Electricity Distribution

Distribution Future Energy Scenarios 2022

Methodology
December 2022

nationalgrid

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transforming energy

Contents

Introduction to DFES

The Distribution Future Energy Scenarios (DFES) outline a range of credible futures for connections to the distribution network.

DFES makes use of a scenario framework that is consistent with other distribution network operators and National Grid ESO, known as the Future Energy Scenarios or FES. These local stakeholder-informed projections encompass potential changes in distributed generation, electricity storage and demand, including electrified heat and transport.

National Grid Electricity Distribution (NG) works with Regen to undertake the DFES analysis out to 2050 for all four of its licence areas, on an annual cycle.

The suite of NG DFES 2022 outputs are available online.

The results are also available as an interactive map.

The need for scenario-based planning

Our energy system is changing. Achieving a net zero electricity system by 2035, and a net zero economy by 2050, requires energy networks to evolve and adapt to changing customer and system needs.

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

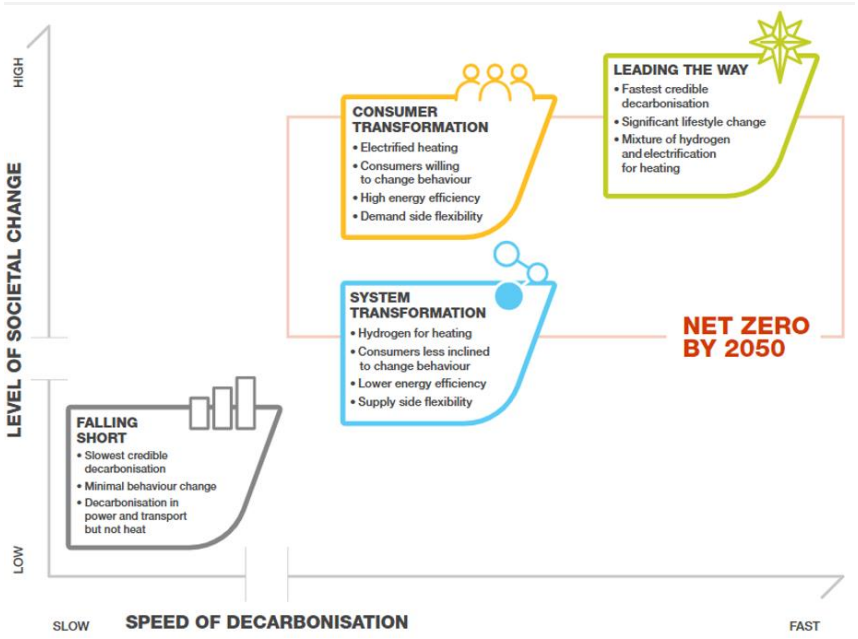
The DFES is used by NG to conduct a detailed review of how its network could be impacted under a range of possible futures. This helps NG to develop strategic reinforcement solutions to solve network constraints.

The DFES has also been used to inform NG's RIIO-ED2 business plan, and to publicly signpost potential system flexibility needs.

The four NG DFES scenarios – incorporating FES 2022

The National Grid ESO FES 2022 scenarios are used as the overarching scenario framework for the DFES 2022. Although the previous ‘Steady Progression’ scenario has been renamed as ‘Falling Short’, the 2022 scenarios follow the same structure and framework as 2020 and 2021.

Three of the scenarios are compliant with the UK government’s net zero emissions target for 2050. Each of these scenarios meets this target in a different way. The four scenarios are defined by different ‘speeds of decarbonisation’ and ‘levels of societal change’.

