electricity north west

Bringing energy to your door

Distribution Future Electricity Scenarios

March 2024

A Word From ...

Ben Grunfeld - Strategy & Growth Director

Welcome to our sixth annual Distribution Future Electricity Scenarios (DFES). The DFES outlines the expected demand, distributed generation (DG) and battery storage uptake in our region up to 2050. The DFES are used to inform our network development and also help our stakeholders make informed decisions about decarbonisation and other investments.

This year, due to the energy and cost of living crisis, we observed a slight decrease in overall electricity demand compared to the previous year.

However, in some substations we observed a rise in peak demand driven by local developments and Low Carbon Technology (LCT) uptake. We also observed a record increase in Electric Vehicle (EV) registrations. There is also increasing certainty that heat pumps will play an ever more significant role in domestic heating. This is reflected in our Best View scenario, which captures the high certainty trends before 2030, and also in our Leading the Way scenario, which captures an increasingly likely accelerated electrification of domestic heating beyond 2030.

This year, our engagement with local authorities and other stakeholders in our area was more extensive. This enabled us to capture a wide range of decarbonisation and local economic growth projects, allowing for a more granular reflection of planned local developments in the forecasts.

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What is DFES?

OVERVIEW

- The DFES are long-term forecasts of electricity demand supplied by our distribution network, as well as forecasts of distributed generation (DG) and battery storage connected to our networks.
- We have produced five scenarios: Falling Short, System Transformation, Consumer Transformation, Leading the Way and Best View.
- The initial four scenarios are aligned to the Future Energy Scenarios (FES), produced by the ESO, in terms of speed of decarbonization and level of societal change.
- The fifth scenario, Best View, offers the highest level of certainty until 2030, diminishing over the following decade, and decreasing further until 2050.
- Best View scenario have changed from last year to reflect the longer term and a more limited role of hydrogen for domestic heating. This is reflected in an accelerated electrification of heating through heat pumps compared to last year. We also still expect an accelerated electrification of transport across our area as we approach 2030.
- All scenarios specifically represent the North West. They are modelled using regional data and learnings from our engagement with local stakeholders, as well as our unique bottom-up methodology developed as part of our ATLAS project.

Our DFES 2023 consists of five scenarios. Four follow the common scenario framework of the 2023 Future Energy Scenarios (FES) from the Energy System Operator (ESO). The Best View (fifth) scenario focuses on the highest certainty trends in our region through 2030. Beyond 2030 the higher certainty range of electricity demand is defined by the common scenarios that model high levels of electrification (Leading the Way and Consumer Transformation).

What is DFES?

WHY IS IMPORTANT

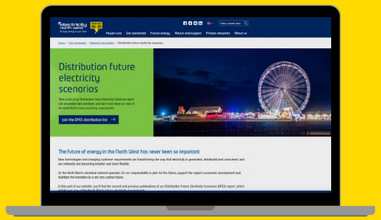
- The Best View scenario forecast is used in our capacity headroom forecasts for the next five years published in our Long Term Development Statement (LTDS).
- The DFES forecasts are used in network impact analyses to establish the network capacity needs.
- The DFES are used to inform our Network Development Plan (NDP), which details future distribution network and non-network solutions to release capacity that facilitates the expected demand and generation growth.
- The DFES are used to inform our load-related investment plan, which release network capacity in a cost-efficient and risk averse way to facilitate the region's decarbonisation and economic growth.

WHAT YOU CAN FIND

- Our updated DFES workbook contains forecasts at primary substations and per local authority areas for electricity demand, renewable DG, battery storage and Low Carbon Technologies, including EVs and heat pumps.

DFES WORKBOOK

You can explore our DFES 2023 forecast in the DFES Workbook by clicking the image below or scanning the QR code on the right



Distribution Future Electricity Scenarios 2023 Data Workbook

This workbook is an accompaniment to our 2023 DFES. It contains detailed datasets and interactive tools which allow our customers to understand what our Distribution Future Electricity Scenarios mean to them.

Please refer to our main DFES report for a full description of our forecasts and scenarios. Our forecasts are not precise predictions of what the future is likely to be, but instead frame the uncertainty within our planning as explained in the main report.

