electricity north west

Bringing energy to your door

Annex 6: Enabling Whole System Solutions

This Annex is intended to provide the reader with a deeper understanding of our approach to whole system. We describe our culture, our processes and insights into the work we have undertaken to date and how we will build on this over the coming years.

December 2021

1 Contents

2 Executive Summary

As we guide our customers on the net zero journey a key role is one of coordination and cooperation with regional stakeholders, other industry sectors and other energy providers so that we collaboratively develop whole system outcomes at the lowest cost to customers.

There are a range of data exchange activities which already exist between DNOs, IDNOs, TOs, and the ESO. Co-ordination with gas networks, local government, social housing providers, Transport for the North and many other regional stakeholders is becoming process driven and systematic. In ED2; the quantity, quality, granularity, and frequency of these data exchanges will increase to deliver enhanced whole system co-ordination and efficiency of decision making. Confidence in the comprehensive and effective nature of this whole system co-ordination is given by the robust Whole System Processes and suite of tools detailed in this Annex including our industry leading Architecture of Tools for Load Scenarios (ATLAS) and embedded Cost Benefit Analysis approaches for Real Options, Common Evaluation and Whole System.

Our plan includes proposals for utilising energy efficiency measures to reduce demands on highly loaded areas of our network, as well as promoting general energy efficiency across the network. By reducing the overall demand on the network and promoting flexibility in how and when people use the network we can reduce the overall level of energy needing to be produced across the whole system, optimise energy usage to when it can be generated from renewable sources, and reduce the amount of overall investment required across the distribution and transmission networks. We have also seen that through engaging with energy efficiency programmes, this can be the catalyst to wider systemic changes to achieving Net Zero.

Our CLASS Customer Value Proposition is a great example of innovative, whole system thinking turned into action and delivering significant customer benefits. Using voltage control technology and the platform provided by our industry leading Network Management System, CLASS allows demand to be varied by the ESO. In ED1 CLASS became business as usual and now, as well as managing our own peak demand needs, CLASS is used multiple times each day by the ESO. With a total net economic benefit of £14.78 per £ spent, CLASS is one of the strongest performing investment proposals for social return on investment in our ED2 plan.

We have used our position at the heart of the energy and net zero landscape to bring stakeholders together to identify whole system approaches to tackling net zero challenges. We think about whole system in three mutually supportive ways - the **whole energy and heat system**, the **whole transport system** and the **whole customer support system** and bring these perspectives themselves together where linked.

Collaborative working is a key feature with our established and continually developing relationships addressing each of these key perspectives. This gives an established platform from which to continue to develop our whole system thinking with confidence. The initiatives in this Annex demonstrate that in ED2 we will deliver a step change in cross-sector engagement, optioneering and planning

2.1 Whole Energy and Heat System

This is fundamental and already how we think about the region we serve. For example, we undertook a leading whole energy system decarbonisation pathways project with multiple stakeholders in ED1 and have actively enabled the development of whole energy and heat system action. This identified that decarbonisation of heat is a key issue as how much electrifies or is met through other means has a significant impact on the needs our customers have for our services.

Across the Greater Manchester city region we have been instrumental in establishing a Strategic Infrastructure Board that brings together utility and transport providers, key experts and local authorities to jointly plan the regions infrastructure development in a whole system manner. Through the Strategic Infrastructure Board we developed the countries first whole energy system decarbonisation pathway for Greater Manchester with our partner Cadent Gas. This approach has been replicated across the rest of the North West with whole energy system decarbonisation pathways produced for Cumbria and Lancashire too.

We are now working to establish a Strategic Infrastructure Board for Lancashire. In Cumbria we have worked with the County Council to develop a whole system Cumbrian Transport and Infrastructure Plan (CTIP) and discussion about a similar, close working relationship with Cumbria County Council and other whole system actors is underway.

We will continue to use our position to develop strategic partnerships, convening regional and national stakeholders to speak about their energy and decarbonisation needs, particularly those associated with regional planning processes. Together we are developing plans for low carbon transportation and housing development as part of supporting the local authorities develop Local Area Energy Plans (LAEP). In ED1 these plans will be completed for all 10 of the Local Authorities in the Greater Manchester city region. In ED2 they will be created for every appropriate Local Government Body across the whole region.

2.2 Whole Transport System

Beyond the energy system, the decarbonisation of transport is the next critical vector to tackle in a whole system journey to net zero. We are undertaking joint planning work with the Office of Zero Emission Vehicles to deliver concentrated populations of EV chargers at strategic locations across the North West strategic road network. This includes assessment of electrical network capacity availability, determining optimal EV charging connection points and future proofing capacity growth.

Transport for the North (TfN) is the sub-national transport body that oversees the development of transport infrastructure across all of our area of operation, working with ourselves and local partners responsible for the provision of public services to holistically deliver whole system outcomes. Our engagement work with TfN focuses upon the provision of electrical infrastructure for the decarbonisation of transport within our area. The whole system approach of our work with TfN means that we support all needs for network capacity to supply electricity to transport; including to bus depots, on bus routes, for on-street and off-street parking, in train and tram car parks, for tramways and even for bike storage and E-bike charging. More systematic engagement with transport planning bodies is a key development in our ED2 whole system solutions.

2.3 Whole Customer Support System

Working with our stakeholders and customers it is apparent that whole system thinking must be extended to include all parties actively tackling the challenges that face our communities today. Trust within communities is paramount if the UK and North West are to reach targets for net zero and bring customers on the journey with confidence. Having a whole systems approach built into our services helps us improve relationships with customers and communities to build trust.

The Smart Street Customer Value Proposition is a key step in building this trust by proactively lowering bills, reducing energy demand and enabling low carbon technology deployment for domestic and small business customers. By combining innovative technology with existing assets, Smart Street makes networks and customers' appliances perform more efficiently reducing electricity consumption by 5-8% per year and saving up to £60 a year off customers' electricity bills. In ED2 we will extend

Smart Street to a further 250,000 households in our region, targeting its deployment to areas where there is the highest concentrations of customers in fuel poverty.

Supplying a basic need of electricity to the North West provides us with an opportunity to maximise every contact we have to benefit electricity users. We have a role to make support accessible, building on our relationship to ensure that we are a trusted source of information to aid in the transition to Net Zero.

This is why we created the Utilities Together partnership uniting electricity with gas, water and waste water networks to provide enhanced support for our customers. All members of the Utilities Together partnership are committed to increasing accessibility to support services, simplifying the registration process for everyone and minimising the effort required by the electricity user. We can achieve this by increasing our network of trusted partners who, with consent, can share data to provide support services to those on our Priority Services Register. This includes data sharing agreements with suppliers of gas and electricity, United Utilities and gas transporters Cadent and Northern Gas Networks. We use embedded 'behind the scenes' processes that ensure customers only have to register once with any partner to receive a wide range of support benefits from us all.

Learning from our experience of the barriers to consumers taking up support offers, we are leading an initiative with Utilities Together and our strategic partner Citizens Advice Manchester. We have identified a gap in the provision of advice which is not being updated to help customers start to understand and prepare for Net Zero using new gadgets, appliances and technology. In readiness for the changes ahead, we are bringing our industry insight and knowledge to energy efficiency support service providers and vulnerability charities, helping them become more aware of what Net Zero might mean to their service users. This includes providing training and expertise in addition to content for their educational materials.

3 Introduction

The term “Whole System” has been widely used over recent years and has been particularly prominent as the RIIO-2 framework has been developed, however the term means different things to different people and during our engagement we have regularly been asked “what does whole system mean?”

There is no universally agreed definition, and here we share how we have interpreted whole system and what it means to us having considered how to deliver benefits for our customers and stakeholders.

We consider there are three main definitions used in connection with electricity distribution:

- Whole Electricity System – meaning the end to end electricity system, including electricity system operation, transmission operation, distribution operation, supply, generation and end consumer.
- Whole Energy System – expanding on whole electricity system to include the gas sector at all levels.
- Whole System – expands further on whole energy system to cover all utility providers, electricity and gas operators (at all levels including system operation), water, and also includes transport and heat as well as local Government. This continues to specifically consider end users, with a particular focus on those in more vulnerable circumstances.

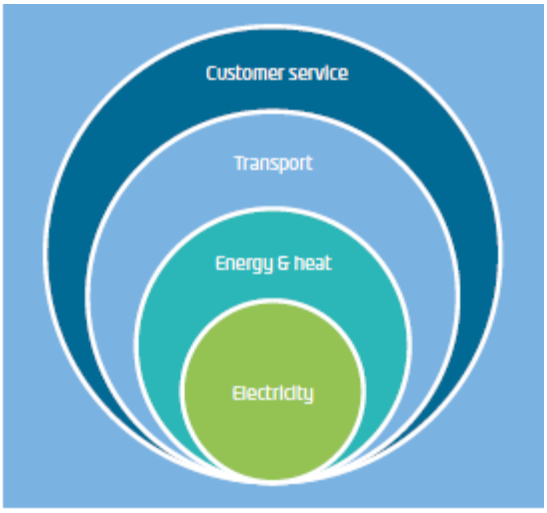
The link within the wider definitions is that all of these have the purpose to serve end users and our society as a whole; they are there to power and heat our buildings, to enable social and economic movement and growth.

When we use the term “Whole System Outcomes”, we do not limit our thinking to solving network issues, but instead go much wider, considering how collaboration and consideration across two or more elements can bring benefits to our customers. Hence we adopts a wide definition of whole system – not just focussing on the electricity system. This is a much more customer driven way to view our services as customers have needs without wanting or needing to see them segmented into individual utility activities. Furthermore, we need to ensure that as society transforms to address the challenges of decarbonisation, those in more vulnerable circumstances are supported by all utility providers in making the necessary transitions.

We tend to use the terms “vector” meaning for example gas, electricity, heat or transport, “sector” such as all electricity licensees and “voltage” to distinguish between distribution and transmission.

Whole System focus is required to avoid piecemeal interventions on single energy vectors, e.g. electricity distribution or gas transmission, and promote strategic interventions that increase the overall benefits for customers. Interactions and synergies between energy vectors need to be included in Whole System thinking and studies to meet the future energy system needs at lowest possible cost and risk. Side effects and benefits from actions taken on one energy vector to another vector need to be considered, otherwise unintended consequences might arise.

Beyond the energy system, the decarbonisation of transport is the next critical vector to tackle in a whole system journey to net zero.



We have used our position at the heart of the energy and net zero landscape to bring stakeholders together to identify whole system approaches to tackling net zero challenges. We think about whole system in four mutually supportive ways and therefore in combination in an entirely whole system way:

- **The whole electricity system**
- **The whole energy and heat system**
- **The whole transport system**
- **The whole customer support system.**

Collaborative working is a key feature of our established relationships addressing each of these key perspectives. This gives an established platform from which to continue to develop our whole system thinking with confidence in ED2. Building on these foundations the initiatives in this Annex demonstrate a step change in cross-sector engagement, optioneering and planning.

Whole System thinking is intrinsically linked to the journeys of decarbonisation, decentralisation and digitalisation and as a result extends beyond that which we would traditionally think as a network operator and with whole system benefits going beyond network benefits and into societal benefits such as environment, air quality and wellbeing.

As we transition towards a low carbon future we will continue to plan and operate the electricity distribution network taking into account the effects of decarbonisation of heat and transport. These two components have been part of our planning and forecasting scenarios for many years, becoming an increasingly important component as we enter ED2.

We do not see whole system as limited to network related initiatives, and there are examples of what we consider “whole system” throughout other aspects of our business plan such as a wide application priority service register, advice to businesses on how they can decarbonise their own operations, and our bespoke proposal on faster street works reinstatement called “Dig, Fix and Go” (further detail shared within Annex 7).

4 Stakeholder Engagement

Stakeholder engagement is integral to whole system thinking and is a key enabler. From working level meetings with the electricity system operator through to high level strategic discussions with BEIS on heat policy all input is considered by the appropriate team or department and in context. We take a wide approach to stakeholder engagement, from high level national policy discussions, through to discussions with customers on the day to day impacts of such policy aims and objectives.

