DSO Strategy for RIIO-ED2

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Serving the Midlands, South West and Wales

Contents

Executive Summary

The UK's electricity system is undergoing a rapid period of change as distribution network customers invest in generation and alter their consumption behaviours to affect a lower carbon future. The recently published Ten Point Plan for a Green Industrial Revolution and the Energy White Paper focus on the changes that we will see. Decarbonisation of Heating and Transport to reduce carbon emissions remains a key priority.

To enable a greater volume of demand, generation and storage to be connected, our networks are becoming smarter and more active. Creating a more efficient and flexible system will benefit all customers and empower them to be at the centre of the energy revolution.

We recognise that change is essential to driving performance and efficiency from our network and to ensure it can meet the future energy demands of all our customers.

A more flexible network operation which embraces Distribution System Operator (DSO) requirements is needed. The enhanced capabilities we are developing will develop markets to give our customers the freedom to access other opportunities within the developing energy system.

Our Flexible Power product has been adopted by other DNOs and is now a national platform for flexibility. Network Operators requiring flexibility and customers who can offer flexibility are brought together on our platform.

We have developed our plans for data and have aligned them with the expectations of the Energy Data Taskforce Report.

In addition to our Digitalisation Commitments we have also published our Digitalisation Strategy which demonstrates how we make best use of new and existing data to manage our networks.

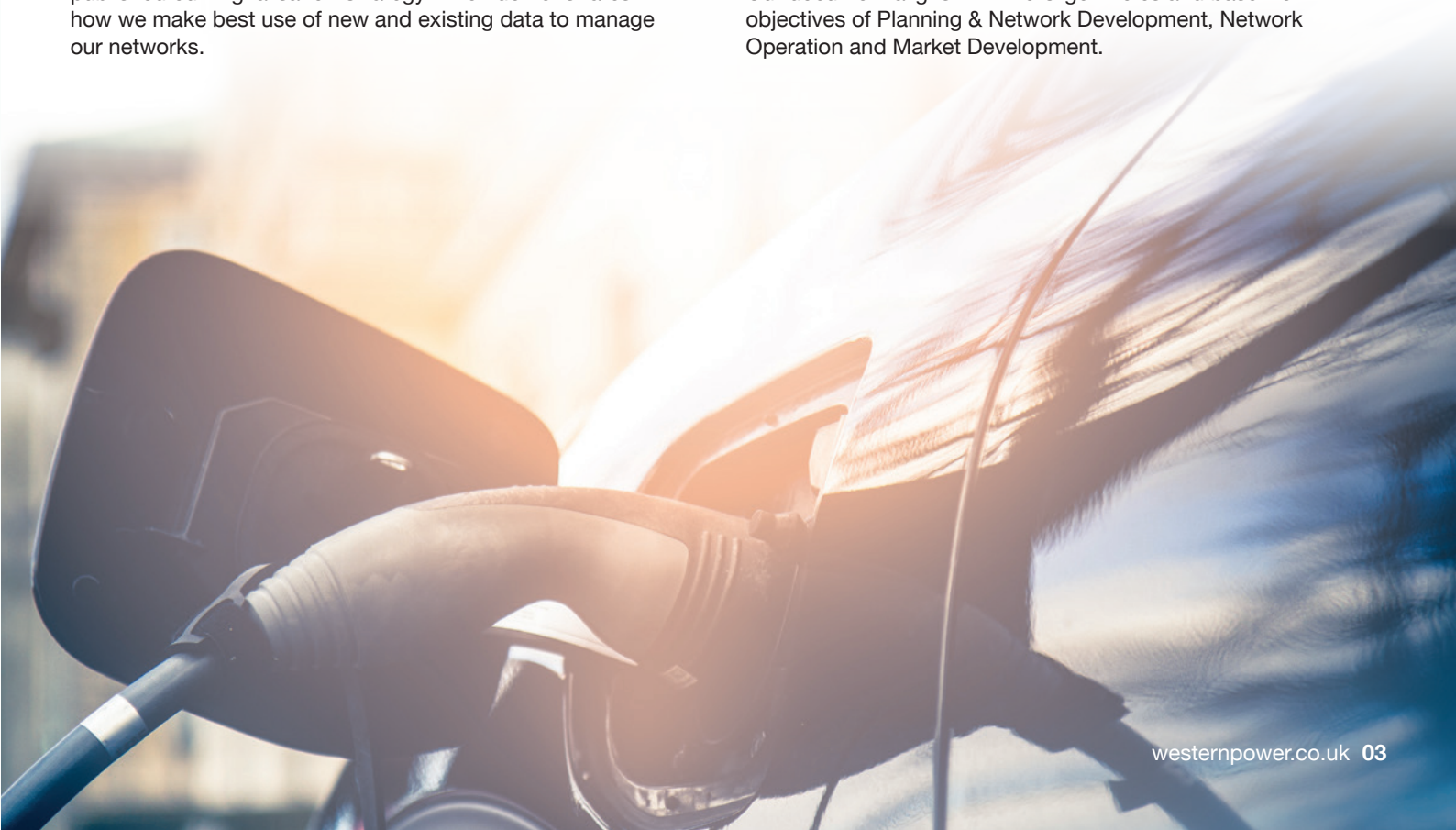
Our industry-leading innovation work, combined with the years of experience of operating a highly-reliable and cost-effective distribution network, makes us uniquely placed to lead the management of an increasingly smart, flexible and efficient local electricity system as energy becomes more decentralised.

We view the network operation of a more active regional distribution network as a natural extension of our current role. With DSOs managing the co-ordination of transmission and distribution services at a local level, it enables the National Transmission System Operator (NETSO) to concentrate on balancing the national network using un-conflicted services competitively made available. This all requires planning and network development which we view as a locally based role, with open data transfer of models and forecasts to the NETSO and other market participants.

Through the Open Networks project, we are working to ensure that our approach, as we transition to the future energy system, is coordinated with other network and system operators.

We will continue to review our proposed actions and workplan in line with views received from our customers, other stakeholders, BEIS, OZEV and Ofgem.

Our document aligns with the Ofgem roles and baseline objectives of Planning & Network Development, Network Operation and Market Development.



1. Introduction

As WPD adds Distribution System Operator roles to existing Distribution Network Operator roles, it will carry out its existing functions and take on some new ones so as to:

Develop and maintain an efficient, co-ordinated and economical system of electricity distribution;

Facilitate competition in electricity supply, electricity generation and flexibility services;

Improve the resilience and security of the electricity system at a local level;

New

Facilitate neutral markets for more efficient whole system outcomes;

Drive competition and efficiency across all aspects of the system; and

New

Promote innovation, flexibility and non-network solutions.

To facilitate neutral markets we have identified functions and activities which are specifically related to DSO. We have also identified the functions that a DNO would provide to any DSO, these are described as DSO enablers and cover areas where the DNO roles support a more flexible network operation through a DSO provider.

With WPD, as a DSO, managing the co-ordination of services at a local level, the complexity and risk can be reduced for the National Electricity Transmission System Operator (NETSO), resulting in a more efficient and cost effective whole system.

As a regulated business with no interests in UK generation or supply, WPD views the facilitation of our customers into these neutral markets as a natural extension of our current role in managing the power across our distribution networks.

We are uniquely placed to ensure simple and consistent access to new markets for our active customers through maximising the utilisation of our existing electrical and communication networks. We are also able to use the flexibility inherent in our network to ensure all customers benefit; through both receiving a resilient and secure supply and through cost effective delivery.

Within WPD we have already completed organisational changes which segregate our DSO functions from those of the DNO.

Each area reports separately to our Operations Director. Within this Strategy we have included two specific sections. The first covers elements related to System Operator, with the second detailing elements of DSO enablers managed by the DNO.

In APPENDIX X we have listed the DSO roles and activities for RIIO-ED2 as listed in the Ofgem Business Plan Guidance.

In our list we have sub-divided some items to provide additional granularity. Where the items are specifically addressed in the document we have included a note to cross reference them.

In APPENDIX Y we have included a gap analysis to ensure that all of the baseline requirements are being addressed by the end of RIIO-ED2.

2. Distribution System Operation - the rationale, benefits and functions

WPD recognises the need to change our role and include a DSO mode of operation to support changing energy uses by customers and a more dynamic operation of networks. We think DNOs are well placed to become DSOs although there are steps we need to take to build the required capabilities.

The move to DSO highlights areas which are new to us, but also shows areas where the DNO business has a role to play in providing base information and detail to support DSO decision making. We see the Operation Enablers as an area of benefit where the DNO business will support all DSO providers.