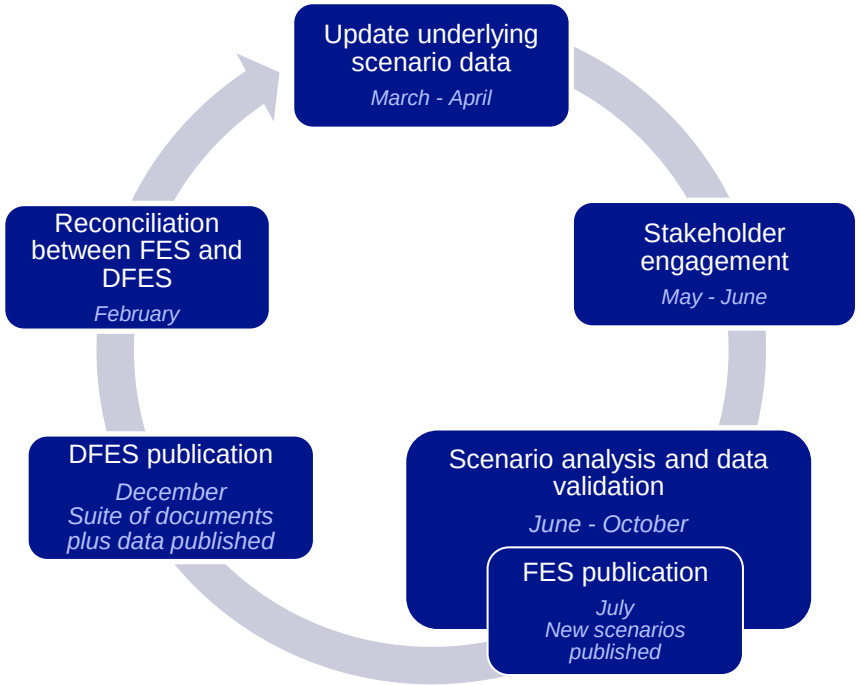


The four NG DFES scenarios – incorporating FES 2022

Key overarching assumptions are published by National Grid ESO for each of the four scenarios, which are applied in the DFES.

Additional local and regional assumptions are made by Regen and NG. This includes the identification of pipeline projects in the area and regional stakeholder and project developer engagement.

Renewable energy resources, building stock and socio-demographics of each local area are also key to the regional analysis.



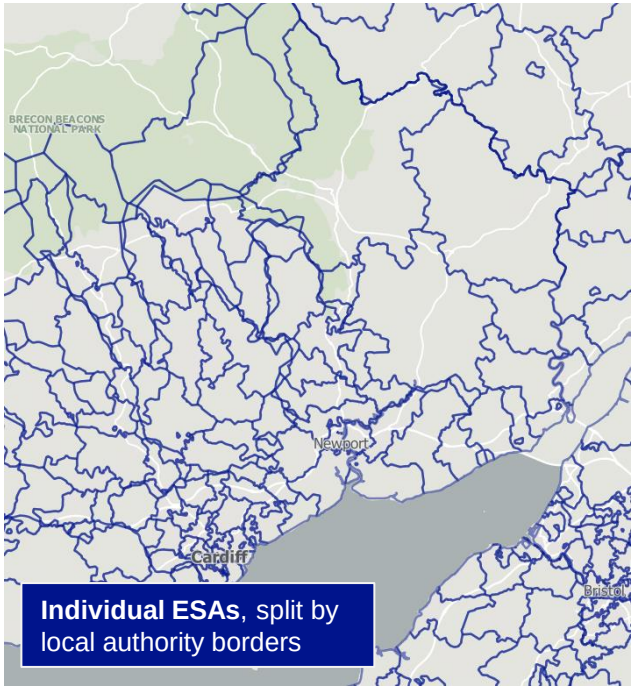
Electricity Supply Areas

DFES analysis is produced at a high granularity, using ‘Electricity Supply Areas’ (ESAs).

An ESA is defined as the ‘geographical area supplied by a primary substation providing supplies at a voltage below 33 kV; or a customer directly supplied at 33, 66 or 132 kV or by a dedicated primary substation.’

Each ESA geographically represents a block of demand and/or generation based on the distribution network substation that it is connected to.

This way, projected new connections are linked to specific parts of the network, allowing for more granular network analysis.



