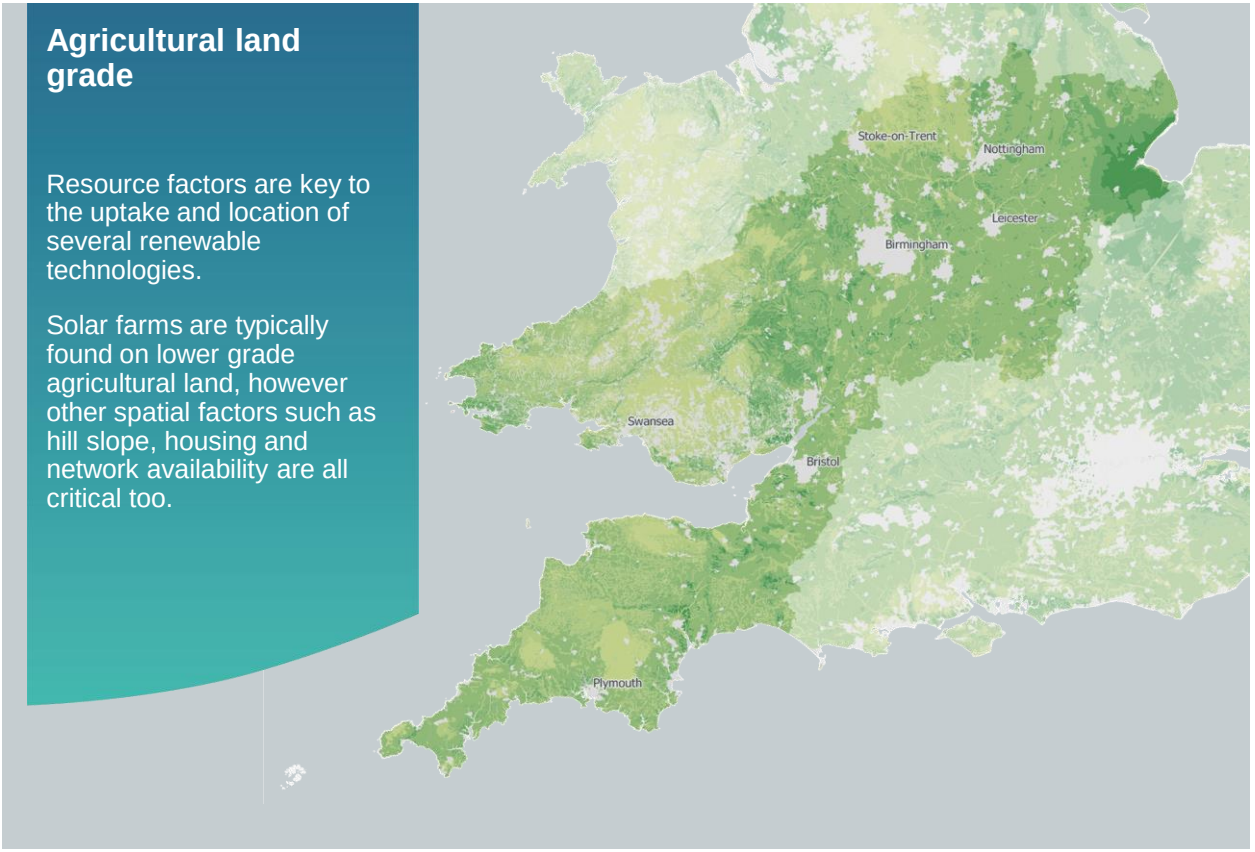
Distance from housing, proximity to the distribution network and agricultural land grade are also included in the spatial analysis.

These spatial resource assessments are verified against existing projects, pipeline sites and in conversation with developers.

Agricultural land grade

Resource factors are key to the uptake and location of several renewable technologies.

Solar farms are typically found on lower grade agricultural land, however other spatial factors such as hill slope, housing and network availability are all critical too.



