Shaping our energy future:
Distribution network future energy scenarios 2021
- Briefing document for attendees -

Background

As part of Scottish and Southern Electricity Networks (SSEN)'s future forecasting, network analysis and investment planning processes, Regen has been working with the SSEN team to deliver a number of Distribution Network Future Energy Scenario (DFES) assessments for the electricity distribution networks in the North of Scotland and Southern Central England licence areas.

The annual DFES assessments use National Grid ESO's Future Energy Scenarios as the overarching framework, but develop a set of bottom-up, local evidence led projections which reflect the unique characteristics and development activity of SSEN's network regions. The scenario projections model the potential increase of key electricity generation, storage and demand capacity that has connected, or will connect, to SSEN's network in the period out to 2050. The DFES process essentially helps SSEN to understand:

- **What** technologies will connect/disconnect from their network out to 2050
- **How much** installed capacity of each technology will connect
- **When** this capacity will come online and begin supplying/consuming electricity
- And **where** across SSEN's licence areas these technologies will likely connect

SSEN uses the outputs of the DFES to determine the potential impacts on the distribution network, to provide an evidence base to support future network reinforcement and investment planning, and to identify opportunities for the use of non-network solutions such as storage and flexibility services.

Examples of previous DFES studies from previous years can be found online via the links below.

➢ Southern England DFES (2020) | North of Scotland DFES (2020)
➢ Southern England Licence Area DFES (2018) | North of Scotland DFES (2019)
➢ SSEN Northern & Southern Low Carbon Technology study (2019/20)

For key low carbon technologies, a more detailed, granular, analysis is completed as part of the DFES assessment, producing 'below street level' future scenario projections for electric vehicles (EVs), EV chargers, heat pumps, rooftop solar and - for the first time this year - domestic battery storage.
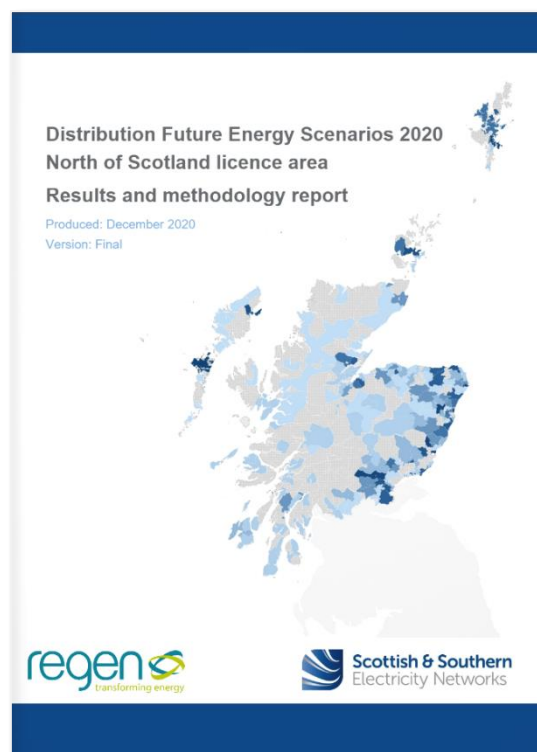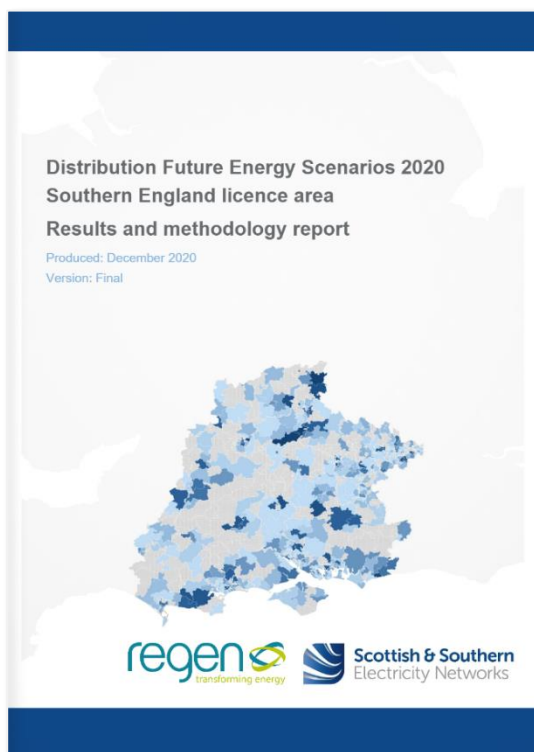
2021 DFES project overview

The DFES 2021 study will again look at the growth of distributed electricity generation and storage, and projections for low carbon technologies out to 2050. The DFES 2021 will also be conducted in the context of ongoing decarbonisation commitments and policies enacted by both the UK and Scottish Governments.