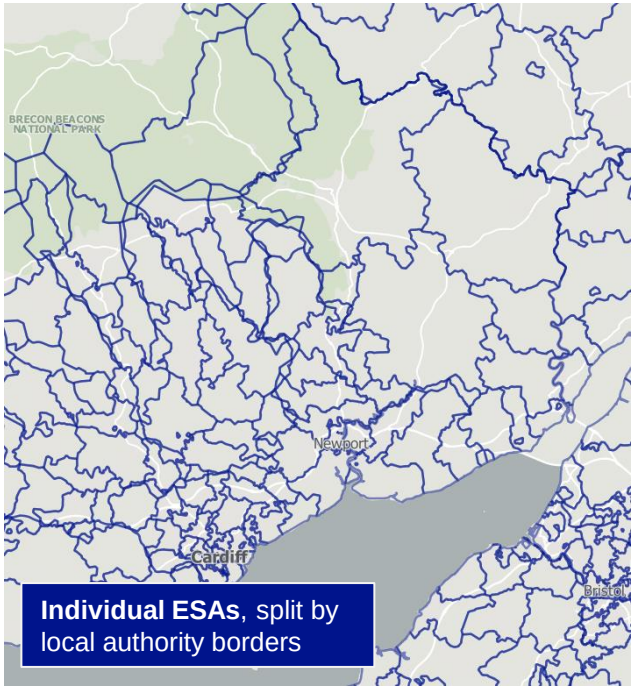
Individual ESAs, split by local authority borders

Electricity Supply Areas

The attributes of the land, buildings and people within an ESA inform the future deployment of each individual technology type.

These attributes include the number of cars registered in an ESA, the number of homes, businesses, the amount of farmland, the level of solar irradiance or the average wind speed.

These network-informed spatial areas are subdivided by local authority borders. This means the DFES 2022 results can be directly aggregated up to local authority areas.



Individual ESAs, split by local authority borders

Stakeholder engagement

NG and Regen ran four consultation webinars in July 2022. Each session focused on elements of distributed energy generation, demand and electricity storage that were particularly relevant or active in the region.

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.

Regen also contacted every local authority in NG's licence areas to collate data and information on new developments and local policies, plans and ambitions to support low carbon energy and infrastructure.

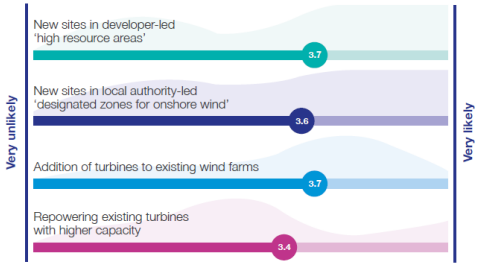
Stakeholder feedback

Onshore wind

Your comments to us	Our response
Stakeholders in South Wales felt that the onshore wind pipeline could be built out on a similar timescale to the ground-mounted solar PV pipeline, completing in the late 2020s and early 2030s; however, stakeholders also felt that only select sites would progress to commissioning, and suggested that, on average, less than half of the c. 750 MW pipeline anticipated to be built out.	The envelope of onshore wind pipeline deployment shown from the results of stakeholder polling will be directly reflected in the pipeline scenario modelling. This will be combined with research on individual pipeline project progress and direct engagement with project developers.
Views from stakeholders in the South West around the location of future onshore wind capacity were evenly spread across a number of factors. Polling results suggested that onshore wind could equally be located at new sites in high resource areas, zones for onshore wind development designated by local authorities, expansion of existing wind farms with new turbines, or repowering of existing turbines with higher capacity models.	We will apply an even weighting of these factors to model the spatial distribution of onshore wind in the English licence areas, specifically in scenarios where onshore wind policy and development in England is unlocked.
Stakeholders highlighted that community energy could be a route to enable onshore wind deployment in England.	We will assess the pipeline of prospective onshore wind projects individually to ensure that all routes to onshore wind deployment in the near term are accurately reflected.
Stakeholders noted that landscape designations in the South West limit onshore wind deployment relative to ground-mounted solar PV.	Our onshore wind resource assessment includes protected and designated areas to understand which parts of the licence area are less likely to host onshore wind.

