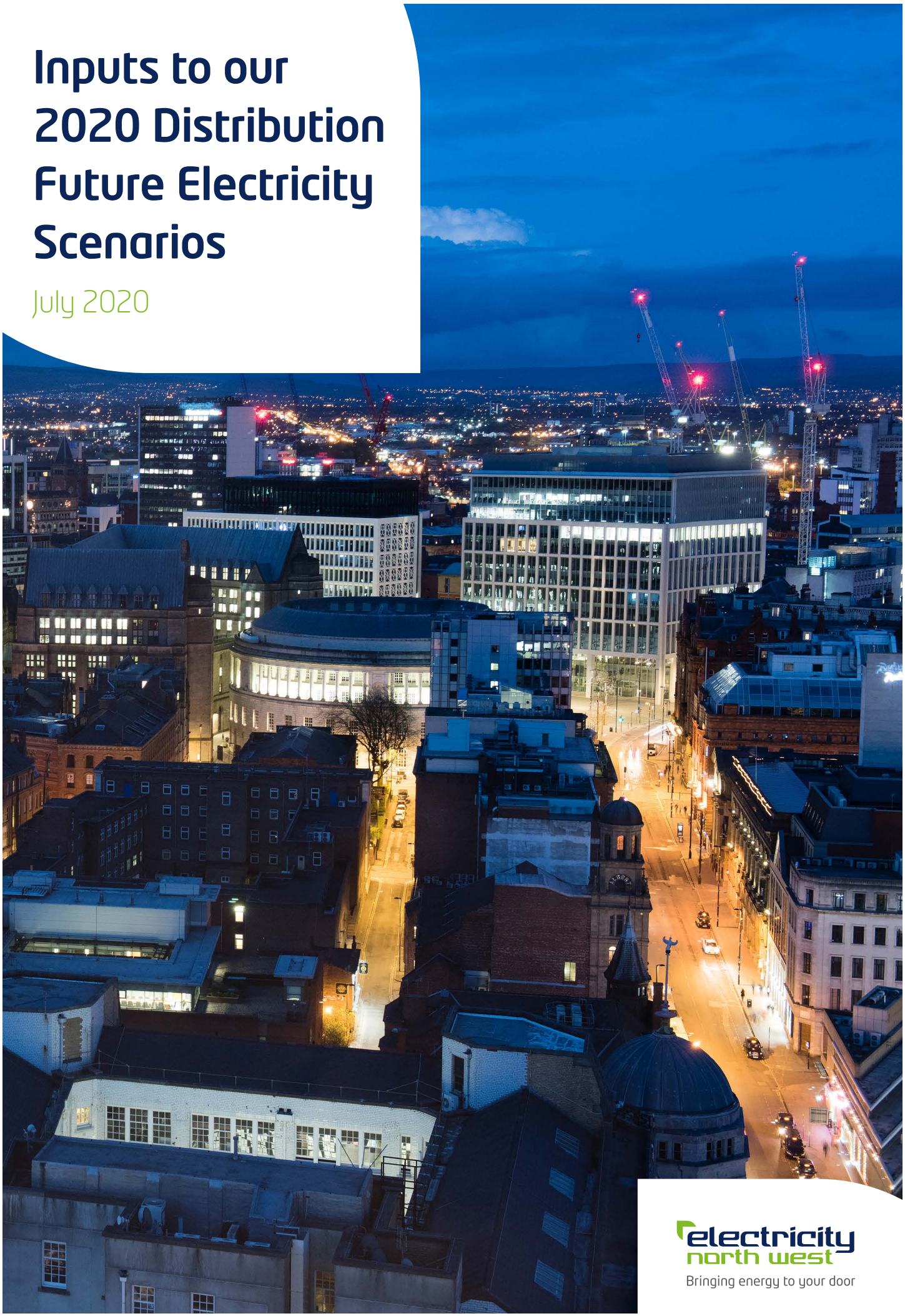
Inputs to our 2020 Distribution Future Electricity Scenarios

July 2020



electricity north west

Bringing energy to your door

Contents

As the UK transitions to a net zero carbon emissions future, the way customers use electricity distribution networks will change dramatically. More customers will change from passive consumers to 'prosumers' who can store or sell electricity based on their needs and the opportunities to participate in new energy markets. Others will rely on the network more than ever before to heat their homes and charge their electric vehicles (EVs). While all this is necessary to enable the UK's transition to net zero by 2050, we expect the speed of decarbonisation will be faster in parts of our region, as many of our stakeholders are committed to achieving net zero much sooner – and this presents a challenge.