Stakeholder engagement is at the heart of our planning approach, has great depth and enabled by well-established business as usual processes. The depth of our engagement will be reviewed for appropriateness during ED2 whilst we already expect the breadth of our engagement to be continually expanding as we approach ED2.

Stakeholder engagement on whole system is not limited to RIIO-2 timeframes, and continues throughout our annual cycle, for example with meetings with policy makers within BEIS, Greater Manchester Combined Authority (GMCA), Lancashire County Council and Cumbria County Council, engagement sessions with local community energy groups or surgeries with connections providers.

What we hear from our conversations with stakeholders helps to shape our whole system approach, whether this be by data transparency, a region by region approach, our agile way of learning through doing, or by having an open feedback loop.

The future of heat and transport is critical within our business planning. We must balance these inputs with customer needs on day to day reliability, resilience to severe weather and other natural events.

Our world class forecasting methodology we call ATLAS, takes inputs from a range of stakeholders, learnings from our cycle of engagement with local stakeholders, data and specialist input on consumer choice. This is truly a whole system approach, accounting for interactions with other energy vectors (e.g. customer access to gas networks) and reflecting key uncertainties around the future role of hydrogen in the heating sector. State of the art data processing tools that implement machine learning techniques which have been developed from our innovation projects, are also used to process our network and monitoring data to allow us to produce well informed and justified local forecasts. As the DFES is used to inform our ED2 load related investment plans, so by its nature our plan is based on whole system consideration.

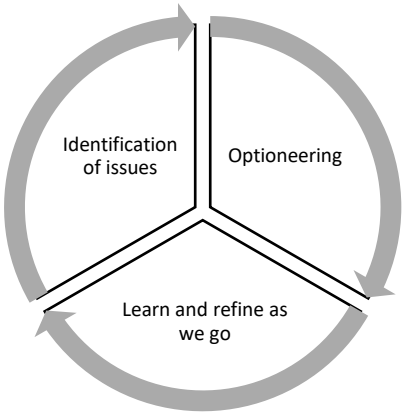
Our engagement with customers and stakeholders tells us that they rarely view (or want to view) the energy system in the traditional divides. Awareness of the electricity industry roles is very low, for example, customers pay an electricity bill and rarely consider or are aware of the different components of generation, transmission, distribution, or supply that go into meeting their needs. We have found our customers are already whole system actors, becoming generators themselves, transitioning to electric vehicles and therefore increasingly linking themselves to the system. Customers expect seamless whole system transitions for them to be enabled.

Our stakeholder engagement also tells us they are fearful that some groups may be left behind in the energy transition, and this has been discussed within our deliberative panel. The expectation is that a whole system approach is required to tackle real and perceived barriers.

5 Our Whole System approach

Our whole system approach is outcome focused, aimed at delivering or enabling benefits for our electricity network customers and society more widely. We recognise that we cannot achieve this singlehandedly and have limits as to the reach of our activity and also what is appropriate for our role. With this in mind we strive to conduct our operations in an open and transparent manner, provide data and network visibility to stakeholders and innovators, not only considering those presented, but actively seeking out whole system solutions to network and customer constraints and issues.

We have a three-phase approach to whole system solutions and during ED1 we have made a step-change as we develop our whole system thinking and have taken an agile approach by learning through doing and intend to continue with this agile approach.



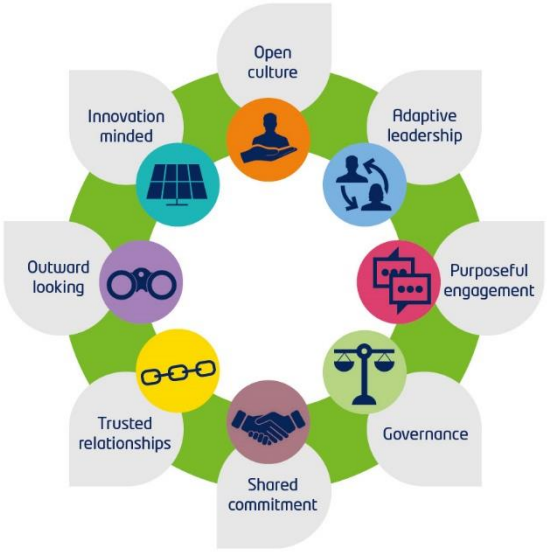
Collectively understand the issue and which system it lies within

Identify and consider options with stakeholders

Evolve as we go, involving stakeholders throughout the process

We have a demonstrable track record of whole systems thinking in ED1 and are continuing to evolve our approach as we prepare our ED2 plans and embed whole system thinking across our business.

Whole system does not belong to one single department, instead it flows throughout our company plans and activities. In order to fully embrace whole system thinking, this needs to be led by company culture and behavioural change. We are already well into our journey of change with this image showing the key elements that demonstrate our whole system philosophy.



This philosophy is led from the top, with Board level engagement on whole systems, indeed our new owners who invested in the business in 2020 are committed to exploring how we can learn from their other businesses elsewhere in the world, and vice versa. Our CEO has been an active member of the ESO RIIO-2 Stakeholder Group to help provide challenge to the ESO as they build their RIIO-2 plans.

As can be seen by the range of examples shared in sections 7 to 9, long term whole system thinking is systemic across all elements of our business, our smaller size is a strength; decision making and collaboration naturally flows cross department resulting in joined up thinking and actions. Neither are we limited to considering whole system purely in the narrow context of network related activities. We also share details as to how these activities will continue to evolve ahead of, and into, ED2.

Whole system is one of our five themes within our innovation strategy. Our focus within innovation is on enabling joined up and efficient approaches across multiple aspects of the energy system around planning, forecasting, design, construction, operation, maintenance and data.

5.1 Drivers for Change

Historically electricity distribution networks operators have experienced reasonably steady levels of demand and power flows in one direction. The foundations for our current network was built largely in the 1950's and 60's and has remained largely the same in the way that it is developed and operated. There has been significant improvements and efficiencies since privatisation in the 1990s and technological advances has also seen system operation continue to evolve. However, the last decade has seen a more dramatic change, particularly with how we use and generate energy, and as we make our preparations for ED2, we are beginning an energy revolution, which will result in the biggest change to the requirements of our network since the industrial revolution.

For decades, we have seen customers and businesses traditionally heat their buildings using gas and power their appliances using electricity. Electricity has been generated by nuclear and fossil fuel powered large generating plans, travelling along the electricity network and converting from the National Grid transmission system to the Distribution system through a network of towers, overhead lines and underground cables. Peak energy consumption times has been stable and predictable as has generation capability. Customers' needs centred on ensuring we have a reliable, safe and affordable electricity network. Power cuts, or interruptions, are recognised as an infrequent occurrence and both frequency and duration have reduced significantly since the 1990s.

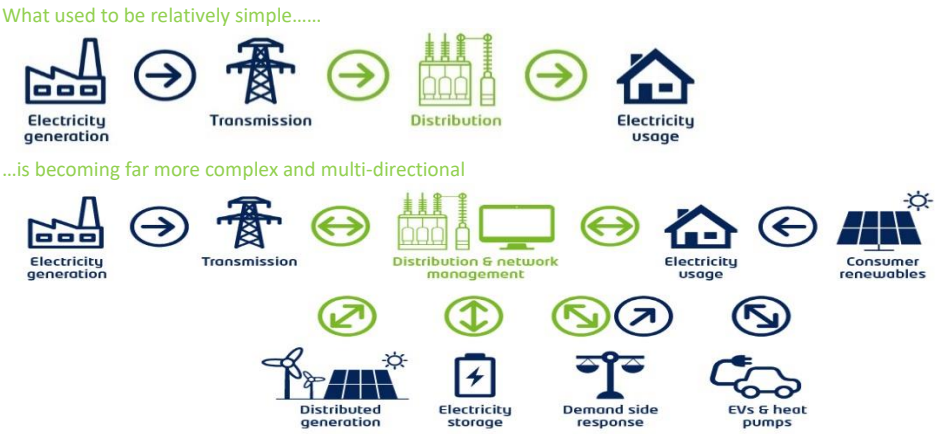
Customers are not only changing how they generate electricity, but also critically, how they use electricity. We have clearly witnessed over recent years a greater reliance on electricity to keep peoples' lives running, we now rely on electricity for internet connection, for social, work and education purposes following the pandemic, and increasingly to power our transport. This change in use may also change the times where we have traditionally seen peak demand as well as affecting overall demand.

Key drivers of change over recent years are decentralisation, digitalisation and decarbonisation:

5.1.1 Decentralisation

Over recent years, as we look to move towards a cleaner, greener energy system, we have seen increasing levels of electricity generation delivered by renewable sources such as wind or solar and the increased use of battery storage, many more of which are connected to the Distribution network. These are known as Distributed Energy Resources (DER). Our customers and businesses are also exploring how they can generate their own electricity, benefit from selling excess electricity back to the grid and maximise their energy efficiency.

This radical change in how electricity moves through our network provides great opportunities for a smart and flexible system, but also comes with challenges as the network was not originally built with these changing power flows in mind.



5.1.2 Decarbonisation

With the UK signing to the legally binding Net Zero target of 2050, more and more we need to consider what impact the various pathways to decarbonisation, changes in technology, consumer behaviour and low carbon energy developments will have on each aspect of the energy sector. No longer can each element be considered discretely on its own; our electricity system, from low voltage in customers premises, to the extra high voltage transmission substations will all be affected by changes in the way we consume our energy, and how we live our daily lives.

Whilst the precise pathway to decarbonisation remains unclear, there are some elements which are more certain than others, for example we know that the decarbonisation of transport will be broadly achieved by the electrification of vehicles and this is therefore one certainty which is factored into our plans.

It is our job to play a proactive role in ensuring our network is ready for the Net Zero transition. This means accommodating increasing demand coming from the electrification of heat and transport as well as taking into account the potential to use new technologies, systems and processes to provide system flexibility and reduce the need for network reinforcement where possible, for example from the impact of time of use tariffs and smart charging. We must balance the need to maintain our levels of reliability, provide great customer service and enable decarbonisation at lowest cost to existing and future consumers.

We also recognise that some of our customers may be unable to fully participate in the energy transition as a result of a range of barriers and our strategy for Electricity Users in Vulnerable Circumstances Annex 8 shares our plans to ensure that customers do not experience detriment or disadvantage as a result.

5.1.3 Data and Digitalisation

Data is a critical component to enable whole system solutions. The Energy Data Task Force has recently undertaken an extensive review into the energy system data and has produced their report and series of recommendations which the sector has embraced.

We were the first network to publish our entire reinforcement programme for high voltage schemes and above, as we believe this provides additional value to potential connectees and market participants, especially when used in conjunction with our other data provisions such as our heat map and DFES workbooks.

The combination of digital data sets has transformed our knowledge and understanding of the communities we serve by enabling the systematic social data mapping of our entire customer base to a high degree of granularity. This enables us to target a wide range of support services to specific populations that need extra care and to share this insight with our third sector partners and across our Utilities Together framework.

Throughout our business plan stakeholders will be able to see how data will be unlocked, used for both ourselves and made available for others to use, some in ways which we have not yet envisaged. Our DSO Transition, Digitalisation Strategy, Data Strategy and Innovation Strategy annexes discuss this subject further, as does Section 6 below where we provide examples of the use of data in ED1 as well as sharing some of our plans for ED2.

Technology and information are vital to almost every business, enabling everything including improved customer service, increased job satisfaction and rapid innovation. Within the electricity industry, it will take on an even greater significance as we transition to delivering Distribution System Operations (DSO), implement the UK's Energy Data Taskforce (EDTF) recommendations and support the road to Net Zero carbon.

Within the sphere of electricity network operations there are a range of data exchange activities which already exist between DNOs, IDNOs, TOs, and the ESO. Within ED2; the quantity, quality, granularity, and frequency of these data exchanges will need to increase to deliver whole system co-ordination and efficiency of decision making.