Figure 6 South West licence area webinar responses regarding the location of future onshore wind development

If current restrictions to onshore wind development are unlocked, what types of projects are most likely to be developed in the next 5-10 years?



Stakeholder engagement

Developers of active pipeline sites (i.e. those with accepted network connection offers or planning permission) were contacted. Developer feedback received was used to augment the detailed desk-based research of each pipeline site, as well as discussing key development factors and drivers in their respective industries.

Wider industry consultation was also completed for some technologies, with a particular focus on emerging technology sectors. This included trade bodies, landowners, asset operators, technology companies and other relevant organisations. Information was gathered predominantly through direct conversations, as well as through existing industry networks and events.

Stakeholder feedback

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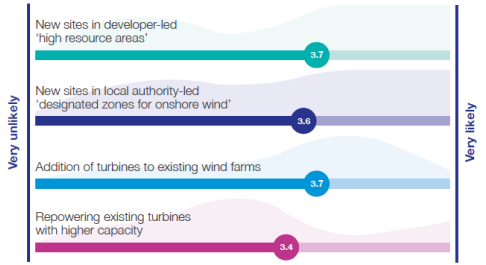


Engagement with local authorities

Local authority development plans are incorporated into DFES to reflect their localised impact on the distribution network.

Regen works with local authorities to maintain an online database of all new development data collected during earlier DFES studies. This was shared with the local authority planners to provide updated data. These updates are then verified against the most recent local planning documents.

The following data is collected for each site:

- Use class, such as domestic, office, industrial, retail etc.
- Total number of homes, or non-domestic floorspace (in sqm)
- Location address
- Stage of development

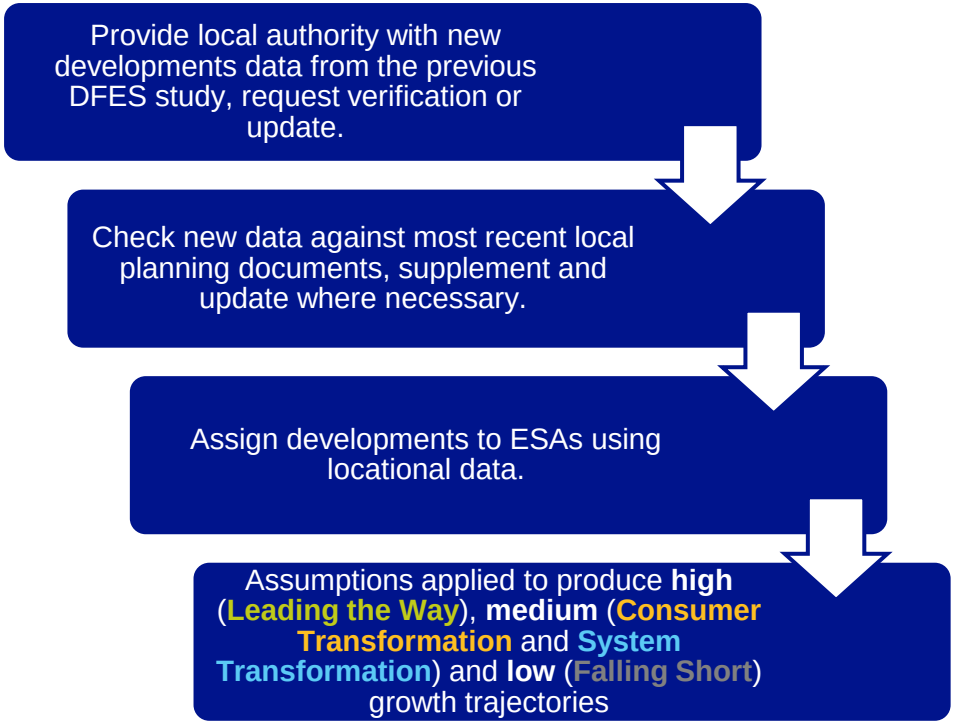
Over 10,000 new development records were processed as part of NG DFES 2022

Engagement with local authorities

Once processed and verified, the build-out rates of individual developments are modelled based on the data provided.