This is an essential part of the neutral facilitation of markets as they evolve with System Operator providers. We also see a part for WPD to play in establishing a System Operator provision. Our role is to stimulate the market in flexibility and create the space in which third party providers can operate. When paired with our Operation Enablers, these System Operator services provide a holistic response to Flexibility.

Transitioning from a network based on passive operation enabled inherently through its design, into one in which demand and generation is balanced locally by a mixture of enhanced sensing with active technical and commercial mechanisms. It will require significant change in our current role, but will facilitate a smarter energy system which can flexibly meet the needs of our users.

WPD has a large research and innovation programme to test new solutions before deploying them across the wider business. Our Future Networks Programme has continually developed better ways of delivering network capacity and providing an improved service to customers.

We have developed significant competence in a number of key areas which fall under the umbrella of Operation Enablers. They have focussed on assessing network capacity in innovative ways and creating the data management and telecommunications systems to operate the network in a more real-time way.

The way we have integrated telecoms, data, ratings and connections is best demonstrated in our work on flexible connections. Our flexible connections suite has developed options in two areas for customers seeking to connect to the grid. A Timed connection offers a very simple way of acting flexibly, without the need for communications or monitoring.

Load Managed connections make use of ANM technology to control generation or demand behind single or more complex constraints. These are particularly useful in areas of constraint as an alternative to network reinforcement. The load managed connections suite combines both contractual and technical approaches. These methods of connection vary in cost and complexity and enable the solution to be tailored to the individual requirements of the customer. We have been able to develop these solutions within WPD to enable our internal systems to manage transmission level constraints and provide efficient, economic and timely access for customers.

Further innovative work has given us an insight into how System Operator tasks can be completed. Our FALCON, SYNC and ENTIRE projects have demonstrated our ability to forecast, manage and dispatch both demand and generation turn up/turn down services and have been designed to do so in conjunction with National Grid, allowing customers full access to a number of markets providing revenue streams, whilst also minimising any risk of operating conflicting services.

Several innovation projects have developed the new remote control, monitoring and telecommunications equipment we need to have a more detailed view of how assets are used. This ensures we get the best value from them, whilst avoiding a potential for them to become overloaded or unreliable.

2. Distribution System Operation - the rationale, benefits and functions

We also continue to test innovative equipment to be used on the electricity infrastructure itself. These include devices such as battery storage and power electronic based equipment (for example Flexible Power Links, Flexible AC Transmission systems and Fault Current Limiters).

Through implementation of our DSO strategy, WPD will ensure that our network, and our business, is embedded with the capability to deliver all the emerging system requirements our customers have, both now and in the future.

By taking strategic decisions now, we can incrementally deliver this capability whilst maintaining enough flexibility that will equally enable a number of uptake scenarios without the risk of leaving assets stranded.

The building blocks of our strategy are grouped into five workstreams which relate back to the Ofgem roles and baseline objectives of Planning & Network Development, Network Operation and Market Development.

A.
Planning & Network Development

As customers adopt low carbon technologies or generate power more locally, the range of connection types for homes, businesses and generators is set to increase to meet customer needs. A DSO will also facilitate flexibility markets and make use of flexibility as an alternative to conventional network construction.

B.
Network Operation – network visibility and data

A DSO required accurate and granular information on asset capability (design ratings and health/condition), how they are connected (or could be) and their actual operation (both real time and historic). A new generation of sensors, control equipment and telecommunications will be used to support market integration and the new customer propositions.

C.
Network Operation – efficient and economic distribution system

A DSO will look at energy in a different way to a conventional DNO. Energy flows and volumes will be more important than absolute maximums. Our systems will need to operate more autonomously and react to signals from other parts of the network. How we dispatch DERs will become a key element of efficient system operation.

D.
Market Development – comprehensive market information

A DSO acts as a platform facilitator for customers, suppliers, aggregators and other participants to offer or receive services. Sharing information on network capability in multiple timeframes will enable businesses to offer customers innovative energy services. Data sharing between Transmission and Distribution is critical to ensuring the whole system is optimised in the interests of customers. Our use of the Common Information Model (CIM) will help data flow smoothly.

E.
Market Development – fair and transparent procurement

We must ensure our costings, requirements and active system details are published in advance to allow customers to participate. Alignment of conditions, terminology and products will allow customers to lever multiple markets.

3. How we are implementing in WPD to address conflicts of interests and segregation safeguards

As a regulated business with no interests in UK generation or supply, WPD views the facilitation of our customers into these neutral markets as a natural extension of our current role in managing the power across our distribution networks.

We are uniquely placed to ensure simple and consistent access to new markets for our active customers through maximising the utilisation of our existing electrical and communication networks.

We are also able to use the flexibility inherent in our network to ensure all customers benefit; through both receiving a resilient and secure supply and through cost effective delivery.

We do not offer a direct route to our systems, all our control instructions are via API links to third party platform providers and aggregators. We actively encourage the emergence of this sector and will continue to offer “plug-in” solutions to remain neutral in the market.

All WPD’s procurement data and system need information is downloadable and processable by third parties.

We have previously used CLEM, NODES and PICLO for procurement routes.

Throughout all of our work to support DSO services we must show neutrality and ensure that actual and perceived conflicts can be addressed.

We have ringfenced the DSO team away from a wider electricity business systems team, responsible for providing the DSO-enablers (such as data, monitoring etc) and the wider DNO business. Each team has separate and equal direct reporting lines into the Operations Director.

4. System Operator Functions

Scope

More intermittent and less predictable use of the electricity distribution system is inevitable as customers substitute carbon based fuel sources with cleaner electricity. Traditional DNO operations would require very substantial investments in passive grid infrastructure, which would be underutilised much of the time. Continued construction, maintenance and operation of passive distribution networks is no longer going to deliver the best outcomes for UK electricity bill payers.

DNOs therefore need to change and provide DSO systems and solutions in order to operate and maintain efficient, economic and co-ordinated networks. WPD plans to be at the forefront of this transformation.

We will roll-out DSO competences using a top-down approach, ensuring the 132kV, 66kV and 33kV networks are targeted first, prioritising those areas which will benefit most. This enables the rest of the network to be incrementally upgraded as the customer need dictates. We aim to develop wider flexibility for the use of import/export capping as an alternative to conventional solutions only reinforcing the networks when these solutions cannot deliver what is required.

Meeting baseline requirements

Planning and Network Development		Promote Operational network visibility and data availability		Facilitate efficient dispatch of distribution flexibility services		Provide accurate user friendly and comprehensive market information		Embed simple, fair, and transparent rules and processes for procuring distribution	
Note	**Timescale**	**Note**	**Timescale**	**Note**	**Timescale**	**Note**	**Timescale**	**Note**	**Timescale**
1.1	✓ RIIO-ED2	2.1.1	✓ RIIO-ED1	2.2.4	✓ RIIO-ED2	3.1.2	✓ RIIO-ED1	3.2.1	✓ RIIO-ED1
1.6	✓ RIIO-ED1	2.1.3	✓ RIIO-ED1	2.2.6	✓ RIIO-ED1	3.1.3	✓ RIIO-ED1	3.2.3	✓ RIIO-ED1
1.7	✓ RIIO-ED2					3.1.4	✓ RIIO-ED1	3.2.4	✓ RIIO-ED1
1.8	✓ RIIO-ED1					3.1.6	✓ RIIO-ED1	3.2.5	✓ RIIO-ED1
						3.1.7	✓ RIIO-ED2	3.2.6	✓ RIIO-ED1
								3.2.7	✓ RIIO-ED1
								3.2.8	✓ RIIO-ED2
								3.2.12	✓ RIIO-ED1
								3.2.13	✓ RIIO-ED1

Note numbers relate to the baseline requirement detail as shown in APPENDIX X

Workplan

Planning and Network Development

Through forecasting using internal data sets, WPD will be able to provide instantaneous and predicted constraint levels for Distributed Energy Resources (DER) within operational timescales.

This will allow the levels of constraint to be used when dispatching flexibility services and ensure the network is managed to maximise capacity, minimising constraints. We will develop enhanced forecasting, simulation and network modelling capabilities, with processes in place to drive continual improvement to meet network and user needs.