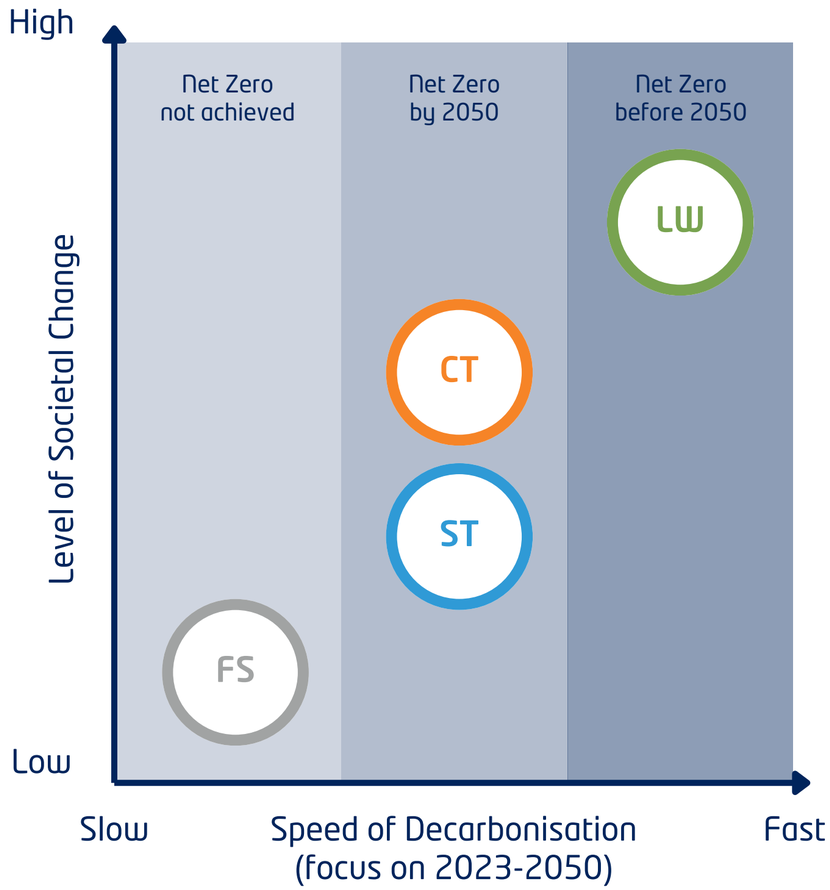
Version	1.0

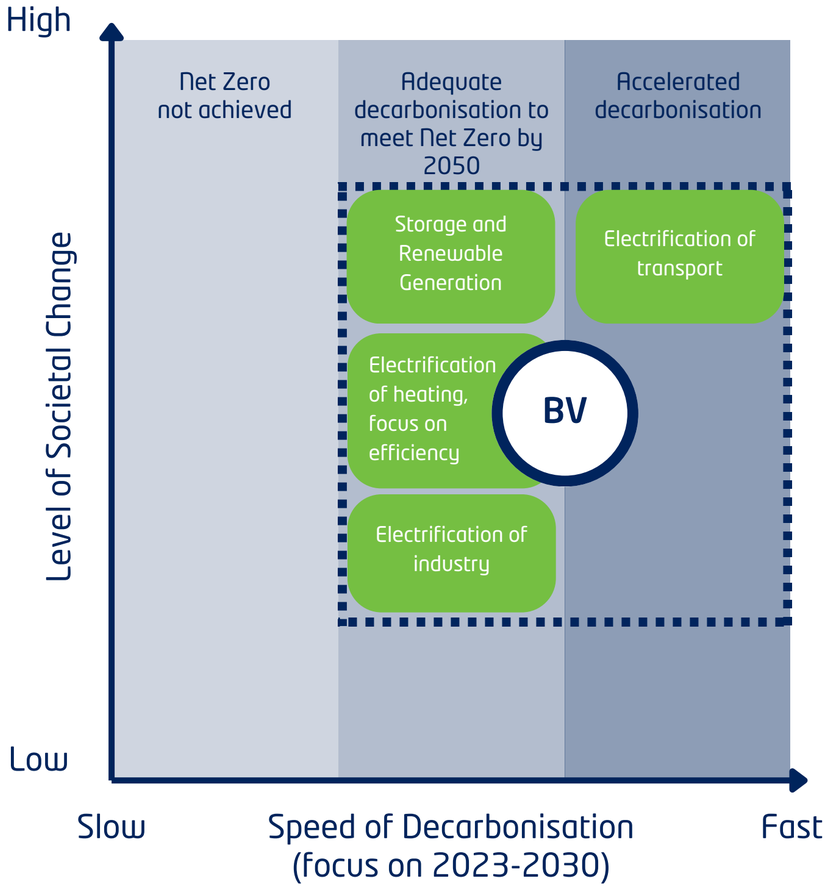
OUR DISTRIBUTION FUTURE ELECTRICITY SCENARIOS	
Best View	Highest certainty scenario in 1 to 10 years horizon
Falling Short	Slow decarbonisation not meeting net zero carbon, limited efficiencies
System Transformation	Hydrogen helps to meet net zero carbon beyond 2040, limited efficiencies
Consumer Transformation	Electric transport and heating and renewable DG to meet zero carbon, high efficiencies
Leading the Way	Net zero carbon before 2050, early electrification of transport and heating

CONTENTS

Section	Tab	Description
USEFUL INFORMATION	Geographical Information	A tool to locate the nearest 10 substations to a specified location and maps showing supply areas
	LCT Profiles	Charts which show electric vehicle (EV) and heat pump (HP) profiles adopted in the forecasts
INTERACTIVE GRAPH TOOLS	Single Primary Charts	Charts which plot minimum/maximum demand, DG/storage capacity and EV/HP volumes for a single primary substation supply area
	Single Local Authority Charts	Charts which plot number of EV, HP, energy from domestic, I&C, EV, HP, Renewable generation, non-renewable generation and the installed capacity for renewable and non-renewable generation. All data is provides per individual local authority
	Single BSP Charts	Charts which plot minimum/maximum demand, DG/storage capacity and EV/HP volumes for a single bulk supply point (BSP) supply area
	Multiple Primary Charts	Charts which plot aggregated minimum/maximum demand, DG/storage capacity and EV/HP volumes for multiple primary substation supply areas
	Multiple BSP Charts	Charts which plot aggregated minimum/maximum demand, DG/storage capacity and EV/HP volumes for multiple BSP supply areas
BSP AND PRIMARY SUBSTATION DATASETS	Maximum Demand	Data table containing maximum demand values for each BSP and primary substation
	Minimum Demand	Data table containing minimum demand values for each BSP and primary substation
	Generation	Data table containing DG capacity values for each BSP and primary substation
	Electric Vehicle uptake	Data table containing the number of EVs per BSP and primary substation
	Heat Pump Uptake	Data table containing the number of HPs per BSP and primary substation
	Storage	Data table containing battery storage capacity values per BSP and primary substation
	Energy Demand	Data table containing energy demand consumption per BSP and primary substation
	Demand - Flexibility Service	Data table containing the maximum flexibility service requirement in MW per primary and BSP
	Energy - Flexibility Service	Data table containing the flexibility service requirement in MWh per primary and BSP
LOCAL AUTHORITY AND COUNTY DATA	Heat Pump Uptake	Data table containing the number of HPs per Local Authority and County
	Energy Demand	Data table containing the total energy demand per Local Authority and County
	Wind Uptake	Data table containing the total wind installed capacity per Local Authority and County
	PV Uptake	Data table containing the total PV installed capacity per Local Authority and County
	PV Energy	Data table containing the total PV energy generated per Local Authority and County
	Wind Energy	Data table containing the total wind energy generated per Local Authority and County
	I&C Energy	Data table containing the total energy demand from Industrial and Commercial customers per Local Authority and County
	Domestic Energy	Data table containing the total energy demand from domestic customers per Local Authority and County
	HP Energy	Data table containing the total energy demand from heat pumps per Local Authority and County
	EV Energy	Data table containing the total energy demand from electric vehicles per Local Authority and County
	Battery Storage	Data table containing the total battery storage installed capacity per Local Authority and County
	EV Uptake	Data table containing the number of EVs uptake per Local Authority and County
	Generation Uptake	Data table containing the total generation installed capacity per Local Authority and County
	Carbon Savings	Data table containing the total carbon savings per Local Authority and County due to low carbon technologies and renewable generation
ENTIRE ENWL NETWORK DATASETS	LCT Seasonal Demand	Data table containing the demand in winter and summer day for low carbon technologies and air conditioning
	Annual Energy Demand & Generation	Data table containing energy for demand and distributed generation for the entire ENWL network broken down by technology
	DG and Storage Breakdown	Data table containing DG and storage capacity values for the entire ENWL network with breakdown per technology
	Total Transport	Data table containing the number of EV per type for the entire ENWL area

DFES 2023 Assumptions per Scenario





BV

Our Best View scenario is designed to provide a high level of certainty through 2030, focusing on the most likely outcomes in terms of demand and generation. However, as we have received insights and information from UK government and National Infrastructure Commission recommendations for higher levels of electrification of heating, our "best view" reflects a higher uptake of heat pumps, especially beyond 2030.