In order to enable the region's transition to net zero carbon emissions, significant investment in our network will be required. Ultimately the costs associated with this will be passed down to customers through their electricity bills. The challenge for us, as a distribution network operator (DNO) and facilitator in the transition to net zero carbon, is to continue to provide and plan for a reliable and efficient network while encouraging and accommodating increases in low carbon technologies (LCTs), such as electric vehicles and heat pumps, and keeping costs low for our customers.

In November 2018 Electricity North West published its first annual Distribution Future Electricity Scenarios and Regional Insights document (DFES). We were the first GB DNO to publish a distribution equivalent to National Grid's Future Energy Scenarios (NGFES) document and we now update the document on an annual basis. Our DFES document was refreshed and published on our website in December 2019, this time with an additional excel workbook containing all the forecast data to help our stakeholders understand what it means on a more granular, local level. This has been well received; the workbook and document have been downloaded more than 500 times in the six months since publication, demonstrating the keen interest our stakeholders have in understanding what our forecasts mean to them.

Other GB DNOs have now started to publish their own DFES documents, with some publishing their own self-created forecasts and others publishing the regional data created under the NG FES work. We have always believed that to plan and manage our distribution network effectively, we need to have accurate and timely information from our stakeholders to create credible demand and generation forecasts that reflect the needs and expectations of our own customers and stakeholders. Because of this, we have never included the NG FES forecasts within our planning process, but rather only used them as a cross-check.

In their open letter to the Energy Networks Association (ENA) Open Networks Project our regulator, Ofgem, and the Department for Business, Energy and Industrial Strategy (BEIS) sought greater clarity and commonality in forecasting. Subsequently DNOs have been working together to standardise the approach to creating and representing the forecasts in a common, easy-to-read and digestible format. We are committed to this, but we also want to go one step further and share with you the information and inputs we use to create our forecasts, so that all our stakeholders can understand the basis of our forecasts. We outline these inputs in this document and describe how we use the data and information we receive to inform our forecasts.

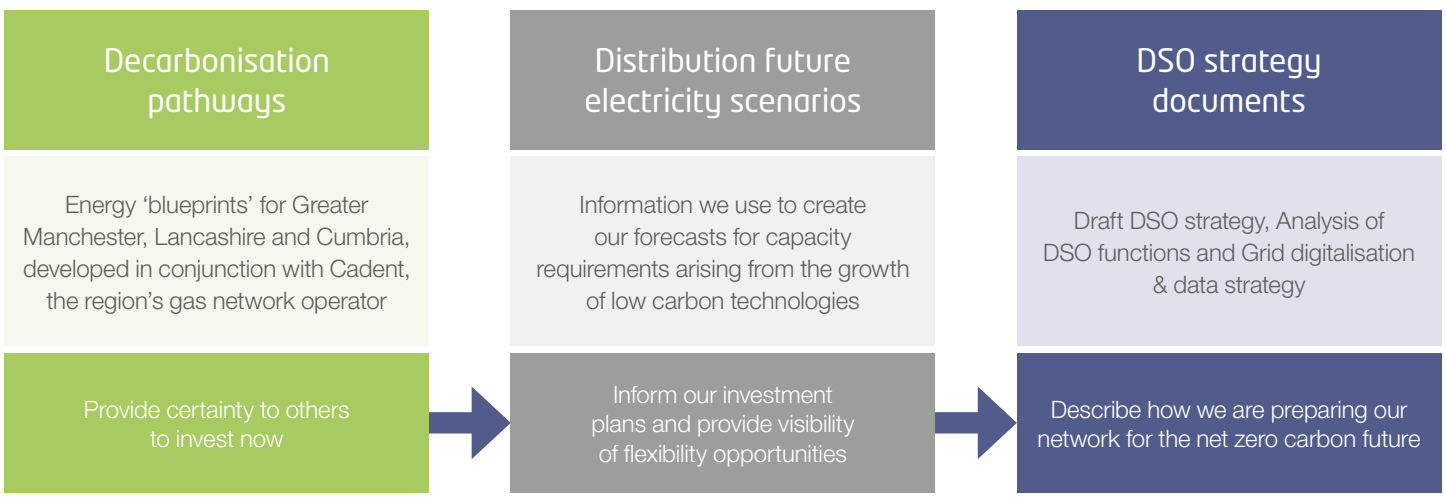
At the end of the document we invite our customers and wider stakeholders to review and comment on our inputs to the forecasting process to ensure we have a good understanding of our customers' and stakeholders' expectations when planning for the future of our network. The consultation questions are displayed in the relevant sections of this document.