During RIIO-ED1 we will have finished conversion of WPD network models to enable switch level analysis and develop the systems to record and simulate network asset behaviour. Through RIIO-ED2, we will improve our understanding of customer behaviour, enabling the impact of consumer-led smart technologies to be modelled alongside smart-grid mitigations, to better understand true network capacity needs. A core forecasting and capacity management team developed within the DSO business will drive improvement in understanding electricity system impacts on customer assets and behaviour. A system modelling team within the DSO business will develop the systems, techniques and data required to understand the electricity system impacts on network assets and behaviour. **Note 1.1**

Enhanced visibility will give us the data, not only for us to manage our network to the highest levels, but also to enable us to give the best information to customers, providing leading indicators on where distribution network capacity is plentiful and where further support from flexibility services is required. By making this information available, WPD will contribute to the neutral facilitation of regional markets for the deployment of third party owned flexibility services.

The space between the LTDS timescales and the DFES forecasts will be filled with a Network Development Plan. We will use this to provide information across current and next business plan periods. We will ensure that our models and outputs are consistently available in all our forecasts. Distribution network options assessment will be a six monthly publication providing transparency in decision making on the use of flexibility and other competitively tendered innovative network mitigations. It will include CBAs of options and provide the long term view to ensure our solutions are timely and appropriate. An industry standard tool, CEM, will be used to compare the investment options around a number of industry standard scenarios and the DSO's own best view. Stakeholder engagement and whole system optioneering will be a crucial part of the DNOA process. The DNOA framework set out by WPD will solidify robust and transparent processes to ensure independence of decision. **Note 1.6**

WPD will develop a front-loaded payment mechanism to catalyse investment in energy efficiency measures, building on the revenue potential of flexibility. Network areas which would benefit from flexibility may also benefit from energy efficiency measures which reduce network loadings at cardinal points assessed by the DSO. A specific energy efficiency proposition should deliver low risk, long-term network utilisation reductions at an economic level. **Note 1.7**

Promote Operational network visibility and data availability

By viewing energy flows on a temporal basis, we can forecast requirements and ensure the network is pro-actively managed in an optimum way. Complex data analytical tools will be deployed to allow us to visualise and interrogate the data. We will share the results of this enhance visibility with customers, their energy suppliers and the NETSO.

WPD publish the network flexibility data for a 5 year window across four future energy scenarios and also publish the procurement data for a 2 year window under WPD's Best View.

These datasets provide information to the market, as well as support the planning process. Month-ahead forecasts are published on the Flexible Power website to outline the expected windows of availability and utilisation needed for DSO operations.

The timescales of this forecast will be updated as forecasting methods improve, with multiple iterations expected all the way up to real-time. **Note 2.1.1**

Through the RDPs in South West and Midlands, WPD is working on providing real-time network headroom, footroom and underlying DER, ESS and Flexibility data to the ESO. This is expected to be made live in 2021.

System utilisation, demand, generation and storage power information is published online in real-time at a licence area level. This will be brought down to a more granular level during 2021. **Note 2.1.3**

4. System Operator Functions

Workplan

Facilitate efficient dispatch of distribution flexibility services

The definitions of different types of dispatch instruction for distribution flexibility services and transparent rules about when and in which markets they should be used are a key consideration.

We have developed acceptance and dispatch principles which have been published since early 2019. Our procurement strategy document clearly sets out what products we procure and how we approach the procurement.

WPD has implemented the industry standard flexibility products developed under Open Networks and was the first DSO to procure the products “Secure”, “Dynamic” and “Restore”. **Note 2.2.6**

During RIIO-ED2 WPD will develop a process for facilitating, analysing, approving and verifying secondary trading of flexibility services. **Note 2.2.4**

Embed simple, fair, and transparent rules and processes for procuring distribution flexibility services

As our Flexible Power products have become more embedded, we have worked to standardise them.

As other DNOs have now joined the Flexible Power platform we have taken the opportunity to collaborate and standardise. Customers have asked us for simpler ways to engage in the distribution flexibility services market and, in response, we have streamlined the process for flexibility providers. Providers can now view locations, procurement and documentation for four DNOs on a single platform. **Note 3.2.1**

WPD uses industry standard products to ensure consistency and standardisation within the market. These have been developed through Open Networks using WPD products for 3 of the 4 main products. In addition to this WPD is developing innovative pathways to improving participation and engagement in the marketplace. FutureFlex and IntraFlex are being run to support BAU flexibility services and, as with any innovation projects, the successful parts will be integrated into the main business. **Note 3.2.3**

WPD provided flexibility system need data to the market multiple years in advance. WPD procures twice a year using a 6 month procurement cycle. Dates and timelines are provided two years in advance. Contracts within Constraint Management Zones are awarded on 1 to 4 year contracts according to the flexibility provider’s preference on contract length. **Note 3.2.4 & 3.2.5**

Clear, comprehensive and transparent mechanisms and associated commercial structures for coordinating distribution flexibility services and ESO flexibility services procurement will help customers participate in markets. Through the Midlands Regional Development Programme (RDP), WPD is working with the ESO to develop co-optimisation, coordination and primacy rules for operating flexibility services for both transmission and distribution network needs. This will feed into Open Networks. **Note 3.2.6**

We do not want to become the commercial route for access to wider ESO services. It should be noted that WPD contracts for flexibility are purely procured for distribution needs. Joint procurement is being explored within the RDPs. **Note 3.2.7**

Customers who provide flexibility will require the freedom to work across multiple markets and services to fully realise the benefits that their DER response can offer. WPD flexibility service contracts have no exclusivity clauses. It is expected joint procurement between WPD and the ESO will be enabled via a common contract with joint terms to facilitate DER servicing both Transmission and Distribution needs via a single procurement exercise. **Note 3.2.8**

WPD want market support services, such as pre-qualification, credit-checking and settlement to be simple and enable cost-efficient participation in markets. We will set out the processes involved with procurement, as well as the resources and costs associated with the activity to enable third parties to compete on a like-for-like basis. Where the market can do so more efficiently, WPD will enable this. **Note 3.2.12**

Throughout all of our work to support DSO services we must show neutrality and ensure that actual and perceived conflicts can be addressed. We have ringfenced the DSO team away from a wider electricity business systems team, responsible for providing the DSO-enablers (such as data, monitoring etc) and the wider DNO business. Each team has separate and equal direct reporting lines into the Operations Director. **Note 3.2.13**

Our Distribution System Operator Projects

We are developing a range of projects to take our DSO operations forward. Details of each of the projects are included in Section 6 which explores Distribution System Operator in more detail.

The suite of projects help develop our analysis tools and the provision of data in a user friendly form for flexibility participants. The current projects include:

- **Network Analysis for DSO**
- **Planning State Estimation**
- **Stability Analysis**
- **DFES Data Architecture and Systems.**

5. Distribution System Operation Enablers

Scope

The DSO enablers provided by a DNO are the activities and functions which support the neutral facilitation of markets and flexibility. They relate to areas where the DNO provides data for a market, and where the DNO is involved in the connection of low carbon technologies such as Electric vehicles and heat pumps.

A DNO will also need to be able to reflect the flexibility responses of a DSO within its own systems for real-time operational decision making. The network management tools must be open to input from proprietary systems used in flexibility markets.

Understanding how the network is performing is key to the efficient use of the network, so data from sensors and measurement devices is required at more places on our network. Existing maximum demand sensors need to be augmented to offer power flow direction and other metrics. We will protect the integrity and safety of lower voltage networks through a combination of advanced modelling, additional visibility and conventional reinforcement. Smart Meter data will be used to enhance models which are applied to our low voltage networks.

Meeting baseline requirements

Planning and Network Development		Promote Operational network visibility and data availability		Facilitate efficient dispatch of distribution flexibility services		Provide accurate user friendly and comprehensive market information		Embed simple, fair, and transparent rules and processes for procuring distribution flexibility services	
Note	**Timescale**	**Note**	**Timescale**	**Note**	**Timescale**	**Note**	**Timescale**	**Note**	**Timescale**
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1.3	✓ RIIO-ED1	2.1.4	✓ RIIO-ED2	2.2.2	✓ RIIO-ED1	3.1.5	✓ RIIO-ED2	3.2.9	✓ RIIO-ED2
1.4	✓ RIIO-ED1	2.1.5	✓ RIIO-ED2	2.2.3	✓ RIIO-ED2			3.2.10	✓ RIIO-ED2
1.5	✓ RIIO-ED2			2.2.5	✓ RIIO-ED1			3.2.11	✓ RIIO-ED2
				2.2.7	✓ RIIO-ED1				
				2.2.8	✓ RIIO-ED1				

Note numbers relate to the baseline requirement detail as shown in APPENDIX X

Workplan

Planning and Network Development

The effective application of both Flexible Connections and DSR Services is contingent on the availability of network data such as real and reactive directional power flows and voltages.