We also anticipate the electrification of transportation will continue to accelerate in the North West region as we approach 2030.

FS CT ST LW

The other four scenarios follow the common scenario framework established by the ESO and the other DNOs as described in last year's DFES in more detail. Falling Short (FS) does not meet Net Zero by 2050. Consumer Transformation (CT) assumes high electrification of transport and heating. System Transformation (ST) assumes hydrogen has a more dominant role in domestic heating. Leading the Way (LW) accelerates decarbonisation to meet Net Zero by mid-2040s.

DFES 2023 at a Glance

2023	Scenario		2030	2040	2050
22.6 TWh Annual Electricity	Falling Short (FS)		27 TWh 0.94 million 0.16 million 1.6 GW 0.6 GW	30 TWh 2.00 million 0.38 million 1.9 GW 0.6 GW	32 TWh 2.26 million 0.54 million 2.2 GW 0.7 GW
114,489 EVs	System Transformation (ST)		31 TWh 1.38 million 0.22 million 2.0 GW 1.0 GW	38 TWh 2.77 million 0.58 million 2.6 GW 1.5 GW	40 TWh 3.05 million 0.74 million 3.2 GW 2.1 GW
25,904 Heat Pumps	**Best View (BV)**		**32 TWh 1.38 million 0.3 million 2.0 GW 1.0 GW**	**44 TWh 2.77 million 1.4 million 2.6 GW 1.5 GW**	**52 TWh 3.05 million 2.5 million 3.2 GW 2.1 GW**
1.5 GW of Renewable Generation	Consumer Transformation (CT)		33 TWh 1.5 million 0.3 million 2.8 GW 1.0 GW	47 TWh 3.0 million 1.4 million 4.3 GW 1.6 GW	53 TWh 3.2 million 2.5 million 5.2 GW 2.2 GW
200 MW of Battery Storage	Leading the Way (LW)		35 TWh 1.5 million 0.5 million 2.1 GW 2.7 GW	50 TWh 3.0 million 2.0 million 2.9 GW 4.6 GW	52 TWh 3.2 million 2.5 million 3.6 GW 5.4 GW

Through 2030 the Best View scenario provides our high certainty assumptions. Beyond 2030, Best View, Consumer Transformation and Leading the Way have higher certainty compared to the other scenarios based on the current landscape as they model higher levels of electrification. Leading the Way and Consumer Transformation define the most likely longer-term demand range based on the pace of electrification of domestic heating.

DFES 2023 at a Glance

VOLUMES RELATIVE TO 2023*

	BV	CT	LW	CT	LW
	2030	2040		2050	
	12x	26x		28x	
	13x	53-76x		98x	
	5x	8-23x		11-27x	
	1.4x	2x		2.4x	
	1.3x	2-3x		2.5-3.5x	

*In this table, for instance, the notation "10x" in 2040 indicates that the volume/number of units of the specified variable/technology forecasted in 2040 is ten times the volume/number of units recorded in 2023.

KEY POINTS

By 2030 there could be 1.5 million EVs in the North West (12x the 2023 volumes) with location and charging speed being critical factors to determine network impact.

While the exact timing is still relatively uncertain, and to some extent will be driven by government policy decisions expected in the next two years we anticipate a significant increase in heat pump adoption between 2030 and 2040, up to 3 millions in our service territory.

Five fold increase of battery storage expected by 2030, up to 23 times in 2040 and up to 27 times by 2050.

We are expecting electricity consumption to increase by roughly 40% in 2030 (Best View) and more than double by 2040, in the scenarios where domestic heating is predominantly electric using heat pumps.

Renewable generation is expected to increase up to 33% by 2030 and double or triple by 2050. Even higher levels are required if regions need to accelerate decarbonisation or transmission connected renewable projects are delayed.

Scenario Assumptions in DFES 2023

	FALLING SHORT (FS)	SYSTEM TRANSFORMATION (ST)	BEST VIEW (BV)	CONSUMER TRANSFORMATION (CT)	LEADING THE WAY (LW)
Domestic Thermal Efficiency	L	M	H	H	H
Domestic Appliance Efficiency	L	M	M	M	H
Domestic Appliance Volumes	H	H	M	M	L
Non-domestic energy efficiency	L	M	M	H	H
Domestic Heat Pumps	L	M	H	H	EH
Non-Domestic Heat Pumps	L	M	H	H	EH
Electric Vehicles (Cars & Vans)	L	M	M	H	H
Smart EV Charging & V2G	L	M	M	H	H
Electric Heavy Duty Vehicles	L	L	M	H	EH
Air Conditioning	H	M	M	M	L
Demand Connections (HV and LV networks)	Lower Confidence	Historical Confidence**	L (access SCR impact)	M (access SCR impact)	H (access SCR impact)
Local Stakeholders Plans	Lower Confidence	Confidence Based on Project Ranking	Confidence Based on Project Ranking	Confidence Based on Project Ranking	Confidence Based on Project Ranking
Electrification of Industrial Processes	L	M	M	H	EH

	FALLING SHORT (FS)	SYSTEM TRANSFORMATION (ST)	BEST VIEW (BV)	CONSUMER TRANSFORMATION (CT)	LEADING THE WAY (LW)
Photovoltaics Small (<1MW)	L	M	M	H	M
Photovoltaics Large (>1MW)	L	M	M	M	H
Wind Generation	M	M	M	H	H
Combined Heat and Power	H	M	M	M	L
Other renewable (hydro, biogas, biomass)	L	M	M	M	H
Flexible generators (gas, diesel)	H	M	M	M	L
Domestic batteries	L	M	M	M	H
Non-domestic batteries	L	M	M	M	H
Demand Connections	L	L	M	H	EH
Generation and battery connections*	Only Accepted (high certainty)	Only Accepted (high certainty)	Only Accepted (high certainty)	Only Accepted (high certainty)	Only Accepted (high & low certainty)

Explanatory note on abbreviations:: L = Low - M = Medium - H = High - EH = Early High