This DFES consultation document is part of a suite of current documents which explain how we are preparing our network for the net zero carbon future. We are also inviting feedback from stakeholders on:

- Our draft DSO strategy, Analysis of DSO functions document and draft Grid digitalisation & data strategy. Consultation on these DSO documents runs from 6 July – 9 September 2020
- Three 'decarbonisation pathways' for Greater Manchester, Lancashire and Cumbria, energy blueprints developed with Cadent, the region's main gas network operator.

We hope you enjoy delving into the detail of our DFES forecasts and associated analysis and look forward to hearing your views.

Consulting stakeholders on our plans

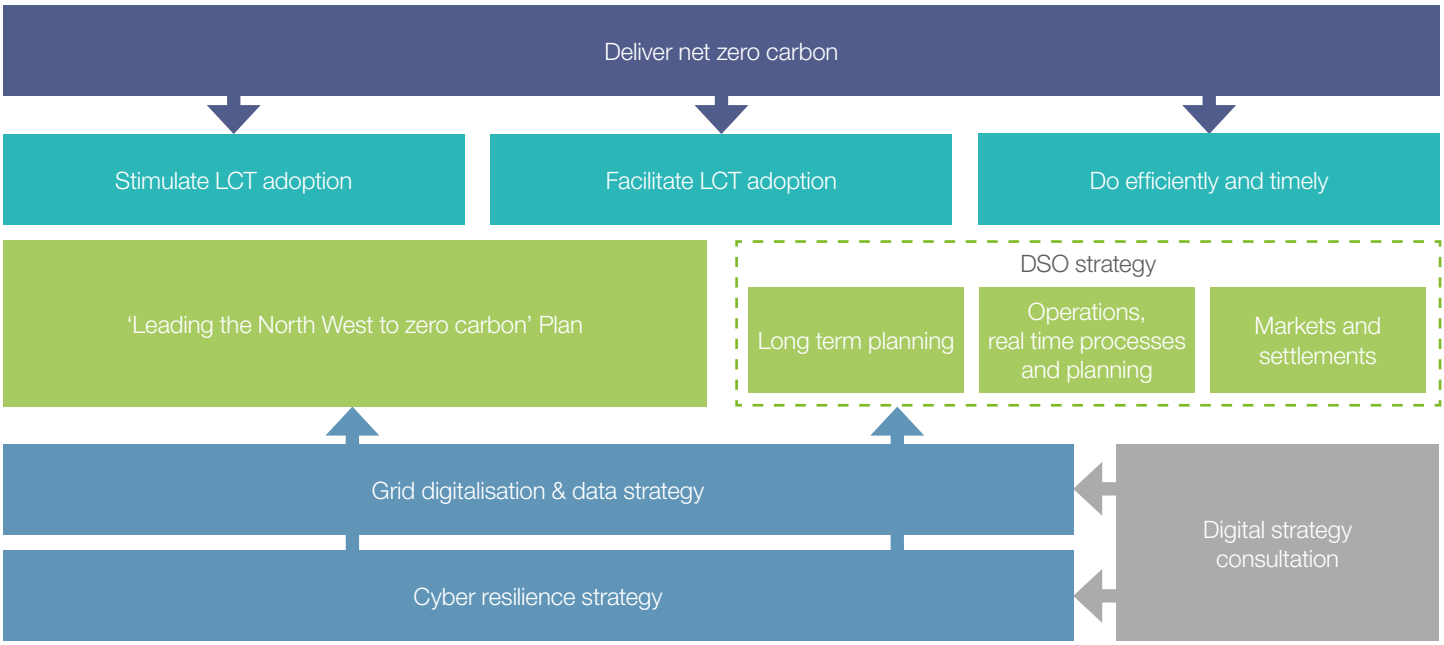


2 Introduction

In October 2019 Ofgem published its position paper on the key enablers for the distribution system operation (DSO) programme of work, in which they identified 19 DSO functions and activities. We have reviewed the scope of these functions as part of the refresh of our DSO strategy, which outlines how we plan to implement the changes needed to facilitate the region's transition to net zero.