On the high voltage (11kV and higher) networks, full network visibility down to Primary Substation level will allow WPD's Active Network Management systems to minimise the amount of curtailment customers are subject to while maximising asset utilisation and maintaining network security. On low voltage networks, monitoring of Distribution Substations will ensure that network reinforcements are carried out when and where they are needed and provide the necessary data to enable "Smart" solutions to be deployed where required to further optimise asset utilisation.

Data sharing in a fast and efficient way becomes key as more data sets interact. We will ensure that our planning data is made available in a standard format to increase the efficiency of data sharing. We will use the Open Networks project to ensure that our approach is coordinated with other network and system operators.

We continue to collaborate with all other network licensees through ENA to establish common data descriptions, metadata standards and approaches to sharing data to ensure that a standardised and interoperable process is taken forwards. We have demonstrated leadership in this area as the first GB DNO to share its complete asset and connectivity data, above LV, in Common Information Model (CIM) format. **Note 1.3**

Visualisation of data is key to ensure that it is used and gains maximum leverage in the transition to net zero. We hold heat maps and information on our website, with forecast DFES data being made available both in "WPD specific" geographical areas and in specific local authority boundaries.

An example of where we have made different formats of data available is associated with our network capacity and future energy scenarios interactive maps, where the maps provide users with an easy to navigate geographic view, but we also make available the more detailed source data for more technical users to build their own analysis. **Note 1.4**

Customers can self-serve this data using our interactive maps and download features. The base data is also available to download for use in third party models and systems. Improving and increasing data management acts as the backbone to drive insight both internally and externally to meet current and future system needs.

Developing data in to a more consistent format has meant that we can now share openly our data via the internationally recognised CIM standard for the transfer and provision of electricity network data, to allow direct access to a complete asset and connectivity model to support investment and operational planning for customers and stakeholders. **Note 1.5**

Promote Operational network visibility and data availability

We have already established the ability to share our network information through the standard CIM format. This allows other operators and stakeholders to run their own modelling and simulations against our base network.

This requires more development to encompass all of the examples of data sharing included in the Ofgem Baseline Requirement and, as an example, we do not share working network configuration in real time. We do share an as-planned network configuration. We plan to address the areas required during the RIIO-ED2 period, developing them as data becomes available and system changes are made for us to offer useful outputs. Some outputs, such as losses recorded at substation level, will rely on third party projects such as the roll-out of Smart Meters so we will develop solutions to make use of these projects as they complete. **Note 2.1.5**

WPD publish the network flexibility data for a 5 year window across four future energy scenarios and also publish the procurement data for a 2 year window under WPD's Best View. These datasets provide information to the market, as well as support the planning process. A month-ahead forecast is published on the Flexible Power website to outline the expected windows of availability and utilisation needed for DSO operations. The timescales of this forecast will be updated as forecasting methods improve, with multiple iterations expected all the way up to real-time. **Note 2.1.1**

We use a common data triage process to assess the openness of data. This is applied to assess data classification and determine whether anonymisation or redaction is required to enable the data to be shared. This results in either Open, Public, Shared or Closed classification. A summary assessment is published along with the dataset to provide stakeholders an explanation of the data classification. **Note 2.1.2**

During the RIIO-ED1 period we established the DER owner/operator forum. That gave operators a route to discuss all matters related to DER ownership, such as Grid Constraint, Outage Management and Forecasting. Details of DERs connected to the WPD network and the respective owners is well established. At future owner/operator forums we will work to collaboratively develop the specification of detail that is required to help secure DERs. We plan to develop this specification into a solution for all DERs. **Note 2.1.4**

5. Distribution System Operation Enablers

Workplan

Facilitate efficient dispatch of distribution flexibility services

The real-time requirement for decision making drives this activity to be completed in our Network Control Centres which have a 24/7 presence.

This is already being completed as a look ahead task with the ESO but the network is managed in real time at arm's length from the NG network, with interactions based on forecasts predictions or unplanned events. Innovation projects such as the UKPN KASM project will provide a useful basis for solutions. We already have our own acceptance and dispatch principles published on the Flexible Power website, they were developed in 2019 and will be reviewed as industry level work continues. **Note 2.2.1**

As systems become more detailed and interactive, rules will be set to ensure DERs can operate efficiently. It is important that rules are equitable to all network participants. These will be created transparently with stakeholder engagement through the WPD DER Owner Operator forum. Through the Midlands RDP, WPD is already working with the ESO to develop these primacy rules. Once developed they will feed into Open Networks. **Note 2.2.2**

We will support the secondary trading of distribution flexibility services and curtailment obligations by providing relevant data. We recognise it's important that our data is presented in the same format, described in the same way and provides the same level of detail as that of other network operators. This allows customers and stakeholders to have a consistent view of the data across the industry to support existing, new and developing markets. **Note 2.2.3**

Our Flexible Power systems are able to work with other systems, such as the interface to Kiwi Power. We remain open to other providers taking signals and data from systems and inputting back into them. Although our ANM systems do not provide a DSR response, we have followed the same ethos and openness. Our PowerOn system already interfaces with ANM systems from two providers and is able to interact with other platforms. **Note 2.2.5**

WPD does not implement hard dispatch controls for flexibility services, all flexibility instructions are through electronic APIs and not direct hardware control. Hard dispatch controls are used solely for disconnection under fault, outage or system emergency conditions. **Note 2.2.7**

WPD does not have a hard coded system for flexibility. The flexibility service platform does not run off any DNO infrastructure. Data exchange to and from DNO control systems is limited to monitoring and real-time control and is implemented through industry standard communications protocols. **Note 2.2.8**

Provide accurate user friendly and comprehensive market information

Our digitalisation activity has already and will continue to deliver change in how we plan, manage, and operate our network and interact with and provide data to customers and third-party system participants.

We are committed to continuing to build on our significant work to date digitalising our business to ensure that we remain an efficient and effective operator of our network and deliver data and solutions in the right format, at the right time to customers and stakeholders to meet their needs and ambitions.

Our core principles are and will remain improving data management, increasing network insight and operation and ensuring data is presumed open. These principles ensure value is driven to all parts of the energy industry and wider, supporting the net zero transition. **Note 3.1.1**

Improving and increasing data management acts as the backbone to drive insight both internally and externally to meet current and future system needs. Standard processes for creating, managing and handling data though a robust data governance process has been implemented and will continue to be developed; investing in solutions to improve our data quality; and ensuring we have a "single source of the truth". **Note 3.1.5**

Embed simple, fair, and transparent rules and processes for procuring distribution flexibility services

We do not offer a direct route to our systems, all our control instructions are via API links to third party platform providers and aggregators.

We actively encourage the emergence of this sector and will continue to offer “plug-in” solutions to remain neutral in the market. All WPD’s procurement data and system need information is downloadable and processable by third parties. We have previously used CLEM, NODES and PICLO for procurement routes. **Note 3.2.2**

Through the Midlands RDP, WPD is working with the ESO to develop how the existing DSO products can serve Transmission constraint needs. This will feed into Open Networks. **Note 3.2.9**

WPD helped support the development of work around the stackability assessment of DSO flexibility products and their interaction with ESO flexibility services. The industry standard products implemented by WPD enable both transmission and distribution needs to be met. Contracts put in place by WPD also provide no barriers to serving whole electricity system needs.

We will investigate the additional arrangements that are required to support DERs and the ESO in a more real time automated basis. **Note 3.2.10**

Presuming our data to be open goes beyond making it available through our systems and services. Our role is to enable data to be harvested, housed and utilised irrespective of specific access point. Our implementation of APIs and Client URLs will ensure that this is available and appropriate.

Our ENA wide work on the creation of an energy digital system map for GB has demonstrated our commitment to and the availability of our data to serve this purpose. **Note 3.2.11**

Our Distribution System Operation Enabler Projects

We are developing a range of projects to take our DSO enabler work forward.

Details of each of the projects are included in Section 7 which explores Distribution System Operation Enablers in more detail. The suite of projects help develop our data and monitoring functions to offer more granular and real time data to DSO Operation providers.

The current projects include:

- **Improved Network Monitoring and Power Flow Sensing**
- **Automated Data Mastering Solution**
- **Time Series Historian Analysis System**
- **Open Cloud Data Platform**
- **Internal Data Platform.**

6. System Operator in Detail – our work to develop DSO Functions

Planning and Network Data

WPD uses numerous sources of data to establish a forecast of future network loads and constraints. Established processes take national forecasts and combine them with local information to generate local forecasts.