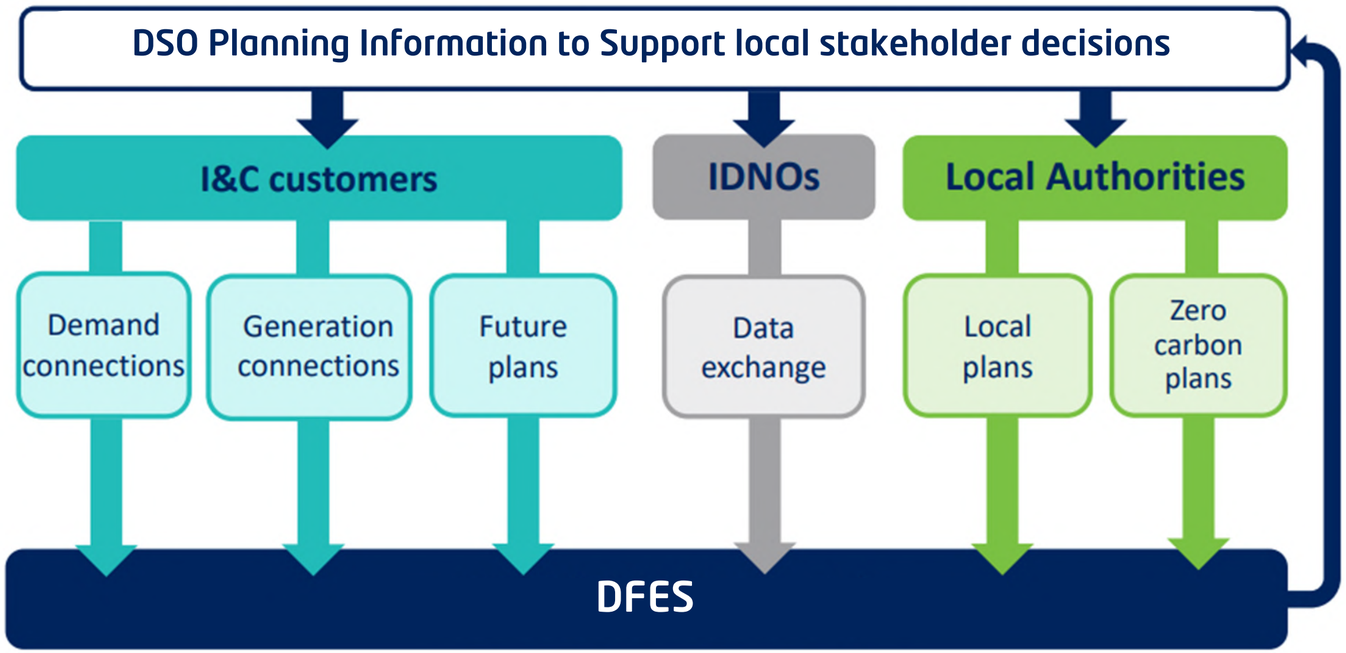
*Accepted refers to generation and battery storage with a submitted connection request, a quote has been provided and connection accepted to proceed.

** Neglects April 2023 access SCR arrangements that are expected to unblock previously delayed/cancelled demand connection projects

Stakeholder Engagement

CONTACT OUR LAEP TEAM

https://www.enwl.co.uk/future-energy/facilitating-net-zero/local-area-energy-planning/



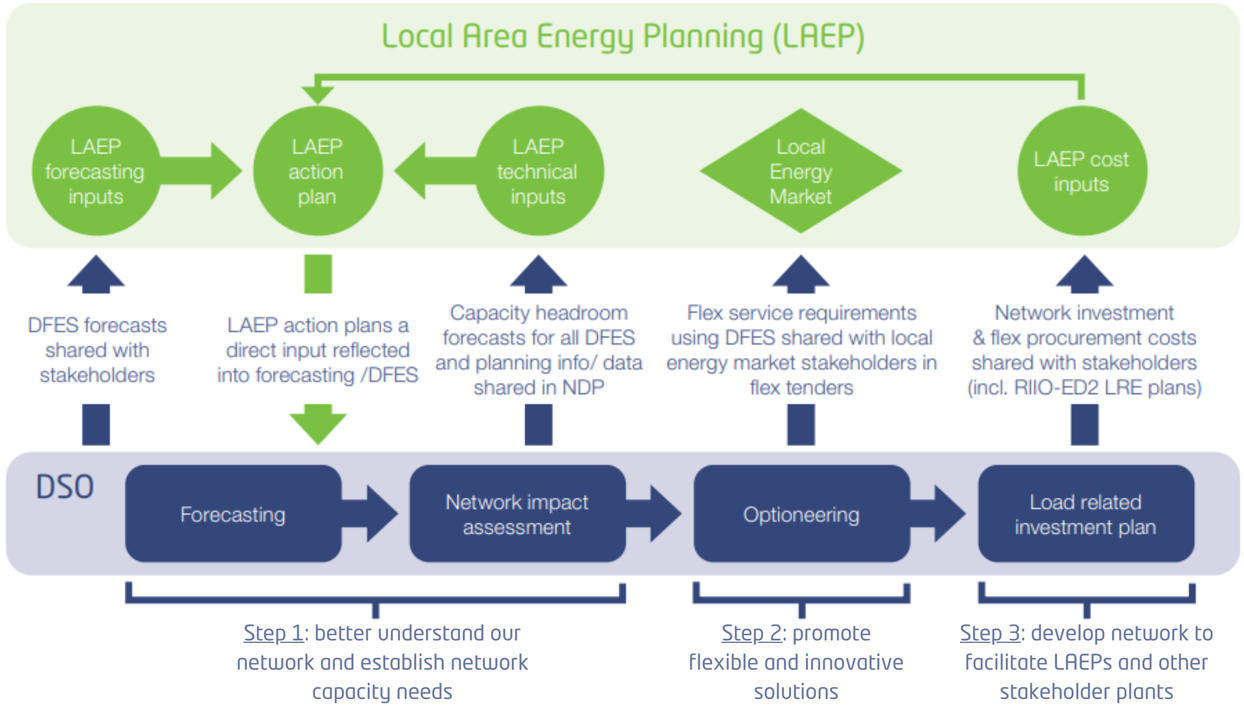
We produce DFES forecasts using direct inputs from stakeholders, lessons learned and input from our broader DSO forecasting and planning engagement with stakeholders

The "cycle of engagement" with our stakeholders is that our DFES and associated datasets (including Network Development Plans and Network Headroom reports) inform stakeholder decisions and plans, which in turn inform our DFES.

Industrial and commercial customer plans reflected in forecasts for both quoted and accepted demand connections. Bespoke information for EHV (132-33kV) connections is considered. Confidence factors taking into account historical performance are considered for hundreds of HV/LV (11-0.4kV) projects in the connections pipeline.