We will utilise data transfer links, e.g. ICCP links, to share near real-time operational data between control rooms and their supporting systems. For activities which do not require near real-time operational data transfers; additional communications pathways will be established to share operational data.

By ED2 we will be sharing enhanced data exchanges of planning data with the transmission owners and ESO. We will also look to develop and integrate additional standardised enhanced data processes with the other networks we share boundaries with i.e. other DNOs, and IDNOs.

We plan to continue to deliver network reliability and security, excellent service and efficient operations by building on our core services and exploiting new and maturing digital technologies that are changing the way companies interact and work with their customers and stakeholders while recognising that some customer segments have digital accessibility challenges.

For our customers and stakeholders, this will mean increased openness and transparency through improved digital services informed by enhanced engagement, which will support market innovation, energy supply chain efficiency and economic growth. In turn this will be a key enabler of Whole System solutions as visibility of data opens up the ability of third party involvement and action.

Three main capability themes that underpin our digitalisation are:

Enablement	Innovation	Insight
Providing access to data and appropriate technology in the right place at the right time to enable our people to work more safely and efficiently and better serve our customers and stakeholders	Enabling the company and the supply chain to adapt quickly to changes in the operating environment and to innovate by continuing to invest in flexible technology platforms, data quality and data sharing	Information and analytics, to enable us, as well as third-parties, to identify opportunities to innovate and continually improve the whole system access in an affordable, secure and reliable manner

To see how we are adapting in greater detail, our full digitalisation strategy can be found in Annex 23.

5.2 How we are preparing our ED2 plans

As the energy system and customer needs change, so must our approach. DNOs have always had strong co-ordination and co-operation with National Grid as the Transmission network owner and System Operator, however that is no longer enough. The same strong relationships are being built with connected DNOs and IDNOs. As we transition to a low carbon future we now also need to consider how the actions taken on one part of the energy network will affect other parts of the system. We must avoid the risk of silo thinking, and strive for the efficiencies that whole system thinking can bring. We can no longer treat gas and electricity as unconnected, nor the changes to use of heat and transport as peripheral.

Our ED2 plan is built with a recognition of whole system interaction, takes into account where there are uncertainties and recommends how these are best managed. The biggest impact from the range of different forecasts and future pathways is to our load related expenditure. The uncertainties, mitigations and considerations of these pathways is covered further in our Load Related Investment Planning Methodology – Forecasting and Planning Processes in Annex 3B.

Our ED2 business plan is informed by a range of stakeholders and considers our governments national commitments and aspirations as laid out in the energy white paper and ten-point plan.

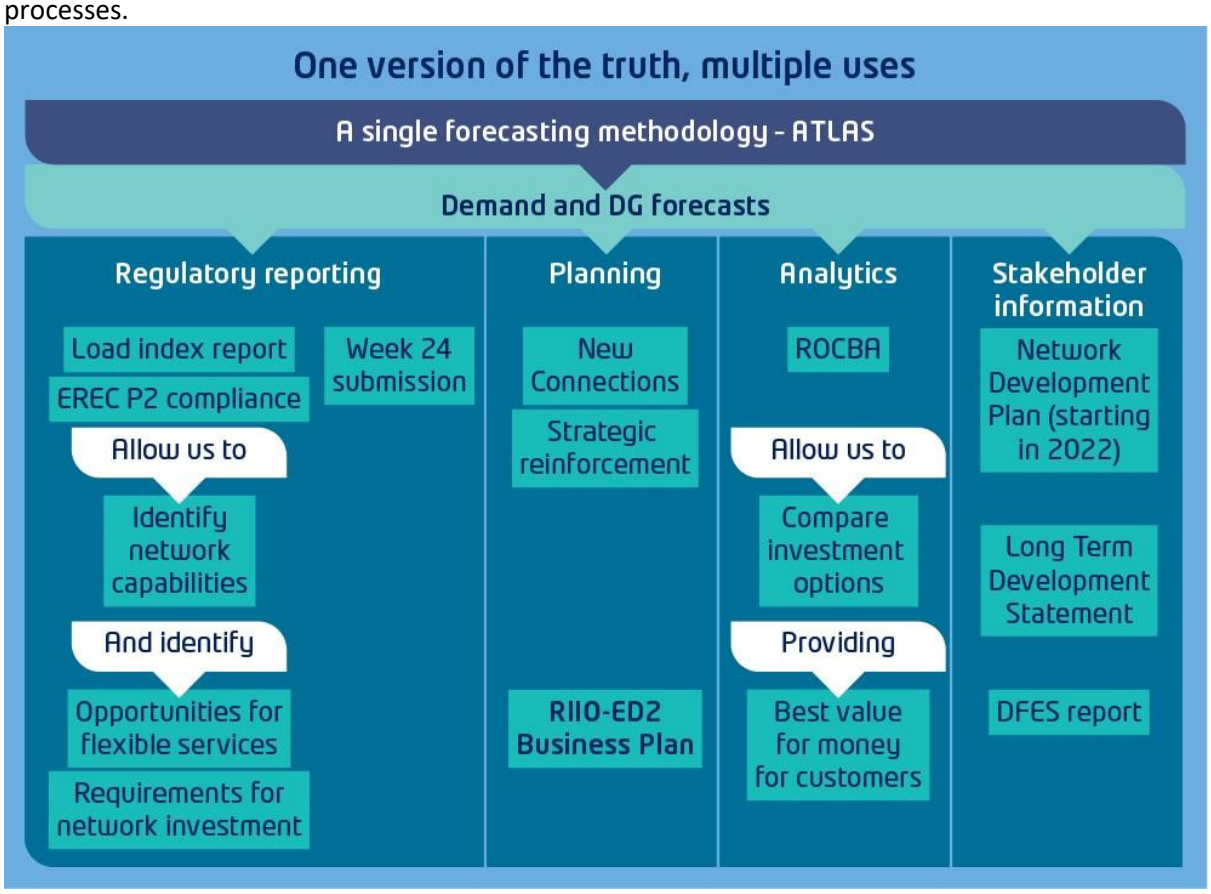
We also recognise that there may be longer-term impacts from the Covid pandemic on the whole system. It is too early to say how our working and living patterns may change more permanently and what this means for our system. We will continue to learn from our own and others research in this area.

Similarly, government policy decisions continue to be a significant driver of consumer behaviour, as was seen in previous price controls with the boost of solar PV in response to stimulus. As such policy changes are a key enabler for whole system and an area we will closely monitor, help shape and respond to as required.

6 Our Whole System processes

To ensure Whole System thinking is embedded within our business, it is critical to have processes to allow us to ensure whole system considerations are at the heart of our decision making. This includes ensuring whole system components are built into our assumptions and forecasts, processes are in place to identify whole system opportunities, and finally to assess them against other available options.

The figure below shows our approach to a single forecasting methodology which feeds into our other processes.



This complements our existing processes within the business to ensure that we coordinate and cooperate with other electricity Distribution and Transmission operators to seek to identify actions and processes that advance the efficient and economical operation the whole electricity system.

ATLAS and other key components of our information and decision making framework are shared in further detail below.

6.1 Architecture of Tools for Load Scenarios (ATLAS)

In ED1 we developed the Architecture of Tools for Load Scenarios (ATLAS) methodology to enhance our forecasting methodologies for electricity demand and generation. ATLAS has allowed us to:

- automate the processing of half-hourly substation and local generation measurements to improve our baseline demand modelling at local level;
- introduce confidence factors based on historical performance to improve our accuracy in capturing demand growth from the connections pipeline;
- apply a bottom-up methodology using consumer choice and half-hourly analysis as core approaches to produce well informed local forecasts of demand and generation.

In ED2 we will use the ATLAS methodology to deliver demand forecasts for all voltage levels, including HV and LV network assets. We will share with the ESO our reactive power (MVAr) forecasts at the interface boundary points with the Transmission network to enable the ESO to enhance their modelling of reactive power flows for managing network voltage, both in planning and operational timescales.

The forecast data will be available to our stakeholders, but we will also use it to develop and publish a full range of heatmaps, from 132kV to LV. These heatmaps will provide valuable information to developers and customers on availability of network capacity, but also signal opportunities to solution providers e.g. energy efficiency/ flexibility services providers; to offer options for mitigating network needs. Information will be presented in easy to read formats for humans as well as machine readable formats; with explanatory detail so that different customer groups can understand and act on it.

6.2 Distribution Future Energy Scenarios (DFES)

Distribution Future Electricity Scenarios (DFES) showing local forecasts of electricity demand and distributed generation are a key enabler to provide stakeholders visibility of where network impacts may benefit from a whole systems approach. Given that DFES is produced using a bottom up modelling approach informed by our stakeholder engagement and the use of local network and monitoring data combined with DNO planning information, they can provide valuable inputs to the decision making of our stakeholders including Local Authority planners, network users and other network companies.

We were the first DNO to publish our Distribution Future Electricity Scenarios (DFES) in 2018. Our regional forecasts from this work were used by National Grid Electricity Transmission (NGET) and Cadent to inform their RIIO2 submissions. As part of our extensive stakeholder engagement, we have developed our approach to increase transparency. As a result, in subsequent years we published our DFES document with a workbook containing the full suite of data used to derive our regional forecasts of various demand, generation and battery storage components. This has provided valuable detail to contribute to the thinking and plans of our stakeholders in the North West and gives visibility of where network impacts may benefit from a whole systems approach.

As part of the Open Networks Whole System Future Energy Scenarios (FES), in our DFES 2020 we have aligned with high level assumptions and scenario definitions with all other DNOs and the ESO. We have also submitted a full range of building block outputs (local forecasts) to inform the ESO FES. This process has allowed local stakeholders understand how the well informed and more granular local trends in our DFES compare with national and less granular figures presented in ESO FES.

6.3 Whole System FES

Focusing on further standardisation on the DFES works across all DNOs, we have proposed to the Open Networks WS1B Product 2 - Whole System FES group that in addition to the common scenarios framework and assumptions per scenario, a common framework should be used for the forecasting steps followed by all DNOs. Our proposals and views have constructively influenced the thinking of DNOs and the ESO and the majority view is in line with our initial recommendations. Following the positive feedback from Ofgem on the use of our Central Outlook scenario that follows ATLAS methodology definition, we have proposed that to be used as a best view forecast by all DNOs. Our support with all other DNOs and the ESO to the initial alignment and feedback model is expected to allow in the long-term the ESO and ET/GT/GD companies to improve their understanding on regional

trends that are captured by DNOs' engagement with local stakeholders and their plans, as well as the associated interactions between DNO planning and local stakeholder decisions. This will also allow DNOs to have better visibility on methodological aspects on how the ESO FES forecasts are produced, as well as engage more actively for the design of the common scenario framework.

6.4 Real Options Cost Benefit Analysis (ROCBA)

In ED1 we developed the ROCBA model to apply the real options methodology to inform decision making process for load related investment interventions. More specifically, the model allows us consider the whole range of DFES scenarios and intervention strategies comparing, on an equal basis, flexibility with traditional reinforcement. Using a sophisticated approach based on real options, the tool can minimise costs and risks providing additional insights for all scenarios to give a "full picture" to the decision maker.

In ED2 we will continue to develop the ROCBA model as well as introduce a process and methodology to identify and evaluate the benefits of the options, from the perspective of other system or network licensees. Where possible it will be quantitative, but even if it is only qualitative it will allow us to consider whole system benefits in our decision-making. We will actively seek alternative solutions to conventional reinforcement; including those from other system and network operators and third parties. Through projects, such as the pathfinder projects, we have already seen the benefits which can be created by allowing other network operators to offer solutions to resolve issues within the distribution network. It is anticipated that IDNOs, transmission owners and other DNOs we share boundaries with may be able to offer solutions to network constraints within the our network, these solutions may be cheaper and more efficient than conventional reinforcement or utilisation of flexible services and connections. Other novel solutions may be presented by other external parties, which will also be encouraged and assessed within options assessment processes. Encouraging as many possible solutions to be considered will also encourage future market liquidity, reduce the cost to operate the network, optimise efficiency of network operation, and provide the best service to our customers.