A common cross-sector scenario (used in the gas distribution and transmission price controls) has been referenced to determine an early WPD best view forecast. This best view has been used to identify future network constraints and inform the future work programme that forms the RIIO-ED2 network reinforcement requirements.

Through forecasting using internal data sets, WPD will be able to provide instantaneous and predicted constraint levels for Distributed Energy Resources (DER) within operational timescales. This will allow the levels of constraint to be used when dispatching flexibility services and ensure the network is managed to maximise capacity and minimise constraints. We will develop enhanced forecasting, simulation and network modelling capabilities, with processes in place to drive continual improvement to meet network and user needs.

During RIIO-ED1 we will have finished conversion of WPD network models to enable switch level analysis and develop the systems to record and simulate network asset behaviour. Through RIIO-ED2, we will improve our understanding of customer behaviour, enabling the impact of consumer-led smart technologies to be modelled alongside smart-grid mitigations, to better understand true network capacity needs.

A core forecasting and capacity management team developed within the DSO business will drive improvement in understanding electricity system impacts on customer assets and behaviour. A system modelling team within the DSO business will develop the systems, techniques and data required to understand the electricity system impacts on network assets and behaviour.

WPD's Track Record and Processes

Since 2015 WPD has been undertaking scenario planning work through Distribution Future Energy Scenario (DFES) reports, updating them regularly to provide a forward looking window of potential low carbon technology uptakes. The DFES projections have been aligned to the latest National Electricity Transmission System Operator (ESO) scenario forecasts that are available when the DFES process is carried out.

A separate process called Shaping Subtransmission determines the impact of the scenarios on the network. This process uses data from the DFES analysis to determine whether the change in use of the network leads to constraints. The information about constraints is used to inform future requirements for investment.

The forecast network requirements are used to provide information for potential flexibility providers. Signposting gives a multiple scenario five year forward view of requirements and Forecasting provides a single two year best view of requirements. This information informs the Flexibility procurement process which operates on multiple cycles up to the point when investment is required.

The options for investment are considered in the Distribution Network Options Assessment process (formerly the Strategic Investment Options process) which determines whether flexibility, conventional reinforcement or alternative innovate approaches provide the most economical solution. This leads on to either implementing the operation of flexibility or proceeding with conventional reinforcement, where flexibility is unavailable. The use of future energy scenarios and the associated processes are embedded as business as usual within WPD and therefore activities in RIIO-ED2 will be focused on expanding, enhancing and evolving these processes.

Enhanced visibility will give us the data, not only for us to manage our network to the highest levels, but also to enable us to give the best information to customers, providing leading indicators on where distribution network capacity is plentiful and where further support from flexibility services is required. By making this information available, WPD will contribute to the neutral facilitation of regional markets for the deployment of third party owned flexibility services.

Strategic Network Planning Process

There are three main stages involved in our strategic network planning process:

Stage 1
Scenario Planning

Stage 2
Converge to a single view

Stage 3
Model expected behaviours

Stage 1: Scenario Planning – Production of Distribution Future Energy Scenarios (DFES)

The first stage of the strategic network planning process is creating the Distribution Future Energy Scenarios (DFES).

The (DFES) use national Future Energy Scenarios (FES) forecasts produced by the Electricity System Operator (ESO) and local information to provide a distribution view of the technology volume changes across DNO license areas.

WPD starting developing DFES studies in 2015 and was the first DNO group to develop DFES analysis and documentation.

Since the publication of the first DFES report for the South West, WPD has continued to work with Regen to carry out the analysis which has been captured and published in license specific DFES documents for all WPD licence areas.

WPD has committed, that from 2020, a full suite of DFES documents will be produced annually. This means that by January each year there will be an updated suite of DFES documents for all WPD licence areas following release of an updated ESO FES in the preceding July.

6. System Operator in Detail – our work to develop DSO Functions

Considerations in DFES Analysis

The DFES investigates ~50 different technology types and assesses the potential for growth under each of the four ESO FES scenarios. It follows a four stage process as shown in the diagram.

Stage 1 Baseline

A baseline assessment
Technology baselines are calculated from WPD's network connection database. This information is then reconciled with other market intelligence and external databases. In addition, further desktop research is undertaken to address inconsistencies.

Stage 2 Pipeline

A pipeline assessment
For technologies with significant lead times WPD's network connection agreement database is reconciled with the BEIS planning database and market research is undertaken. This allows an assessment of which commercial projects in the pipeline may go ahead and in what timescale.

Stage 3 Resource

Resource assessment
Locational data from a wide range of data sources and GIS analysis is used to understand the geographical distribution, local attributes, constraints and potential for technologies to develop within the licence area and each Electricity Supply Area.

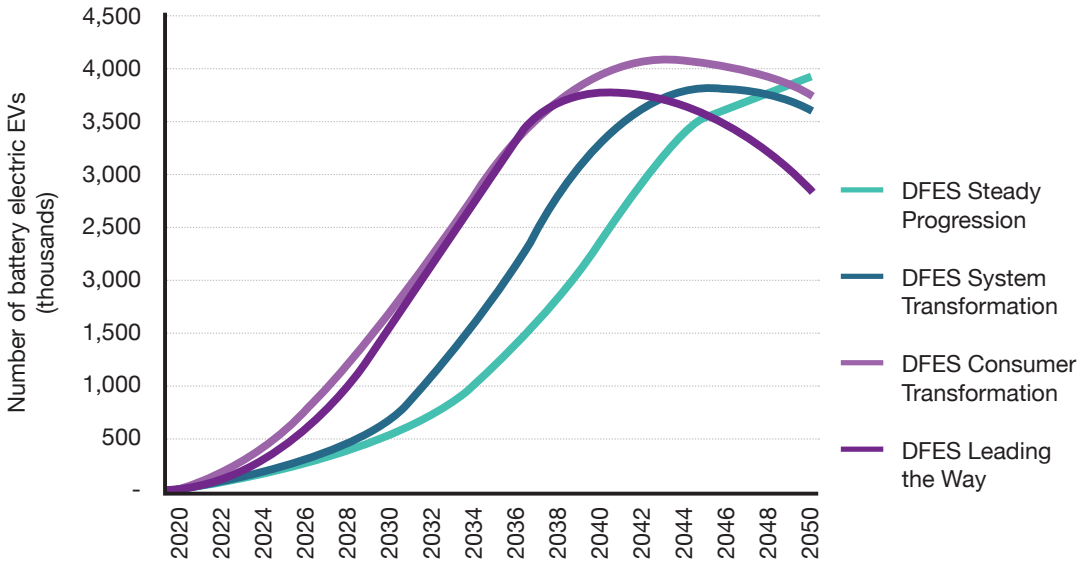
Stage 4 Scenarios

Scenario projection.
The National Grid FES scenarios are interpreted for specific local resources, constraints and market conditions. This includes the findings from a local consultation event and interviews from developers, investors and other stakeholders.