We engage with local authorities and developers on their Local Area Energy Plans (LAEPs) and decarbonisation plans and also at early stages before connections application for major developments that support local economic growth.

ENWL Role in LAEP



This year we had more extensive engagement with local authorities from the county council down to individual council level. This allowed us to capture a diverse array of planned developments that support decarbonisation and economic growth.

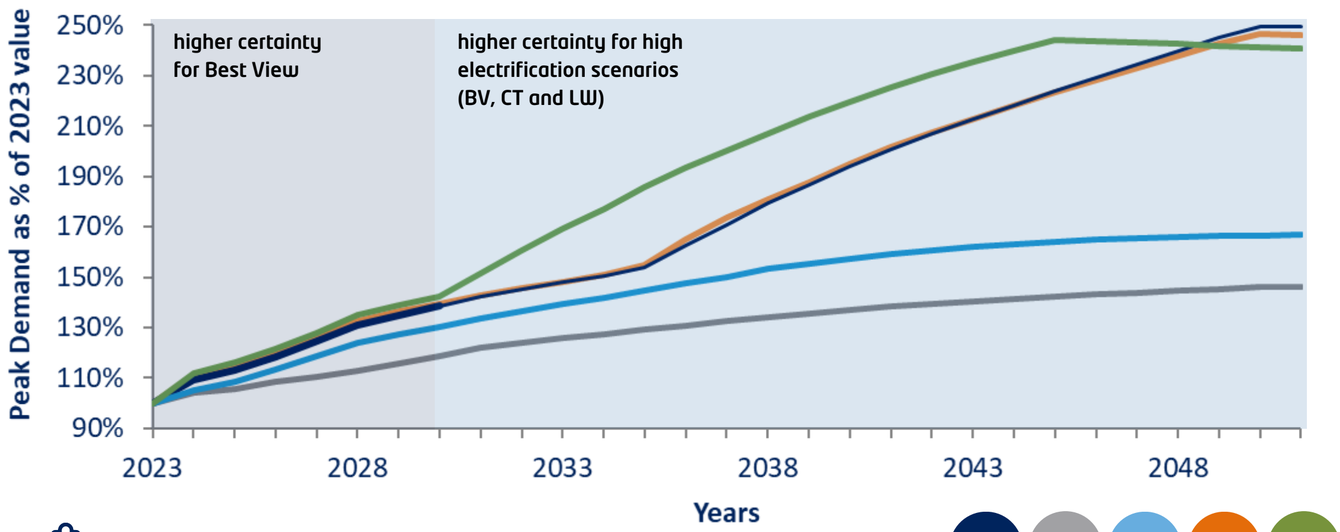
<u>Whole system planning</u>

LAEPs optimise local paths to Net Zero. DFES captures granular and very local characteristics including LAEPs. In a whole energy system planning environment DFES is further informed by an even wider range of stakeholders to drive a cost efficient and coordinated network development that will facilitate the Net Zero transition in the North West.

There are data exchanges between LAEPs and DSO planning (including DFES). Stakeholder data including LAEP action plans are reflected in DFES, which is the vehicle to release electricity network capacity to facilitate the local decarbonisation plans.

Our role beyond the facilitation of LAEPs is to provide technical insights and data that will help Local Area Energy Planners produce their action plans.

Electricity Power Demand



OUR FINDINGS

BV FS ST CT LW

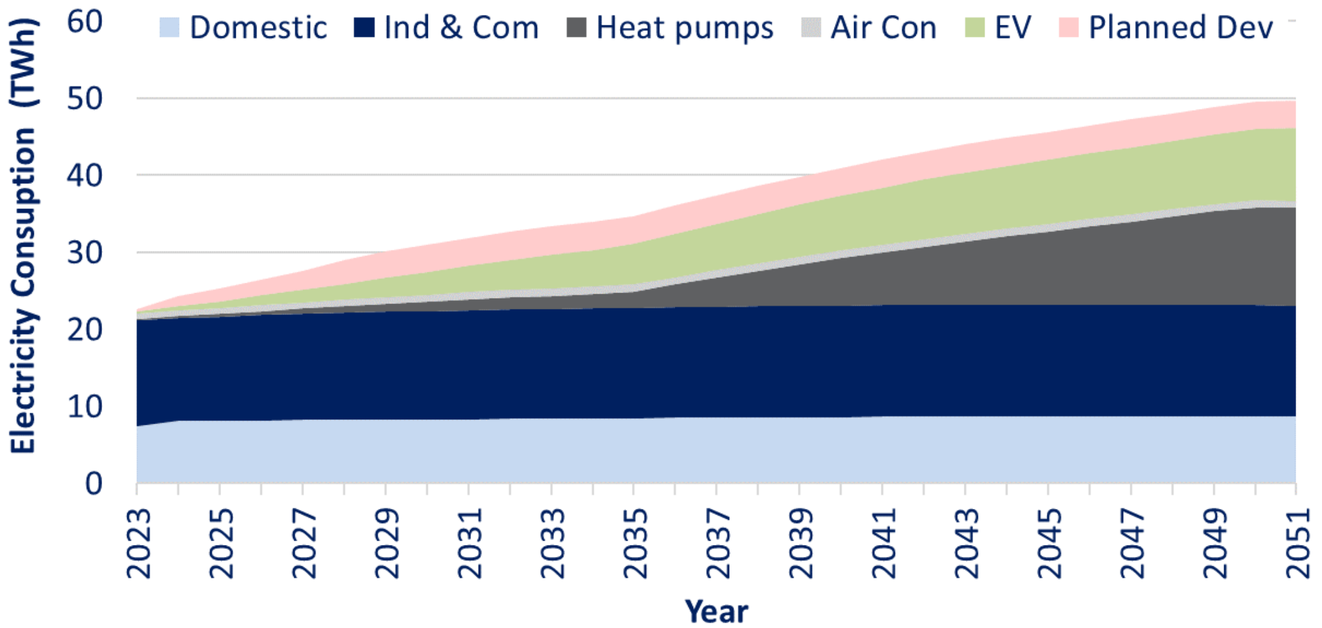
The electricity peak demand growth by 2030 will be driven mainly by local developments and the electrification of transport with Best View defining the highest certainty trend. Beyond 2030 there is higher certainty in the range of peak demand growth defined by Consumer Transformation and Leading the Way scenarios depending on the pace of electrification of heating.

All scenarios show that peak demand will bounce back from the energy and cost of living crisis impact experienced last year, with demand connections unblocked due to Access and Forward-Looking Charges Significant Code (Access SCR) arrangements that reduces the connection charges. In the longer term, the anticipated uptake of electric vehicles and especially heat pumps will have the largest impact on peak demand.