We published the DSO strategy recently alongside a series of strategy documents that support our business objectives to help deliver net zero and develop the capabilities to undertake DSO activities, as depicted in Figure 1 below.

Figure 1: How decarbonisation and DSO transformation fit together



Each document has been published along with a set of questions to gain public insight and feedback from our stakeholders so that we can ensure we have a good understanding of their expectations when planning for the future of our network.

This document relates directly to one of the 19 functions identified by Ofgem, entitled 'Forecasting demand and generation and DER'. We define this function as the forecasting of all demand, generation in and out of the network with the information being used to inform our business plans, investment decisions, connections activities and system operations, as well as sharing this information with our customers and stakeholders.

The aim of publishing this document now is to provide a wider understanding of our DFES and allow all our customers and stakeholders the opportunity to comment on the inputs to our forecasting methodology, as we start to develop our business plans for the next price control period RIIO-ED2, (April 2023 – March 2028).

In the following sections we describe:

- The innovation work, undertaken by Electricity North West since 2010, to develop the methodology, processes and tools for forecasting demand and generation
- The work under the Open Networks Project to develop a standard DFES
- The types of data and information and their sources used in the forecasting processes
- How you can provide your comments on this document.

Innovation

In April 2015 Electricity North West initiated an innovation project called ATLAS (Architecture of Tools for Load Scenarios) which used funding from the RIIO-ED1 Network Innovation Allowance (NIA) funding and closed down in March 2017. The objective of the ATLAS project was to develop the methodology, processes and tools for forecasting demand and generation and represent the different potential outcomes using scenarios.

ATLAS built on elements from a number of our previous innovation projects, as explained below:

Projects	Learning
'Low Voltage Network Solutions' First Tier Low Carbon Networks Fund (LCNF) project 2011-2014	The learning from this project has been used in the ATLAS project to provide options and associated specifications for the future capacity headroom (FCH) model that is currently used by Electricity North West for the impact assessment for thermal and voltage issues on the whole of the high voltage (HV) and low voltage (LV) network. The specifications in the ATLAS project have highlighted the importance of actual monitoring data used across the network (ie, FCH model uses half-hourly measurements across all HV feeders) and the recommendation of detailed network modelling of the HV and LV networks to improve regional accuracy of results.
'Load Allocation' Innovation Funding Incentive (IFI) project 2012-2013	The Load Allocation project produced a software tool that uses monitoring, network and other data (eg, customer volumes per network region) to estimate loadings on HV circuits and distribution transformers every half hour. This work demonstrated that available monitoring data can be used to produce informed estimates of network loading. This learning was used in the ATLAS project to: a) use available half-hourly HV monitoring and network data to model load transfers/network reconfigurations in forecasts; and b) use monitoring data from generators (eg, for onshore wind generation) to produce typical profiles in estimates for small non-monitored generators connected in the HV and LV network.
'Demand Forecasts & Real Options' IFI project 2013-2015 'Demand Scenarios with Electric Heat and Commercial Capacity Options' (Demand Scenarios) NIA project 2015-2016	Both projects focused on enhancing the business as usual approach to forecast the annual winter and summer peak demand forecasts. The Demand Scenarios NIA project enhanced the modelling of domestic heat pumps through analysis based on both trials and simulations (work by Delta EE and Imperial College), as well as the modelling of air conditioning through the analysis on the effects on summer loading (work by Tyndall Centre). The ATLAS project used the half-hourly profiles for the different types of heat pumps and for the air conditioning from the Demand Scenarios project and enhanced the summer/winter peak demand forecasting to a full half-hourly through year forecasting, not only for demand, but also generation. It also enhanced the approach followed previously to assess the baseline/starting year true demand, by introducing machine learning approaches for the demand data cleansing and a methodology for the estimation of the demand suppressed by small non-monitored distributed generation.
'Reactive Power Exchange Application Capability Transfer' (REACT) NIA project with National Grid and all GB DNOs 2013-2015	This project produced a detailed time-series network modelling methodology for reactive power that was demonstrated for ten transmission-distribution interfaces (grid supply point (GSP) substations) across GB. The ATLAS project enhanced the REACT methodology in the way that the future loadings below primary substations were modelled and implemented the enhanced methodology for all transmission-distribution interfaces of the Electricity North West license area, modelling the whole of the 132 to 33kV network.