6.5 Common Evaluation Methodology (CEM)

We have led the development of the Common Evaluation Methodology (CEM) and tool within the Workstream 1A of the Open Networks Project in collaboration with other DNOs and supported by Baringa. The CEM builds on much of the learning from the ROCBA model, and similarly is based on the Ofgem CBA model.

We will use the CEM tool for evaluating all innovative solutions against traditional reinforcement, but particularly for flexibility. We will supplement the CEM analysis with ROCBA where it facilitates the comparison of additional parameters, or provides greater granularity e.g. network losses. The outcome of each flexibility tender round will be published on our website following each event, with the accompanying analysis and an explanation of the chosen intervention. Note, where it is not possible to fully evaluate options using either of these assessment tools we will use the Whole System CBA developed within the Open Networks Project (see below).

6.6 Whole System Cost Benefit Analysis (CBA)

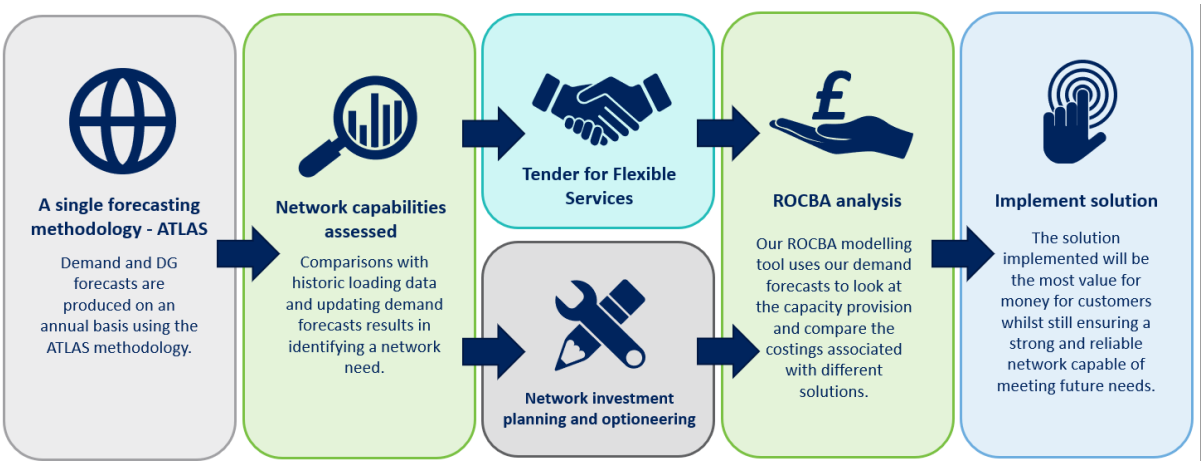
We have been a strong advocate that a key enabler for whole system opportunities is the development of a whole system CBA. Through our involvement with the Open Networks whole system workstream,

we proposed the inclusion of a Whole System CBA in their product workplan; writing the product initiation document and closely involved in the project through to its publication in late 2020.

We have also championed the evolution of the ED1 CBA to better reflect wider societal benefits in readiness for ED2, supporting with drafting of guidance to ensure that there is consideration of wider benefits, and also considering the interaction with flexibility services.

One other useful tool we have developed , supported and co-ordinated with other DNOs, is the Social Return on Investment (SROI) model. Whilst not fully reflecting benefits in other sectors, it is a useful tool to be able to assess the impact of initiatives, and particularly lends itself to non-network whole system initiatives such as welfare partnership initiatives.

The image below shows our process of forecasting through optioneering, to analysis and implementation.

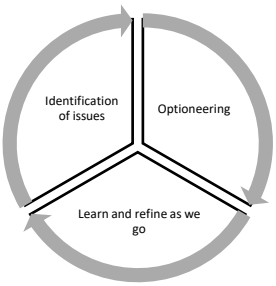


6.7 Co-ordinated Adjustment Mechanism (CAM)

Our optioneering and RIIO-2 business plan development has not identified any projects which would be suitable for an application via the CAM at this stage. We are confident on this current position as we have engaged with Gas and Transmission companies on their RIIO-2 business plans and would have raised at the time if there was a solution to the issues we were made aware of. Equally, as we share our ED2 plans with other licensees over the coming months, new opportunities may arise for a whole system solution appropriate for CAM.

To ensure we consider CAM opportunities throughout ED2, we will include a step in our strategic planning processes which considers both our investment plans and outputs, and those of other licence holders to identify where there may be an opportunity for CAM to be utilised for the benefit of consumers.

7 Whole Energy & Heat System Interactions



Whole electricity system co-ordination and collaboration has matured during ED1 in terms of collaboration, co-ordination, ongoing dialogue and an understanding between each of the components in the electricity system. The Pathfinder, RDP and Appendix G process are good examples of our three phase agile approach. We are also developing our work with gas networks in ED1 to better understand the longer term impacts developments in each fuel combined with government policy and pace of decarbonisation will mean to the needs of our customers and subsequently our own business plans. Much of the work to date in this area has been to better understand future pathways and their impact on the distribution network.

Our studies, DFES and decarbonisation pathways work tell us that hydrogen is unlikely to become a force until later in the 2020's and therefore whilst many of our day to day processes and co-ordination is electricity based, our longer term strategic direction is informed by the wider whole energy system landscape. As government policy on heat in particular becomes clearer during ED2 our engagement with the respective gas networks in our region becomes ever more critical.

Our relationships with local Government, key regional stakeholder bodies and all parties involved in the energy supply chain ensures that in ED1 we now have a significant presence across our region in an advisory capacity, working to support plans for decarbonisation and sustainable growth by acting as provider of impartial advice. In ED2 we will strengthen this engagement with more systematic processes for data exchange and joint planning.

7.1 Electricity System Operator (ESO) collaboration

Whole system interaction analysis		Examples of Established ED1 Whole System Processes	Examples of Planned ED2 Whole System Processes
Current Maturity	Vision for 2026		
		System balancing with CLASS	Wider adoption of CLASS
		Pennine Pathfinder Regional Development Plans Accelerated Loss of Mains	Quest: Voltage Optimisation Quest: LCT connection Quest: Losses minimisation

We have worked closely with the Electricity System Operator over many years to build an effective relationship that enables not only whole system planning and data exchange, but practical action to improve operations and reduce costs for consumers. The following sections set out a range of key examples of our effective whole system approach.

7.1.1 CLASS

CLASS is a great example of innovative, whole system thinking turned into action and delivering significant customer benefits. Using voltage control technology and the platform provided by our industry leading Network Management System, CLASS allows demand to be varied by the ESO. In ED1 CLASS became business as usual and now, as well as managing our own peak demand needs, CLASS is used multiple times each day by the ESO. In ED2 the CLASS functionality will be evaluated further to be offered to the ESO for the provision of reactive power absorption for managing network voltage.

The primary first order benefits which have been modelled include:

- Financial savings for customers; and

- Carbon reduction societal benefits.

The total net economic benefit per £ spent is £14.78, making CLASS one of the strongest performing investment proposals for social return on investment in our ED2 plan. Caution has been exercised in our benefits modelling by constraining the use of CLASS to the north west, however, it could easily be replicated and deployed at a national scale. This has been made possible through leadership shown by us and the IPR developed and shared freely with all DNOs.

The original CLASS trials were carried out in 2014. Working with National Grid, we developed four sets of trials, using a range of equipment installed in our control room and at 60 primary substations serving 485,000 customers – around 17% of our network. The substations were selected to ensure that the trial area was representative of our geographic area and our different types of customers.

The project demonstrated that the relationship between voltage and demand is more or less linear, meaning that a 1% reduction in voltage leads to a 1% reduction in power. This equates to a customer's kettle taking eight seconds longer to boil. As part of the project over 1,300 customer surveys were carried out to understand if CLASS techniques had any adverse effects on customers' electricity supply. The findings from these surveys and the technical trials proved conclusively that by using CLASS techniques we can use voltage control to reduce demand without affecting customers' perception of their electricity service.

This ground-breaking approach can be used to help balance electricity supply and demand for the whole of Great Britain and brings a number of other benefits:

- Reduces costs for all electricity customers.
- Makes it easier to adopt low carbon technologies onto the electricity network such as wind and solar power
- Avoids or defers the need to expand our network of overhead lines, underground cables and substations

Following a six-month extension to the original CLASS project which demonstrated how the technology could be deployed commercially, we have since rolled out CLASS techniques into our business as usual processes. New, cutting-edge voltage controllers which have been installed at c260 primary substations across the region which serve nearly 2 million customers. These controllers receive instructions from the CLASS dashboard developed as part of our network management system.

Links between our control room systems and National Grid allow for the provision of 'balancing services' to maintain electricity supplies for millions of customers across Great Britain.

Balancing services are a range of energy and capacity products used by National Grid in response to a sudden change in generation. Using CLASS as a balancing service helps reduce the need for additional expensive sources of power such as coal-fired power stations or balancing services from diesel engine generators.

Providing balancing services in this way CLASS can help keep the entire national electricity grid stable and secure, all without our customers noticing a difference to their service. This is a ground-breaking innovation and we are the only network operator who can currently offer this capability.

7.1.2 QUEST

QUEST is an ED1 NIC (Network Innovation Competition) project which will create an overarching control system to co-ordinate our voltage management techniques and allow us to fully exploit their benefits.

Key partners in the QUEST project include:

- National Grid ESO
- Schneider Electric
- Fundamentals Ltd
- Smarter Grid Solutions
- Impact Research

Building upon learning and outputs from previous projects, QUEST will identify and trial novel methods to deliver a business-ready solution which will integrate and optimise the techniques in use across the whole distribution system.

As well as boosting the benefits of existing voltage management techniques such as CLASS and Smart Street, the co-ordination approach will:

- Ensure the network operates as efficiently as possible, optimising system voltage and minimising losses
- Facilitate the increased connection and use of low carbon technologies
- Maximise benefits to customers through energy consumption reduction
- Maintain security of supply as we move towards a Net Zero carbon economy.

7.1.3 Pathfinder Projects

We are supporting the ESO's Pennine Pathfinder project which is looking to manage transmission network voltages via reactive power services including providers connected to our distribution network. Our key role is to help validate responses to the ESO's tender issued in March 2021 and provide essential information to enable the ESO's comparison of potential solutions. Working closely with the ESO and via regular meetings, we have developed an understanding of the requirements of the work, prepared detailed data and scoped the system studies. Additionally we propose to undertake studies to analyse the efficiency and effectiveness of service providers for the ESO as part of their decision making as required.

7.1.4 Regional Development Plans

The transmission and distribution network that supplies Lancaster and the surrounding areas towards Heysham have in recent years seen a large increase in the connection of renewable technology, particularly offshore wind. This has resulted in a lack of capacity at Heysham grid supply point for further generation connections. A Regional Development Programme (RDP) for the area has been undertaken, resulting in a flexible network solution which will allow new parties to imminently connect to the Heysham group and the delivery of the most economic outcome for all end customers. Through the RDP work we have developed with the ESO the technical requirements for our customers connections.

7.1.5 Accelerated Loss of Mains Programme

We are supporting the delivery of the Accelerated Loss of Mains Change Programme, led by the ESO. It is a requirement of the Distribution Code that all owners of generation installed prior to February 2018 comply with new setting requirements for the interface protection in accordance with EREC G59. To help owners of generation make the necessary changes working in conjunction with the ENA and

ESO, we are managing applications via an online portal, which has been set up to allow generators connected to the network to register their intention to make settings changes and to facilitate the development of a prioritised delivery programme. The portal became available to generators in late 2019 and we have received a good number of applications which have been accepted by ESO. We have already seen a good proportion of these sites have their protection settings modified in line with the latest revision of EREC G59. Generator owners who make the changes are being recompensed by us, according to the degree of work involved in making the changes, with the costs recharged to NGESO. We continue to promote the programme via letter drops, social media activity, articles in newsletters and direct contact with larger organisations.