Our Best View considers the UK government policy changes on postponing the phase out of petrol/diesel cars and gas boilers. The higher heat pump uptakes in this scenario (combined with increased energy efficiency measures) as a result of the reduced certainty for the future role of hydrogen for domestic heating drive a significant demand growth beyond mid-2030s.

Leading the Way scenario is projecting an accelerated high peak demand growth in the long term despite considering the most aggressive assumptions on energy efficiencies and only 10% more EV volumes by 2050 when compared to Best View. Best View, Consumer Transformation and Leading the Way scenarios have a higher demand growth in the longer term driven by the higher heat pump uptakes. Indeed, heat pumps have a more significant impact on peak demand than EV charging because, even with use of hot water storage tanks, heat pumps will need to be in operation during peak hours while EVs are expected to use smart charging and charge overnight.

Electricity Consumption



Even though the impact of EV charging at times of peak load (peak demand), especially in the longer term, is reduced by flexibility measure such as smart charging, the overall annual electricity requirements for EV charging is comparable with heat pumps in the longer term.

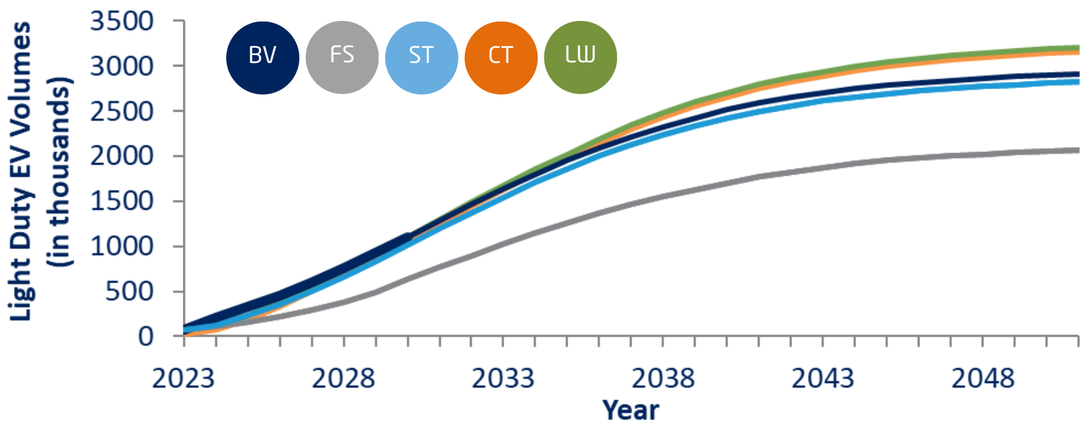
OUR FINDINGS

In Best View scenario, EVs, heat pumps and planned development are projected to be the top three contributors to the growth in energy consumption. In contrast, the domestic sector is expected to encounter a marginal decrease due to efficiency measures as high heat pump uptakes are combined with retrofits and other energy efficiency measures. Meanwhile, an increase in Industrial & Commercial (I&C) demand is anticipated due to the electrification of some processes like 'low temperature heat' (e.g. electric boilers and heat pumps), some 'high temperature' applications (e.g. electric glass furnaces) and carbon capture and storage. However, there is increased certainty at the moment that hydrogen is expected to play a more dominant role for the decarbonisation of industrial processes and therefore there is limited impact from electrification of industry.

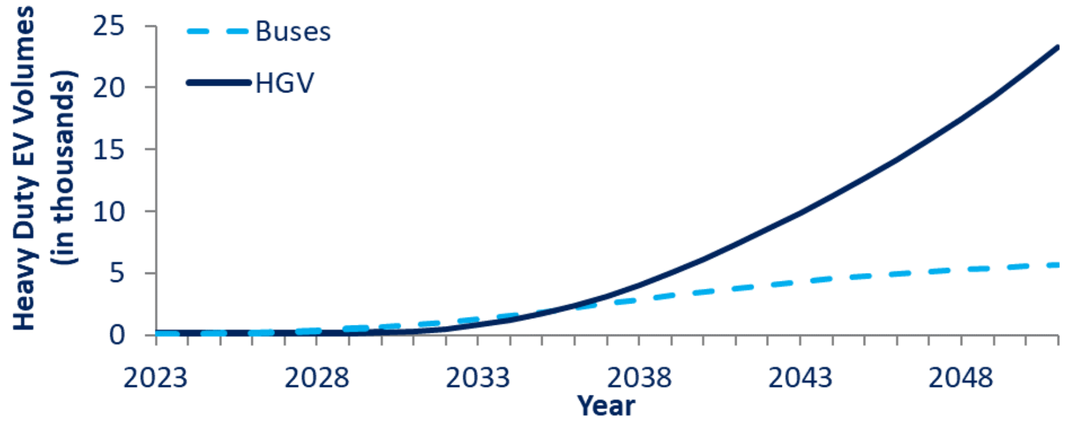
The annual energy consumption forecasts for the Consumer Transformation and Leading the Way scenarios in our DFES workbook show similar levels of growth as the electrification of transport and domestic heating are the main paths to decarbonise these sectors.

Electrification of Transport

Volumes of light duty EVs for all scenarios (cars and vans)



Volume of heavy duty EVs in Best View (buses and HGVs)



Electrification is expected to be the main path to decarbonise the transport sector, especially for light duty vehicles such as cars and vans. It is also anticipated that a notable proportion of heavy-duty vehicles, particularly buses and trucks under 25 tonnes, will be electric and will predominantly rely on electricity distribution networks for their battery charging.

OUR FINDINGS

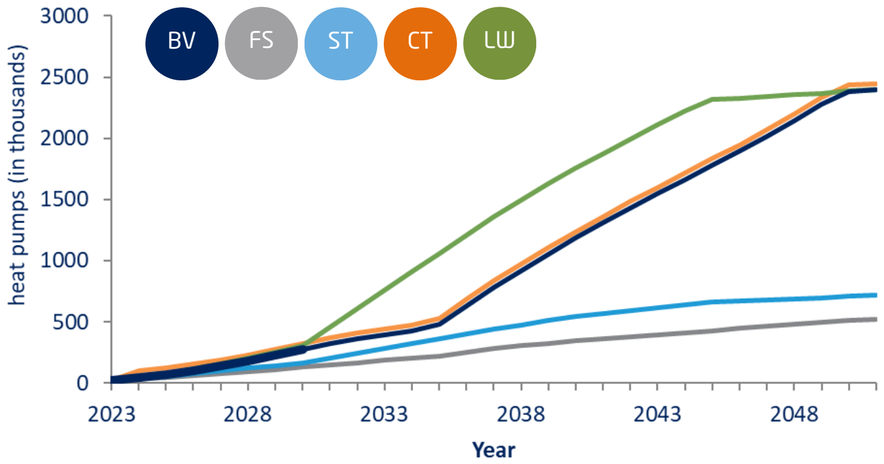
We have seen a record number of EVs registered in the North Wes, which is part of a wider national trend. This is a clear indication that even though there is a cost of living crisis, customers see the benefits of EVs. By the mid-2020s EVs are expected to have the same whole life cost of petrol/diesel cars and vans.