A delay in this schedule is applied to sites in earlier stages of development, to reflect potential build-out delays and uncertainty.

The delay methodology means that the precise spatial data and scale of development is maintained, but the period over which the sites are built out varies, reflecting a realistic range of building rates over the coming years.



Engagement with local authorities

For planned new developments, each individual development is assigned to an ESA. This creates highly granular scenarios for domestic and non-domestic developments in the near and medium term.

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

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

To account for this reduction, additional domestic dwellings and commercial floorspace are modelled. Their locations are weighted towards areas of similar characteristics to those that have seen a recent deployment of new developments.

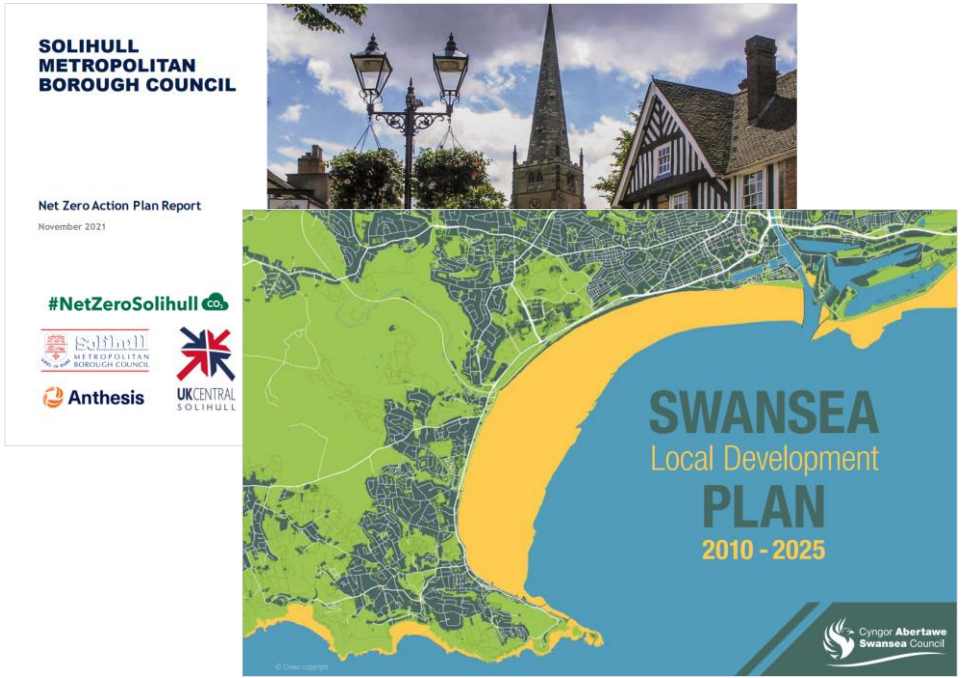
New build deployment also feeds into other areas of the DFES modelling, such as for heat pump uptake, rooftop solar PV deployment and electric vehicle (EV) uptake.

Engagement with local authorities

Local authorities in the NG area were surveyed for plans and policies that could impact local uptake of DFES technologies.

This included EV charging infrastructure or clean air zones, planned heat networks, waste collection, renewable energy policies or local area energy plans.

The surveys provided valuable insight into multiple factors which fed into future projections and technology uptake. This process is repeated annually, as local policies can change year-on-year.



Creating the DFES projections

Baseline

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

This is based on NG data, planning applications and other data sources, such as Feed-in Tariff registers and Department for Transport data.