During the pandemic we have worked with generator owners and witness testers, and have ensured that safe working practices have been adopted to comply with government guidelines. Procedures have been put in place that accommodate virtual witness testing and sample site visits should it become necessary.

7.2 Transmission Owner (TO) collaboration

Whole system interaction analysis		Examples of Established ED1 Whole System Processes	Examples of Planned ED2 Whole System Processes
Current Maturity	Vision for 2026		
		Outage Co-ordination	Outage Co-ordination
		Harker GSP Steering Group Appendix G process	Harker GSP Steering Group Appendix G process

We routinely co-operate and collaborate with National Grid as the transmission and system operator, through regular bilateral interactions and via established industry working groups, and this has been the case for many years to ensure that work and assets are optimised at the transmission and distribution boundary.

7.2.1 Outage co-ordination

There are regular operational liaison meetings to ensure outages on either network are co-ordinated. Outage schedules are shared in order that they can be reviewed so as to avoid multiple circuits being out of service in the same part of the network, and so prevent impacts on security of supply.

7.2.2 Harker steering group

Where there are specific issues that cross boundaries that are complex in nature, specific steering groups are established, one such example is at the Harker Grid Supply Point (GSP) which is a site shared across Distribution and Transmission between ourselves SPT and NGET TO. We instigated last year a steering group to ensure full co-ordination at a strategic level, with monthly meetings being held during 2021 between us, the ESO and TO in order to enable the scheme to progress as smoothly as possible. In addition to the steering group a working group has also been active for some time focussing on delivery of actions to improve the outcomes we achieve collectively.

As one of the major connection points into the our DNO network, National Grid's works at Harker is critical to enable to decarbonisation and transition to Net Zero for the North West as until works are completed there is a queue of generation connections waiting on National Grid TO to complete its works which have been delayed.

Co-ordinating works with National Grid at these Transmission/Distribution sites brings cost potential efficiencies through tendering for all works together and interlinking of activities allowing efficient scheduling, amongst other whole system benefits.

7.2.3 Appendix G process

In addition to the standard engagement processes developed for sharing data e.g. Weeks 24 and 42, as prescribed by the Grid Code and the various liaison and co-ordination meetings e.g. Joint Technical Planning Meetings, and Access and Operation Liaison meetings etc we participate in a regular bi-weekly teleconference call with ESO and TOs. Its purpose is to discuss the Appendix G data and various ongoing issues, thus creating a regular interface touch point which has been beneficial in moving a number of issues forward.

In respect of assessing whole system opportunities at the transmission – distribution boundary, including provision of capacity information at the interface and development of efficient reinforcement solutions, we have converted all of our Grid Supply Points (GSP) through the 'Appendix G' process in 2018. This engagement has resulted in enhanced visibility of thermal and fault level capacity headroom for all new distribution connected generation greater than 1MW. This information is refreshed in conjunction with the ESO every month and provides new Distributed Generation (DG) applicants with the opportunity to identify where their project may be subject to a transmission constraint.

7.3 Distribution Network Operator (DNO) collaboration

Whole system interaction analysis		Examples of Established ED1 Whole System Processes	Examples of Planned ED2 Whole System Processes
Current Maturity	Vision for 2026		
		Embedded Capacity Register	Mature flexibility market
		Data Exchange Planning Timescales Common Evaluation Methodology (CEM) CBA tool Common Flexibility Agreement	Standardisation of contracts, dispatch and settlement of flexibility services Peer to peer trading of curtailment and flexibility services

There are a wide range of different examples of whole system joint working that have been developed with other DNOs via our collaborative relationships governed by the structures enabled through our trade-body the Energy Networks Association. Key examples are given below seeking to illustrate the breadth and innovative nature of some of the whole system approaches we have lead for the sector.

7.3.1 Open Networks

The Open Networks project has brought together all the DNOs and the other three electricity grid operators in the UK and Ireland to work together to standardise customer experiences and align processes to make connecting to and using the networks as easy as possible. Through Open Networks we are also working with the UK Government (through the Department for Business, Energy and Industrial Strategy), the energy regulator Ofgem, respected academics and industry trade associations.

Open Networks tests key developments with an Advisory Group of experts, as well as seeking broader views through consultations, stakeholder forums, webinars and guest presentations.

As part of our engagement with the Open Networks Project we have been instrumental in the development of a System Wide Resource Register (SWRR) and we provided open access to it with publication of phase 1 of the Register on our website. The SWRR published details of the distributed energy resource connections to the distribution network with the aim of assisting new connections, facilitating the flexibility services market and driving efficiency in the Capacity Market. This was superseded by the development and publication of the Embedded Capacity Register in July 2020 following the DCUSA change proposal DCP350 raised by us, that expanded and mandated the publication of this data to specifically address the need to deliver efficiency of the Capacity Market.

We lead the Open Networks project stream (WS1B P4), Data Exchange in Planning Timescales, this has proposed both Grid and Distribution Code modifications to enhance levels of planning data exchange with the aim of facilitating development of Smart distribution networks and whole system planning. We have continued to drive these proposals by formally initiating a Grid Code Modification (GC0139) and a Distribution Code Modification. Both these modifications are progressing.

7.3.2 Flexibility Services

We procure flexibility services bi-annually in line with our internal reviews and associated publications such as DFES. These procurement rounds are issued in the Autumn and Spring of each year, and promoted widely via our website, press releases, dedicated events, and multiple other channels e.g. Incentive for Connections Engagement events, innovation and community energy newsletters. We recognise that this is a nascent market and we continuously seek feedback directly from stakeholders who participate in our tenders, and more widely through the Open Networks platform.

We are proud to have been the first DNO to implement a standardised set of flexibility services and contractual arrangements in our Spring 2020 flexibility tender and in March 2021 we became the first DNO to use the newly developed Common Evaluation Methodology (CEM) Cost Benefit Analysis tool. We have subsequently utilised this tool to derive ceiling prices for our recently issued Spring 2021 tender, which we believe will help to provide further guidance and assurance to the market of the value of these opportunities.

Feedback from participants regarding the lack of participation over recent years has identified that the greatest barrier to entry to this market is geographical and so we endeavour to maintain this continued engagement of our stakeholders, to encourage participation at a later date as more opportunities arise across our region. To counter this we have begun to issue tenders for planned outages and restoration support. This increases the number of regions in which we can offer flexibility services, while demonstrating the additional value that flexibility can deliver across the electricity system instead of simply reinforcement deferral programmes.

Our encouragement of market development and liquidity benefits our regional stakeholders in driving down the requirements for asset reinforcement. This also offers whole system benefits by developing a market for DER providers to stack service provision to multiple entities and begin to offer peer to peer energy trading within local and national energy markets.

In ED2 we will work towards further standardisation of products, baseline standards, contracts, dispatch, and settlement. Through standardisation it allows for the development of best practice, as well as offering stakeholders a common approach to flexibility.

The sharing of planning and operation data with other network and system operators allows for opportunities for conflict management of services without the requirements for exclusivity clauses. We currently utilise an industry agreed Common Flexibility Agreement for all flexibility tenders which do not contain any exclusivity clauses, and we have committed that we do not intend to introduce any. This allows for the freedom for service providers to stack revenues of offering different services to multiple parties. In ED2 we will develop the capabilities for users to trade positions in curtailment and flexibility services stacks, which opens up a new market of energy trading and ensures that users have the opportunity to trade their way out of a curtailment stack in order that they can fulfil contracts with other network & system operators. Our DSO Transition Plan Annex 2 provides further information on this along with delivery milestones for these activities.

Another key area of development is the treatment of Active Network Management and flexible connections, ensuring that there is sufficient data provided in relation to curtailment and contractual terms so as not to exclude these connectees from participating in either transmission or distribution energy markets.

We also have well established relationships with Scottish Power (SPEN) and Northern Power Grid (NPg) where we have touch-points at the distribution boundary between one network operator and another.

In 2019 we explored the possibility of providing services to SPEN when it was recognised that their tender for flexibility services covered two locations on the boundary of our networks. Ultimately, it was concluded that boundary solutions could not meet the technical requirements, however, the process of looking at the SPEN issues, developing potential solutions and examining their technical viability provided useful learning to inform our future approach.

7.3.3 DSO

Our DSO Transition Plan Annex 2 explains how we design and implement our systems and processes with the aim of delivering whole system outcomes when making decisions. This system wide responsibility is central to our DSO Transition plan and encompasses data sharing, forecasting, planning, optioneering, and solution provision.

7.4 Independent Distribution Network Operators (IDNOs) collaboration

Whole system interaction analysis		Examples of Established ED1 Whole System Processes	Examples of Planned ED2 Whole System Processes
Current Maturity	Vision for 2026		
		Online surgery sessions	Standard data templates
		Data sharing for DFES	Systematic annual data exchange

In 2020 we initiated a major engagement activity with IDNOs via a series of online surgery sessions and a consultation on data sharing. We explained our ideas and provided IDNOs an open discussion

opportunity. As a result the six major IDNOs operating in the North West provided data on loading on their networks and their own forecasts. This data was used in the creation of the 2020 DFES and established a series of effective communication channels.

The level of engagement throughout ongoing data exchange exercises continues to be really encouraging, and we feel positive that IDNOs will continue to engage with us and participate in data exchange exercises in the future. In ED2 this will become more systematic, facilitated by improved sharing technology and standardised data templates. This sharing of enhanced planning data allows all parties to build a more granular picture of the other networks and facilitates the increased development of whole system solutions and collaborative working.

7.5 Gas Networks (Cadent & Northern Gas Networks) collaboration

Whole system interaction analysis		Examples of Established ED1 Whole System Processes	Examples of Planned ED2 Whole System Processes
Current Maturity	Vision for 2026		
		Decarbonisation Pathways	Standardised collaboration
			Decarbonisation planning best practice model

7.5.1 Decarbonisation Pathways

We have displayed thought leadership with our collaboration with Cadent to develop pathways to decarbonisation across our three key geographical regions and how this work can help both ourselves with our RIIO-2 planning, but also our stakeholders, local authorities and businesses as they grapple with the challenge that has been set by both national targets, and increasing, more local targets and ambitions. For example, the pathways work for Greater Manchester the plan provides near and medium-term certainty over the future of energy in the city-region and a high-level pathway for achieving decarbonised energy supply 12 years ahead of the UK's legal target of 2050. This includes recommendations for local and national policy changes to create a more catalysing framework for low carbon technology adoption. It provides the certainty that businesses need to unlock investment in low carbon technologies and to inform future business planning cycles.

A campaign to support the launch of the plans took place in 2020 to ensure that local authority and business stakeholders across the region are engaging with and accessing this information. This stimulated greater data exchange that improved the quality of our 2021 DFES. The work we have done has already been replicated more widely across the North West region after our approach was championed by Greater Manchester Mayor Andy Burnham and Liverpool City Region Mayor Steve Rotherham. We worked with Liverpool City Region and Scottish Power Energy Networks
sharing best practice and helping develop a wider North West plan incorporating areas outside of our own operational footprint.

In ED2 our joint commitment with Cadent to produce update decarbonisation pathway analysis every other year will help us to standardised our collaboration processes and disseminate a best practice model to a greater number of regions, particularly where other DNOs overlap with Cadent. We are also developing a closer whole system working agreement with Northern Gas Networks.

7.5.2 Whole system RIIO-2 Planning

Throughout the RIIO-2 planning process, since Ofgem opened the conversation back in March 2018, we have been closely following the RIIO-2 developments, both in terms of how the framework will shape companies plans and investments, and the companies plans themselves. We have been an active participant at industry events and webinars, attended bilateral sessions with GDNs, TO and ESO to discuss their RIIO-2 business plans as they develop, and attended the formal open hearings towards the end of the process.

We take particular note of those companies who overlap or connect to our networks, therefore National Grid TO, ESO, NGN and Cadent and have met with them to discuss their investment plans and what that means for us and our customers.