We have enhanced the modeling of Heavy Goods Vehicles (HGV) by improving the allocation of their charging demand across our network. This adjustment is critical in anticipating and mitigating the potential clustering impact of these vehicles in specific areas where they charge between trips.

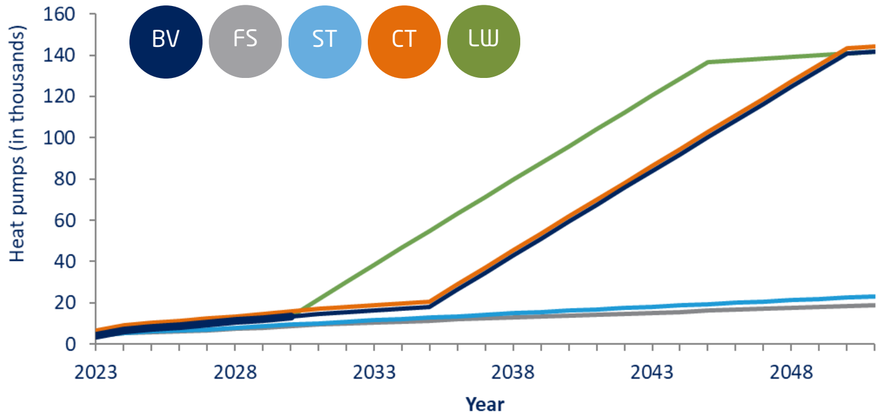
In the near future, the number of electric buses is projected to surge at a faster rate than that of HGV due to governmental backing (e.g., ZEBRA scheme). However, in the long run, more of the current HGV fleet will move to fully electric to outnumber the electric bus volumes.

Electrification of Heating

Volumes of domestic heat pumps for all scenarios*



Volumes of non-domestic heat pumps for all scenarios*



*The heat pump uptake for both Best View (BV - represented by the blue line) and Consumer Transformation (CT - represented by the orange line) are identical. However, just for illustrational purposes a small difference has been created so the trend are easily identifiable.

In our Best View scenario, we expect a higher uptake of heat pumps compared to last year's forecast. This is mainly driven by increased certainty that heat pump will play a more dominant role in domestic heating. The latest updates from the Department of Energy Security and Net Zero Heat Infrastructure Transformation project suggest that hydrogen would be at most used for domestic heating only around industrial clusters.

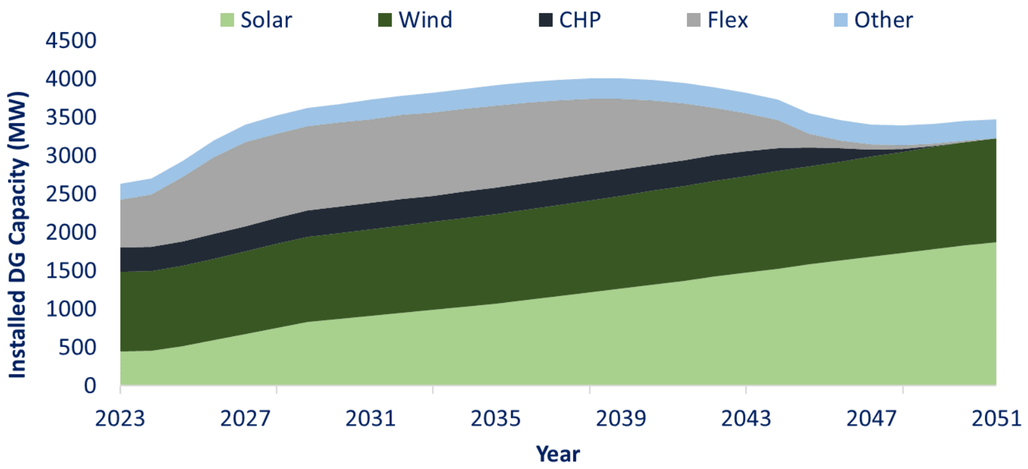
OUR FINDINGS

In Best View, Consumer Transformation and Leading the Way electrification is the main path to decarbonise the heating sector. We assume that the UK government's ambition for 600,000 heat pump installations is met taking into account the increased UK government grants.

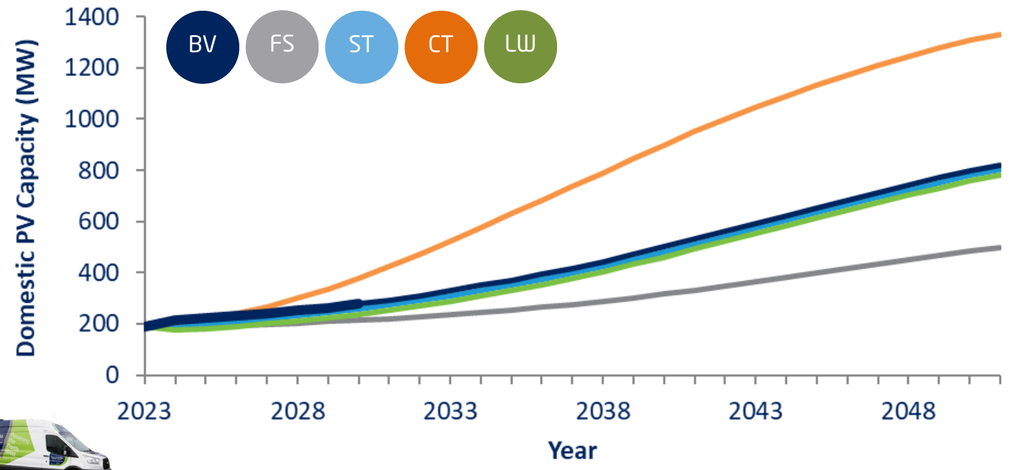
In the System Transformation scenario, we model a world where hydrogen plays a more dominant role in domestic and commercial heating. As discussed previously in this report, we have seen more evidence and greater confidence on a more dominant role for heat pumps.