Pipeline

Proposed sites that may connect in the near term are individually assessed. Where possible, individual site developers are contacted as part of this process.

Pipeline sites are modelled to go ahead at different rates depending on the technology and the scenario.

Stakeholder engagement

Local information is collected from consultation with regional stakeholders and engagement with every local authority in NG's licence areas.

This is combined with analysis of existing trends and spatial data, and direct engagement with project developers, major energy users and industry bodies.

Scenario projections

The baseline, pipeline, local evidence and National Grid ESO FES 2022 assumptions are combined to create the DFES projections spanning from an April 2022 baseline to 2050.

Projections are produced at an ESA level based on local, regional and national factors.

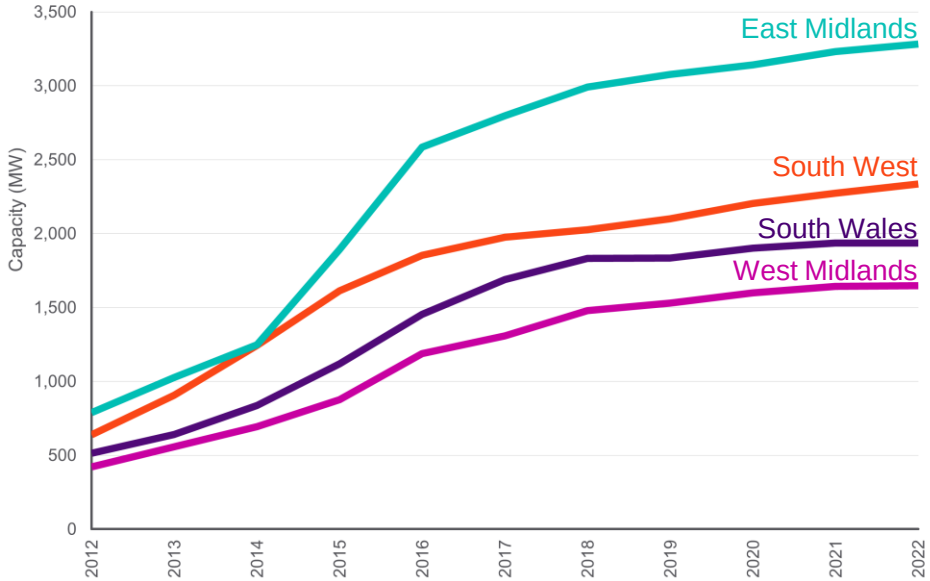
Creating the DFES projections

Baseline

The primary source of data for the baseline of connected generation and storage sites is NG connection agreement data.

Additional data is sourced from public registers, records and other databases such as Feed-in Tariff registers, Capacity Market registers, Contracts for Difference auction data, Department for Transport statistics and Energy Performance Certificates.

Baseline large-scale generation and storage capacity
By NG distribution licence area



Creating the DFES projections

Pipeline

Sites with an accepted network connection offer are individually assessed to establish if, and when, they could connect to the distribution network under each scenario.

Records of planning applications, Capacity Market activity and Contract for Difference auctions are also used to assess progress.

The planning activity of the individual pipeline sites is also assessed through reviewing the Renewable Energy Planning Database and local planning portals.

The impact of planning status on the scenario projections varies, as planning is a more significant barrier for some projects than for others. This is backed by analysis of historic planning outcomes.

In addition, direct discussions are held with the developers of pipeline sites, to identify their stage of development and any plans that could affect the year of connection.

These discussions are also used to gather broader information about the developer's sector, to inform the scenario projections.