We have undertaken the same discussions with these companies as we develop our own ED2 business plans, for example providing copies of our Engineering Justification Papers to National Grid for comment on projects which have a touch-point with the transmission network.

7.6 City Region, County Council and Local Authority collaboration

Whole system interaction analysis		Examples of Established ED1 Whole System Processes	Examples of Planned ED2 Whole System Processes
Current Maturity	Vision for 2026		
		GMCA Strategic Infrastructure Board	Lancashire Strategic Infrastructure Board
		Local Area Energy Planning for 10 GM Local Authorities Cumbrian Local Enterprise Partnership Clean Energy Plan	Local Area Energy Planning for all Local Authorities or Unitary Bodies

Working with other energy vectors will be a key part of developing whole system changes to planning processes. We will continue to use our position to develop strategic partnerships to provide a common front for regional and national stakeholders, to speak about their energy and decarbonisation needs particularly those associated with regional planning processes. We are already seeing others plans influenced by our involvement, particularly as a result of the regional insights work demonstrated in this section.

7.6.1 Regional Insights

We have a significant presence across our region in an advisory capacity, working to support plans for decarbonisation and sustainable growth by acting as provider of impartial advice. Across the Greater Manchester city region we have been instrumental in establishing a Strategic Infrastructure Board that brings together utility and transport providers, key experts and local authorities to jointly plan the regions infrastructure development in a whole system manner. The effectiveness of this whole system planning approach continues to build as all parties gain in experience, and stakeholders become more aware of the proactive actions we can take to provide and advise on whole system solutions to deliver their needs. Through the Strategic Infrastructure Board we developed the countries first whole energy system decarbonisation pathway for Greater Manchester with our partner Cadent Gas. This approach has been replicated across the rest of the North West with whole energy system decarbonisation pathways produced for Cumbria and Lancashire too.

We are now working to establish a similar Strategic Infrastructure Board for Lancashire. In Cumbria we have worked with the County Council to develop a whole system Cumbrian Transport and Infrastructure Plan (CTIP) and discussion about a similar, close working relationship with Cumbria County Council and other whole system actors is underway.

In ED2 plans are in place for local authorities in Cumbria to merge into two larger unitary bodies. When these are established we will assess whether we continue to work with our stakeholders at a pan-Cumbrian level or need to focus on each unitary body separately. Longer term a unitary body may also be set up for Lancashire.

We will continue to use our position to develop strategic partnerships, convening regional and national stakeholders to speak about their energy and decarbonisation needs, particularly those associated with regional planning processes.

Together we are developing plans for low carbon transportation and housing development as part of supporting the local authorities develop Local Area Energy Plans (LAEP). In ED1 these plans will be completed for 10 of the Local Authorities in the Greater Manchester city region.

In ED2 to aid the development of effective local plans for all Local Authorities and Unitary Bodies across our region we plan to recruit three new energy planning engineers to share our knowledge, experience and data in network planning for the benefit of our local communities, ensuring that there is a coordinated whole system approach across the electricity, energy, heat and transport sectors embedded into the LAEPs across our region.

7.6.2 Greater Manchester

For the last few years we have been a member of the GMCA Strategic Infrastructure Board alongside United Utilities, BEIS, Cadent, Transport for Greater Manchester and the Environment Agency. The work informed by this group amongst others is the Greater Manchester Spatial Framework.

We also undertake an advisory role within the Greater Manchester Local Energy Market (GM LEM) project, which seeks to achieve the region's ambitious Net Zero carbon targets through active participation with customers and the ten local authorities within the region. This work produces Local Area Energy Plans for each LA region with ourselves and Cadent being key advisors to the project development and feeding in data as a key enabler.

Extract from project scope:
The Greater Manchester Local Energy Market (GM LEM) project forms a key part of Greater Manchester Combined Authority's plans for decarbonisation, set out in the 5 Year Environment Plan, complemented by the Smart Energy Plan. Together these enable Greater Manchester to work towards the target for a zero-carbon emissions city region by 2038. The Greater Manchester Local Energy Market (GM LEM) project is an ambitious integrated, whole system energy vision that addresses how energy is generated, traded, transported, supplied, and used across the city region. Co-ordinated by the Greater Manchester Combined Authority (GMCA) it brings together a diverse array of partners from the private, public and Third sectors including, commercial and legal advisors, service design consultants, financial and regulatory specialists and the energy, technology, and systems resources.

The project vision combines two key themes; a place-based approach to geospatial energy system planning, harmonising the demands of the energy transition with traditional local authority-led approach to planning and enables us to understand current energy assets and networks and to plan

how they may change over time; and the development of a unique new local energy market aggregation platform, integrating new smart technologies across heat, power and transport and linking into local distribution and national transmission platforms.

7.6.3 Cumbria

We are also working with Cumbria Local Enterprise Partnership (CLEP) specifically on their Clean Energy plans and ambition to contribute to cultural and societal change in an innovative sustainable rural economy.

One project we have worked on is St Cuthbert's Garden Village in Carlisle where we have provided impartial advice and support on the plan for green energy, green systems, options and benefits, going over and above the traditional role a distribution network operator would normally perform.

7.6.4 Lancashire

Similar strategic planning engagement to GM and Cumbria are also taking place within Lancashire. One strategic project that we are investing in currently (work starts 2021) is the creation of a new primary (33kv) substation to support the aerospace enterprise zone at Samlesbury. This investment will facilitate the delivery of the 50-hectare Samlesbury Aerospace Enterprise Zone to become a national centre of excellence for advanced engineering and manufacturing related companies, capable of accommodating up to 1.5 million sq ft of floorspace. It is a strategically important employment site and vital to the economic recovery of Lancashire and presents an opportunity to accelerate and shape economic growth and business productivity across Lancashire.

7.6.5 Cheshire East

Whilst the area that we serve predominantly covers GM, Cumbria and Lancashire, we also serve a smaller area of Cheshire. Strategic engagement is underway for this area, with one potential development of a new garden village under discussion as to how we can support this aspiration driven by a green agenda.

7.6.6 Regional Advisory Panels

We also receive significant regional insight from our regular and established Advisory Panels. Our planning processes and reports are discussed with and promoted to our Sustainability and Vulnerable Customer Panels stimulating additional stakeholders to engage more deeply each year. Our Regional Advisory Panels in Cumbria, Lancashire and Greater Manchester also provide rich regional insight that we can action in our whole system planning processes and encourage greater engagement across many regional stakeholders beyond regional government.

7.7 Community and Local Energy collaboration

Whole system interaction analysis		Examples of Established ED1 Whole System Processes	Examples of Planned ED2 Whole System Processes
Current Maturity	Vision for 2026		
		Published Community Energy Strategy	Expanded support package
		Dedicated support service	including shareholder funded delayed payment approach

Community and local energy groups are driven by decarbonisation aims and therefore whole system thinking is already embedded in their approach.

Customers and stakeholders have told us they want our help and support to enable them to meet their decarbonisation and Net Zero targets. They recognise the role of the electricity network in facilitating their ambitions and the barrier it can put in their way if getting connected to the grid is unaffordable. They have also told us they trust us as a source of information and they think we have a role to play beyond delivering network connections to help them understand what action they can take.

In ED1 we have been delivering a dedicated service to support community and local energy customers and stakeholders which has been called best practice by independent organisation Regen who are a not-for-profit energy experts with specialisms in community energy and electricity networks. We intend to build on this success in ED2 and expand our support to further address the issues our customers and stakeholders have told us they are facing. How we will achieve this is described in our Community and Local Energy Strategy, Annex 5.

8 Whole Transport System Interactions

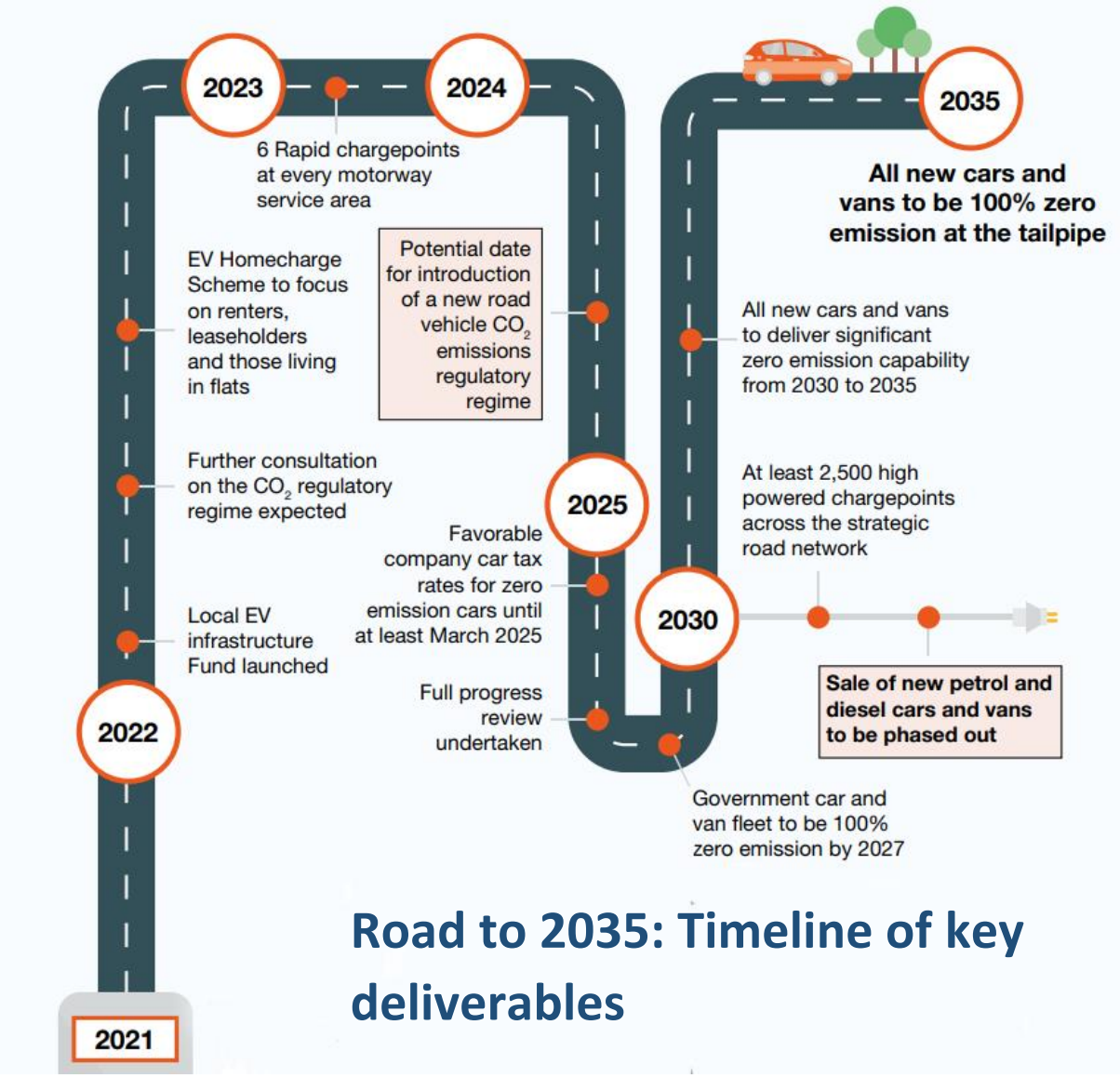
Beyond the energy system, the decarbonisation of transport is the next critical vector to tackle in a whole system journey to net zero. The appointment of a dedicated planning engineer for Whole Transport Systems in ED1 together with dedicated EV Liaison engineers to work with EV charging developers on projects across the North West in the last few years has enhanced the integration of our whole system planning for transport infrastructure.

8.1 Office of Zero Emission Vehicles (OZEV) collaboration

Whole system interaction analysis		Examples of Established ED1 Whole System Processes	Examples of Planned ED2 Whole System Processes
Current Maturity	Vision for 2026		
		Dedicated EV Liaison Engineers	Systematic monitoring of EV Charger roll out
		Project Rapid Capacity assessment and future proofing	Strategic Capacity for Special Delivery Entity Annual report on charger availability

Our regular dialogue with the Office of Zero Emission Vehicles (OZEV) indicates that rapid acceleration in EV sales continues month on month with 23% of all new car registrations in 2021 to date and EV sales consistently outstripping diesel car sales.