Distributed Generation

Installed Generation Capacity in Best View



Domestic PV Capacity



Solar and wind will play a key role in the decarbonisation of electricity generation in the North West and in meeting the increased demand from the long-term electrification of transport and heating.

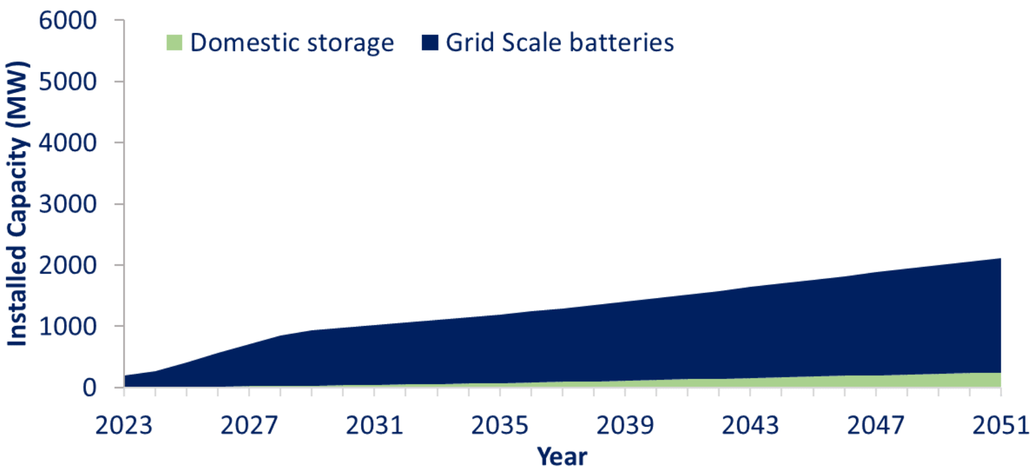
OUR FINDINGS

Best View, System Transformation and Leading the Way indicate a moderate adoption rate of all Distributed Generation (DG) technologies, including solar and wind. Our analysis is based on average assumptions for technology capital expenditure (capex) and electricity price for larger renewable DG units. Over the short-term (one to five years), the DG adoption rate is drive by the connections pipeline, where flexible generators represent the dominant technology.

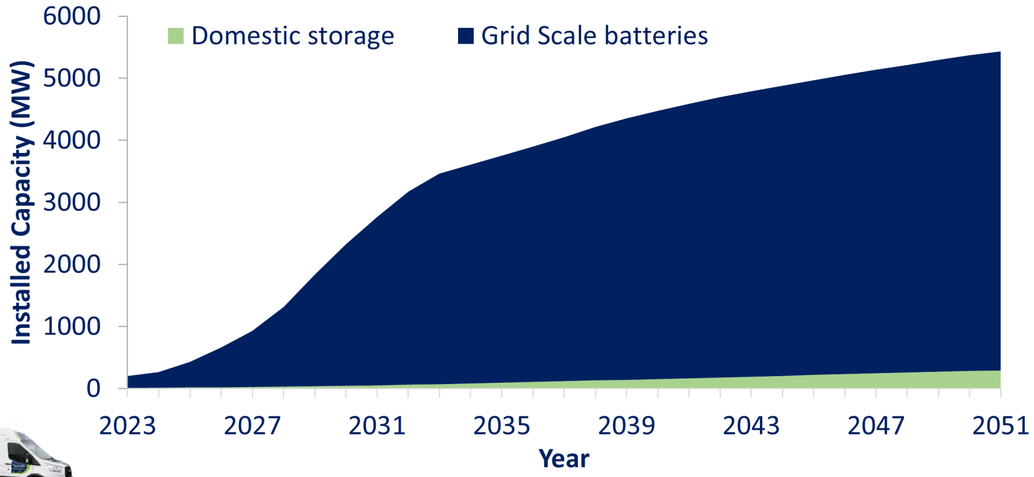
Consumer Transformation involves the installation of 2200 MW of additional solar and 440 MW of additional wind generation by 2040.

Battery Storage

Battery Storage in Best View



Battery Storage in Leading the Way



There are a number of factors impacting the pace large-scale grid batteries connect to our network. At present, large batteries are primarily utilised to provide balancing services to the ESO or behind-the-meter services to I&C customers. Moving forward, they are expected to benefit more from electricity price arbitrage and are expected to provide DSO flexible services.

OUR FINDINGS

As in last year's DFES our Best View scenario considers medium uptake trends for domestic batteries, which are driven by the corresponding average uptake of domestic solar in this scenario.

In the longer-term (beyond 2030) we forecast that battery uptake in our Best View will exceed last year's Best View scenario, with just over 2,100 MW by 2050. This trend was taken from a series of recent studies that estimate higher levels of battery storage required for a 2050 Net Zero UK.

The full range of battery forecasts across all scenarios can be found in the DFES workbook, which shows peak battery capacity of 2.8GW installed by 2050 for Leading the Way.

DFES Workbook

The Workbook contains a comprehensive collection of our detailed demand and generation forecasts covering all scenarios up to 2050.

Generation

Generation data with breakdown per technology (including battery storage).

Demand

Peak, minimum, consumption residential and I&C, LCT uptake.

Flexibility

The amount of flexibility required to postpone investment and save customer money.

Time

The forecast extend until 2050.

Scenarios

With the four aligned FES Scenarios + our Best View

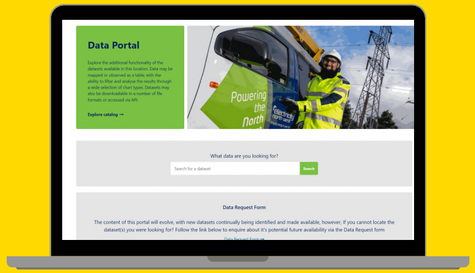
Asset Level

From bulk supply point, to primary substation and aggregated by Local Authority and County.

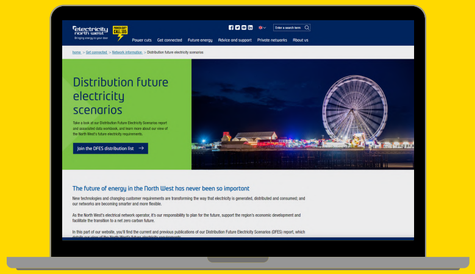
MORE DATA

You can explore the detail results of our DFES 2023 forecast in the DFES Workbook and portal by clicking the images below or scanning the QR code on the right.

ENWL Data Portal



DFES Workbook



Do you have any questions?

If you have any questions or suggestions about our forecast, please contact us. We're always here to help!

DFES Workbook and Reports
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