Creating the DFES projections

Scenario projections are derived from a number of factors:

	Solar	Wind	Bioenergy	Other renewables	Fossil fuels	Energy storage	Heat pumps	Electric vehicles	Hydrogen electrolysis
Analysis of pipeline sites	●	●	●	●	●	●	●		●
ESA-level resource availability	●	●	●	●		●			●
ESA-level housing and demographics	●		●			●	●	●	
FES 2022 assumptions	In line	In line	In line	In line	In line	In line	Led by	Led by	In line
Local authority factors	●	●	●	●	●	●	●	●	●
National and devolved policy	●	●	●	●	●	●	●	●	●
Local stakeholder input	●	●	●	●	●	●	●	●	●

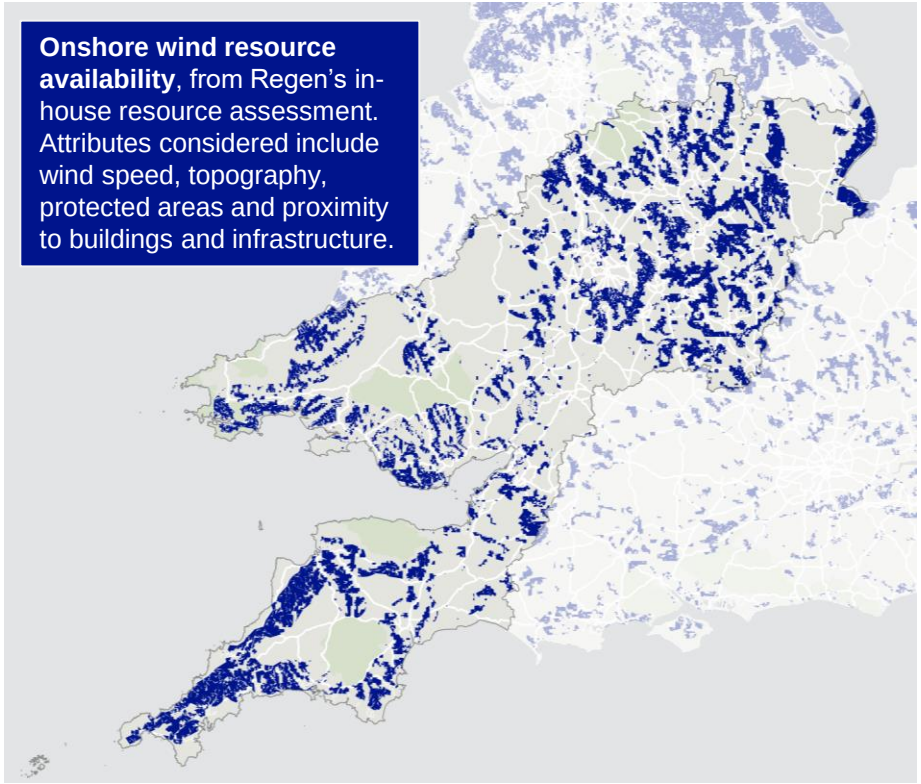
Creating the DFES projections

Resource availability

Projections for generation technologies, such as solar, onshore wind and anaerobic digestion, require areas of good resource. This includes solar irradiance, high wind speeds or biological feedstocks.

Constraints are also considered, such as protected areas and prime agricultural land, which are avoided due to planning considerations.

These spatial resource assessments are verified against existing projects.



Onshore wind resource availability, from Regen's in-house resource assessment. Attributes considered include wind speed, topography, protected areas and proximity to buildings and infrastructure.