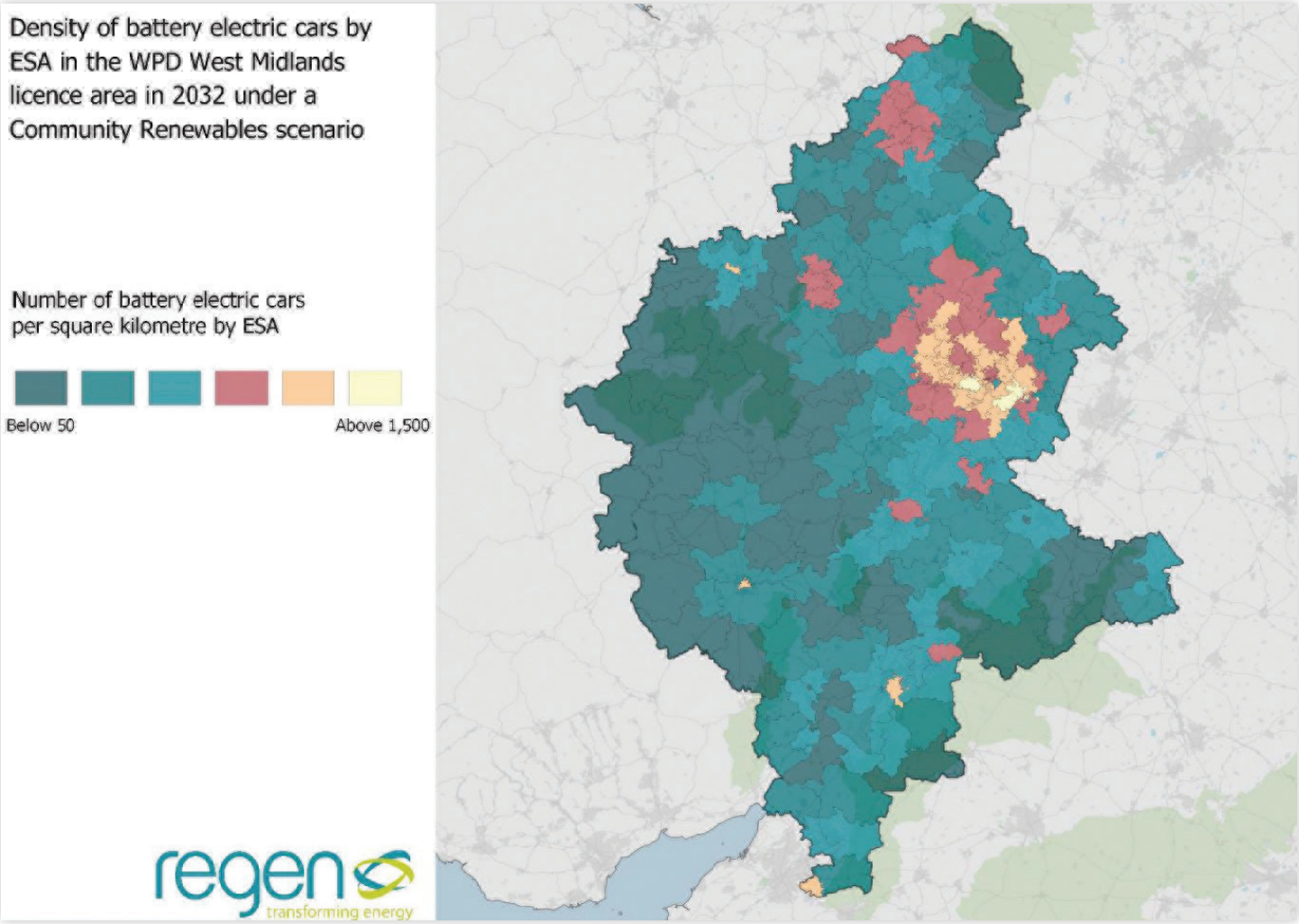
The DFES uses the concept of Electricity Supply Areas (ESA) to define the level of granularity of the analysis. These are aligned to primary substations, resulting in around 1150 ESAs across WPD.

The growth of each of technology is considered for each individual ESA informed by information on local circumstances.

Battery Electric Vehicles by scenario



The image below shows a heat map of the West Midlands licence area showing the impact of growth in electric vehicles under the ESO FES 2019 Community Renewables scenario, illustrating the different effect on each electricity supply area.



The analysis for results in a report and an associated dataset of scenario projections for each unique combination of technology, scenario, year and Electricity Supply Area.

This data is available on the WPD website at:

www.westernpower.co.uk/distribution-future-energy-scenarios-map

The scenario projections for each technology are given in quantifiable units – i.e. a value that can be counted. Examples of this are MW of installed capacity (for generation and storage) and number of Heat Pumps and Electric Vehicles.

Electrical behaviour assumptions are not included at this stage. The DFES is a key input to our continual assessment of the distribution network. The outputs from the DFES inform multiple business operations, including informing the electrical analysis underpinning our Shaping Subtransmission series of reports.

6. System Operator in Detail – our work to develop DSO Functions

Development of Local Area (LA) DFES (Note 1.3)

As part of our extensive stakeholder engagement programme, WPD invited all 130 local authority stakeholders covered by the WPD area to work with WPD to build a joined-up energy plan.

As part of the interactions, WPD shared DFES projections which had the electricity supply area data in the WPD DFES analysis recut into each local authority area. WPD Distribution Managers from depots in the local areas held meetings with local authority energy representatives to review the assumptions and projections.

This resulted in a range of responses, with some local authorities being more ambitious that the LA DFES and other local authorities finding the interaction helpful to assist them in formulating their LAEPs.

The chart opposite shows the progress that local authorities are making in developing their LAEPs, with one third having established a LAEP, around half still developing their plans and a fifth with no plans yet under development.

This is an evolving area and therefore it will be important to revisit this interaction to gain further knowledge about local energy plans.

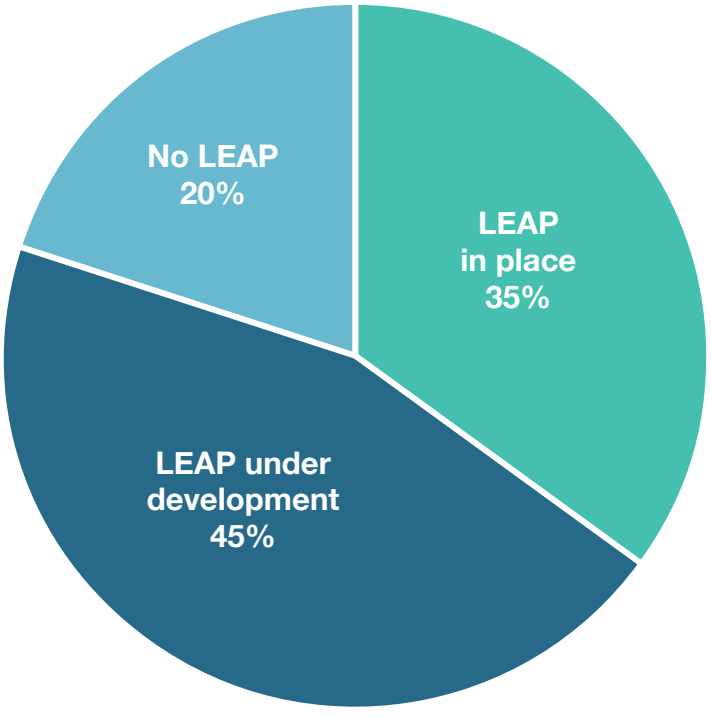
The feedback from local authorities has been used to refine the allocation of growth projections across the WPD licence areas, which makes them more representative of local requirements and more certain that they will be required.

It is proposed to continue the interaction with the local authorities on an annual basis to feed into the annual review of WPD DFES scenarios and also use this data to feed back regional information into the ESO FES process.

WPD sought the following data from the local authorities:

- **General data based around a local energy strategy, declaration of a climate emergency and setting a target date to reach net zero.**
- **Technology projections for electric vehicles, heat pumps, new industrial, commercial and domestic developments, generation including solar, wind and battery storage.**
- **Availability and comparison of data sets.**

LAEP Status



Stage 2: Defining a single WPD Best View

Having created a series of scenario projections, the next stage is to converge these into a single WPD 'Best View'.

Determining a WPD Best View Scenario

To derive the WPD Best View, WPD uses an iterative process. DFES data and previous Best View is used to support stakeholder and Local Area engagement, which then allows the quality of Local Area Energy Plans to be assessed using criteria derived from Ofgem guidance to gauge the ambition, engagement and deliverability.

The assessment is carried out by WPD's senior regional managers, scoring against the criteria matrix and a Local Area specific DFES scenario is selected.

The DFES scenario is chosen by closely comparing the ambition of the planned volumes across all technology types within the area, and then further ranked on how close this ambition is likely to be to the needs of stakeholders (engagement completed), how accurate the modelling is and the capability of the area to deliver.

A single DFES scenario is currently chosen to approximately represent all technologies, but there is scope in the future for differentiation between expected uptakes of technologies to also be simultaneously assessed.

This process enables these scenarios volumes to be summated up to a licence area level, checked against WPD strategic views of development and a new WPD Best View can then be provided.

Before the WPD Best View is finalised, the licence area totals are checked against national ambition to ensure WPD targets are aligned to deliver governmental policy. Scenario boundaries across the rankings may be moved to more closely aligned, assuming incentives and policy is directed at achieving national net zero ambitions.

Each primary substation also receives a disaggregation of this "WPD Best View" and this is used to inform the growth rates required for investment across the network.

6. System Operator in Detail – our work to develop DSO Functions

Stage 3: Modelling Expected Behaviours

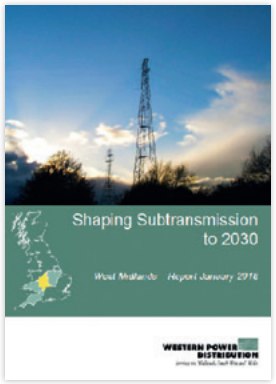
Shaping Subtransmission Reports (Note 1.4)

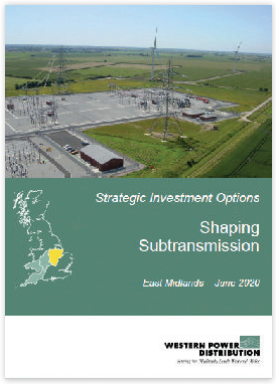
The process considers the MW impact, the timing of the impact and diversity of the impact to identify where the growth will result in specific network constraints.