There is an increasing need for electricity network operators to demonstrate to customers, stakeholders and the regulator (Ofgem) that they are delivering a network that meets a variety of economic and societal objectives, including primarily the UK's net zero greenhouse gas emissions target.

The need for investment to support strong energy decarbonisation has grown in urgency, alongside a number of other priority areas such as supporting a green recovery from the COVID-19 pandemic locally, regionally and nationally, providing energy security and addressing wider societal issues such as fuel poverty and supporting vulnerable customers.

Stakeholder engagement is critical

A key part of the DFES process is to engage with regional and local stakeholders and feed evidence and local data in to the analysis. Examples of local data that the DFES uses include:

- A data exchange with local authorities to identify new housing and commercial developments
- A pipeline of connection offers for generation and storage projects located in SSEN's regions
- DVLA vehicle registrations located within the regions/local authorities
- Local data on energy resources, land-use, demographics and housing
- Data and evidence related to local and regional energy strategies, local plans and net zero

In addition to local data sources, regional and local stakeholder input is a key facet of the DFES process. As part of the online webinar events Regen are running with SSEN on the **13th October (Southern England)** and **19th October (North of Scotland),** the team will be:

1. Outlining the **overall thinking and approach to DFES analysis** covered in this document
2. **Testing some of the assumptions** used for modelling the ongoing deployment and geographical location of a selection of the technologies within the scope of the assessment
3. **Gauging views on the uptake of new or disruptive future energy technologies** such as battery storage, electric vehicles, heat pumps and hydrogen electrolysis
4. **Understand some of the regional characteristics** for the North of Scotland and Southern England regions that may align with, or diverge away from, national trends

Online polling platform

The webinar will be broadcast via Zoom Meetings, but the team will be using **Mentimeter**, an interactive online polling platform, to gauge your views on the questions and rankings we'll be raising.

In order to participate in these polls on the day, simply open the browser in your phone - whilst you are still also tuned in to the webinar broadcast through Zoom - visit Menti.com, and then enter the event code (which will be shown on screen across the event throughout the morning). You can then submit your answers/views to the various polls through your phone, and also see the collective response from everyone to these polls in real time through the Teams broadcast, where we will show the live results.

Mentimeter

Please enter the code

Code will be provided on the day

Submit

Project team and contact

Regen and SSEN welcome your input at this stakeholder workshop, and at any time during the project.

If you have any questions relating to this overview document or about the DFES elements of the event, please contact **Ray Arrell**, Head of Technical Development at Regen on rarrell@regen.co.uk.

If you have any questions relating to accessing the webinar, please contact **Hannah Stanley**, events manager at Regen on hstanley@regen.co.uk.

Lastly if you would like to speak to someone at SSEN regarding DFES or wider future network issues, please contact: **Steve Atkins**, DSO Transition Manager, steve.atkins@sse.com.

Geographic scope

The geographic scope of the DFES projects is clear, with the project team assessing all major energy technologies that connect directly to SSEN's electricity distribution networks in the **North of Scotland** and **Southern Central England** (see map).

As with 2020, this year Regen is completing the analysis and projections for both licence areas concurrently, using the same scenario framework, technology capacity growth/uptake assumptions and other key modelling approaches and factors.

There are some local authority boundaries that span the borders of SSEN's licence areas with other network operators (e.g. SP Energy Networks in the north or Western Power Distribution or UK Power Networks in the south). The modelling allows for this fully by only focussing on projects, properties or developments that are located within the boundary of SSEN's licence area and/or directly supplied by SSEN's network.

Use of the national future energy scenarios framework

The project will be using National Grid ESO's 2020 edition of their [Future Energy Scenarios](https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2021) (FES), as the underlying framework that the DFES and LCT analysis will be based upon.