Project Rapid has been given the go ahead and sufficient funding to ensure that by 2023 motorway service areas will have at least 6 high powered (>150kW) open access charge points and a driver will never be more than 25 miles away from a rapid ChargePoint when travelling along motorways and A roads. Set out in the 2035 Delivery Plan: Transitioning to Zero Emission Cars and Vans, OZEV have much greater ambitions which requires a more holistic planning approach to Network Development Planning.



In ED1 joint planning work with OZEV to support Project Rapid and its implementation Special Delivery Entity includes assessment of electrical network capacity availability, determining optimal EV charging connection points and future proofing capacity growth. In ED2 we are planning to implement the systematic monitoring of EV and EV charger roll out, standardising processes across DNOs to produce region wide mapping of charger placement and annual reports that will track the geographic spread of charging availability. This will identify any potential EV charger 'deserts' where additional intervention may be required by Government.

8.2 Transport for the North (TfN) collaboration

Whole system interaction analysis		Examples of Established ED1 Whole System Processes	Examples of Planned ED2 Whole System Processes
Current Maturity	Vision for 2026		
		Bus Depot Assessment	EV Charging Infrastructure Framework
		Strategic assessment of EV charging in car parks	

Transport for the North (TfN) is the regional body that oversees the development of transport infrastructure, working with ourselves and local partners responsible for the provision of public services to holistically deliver whole system outcomes. Our engagement work with TfN focuses upon the provision of electrical infrastructure for the decarbonisation of transport within our area. The whole system approach to our work with TfN means that we support all needs for network capacity to supply electricity to transport; including to bus depots, on bus routes, for on-street and off-street parking, in train and tram car parks, for tramways and even for bike storage and E-bike charging.

An example of our Whole Transportation System planning for ED2 with TfN is the development of an EV Charging Infrastructure Framework which will show predicted EV uptake, availability of charging, and electric infrastructure capacity. This project will deliver an integrated modelling system which builds the supporting evidence base, and associated assessments and collaborations, required to fulfil EV supporting elements of our longer-term Zero Emission Vehicle strategy for the North. This system will be made available to support local partner development, enhancing decision making by those with location specific knowledge and communicating a clear pan-Northern requirement for optimum results across the whole energy system.

The objectives for the EV Charging Infrastructure framework are:

- **Support delivery of an integrated EV network** – a whole system approach which supplements Local Authority activities, and facilitates an enhanced EV infrastructure network delivery across the Major Roads Network (including the Strategic Road Network and interactions with local roads). To deliver a full and effective EV network which accounts for transboundary nature of private car and freight movements in the North.

- **Provide a collective roadmap towards an effective, attractive and inclusive network** – at a manageable scale which supports mass adoption of electric vehicles across all place types of the North, and creates an attractive investment environment across the region. Communicating policy certainty and clear opportunities for ChargePoint operators and investors to develop and embed sustainable and inclusive long-term commercial models.

- **Improve outcomes for Electric Vehicles based on robust and data driven evidence** – TfN's established Technical Assurance Modelling and Economics capabilities will provide integrated evidence on an regional scale, whilst capturing local government spatial and decarbonisation plans. To understand future cross-boundary travel across the North; what this means for associated aspects such as on-street and off-street charging capacity; and of different places and socio-economic groups so that impacts and outcomes are optimised.

- **Future-proof EV infrastructure decision making** -applying TfN's Future Travel Scenarios we can identify different EV infrastructure delivery models required to support potential future user travel patterns and choices; understand the associated grid requirements; and also provide intelligence to future proof EV take up.

8.3 Northern Powerhouse Rail collaboration

Whole system interaction analysis		Examples of Established ED1 Whole System Processes	Examples of Planned ED2 Whole System Processes
Current Maturity	Vision for 2026		
		Rail Electrification Demand assessment	Systematic process of data exchange

Increasing the use of rail travel is a key decarbonisation action for our region and therefore there are plans for rail transport across our region to expand substantially with new lines and existing routes being converted to focus on electrically powered trains. The TfN Decarbonisation Strategy identifies that route electrification is the most efficient way of reducing rail emissions in the long-term. Not only does it remove tailpipe emissions on those routes, but it supports the use of bi-mode trains on other routes. Overhead electrification also helps to improve rail journey times and reliability, making rail a more attractive mode of transport and encouraging mode shift.

Leaders from across the North have agreed on a blueprint for a transformational upgrade to the region's rail network that will help to unlock its huge potential – Northern Powerhouse Rail (NPR) is a major strategic rail programme, specifically designed to support the transformation of the North's economy by providing effective and efficient rail connectivity between the North's major economic centres

There are proposed new lines from Liverpool to Manchester via Warrington Bank Quay and a new line from Manchester to Leeds, via Bradford as well as improvements for the line between Manchester and Sheffield via Stockport. Faster speeds to connect the conurbations either side of the Pennines will result in additional electrical demand to support 2 more trains per hour with journey times reduced by up to 50%.

These developments will mean that 3.1million people will be within 90mins of the Manchester City region and the new HS2 Manchester Airport Station will double the number of people in a 90min radius of the airport to 4.3m people.

Our whole transport system approach ensures that we are actively consulted as the Northern Powerhouse Rail plans develop. Long-term planning scenarios informing the DFES include assessment of rail electrification electricity demand in capacity planning. Initial engagements include integrated system assessment of the multiple use-case for EV charging requirements at rail heads and station car parks. These will be developed from ad hoc engagements into a systematic process of data exchange for integrated whole system planning in ED2.

8.4 Transport For Greater Manchester (TfGM) collaboration

Whole system interaction analysis		Examples of Established ED1 Whole System Processes	Examples of Planned ED2 Whole System Processes
Current Maturity	Vision for 2026		
		Tram strategic planning	Electric Bus Infrastructure Provision
		Intermodal transport transfer point analysis Bus flexible charging regime planning	EV Charger location co-ordination

We have worked with Transport for Greater Manchester (TfGM) for many years as they have focussed on expand the electricity tram system, Metro, across the city. As part of this collaboration, we worked with other utilities including water, sewerage and telecoms, to clear the 'swept path' of the trams, minimise disruption and road closures including the sharing of excavations to minimise costs. Innovation projects explored include the assessment of battery charging or electricity export on to the network by regenerative braking technologies.

Whole Transport System planning includes the assessment of infrastructure support at inter-model transport transfer points. This includes park, charge and ride feasibility studies for the tram network and car parks.

We have further built on this relationship with TfGM to better understand their decarbonisation transport plans and our role as facilitators of EV charging and further public transport decarbonisation such as collaboration on electric buses.

Bus trips make up around 75% of all public transport trips in Greater Manchester with an average of around 3.48 million trips per week. Greater Manchester is delivering a London-style transport network – the Bee Network – with London-level fares and a modern bus fleet and is the only place outside London putting buses under public control. The city region wants to deliver a modern low-emission accessible bus system and in October 2021 published a Bus Service Improvement Plan (BSIP). The Plan confirms that Greater Manchester's bus franchising will be delivered in Wigan and Bolton in 2023 and then will be rolled out across all of the city-region by 2025. Greater Manchester's target for bus travel by 2030, an increase of more than 30%, will enable Greater Manchester to remove around 450,000 tonnes of carbon tailpipe emissions by removing car journeys. The plan will see the introduction of a full fleet of zero emission, high quality electric buses by 2032, with 50% of the fleet to be zero emission by 2027 and a fleet expansion of 330 zero emission vehicles to meet the passenger demand generated from the service enhancements and fares reduction initiatives.

Our work in support of this plan includes assessment of bus depot locations for electric charging infrastructure siting and potential for flexible charging regimes.

8.5 Cumbria County Council collaboration on Transport Infrastructure Planning

We have been working with Cumbria County Council (CCC) to better support their infrastructure plans for the region and ensure a whole system approach. The Cumbria Transport Infrastructure Plan (CTIP) highlights the strategic road and rail links and in a decarbonising world naturally has a significant impact on energy networks. We know that understanding network capacity is crucial to CCCs implementation and investment plans from 2021-2035 and therefore we have been engaging with them to explain our decarbonisation pathways work, and the DFES publication.

9 Whole Customer Service System Interactions

Whole System focus is required to avoid piecemeal interventions on single energy vectors, e.g. electricity distribution or gas transmission, and promote strategic interventions that increase the overall benefits for customers.

We do not see whole system as limited to network related initiatives, and there are examples of what we consider "whole system" throughout other aspects of our business plan such as a wide application priority service register or the provision of advice to business customers on how they can decarbonise their own operations.

We have used our position at the heart of the energy and net zero landscape to bring stakeholders together to identify whole system approaches to tackling net zero challenges and our whole system approach encourages us to consider and engage with developments and solutions that are potentially beyond the electricity meter.

Our strategy for Electricity Users in Vulnerable Circumstances, Annex 8, includes the establishment of an innovation fund to enable third party partners to identify barriers that prevent the more vulnerable in society from participating in the transition to net zero and to create whole system solutions to address these challenges. Utilising data from multiple sources, including smart meters and geographic demand patterns, we can monitor the effect of targeted interventions on energy efficiency, social support and system capability and share this data with our partners across the whole system.

Using the vulnerability fund we will carry out research and trials to ensure that we can remove the blockers for those identified as least likely to take up smart energy offers.

The barriers identified so far include:

- Digital literacy
- Financial situations and payback periods
- Broadband capacity and capability
- Housing situations, such as rented accommodation
- Energy need dependant of the characteristics of the occupants i.e. customers with low mobility
- Mental health
- Learning disabilities

Measuring success in balancing the electricity demands from low carbon technologies with flexible solutions and the involvement of targeted communities in those flexible solutions will demonstrate that we have stimulated whole system solutions to enable engagement.

9.1 Energy Efficiency

In our DSO Transition Plan Annex 2 we outline our proposals for utilising energy efficiency measures to reduce demands on highly loaded areas of our network, and we will adapt our tender and evaluation processes to actively encourage energy efficiency schemes to participate in our flexibility tenders, as well as promoting general energy efficiency across the network. By reducing the overall demand on the network and promoting shifting when people use the network we can reduce the overall level of energy needing to be produced across the whole system, optimise energy usage to when it can be generated from renewable sources, and reduce the amount of overall investment required across the distribution and transmission networks. We have also seen that through engaging with energy efficiency programs, this can be the catalyst to wider systemic changes to achieving Net Zero.

We will further seek opportunities with local authorities and the local gas distribution network operator to combine our reinforcement spend with their funding to promote 'whole house' energy efficiency.

We will also encourage wider awareness of how every household can contribute to decarbonisation through information and knowledge-transfer, making use of smart meter readings by households of their energy consumption and explaining the benefits of energy efficiency measures. We will provide free advice to households and businesses, to help them adopt low carbon technologies and make their properties more energy efficient. Information will be delivered through the development of our online hub, awareness campaigns on social media and a range of other communication methods. We will also work with partners to ensure information is up to date and accurate regarding the power network.

9.2 Smart Street

As we become more reliant on electricity as our main source of power, our customers will use more low carbon technologies such as electric vehicles, heat pumps and solar panels. These technologies tend to occur in clusters which has a dramatic effect on the electricity network. While electric vehicles and heat pumps could cause voltage to fall below statutory limits, new generation from solar panels exporting electricity to the network will have the opposite effect. If voltage levels fall outside statutory limits, the way our customers' appliances perform could be affected.

By combining innovative technology with existing assets, Smart Street makes networks and customers' appliances perform more efficiently and makes it easier to adopt low carbon technologies onto the electricity network. Smart Street combines the concepts of interconnection of networks, developed within our Capacity to Customers Project, and voltage control, developed within CLASS.