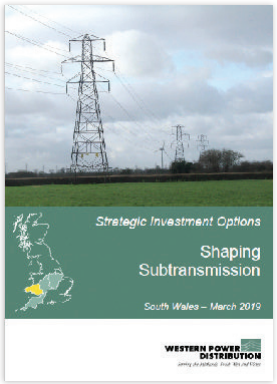
The output is published in Shaping Subtransmission reports for each of the four WPD licence areas. The constraints identified feed into WPD's longer–term Signposting process for identifying long term flexibility requirements. Different strategic investment options are considered to alleviate potential network constraints, which incorporates both flexibility service provision and conventional reinforcement.

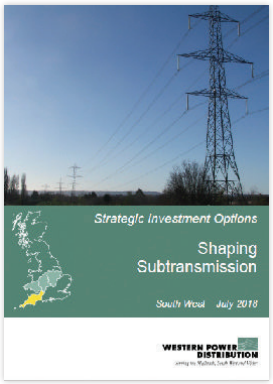
The following tables summarise some of the high level figures for WPD from the calculation of the WPD best view for each licence area at the start (2023) and the end (2028) of RIIO-ED2.

For RIIO-ED2, the data shows that there will be a significant growth in EVs, increasing from 550,000 to 2.1 million while the number of heat pumps is set to grow from 265,000 to 893,000.









WPD Best View 2023

Technology	Units	WMID	EMID	SWALES	SWEST	WPD
Solar Generation	GW (installed capacity)	0.971	1.922	0.772	1.676	5.342
Onshore Wind Generation		0.050	0.409	0.548	0.354	1.362
Other distribution connected generation		1.445	2.208	0.893	0.954	5.500
Battery storage	GW (installed capacity)	0.251	0.357	0.027	0.155	0.789
Electric vehicles	Number of vehicles	255,510	184,320	34,863	73,734	548,427
Heat pumps	Number of heat pumps	72,205	95,738	30,839	66,068	264,850

WPD Best View 2028

Technology	Units	WMID	EMID	SWALES	SWEST	WPD
Solar Generation	GW (installed capacity)	1.290	2.784	1.090	2.036	7.200
Onshore Wind Generation		0.050	0.414	0.587	0.407	1.458
Other distribution connected generation		1.505	2.353	0.944	1.074	5.876
Battery storage	GW (installed capacity)	0.347	0.430	0.065	0.223	1.065
Electric vehicles	Number of vehicles	859,665	739,693	168,661	318,053	2,078,872
Heat pumps	Number of heat pumps	248,492	352,980	109,712	181,870	893,054

Network Planning

During RIIO-ED1 WPD has established flexibility markets that provide an alternative means of addressing network constraints. These make use of new technology and the ability for some network users to provide flexibility in their own consumption either by increasing, reducing or shifting their net import or export.

This flexibility can be commercially controlled by WPD to offset the need for reinforcement, provide more capacity to other connections, improve network security or increase system operability. When considering how to address a network constraint, WPD will consider whether flexibility provides a more economical solution. Adopting a 'flexibility first' approach will enable the network to developed efficiently and economically.

Timing of Investment and Use of Flexibility

Ideally the capacity of the network is increased once the network approaches its capacity limits, with work being started just ahead of need so that it is completed as the new capacity is required.

Conventional reinforcement, using larger capacity assets releases large blocks of capacity due to the discrete sizing of network upgrades. These large steps in additional capacity generally do not require further investment for a number of years resulting in longer term capacity availability. However these large steps in capacity increases may be excessive for the anticipated future network requirements.

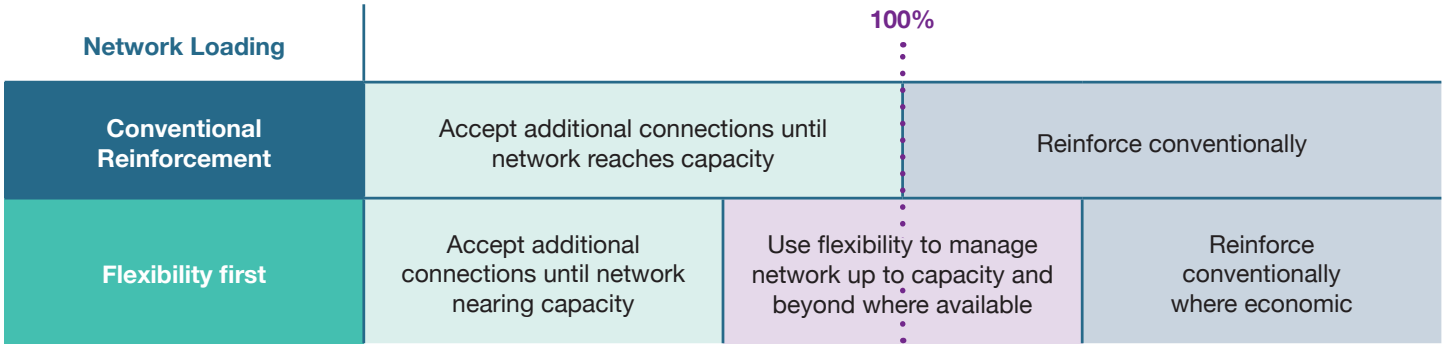
Since conventional reinforcement can take a long time to deliver, this can cause problems and delays for customers that want to connect to heavily loaded parts of the network. They may have to wait until the network is reinforced until they can connect or accept a lower capacity connection.

Flexibility can provide more granular network capacity increases, better matching the in-year requirements of network users.

Flexibility has the potential to manage capacity short-falls economically and responsively until the need for conventional reinforcement is more certain. In some circumstances, particularly where uncertainty is high, a greater period of operation of flexibility may allow for more optimal longer term investment plans to be implemented. Flexibility can also be used to allow new customers to connect to heavily loaded parts of the network without the need for reinforcement.

While we will be making greater use of flexibility, we anticipate that there will be situations where it is necessary to carry out conventional network reinforcement. This will be where there is insufficient flexibility provision for the scale of network constraint.

The following diagram illustrates the different approaches that may arise.



Approaches to using flexibility to improve network utilisation.

6. System Operator in Detail – our work to develop DSO Functions

Timing of Investment and Use of Flexibility

Until distribution flexibility is sufficiently developed and ubiquitous enough to be relied on, the identification of flexibility provision needs to be carried out at an earlier stage compared to when conventional reinforcement work would start. This is to allow sufficient time for the assessment of whether there is sufficient flexibility available and (in circumstances where it is not available) still have sufficient time to carry out the conventional reinforcement.

WPD has an investment trigger for flexibility ahead of when conventional reinforcement would be undertaken.

This ensures that the flexibility market is fully explored in advance of when conventional reinforcement needs to start. Generally, this will involve publishing flexibility requirements and investing in flexibility 12 months ahead of when a conventional investment decision would be made.

At the time of reaching the decision for conventional reinforcement, further flexibility can be sought to determine whether the conventional reinforcement can be deferred or replaced completely by flexibility solutions.