Credit & source: National Grid ESO, Future Energy Scenarios 2021, https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2021
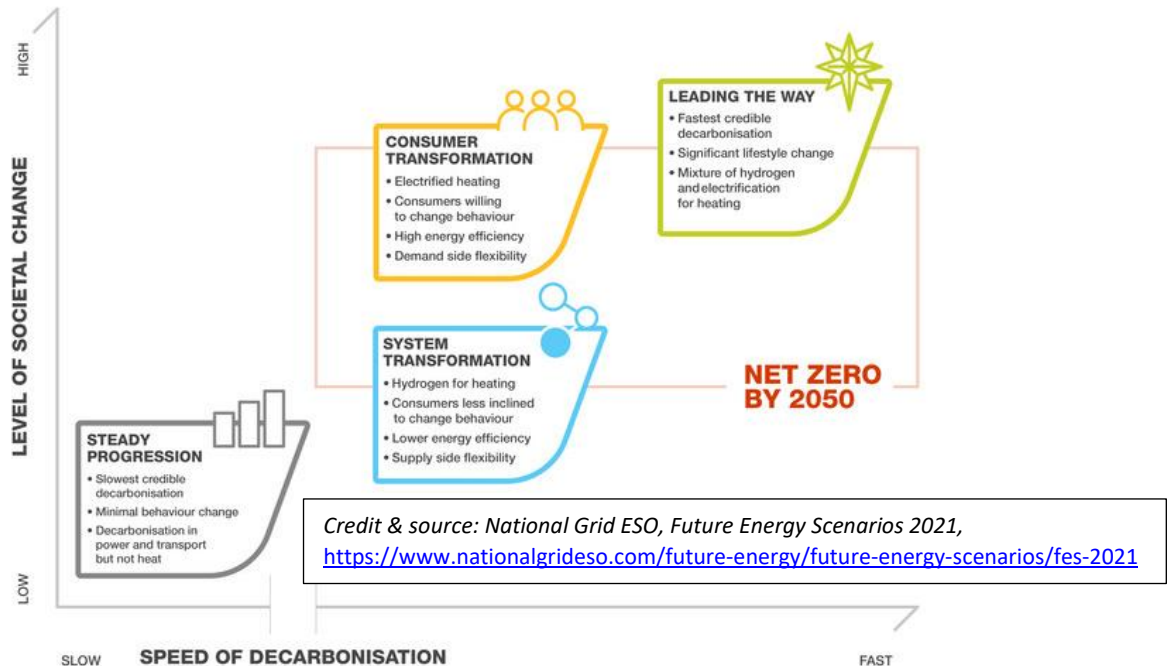
At a glance, FES 2021 echoes the framework and scenarios defined in the FES 2020. This framework identified four scenarios, mapped against two national progress axes: **Speed of Decarbonisation** and **Level of Societal Change.** Three of the four scenarios proposed, **Leading the Way**, **Consumer Transformation** and **System Transformation**, are consistent with achieving net zero carbon emissions by 2050, with only one, **Steady Progression**, not achieving net zero by 2050.

Use of these national scenarios provides a common framework of future 'worlds' to draw from and an overarching set of national societal and economic assumptions to reconcile to. However, the DFES analysis provides an opportunity to develop a set of more detailed regional scenarios that are produced through a bottom up process of regional data gathering, investigation of prospective project developments, energy system analysis and local stakeholder engagement. The webinars we running on the 13th and 19th are a key part of that process.

Scenario forecasting method

At its heart, the DFES follows a method of four key analysis stages which, for each of the energy technologies in scope:

1. Determines the **existing and historic baseline** position (e.g. how much is connected now)
2. Assesses the **near-term pipeline** (e.g. what known projects or developments are in the area)
3. Develops **medium and long term projections** (e.g. what might happen out to 2050)
4. **Geographically distributes** these technologies/capacities (e.g. where will they be located)
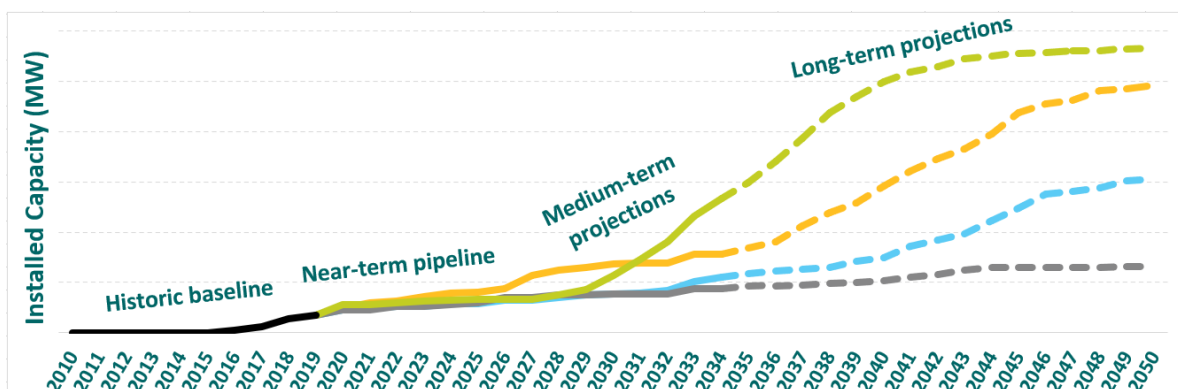
Energy technologies in scope

The project aligns closely to the Energy Networks Association's Open Networks 'building block' technologies for DFES assessments, which identifies all major 'grid scale' electricity generation and storage technologies connecting to the distribution network, and key low carbon technologies connecting at lower voltages, including those at domestic level. In summary, the core technologies that are being assessed in the DFES and LCT assessments are shown below:

DFES Generation & Storage Technologies	
Category	**Technology (distribution network only)**
Renewable energy technologies	Ground mount solar PV (>1MW)
	Commercial rooftop solar PV (10kW-1MW)
	Domestic rooftop solar PV (<10kW)
	Onshore wind (>1MW)
	Onshore wind (<1MW)
	Offshore wind
	Hydropower
	Geothermal
	Marine technologies
	Hydrogen peaking generation
	Hydrogen electrolysers
Renewable generation - waste technologies	Anaerobic digestion
	Biomass CHP
	Landfill gas
	Sewage gas
	Energy from Waste
	Advanced Conversion Technologies
Fossil fuel generation technologies	Diesel (excluding 'back-up only')
	Natural gas Closed Cycle Gas Turbines (CCGT)
	Natural gas Open Cycle Gas Turbines (OCGT)
	Natural gas reciprocating engines
	Natural gas Combined Heat & Power (CHPs)
Electricity storage technologies	Battery storage – Standalone grid services
	Battery storage – Generation co-location
	Battery storage – Behind-the-meter high energy user
	Battery storage – Domestic batteries
	Liquid Air Energy Storage (LAES)
	Pumped hydro

Low Voltage Low Carbon Technologies	
Category	**Technology**
Electric vehicles	BEV buses & coaches
	BEV cars
	PHEV cars
	BEV heavy goods vehicles
	BEV light goods vehicles
	PHEV light goods vehicles
	BEV motorbikes
Electric vehicle chargers	Domestic off-street chargers
	Domestic on-street chargers
	Workplace chargers
	Fleet/depot chargers
	En-route/local charging stations
	Destination chargers
	Car park chargers
Heating technologies	Domestic pure electric heat pumps
	Domestic hybrid heat pumps
	Domestic direct electric heaters
	Non-domestic pure electric heat pumps
	Non-domestic hybrid heat pumps
	Non-domestic direct electric heaters
Rooftop solar PV	Domestic

In-region geographical distribution

The requirement to create regional scenarios that can be used for strategic network planning, has led to the creation of geographic zones or '**Electricity Supply Areas**' (ESAs) within both the North of Scotland and Southern Central England regions. These ESAs are at two levels, one for the DFES generation & storage study that associates to primary 11kV network substations and a second more granular set of ESAs for the LCTs that associate to low voltage substations and feeders.

The final stage of the scenario projections developed by Regen is to distribute the capacity geographically across these ESAs, by scenario and by year. This enables SSEN to view the scenario projections for each technology (out to 2050), down to a finer resolution and can help to identify electricity demand / generation 'hot spots', potential future constraints on the network and determine the need for investment to reinforce the network in specific areas.

Data can also be collated by local authority and will be made available by SSEN to support local authority and other third party planning activities.