3 From innovation to business as usual and industry standardisation

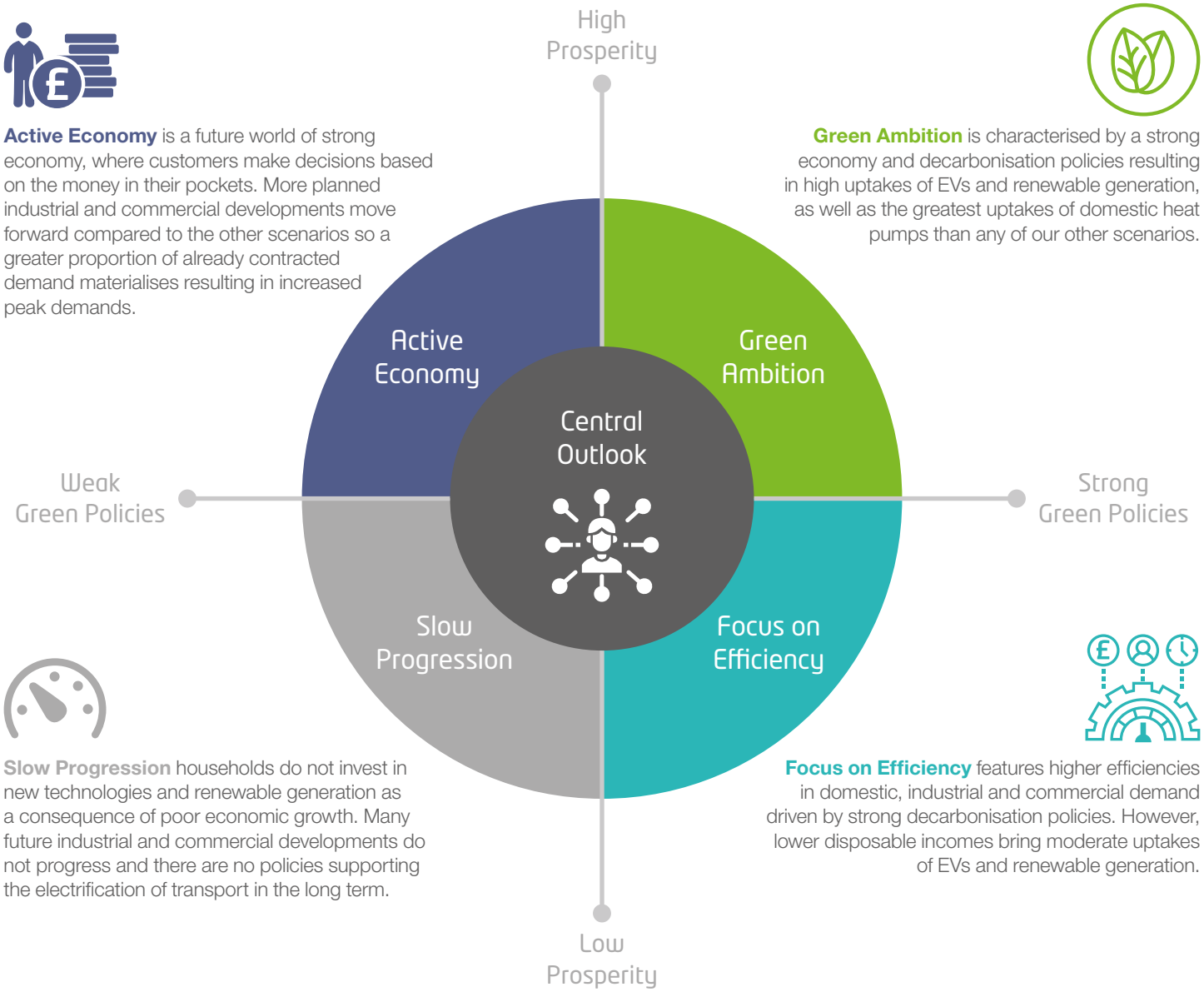
Learning from the ATLAS project

The ATLAS project gave us the ability to study regional differences in the uptake of LCTs and associated growths in demand and generation affecting power flows on our network, by taking a bottom-up approach to develop our forecasts, starting at postcode sector granularity. Area-specific forecasts allow us to understand the changes we expect to see on our network at a local level, ensuring we make the best decisions for our customers in relation to what we need to do, where and when.

We also developed a scenario framework and a range of scenarios that we believe can frame the uncertainties of future levels of electricity demand and distributed generation across the Electricity North West distribution network. This means that we can consider many possible outcomes and have a well-rounded view when making decisions which affect our customers.