In October 2019 Smart Street was awarded £18 million from Ofgem's innovation rollout mechanism (IRM). The IRM provides funding to implement proven innovations like Smart Street which will provide long-term value for money to customers and deliver environmental benefits.

In 2020 we began a three-year programme to install Smart Street technology at 180 distribution substations, targeting areas with a high uptake of low carbon technologies, particularly where these overlap areas of fuel poverty. This is bringing benefits for up to 45,000 customers, reducing electricity consumption by 5-8% per year and saving up to £60 a year off customers' electricity bills.

In the longer term this rollout will save a massive 143,860 tonnes of carbon between now and 2050, the same as removing 2,570 cars from our roads every year.

Smart Street demonstrates a step change in the co-ordination and operation of electricity networks in Great Britain and is the first demonstration of a fully centralised low voltage network management and automation system.

The Smart Street Customer Value Proposition is clearly thinking about the whole system from the customers perspective. In ED2 we will extend Smart Street to a further 250,000 households in our region, targeting its deployment to areas where there is the highest concentrations of customers in fuel poverty.

9.3 Utilities Together

Earlier in ED1 we joined forces with other utilities to co-fund a priority service register (PSR) awareness campaign that was facilitated through a network of independent pharmacies.

Since that time we have deepened our collaboration with forum members Northern Gas Network, United Utilities and Cadent Gas with the aim to:

- Raise awareness of our organisations impact and collective abilities
- Benefit our shared customer base by delivering efficient services
- Deliver innovative approaches to common issues for our organisations and/or our stakeholders
- Support the most vulnerable in society and minimise the social impact of our essential works
- Encourage stakeholders to engage with us as a collective, recognise and promote the value we add to the region(s)
- Establish and engage with others (utilities, housing associations, local authorities, charities etc.) who can support our ambitions

Examples of the key areas of focus and impact to date are:

- Share best practice training programmes; for example we worked with NSPCC on internal training, this was shared with the group and now all members are engaged with NSPCC and delivering the same across their organisations.
- Enhance social data mapping through additional data sets; the work we have undertaken to date on data mapping has been built on through knowledge sharing across the member organisations
- In partnership with Age Concern, the member companies have co-funded a Mobile Advice Centre (MAC) as community outreach, with the vehicle being used to help access the harder to reach and provide valuable support to isolated people and communities. Amongst other uses, the facility will offer energy efficiency advice, including access to grants.
- Expansion of pharmacy campaign with multi-utility PSR and energy efficiency messaging on 400,000 prescription bags across the North West. This included distribution of PSR leaflets, with locations selected through social data mapping with a range of data sets which enabled us to identify hard to reach communities. Information included within the campaign was broadened to incorporate safety advice such as locking cooker valves or socket covers.

Forthcoming initiatives include the creation of an energy saving leaflet focusing on reduction of water consumption and how in turn energy is also saved.

Promotion of PSRs in a joined up manner across utilities and multi-utility data exchange helps us close any gaps in our knowledge of customers in vulnerable circumstances who need extra support. This ensures all homes with a vulnerability are registered to receive support from all utility providers.

We have recently shared our approach and outcomes during a spotlight session which is hosted quarterly by National Energy Action (NEA). This session received the most attendees for any spotlight session ever, and as a result, we have had requests from across the country not just utility organisations who want to learn from our experiences how to best work collaboratively across organisations.

Outside of the direct benefits to customers of our activities, by working with other organisations we have developed greater creativity and continue to learn how to harness our collective forces to maximise whole system benefits. For example, every new activity/partnership we explore is now considered as to whether it is for us only, or mutual via Utilities Together.

9.4 Telecommunications interactions

Our whole system engagement with Telecommunications providers is currently ad hoc and issue driven. In part this is driven by the fact that we operate quite independently of telecommunications providers for many of our communications needs and partly because we have an effective client-customer relationship with multiple telecommunications providers. Recent joint working has shown the benefit of applying our whole systems approach to telecommunications. In ED2 we will work to strengthen the communication and protocols with telecommunication providers and systemise our relationships to enable better whole system planning.

9.4.1 ENWL 21st Century Network

In 2017 BT (now Openreach) announced the digital switchover. This means that individual connections are no longer between distinct physical infrastructure point-to-point. This digital 'non-deterministic' network as it is known, can not guarantee the speed and integrity of connection required to support the very fast acting (less than 6 milliseconds) communication required in the Technical Specifications for electrical infrastructure protection services.

To provide a long-term and sustainable communications solution for our customers and network the most cost-effective approach was to build our own telecommunications network using a mixture of existing infrastructure where possible, and the minimum possible amount of new infrastructure. The ENWL 21st Century Network was designed and built between 2009 and 2015 at an initial cost of £26m, providing communications services to meet our protection and SCADA requirements to all of our bulk, grid and primary substations and our Control Centre. The network was extended in early ED1 to bring online our two, on premise, operational data centres based in Preston and Blackburn.

Many of our non-operational communication services have since been migrated onto the newly created network including corporate voice and data between all of our offices and depots in order to drive down third-party communications costs. We have also leveraged the infrastructure investment to deliver new corporate capability including substation-based corporate data using substation Wi-Fi.

Since setting up our core network, technology drivers have changed significantly with the move to standardized Internet Protocol based communications networks and the evolution of the "digital substation". This communication network is key to the effective operation of our world-leading Network Management System and underpins the control of ground-breaking technologies such as CLASS. The network continues to be developed and upgraded as control technologies develop, substations are refurbished and new substations are constructed.

We have created our own in-house dedicated telecommunications team who operate, maintain, improve and expand the ENWL 21st Century Network. The integration of telecommunication technology with electrical infrastructure requires a much wider sharing of the key skills developed by this team with their colleagues. This activity is a key component of our upskilling programme as described in our Workforce Resilience Annex 27.

9.4.2 Preparing for Public Switched Telephone Network (PSTN) Shutdown with TalkTalk

By December 2025, the traditional analogue phone network (the Public Switched Telephone Network, or PSTN) will reach the end of its life and Openreach have decided that newer digital technologies will take its place.

This means that around 16 million lines and channels will need to complete their upgrade to alternative products over the next four years.

Our whole system planning and engagement with Telecoms provider TalkTalk identified a risk of consumers being impacted by the planned (PSTN) switch-off in 2025. Consumers migrating from the traditional telephone network to newer digital technology will restrict the ability of some groups (e.g. those who only have access to a landline telephone service or rely on telecare devices) to communicate or signal their need for support during electricity supply interruptions.

We provided TalkTalk with access to our social data mapping and worked collaboratively together to enhance this data with mobile coverage information. We will use this data to target Battery Back-up (BBU) packs at hard-to-reach consumers, which enable continuity of broadband service during a power cut.

We are continuing our dialogue with TalkTalk, and with Vodafone who support our mobile phone communication, to explore the feasibility of them joining the Utilities Together partnership.

To enable better whole system planning we are working with these telecommunication providers in the first instance to strengthen the communication and protocols between our organisations and systemise our relationships.

10 Whole system interaction analysis

There are a range of stakeholders/actors/components to consider in whole system interaction. The chart below shows our view of the current maturity of our interaction with each of these components and our vision for 2026 as the mid-point of ED2. As described above there are activities underway for the majority of those which are not yet rated green, however time and deeper or broader level of activities will be required in order for all those areas to become more mature. It should also be recognised that the desired level of maturity is linked to the need/benefit for customers, for example it may not be necessary for interactions with suppliers to be as deep or broad as with the ESO. We will keep this view of where the focus needs to be under review during ED2 so we target the most beneficial whole system interactions for our stakeholders and customers.

Interaction	Current Maturity	Vision for 2026	Category
ESO			Whole Energy System
TO			Whole Energy System
DNO			Whole Energy System
IDNO			Whole Energy System
Supplier			Whole Energy System
DER			Whole Energy System
Connecting Customer			Whole Energy System
Consumer (Domestic & Business)			Whole Energy System
GDN			Whole Energy System
GTO			Whole Energy System
Water			Whole Customer System
Telecoms			Whole Customer System
Local Authorities			Whole System
LEM/LEPs			Whole System
Office for Zero Emission Vehicles			Whole Transport System
Transport for the North			Whole Transport System
Northern Powerhouse Rail			Whole Transport System
Transport for Greater Manchester			Whole Transport System
Heat			Whole Energy System

In its RIIO-2 business plan, the ESO has identified a potential £2bn of whole system benefits itself based on its experience. At the time these were published we noted the interlinkages though limited engagement on the detail or any dependencies.

We noted that the ESO was using a whole system benefit assessment that could be improved if it were subject to wider whole system collaboration[1]. Whilst these early steps made by the ESO towards whole system benefit numbers are welcome, they do need to be developed further. How the benefits were presented gives concerns as the whole system benefit was used to justify only the part of the changed energy systems costs of the ESO. This misses a key point which is that whole systems solutions should be whole system optimised, ideally co-created with the other actors and informed by whole system costs of the various options for delivering benefits. So overall, we welcomed this work by the ESO as an early step, but concluded the work needs to be enhanced.

In response, we have taken action, seeking to enhance whole system decision making especially when focussing on the whole electricity system. We have provided a high degree of transparency around our plans to date, being one of only two DNO groups to have shared our draft plan before submission to the Ofgem Challenge Group and publishing the most material in our Draft ED2 Business Plan of any DNO. Secondly, we have identified the ESO as a special stakeholder for us offering detailed bi-lateral engagement and insights into our proposals as well as actively engaging with the ENA Open Networks Project, in which the ESO is a key part, along with the transmission owners. This will lead to a joint understanding of the costs and benefits for the whole electricity system and beyond from a consumer perspective, for our region and will pool insights from across the country, from a range of stakeholders. This should build on the ESO's views of where Distribution companies can best contribute and should also enable distributors to contribute in more detail to the ESO's views.

We have held bilateral discussions with the ESO on our draft business plan and final business plan. As part of these we explored with the ESO how they would like to engage in depth on whole electricity system matters. Our proposal to the ESO is that the depth of understanding and value of co-ordination merits undertaking this co-ordination through the ENA's Open Networks project and developing further processes to embed whole electricity system. Open Networks has initiated Work Stream 4 in which we were instrumental in setting up and taking forward the whole system CBA developments under Product 1, developed alongside other DNOs and GDNs, with involvement from the ESO. The ENA's open networks programme gives a vehicle for the ESO to engage multilaterally with all DNOs and other stakeholders and undertake this efficiently, in a structured way. An example where we proposed this approach and it is now underway is in respect of the Whole Electricity System co-ordination register recently introduced for ED1. Open networks is key enabler of whole electricity system working across so much of what it does, for example developing standard products from service providers in coordination with the ESO.

Subject to further clarity on the ESO's own views and that of other stakeholders, we are making the case in Open Networks for additional actions to co-ordinate the identification and assessment of whole electricity system benefits. These whole electricity system benefits in our plan need to be developed with a whole system mindset from the start and with the right inputs and parties along with clarity on delivery roles and dependencies. That approach will result in improved decisions leading to maximum consumer benefits and link together the shares across actors such as ourselves,

[1] At the RIIO-ESO2 draft determinations stage we said, "*We would like to draw out the increasing need for formal collaboration between DNOs, the ESO, and industry (including Ofgem). Whilst the ESO has some insights and experience in managing markets and network planning, it is unwise to try to develop wider plans in isolation or to consider the ESO is naturally positioned to take industry leadership. The industry has embarked on a long-term transition to DSO, collaborating through the Open Networks ENA project and elsewhere. It is critical that the ESO and DNOs work together collaboratively over the coming years to maximise benefits for consumers and take learning from each other. This is demonstrated through the aspects of role three which have proved hard to measure, and Ofgem's grading and comments on the delivery schedule. There are several references to integration and seamless interface/planning with distribution and this must be planned together rather than specified within one company's plans which effectively beholden the other party.*"

the ESO and wider. We expect and support that the ED2 framework will contain the Co-ordinated Adjustment Mechanism which gives the ability to move outputs between price controls, if required.