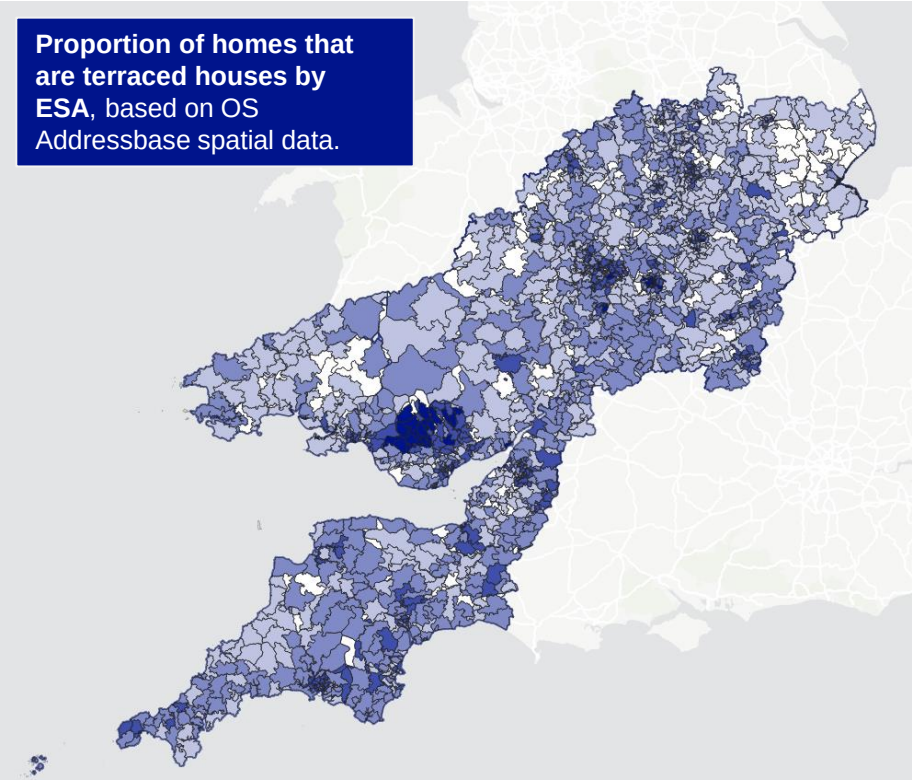
Creating the DFES projections

Housing and demographics

Uptake of domestic technologies, such as heat pumps, rooftop PV and EVs, is heavily affected by housing and demographic factors.

For example, heat pump deployment is impacted by gas network availability, the building type and the tenure of the household.

These demographics are assumed to have a greater impact in the early stages of technology adoption.



Reconciliation with FES

Scenarios

The DFES 2022 uses the same scenario framework as the National Grid ESO FES 2022.

This means there is a common and consistent set of assumptions that allow for comparison between the studies.

The scenarios are updated annually by the FES team in National Grid ESO.

Technologies

The technology types used in DFES and FES data have been standardised using ‘building blocks’. In some areas, Regen and NG have included greater detail.

For example, the standard ‘non-domestic’ demand technology type is divided into ten sub-technologies for DFES, as these developments can have wide-ranging impacts on the distribution network.

Assumptions

Underlying assumptions in FES 2022 are incorporated in the NG DFES analysis where applicable.

Further technology-specific assumptions are made in DFES, for example around the deployment of projects in the pipeline or where the region or local area has different characteristics to the national picture.

Reporting

Like the FES, a suite of NG DFES publications is produced to meet stakeholder needs.

This includes a summary report for each licence area detailing assumptions and results by technology, and visualised outputs on the NG DFES map.

‘Regional View’ reports and summaries of stakeholder engagement results are also separately published.

Reconciliation with FES

The DFES results are produced at ESA level. During the analysis, the outputs are aggregated and compared against FES data at a licence area level. The DFES summary reports include a review of any variances.

The DFES uses FES as a framework and benchmark, but 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, as the outcomes for many technologies are based on national-level outcomes and strategies. However, regional factors or those raised by local stakeholders also affect the DFES results out to 2050.

Typical regional and local variations include:

- Baseline and pipeline analysis
- Resource availability
- Local and national policy impacts
- Stakeholder input
- Socio-demographic factors
- Housing stock

Next steps

The DFES is an annual process; the NG DFES 2023 analysis will begin in Spring 2023.

Stakeholder consultation will run from February to July 2023. NG Distribution System Operator's (DSO) newly appointed Strategic Engagement Officers are in contact with local authorities to discuss the results of the DFES 2022.

If you have any questions in relation to the NG DSO Forecasting & Capacity team or would like to be consulted for the DFES 2023, please get in touch via the details below:

nged.networkstrategy@nationalgrid.co.uk

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