The 2018 and 2019 DFES documents outlined the five scenarios within our scenario framework and described the two main dependencies, specifically:

- **Financial conditions** - the scenarios consider different levels of future prosperity with more or less money available not only for domestic and industrial and commercial (I&C) customers, but also for investment in the energy sector and local communities
- **Future decarbonisation** - the scenarios consider an increasingly decarbonised and sustainable world reflected by the uptake of more LCTs influenced by policies supporting a green future.



Active Economy is a future world of strong economy, where customers make decisions based on the money in their pockets. More planned industrial and commercial developments move forward compared to the other scenarios so a greater proportion of already contracted demand materialises resulting in increased peak demands.

Green Ambition is characterised by a strong economy and decarbonisation policies resulting in high uptakes of EVs and renewable generation, as well as the greatest uptakes of domestic heat pumps than any of our other scenarios.

Slow Progression households do not invest in new technologies and renewable generation as a consequence of poor economic growth. Many future industrial and commercial developments do not progress and there are no policies supporting the electrification of transport in the long term.

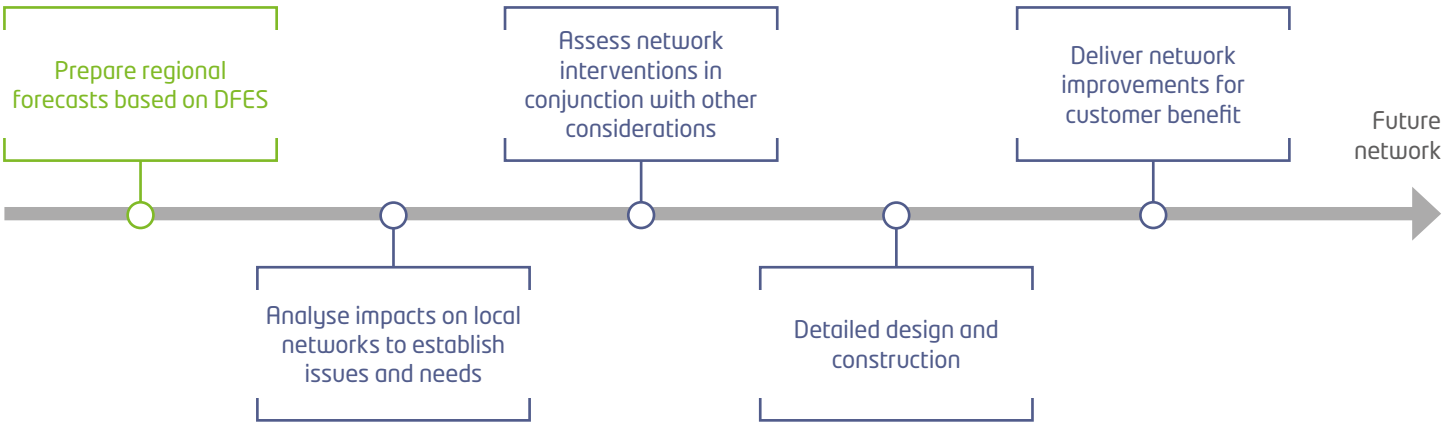
Focus on Efficiency features higher efficiencies in domestic, industrial and commercial demand driven by strong decarbonisation policies. However, lower disposable incomes bring moderate uptakes of EVs and renewable generation.

Implementing new methodology

Electricity North West has a strong track record of taking innovation projects and transferring the learning into business as usual. Since the ATLAS methodology, processes and tools were developed in 2017 they have been used every year since.

Our annual DFES document, first published in November 2018, uses our forecasts to explain our views of the future. The DFES is one of the first steps in the development of our network investment strategy, informing the next steps by defining the inputs to detailed network analysis as shown below in Figure 2.

Figure 2: DFES in relation to planning the future of our distribution network



Shared learning and the future of DFES

The ENA launched the Open Networks Project in late 2017 bringing together the GB and Irish electricity network and system operators, the UK government and the energy regulator Ofgem. The project was established to look at how the networks will change their operations to facilitate the transition to a smart, flexible energy system. This will see DNOs take a more active role in managing their networks, allowing them to address periods of high and low demand, and power outages efficiently, with new low carbon solutions.

Over the last three years the Open Networks Project has looked into the area of forecasting and the publication of forecasting data, and several best practice guides have been published to date. In 2020 the Open Networks Project initiated the product 'Whole System FES – Coordination of National and Regional FES' (under Workstream 1B) with the aim of standardising DFES by developing:

- A single set of agreed GB scenarios that facilitate regional sensitivities
- A DFES template document
- Aligning DFES publication dates.