DFES reconciliation with FES

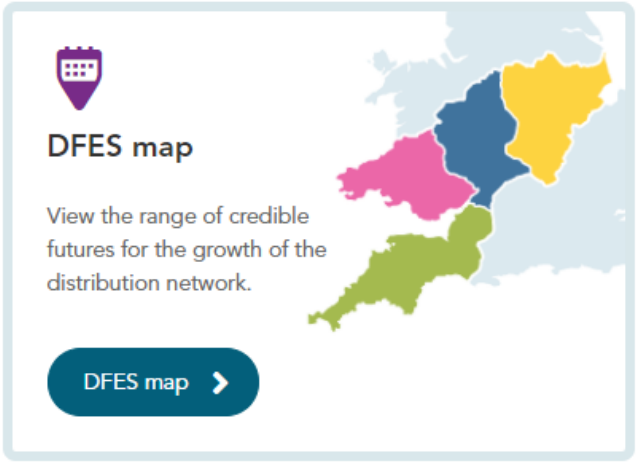
Reporting consistency across DFES and FES

The WPD DFES 2020 uses the same scenario definitions as the National Grid ESO FES 2020. This means there is a common and consistent framework and set of assumptions that allow for comparison between the studies. The scenarios are updated annually by the FES team.

The technology types used in DFES and FES data have been standardised for better consistency. In some areas, Regen and WPD have included greater detail. For example, the standard 'I&C' demand technology type is divided into 10 sub-technologies for WPD DFES, as these developments can have wide ranging impacts on the network.

The set of underlying assumptions in FES 2020 are incorporated wherever possible in WPD DFES. Further technology-specific assumptions are made in DFES, for example around the deployment of projects in the pipeline.

Like the range of FES documents, the suite of WPD DFES publications is designed to suit a variety of stakeholder needs. A summary of results and the underlying assumptions by each technology is published for each licence area, alongside the data available through the WPD DFES map hub. A summary of the stakeholder consultation event, these methodology slides and a DFES 'in 5 minutes' report are also published.



DFES results are available online at the WPD map hub

DFES reconciliation with FES

Data reconciliation across DFES and FES

The WPD DFES results are produced at ESA level and as part of the analysis is aggregated up to be compared with FES data published at both national and GSP level.

The WPD DFES uses FES as a framework and benchmark but in addition reflects the regional and local factors for each technology and scenario. Therefore some variance between the DFES and FES views is expected.

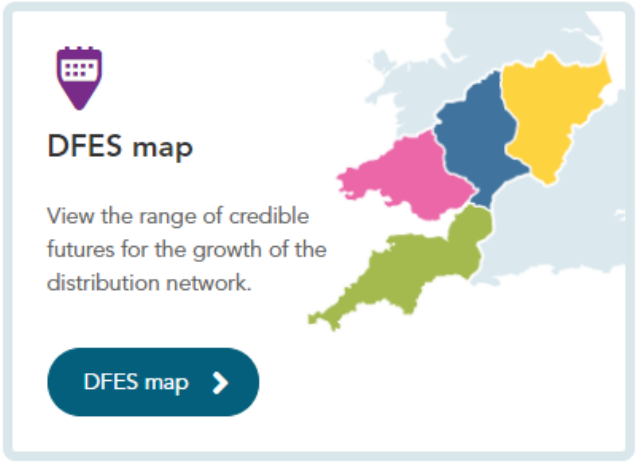
This variation is typically greatest in the near term as the DFES projections are based primarily on analysis of the pipeline sites.

In the medium and long term there is more convergence, although specific local resource availability or factors raised by stakeholders continue to affect the DFES results out to 2050.

Any technology specific assumptions and reasons for variance between the local DFES and FES results are published in the WPD DFES summary reports for each licence area.

Typical regional and local variations include:

- Resource availability
- Historic factors
- Political factors
- Stakeholder input
- Pipeline analysis
- New technology adoption factors



DFES results are available online at the WPD map hub

Next steps

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

- Stakeholder feedback summary reports – available here
- Data available through the map hub
- Technology results and assumptions reports
- Methodology walkthrough slides
- DFES Regional Review summary reports

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

The DFES is an annual process conducted by WPD and Regen, the WPD DFES 2021 process will begin in February 2021.

WPD Distribution Managers are in contact with local authorities to discuss the results. The stakeholder engagement process runs from February to July 2021, if you have information to feed into the creation of the local factors for the DFES 2021 please get in contact using the above details.

DFES results are available online at the WPD map hub

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