Electricity North West is a key contributor to this work and intends for its 2020 DFES publication to align with the recommendations from the product team.

Q

1. Do you agree with the proposed standardisation of the DFES scenarios, the DFES document and a common DFES publication date? If not, please describe what you would like to see.

4 A wide range of information used in the forecasting process

The aim of our forecasting approach is to generate accurate and credible sets of regional long-term demand and generation forecasts within a scenarios framework that illustrate the potential future outcomes. Each scenario can be seen as a potential future world, where differences between two worlds can be, for example, about having less or more focus on decarbonisation.

In reality an accurate assessment of future demand and generation might not be feasible when long forecasting horizons are examined, thus it is crucial that forecasting scenarios can effectively frame the associated uncertainties. In forecasting, uncertainties surround the future demand and uptake of generation on our network, in terms of how much it will change, where it will change and when.

To understand these uncertainties we need to be aware of our customers' plans. We therefore seek a wide range of data and informational inputs from numerous public sources and commercial organisations. In particular we source data from local stakeholders, such as local authority plans, as this can reduce uncertainties at regional level, which in turn allows us to produce more accurate regional forecasts.

Our primary focus is to gain as much insight as possible on all matters relating to the production and use of electricity, including current and potential future technologies. We must also be aware of the potential of other fuel sources like hydrogen, biomethane etc that could form part of the pathway to net zero carbon emissions and reduce the requirement for electric heating for our customers.

In general, we look at the following types of information and use it in the following ways:

Type of information	Use for information
Macro-economic data	Influences the prosperity of the region and the associated impact on industrial and commercial electricity consumption growth
Local housing and population data	Influences the number of households and changes in electricity consumption. Influences changes in building stock and the associated impact in reducing domestic electricity consumption due to increased heating efficiencies of new housing
Low carbon vehicles, specifically EVs and EV charging	Influences increased electricity consumption across different charging locations (eg home, destination and en route) and different charging profiles (eg peak, duration and time of day)
Heat pumps (domestic and I&C)	Influences increased electricity consumption across domestic and I&C customers and different charging profiles (eg air source, ground source and hybrid)
Renewable generation eg solar photovoltaics, wind etc	Influences network fault levels and volume of electricity exported onto our network at different voltage levels
Energy storage (domestic and I&C)	Influences network fault levels and volume of electricity generated for own use and exported onto our network at different voltage levels
Flexibility driven by smart metering, use of system tariffs, balancing services etc	Influences the amount of electricity consumption shifted from between time periods during day and/or night ie from times of peak loading
Data and information on developments	Influences demand and generation growth for future planned projects
Information on availability of other fuel sources eg hydrogen, biomethane, etc	Influences the likelihood of the adoption of LCTs eg more likelihood to have electric heat pumps in areas without access to the gas networks or less likely if natural gas network shifts to hydrogen
New technologies or advancements in LCTs, including fuel and technology costs aspects	Influences our customers' choice for adopting LCTs eg reduced battery cost combined with higher storage capability are more attract to customers
Existing and potential future policy	Influences timing and scale of adoption of LCTs eg recommendations from Committee on Climate Change to ban sales on pure petrol and diesel vehicles before 2035

4 A wide range of information used in the forecasting process

The organisations and data sources listed below highlight the breadth of the data and information that we take into consideration. It is not exhaustive, and it is populated to give you a flavour of the range of organisations that we engage with as part of the forecasting process:

Category	Information source
HM government	Office of National Statistics, Department for Community and Local Government and Office for Budget Responsibility
Non-government organisations and agencies	Ofgem, Committee on Climate Change, National Infrastructure Commission, Innovate UK and the Catapults, specifically the Energy Systems and Smart Cities Catapults, Local Enterprise Partnerships for Greater Manchester, Lancashire, Cumbria, Cheshire and Warrington
Local government	Local planning and combined authorities
Network users	Domestic, industrial and commercial customers, including generation and storage and IDNOs; plus interconnected networks with other DNOs and NGET
Innovation projects and trials	GB and EU-funded innovation, specifically LCN Fund project outcomes, NIA and NIC project outcomes, EU , UKERC projects, Innovate UK project outcomes
Other regulated entities	National Grid ESO Future Energy Scenarios, NGET and SPT, other GB DNOs, Cadent, Northern Gas Networks, United Utilities
Other sources	ENA Open Networks Project, ENA Future Electricity and Gas Network Groups, Element Energy, Regen, Baringa, Navigant, other consultancy practices and academic institutions

Although the ATLAS forecasting methodology was developed by Electricity North West, we use the specialist supplier, Element Energy, to recalibrate some key components of our demand and generation forecasting processes on an annual basis. Importantly this includes the consumer choice models that allow us to understand the likelihood of our customers adopting LCTs, depending on policies supporting them and costs associated etc. These components recalibrated by Element Energy are combined with in-house processes that are either pre/post processes or completely independent processes that run in parallel (eg, modelling of demand connections activity).

Q

5. Is it appropriate that we source data and information from this wide range of organisations, bodies and agencies? If not, how could we improve our approach?
6. Are there other sources of data and information that we should take into consideration in our forecasts?
7. Do you think the approach we have detailed will produce a robust plan that represents the needs of stakeholders? If not, please suggest how we can improve it so that it does.
8. Do you have any other comments on this document?

Q

2. Should we apply bottom-up modelling using a wide range of inputs from our regional stakeholders to generate accurate and credible regional long-term demand and generation forecasts? If not, please suggest what alternative method would be better?
3. Is it appropriate to generate a range of forecasts to frame the future uncertainties? If not, how do you think we could improve it?
4. Should we take into consideration the potential role of other fuel sources in our forecast? If not, please explain what you would like to see?

5 Consultation process

We are inviting our customers and wider stakeholders to review and comment on the information we take into consideration, and how we use the data, when we develop the future demand and generation forecasts published in our DFES document.

Your input will help ensure we are prioritising your needs and these will be fed into the updated DFES document to be published in early December 2020.

The consultation opens on Monday 6 July 2020 and closes on Friday 7 August 2020 at 6.00pm.

Please provide your response to the consultation by completing our online survey. If you have any other comments or questions, please contact Simon Brooke at development.plans@enwl.co.uk.

6 Glossary

Term	Description
ATLAS	Architecture of Tools for Load Scenarios project which developed methodologies, prototype tools and specifications to develop detailed loading scenarios
BEIS	Department for Business, Energy & Industrial Strategy
Cadent	Gas distribution network for the North West, West Midlands, East of England and North London
DFES	Distribution future electricity scenarios – forecasting plans for a range of scenarios for how low carbon technologies will be taken up and how the network could respond. The scenarios inform our investment plans and provide visibility of flexibility opportunities
DNO	Distribution network operator - company licensed to distribute electricity in Great Britain by the Office of Gas and Electricity Markets (Ofgem)
DSO	Distribution system operation
ENA	Energy Networks Association – industry body which represents transmission and distribution network operators for gas and electricity in the UK and Ireland
HV	High voltage
IDNO	Independent distribution network operator
IFI	Innovation Funding Incentive - funding allowance replaced by NIA in 2015
Key enablers	The technology, data and engineering competencies and capabilities needed to deliver DSO functions
LCN Fund	Low Carbon Networks Fund - funding provided to DNOs from Ofgem for innovation research projects during the previous price control period
LCT	Low carbon technology such as electric vehicles, electric heat pumps, solar and wind energy
LV	Low voltage
National Grid ESO	National Grid Electricity System Operator
Net zero carbon	The achievement of balancing carbon dioxide emissions with carbon removal or eliminating carbon dioxide emissions altogether
NGET	National Grid Electricity Transmission – electricity transmission network in England and Wales
NGFES	National Grid's Future Energy Scenarios
NIA	Network Innovation Allowance - a set allowance each network licensee receives as part of its price control allowance
NIC	Network Innovation Competition - annual competition where network companies compete for funding for research projects
Ofgem	Office of Gas and Electricity Markets – the government regulator for gas and electricity markets in Great Britain
Ofgem DSO functions	A list of 19 key distribution system operation functions published by Ofgem designed to describe the activities performed by a DNO in distribution system operation
Open Networks Project	A key industry initiative to deliver government policy that will transform the way our energy networks work and help deliver the 'smart grid'
Prosumer	A person who both consumes and produces a product, in this case electricity
RIIO-ED1	Current electricity industry price control period, 2015-2023
RIIO-ED2	Next electricity industry price control period, 2023-2028
SP Transmission	Transmission network for electricity in central and southern Scotland
UKERC	UK Energy Research Centre

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