Cost Benefit Analysis will underpin any decision making;

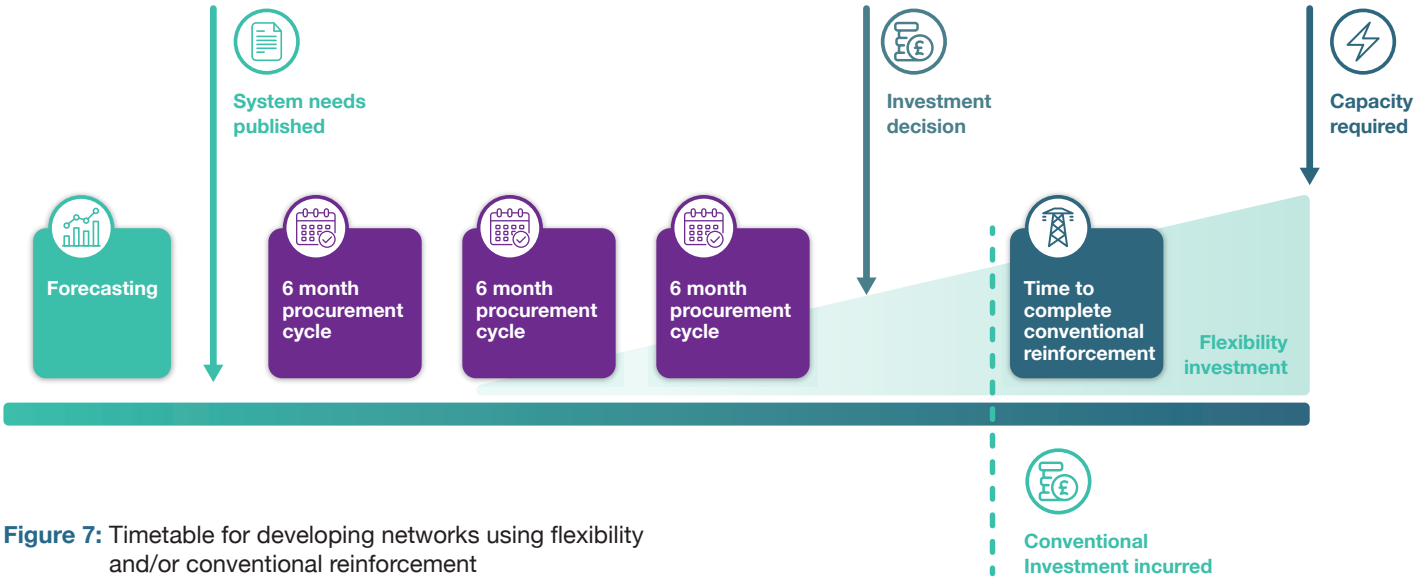


Figure 7: Timetable for developing networks using flexibility and/or conventional reinforcement

If, however, there is insufficient flexibility available in the market, the conventional reinforcement will need to take place.

Using flexibility to provide capacity for new connections

As well as using flexibility to provide additional capacity to manage load related constraints, WPD has developed and trialled processes to use flexibility to provide additional capacity for new connections coming onto the network.

As well as using flexibility to provide additional capacity to manage load related constraints, WPD has developed and trialled processes to use flexibility to provide additional capacity for new connections coming onto the network.

In Constraint Management Zones, any flexibility that is provided from the market in excess of requirements to meet existing network constraints can be used to offer capacity for new connections. New connections that trigger the need for reinforcement will be offered the option of having a flexibility solution as an alternative to conventional reinforcement. Depending on the scale of requirement this may allow more time for the construction of the conventional reinforcement, defer the conventional reinforcement or remove the need for conventional reinforcement. This will allow the connection to proceed more quickly and may reduce the costs for the connecting customer. Similar to conventional reinforcement, WPD will take on the liability and costs associated with providing the network capacity by contracting with the flexibility provider.

This will provide confidence for the connecting customers that the network will be managed in a way that provides them with the power they require.

Connecting customers will be offered two methods of paying for these costs; one option will be to pay the costs for flexibility and assets retrospectively on an annual basis, the other option will be to settle the costs upfront, based on WPD's best view of the blend of flexibility and asset costs that will be required.

The first option will be settled against actual costs incurred and will be subject to variations due to external factors such as the market cost of flexibility and deviations from assumed network loadings. The second option will be a fixed cost and benefit from a reduction due to NPV applied for future costs.

Both of these options will allow the connection to be made without using Active Network Management and without any risk of curtailment and both will still have costs apportioned based on the network capacity. WPD will manage the constraints using flexibility and take on the risk and responsibility for doing so.

These arrangements were piloted as part of WPD ICE plan in 2019 and the pilots have allowed the development of the commercial details.

Distribution Network Options Analysis (DNOA)

WPD's DNOA process (formerly the System Investment Assessment process) provides a systematic methodology to recommend a single investment option.

Conventional network reinforcement typically requires a large upfront capital expenditure and for larger investments, which take a longer time to construct, the costs might be incurred across a number of years.

Deferment of reinforcement by flexibility requires ongoing payments to flexibility providers to turn down/up import or export of power to allow other customers in the CMZ to save the power for their needs.

Initially flexibility costs may be small, however as network requirements grow more flexibility will need to be procured, resulting in flexibility costs rising year-on-year. Should changes in demand or generation reduce the network requirements, these flexibility costs may reduce.

WPD compares the viability of the various options by using the Common Evaluation Methodology (CEM) process, which has been developed under Open Networks. This process considers multiple factors including financial, society, losses, safety and carbon benefits to determine the right investment pathway.

6. System Operator in Detail – our work to develop DSO Functions

Network Operations

Changes to Network Operations

Traditionally the operation of the distribution networks has been relatively passive. Power flows have been one directional from the transmission system to consumers. Network Operation has mainly focused on responding to network faults and alarms, outage planning and coordinating access to the network for work activities. These functions will continue into the future.

However, the growth in intermittent distributed generation and decarbonisation of transport and heat has led to reverse power flows, increase loads and greater need to redirect power flows away from heavily loaded parts of the network. This has resulted in implementation of Active Network Management for constraining new connections and evolution of flexibility markets, where capacity is provided by flexibility providers adjusting their demand or generation output.

In addition, there are other drivers of optimising the operation of the network including managing voltages, losses and power factor that need increasingly sophisticated and smart ways of network operation.

This is requiring new data and processes for analysing what is happening on the network and more active ways of managing constraints such as processes for dispatching flexibility and greater coordination with the Electricity System Operator.

The volumes of data will significantly increase and systems will need to be enhanced or developed to enable efficient and effective operation of the networks. The primary objectives of operating the network safely and maintaining network reliability will remain unchanged.

Flexible Connections and Flexible Power

Traditional approaches to providing connections require customers to fund a proportion of the network reinforcement costs where additional network capacity is required. At higher voltages this work may also take a number of years to deliver. For new connections this poses delays and costs.

WPD has developed a suite of flexible connections that offer the opportunity for the connection to be made at lower costs and with quicker timescales recognising some form of curtailment may be required at times of high network loads.

Our flexible connections suite has developed options in two areas for customers seeking to connect to the grid. A Timed connection offers a very simple way of acting flexibly, without the need for communications or monitoring. Timed connection customers schedule their load to avoid specific times. Load Managed connections make use of ANM technology to control generation or demand behind single or more complex constraints. These are particularly useful in areas of constraint as an alternative to network reinforcement.

Flexible Power solutions are contractual arrangements where customers with controllable demand or generation are able to provide services to help WPD manage the capacity of the network. They are used as a lower cost alternatives to reinforcing the networks and the services are procured through a flexibility market.

WPD has been pioneering the use of flexibility solutions during RIIO-ED1, but they will be used increasingly as more demand connects to the network.

There are three types of flexibility services that are used:

Secure – used to proactively manage peak demand.

Dynamic – used to support the network in case of a coincident fault during network maintenance.

Restore – used to reduce the stress on the network during fault situations, with flexibility providers responding within 15 minute.

The existing IT platform used to assess the requirements for flexibility, manage the dispatch and make payments for the flexibility provided has limited capacity and a more enduring solution is required to ensure that flexibility can be used to a greater extent.

Market Development

Providing market information for flexibility services

WPD recognises that across the distribution network there are many electricity consumers that have the potential to shift their demand, by amending when they use power, or adjusting their export from on-site generation.

The flexibility market allows these customers to earn a financial payment for the provision of specified flexibility services. The type and amount of service required is dependent upon the nature and scale of a constraint on the network, which could be as a result of increased loads at certain points in time or increased generation.

Forecasting

Forecasting is a more accurate single-scenario view of the constraint on the network across a two-year window. It explicitly states WPD's flexibility requirements and is used to advise what flexibility is being sought during procurement cycles.

Like Signposting, Forecasting also describes the amount of flexibility required and specifies the availability window (i.e. when the flexibility is required), but over a shorter, more defined timescale.

Forecasting data enables flexibility providers to respond to flexibility tenders and as it is openly available allows different providers to have the same opportunity to participate in the market.

Accessibility to markets

WPD expects that flexibility services will be provided by many different market participants including: demand-response aggregators, electricity suppliers, generation operators, battery operators, industrial and commercial customers, local authorities, community groups and electric vehicle charging operators.

Recognising that each of these participants may wish to provide services to WPD through a variety of routes, we have established access through a number of channels.

Flexible Power

The Flexible Power brand has been created by WPD to deliver the procurement of demand response services. It acts as our customer facing brand when seeking flexibility services and is implemented consistently across all four of our licence areas. As well as providing visibility and enabling routes to participation, Flexible Power also encompasses our flexibility participant portal and electronic dispatch, monitoring and settlement services.

piclo®

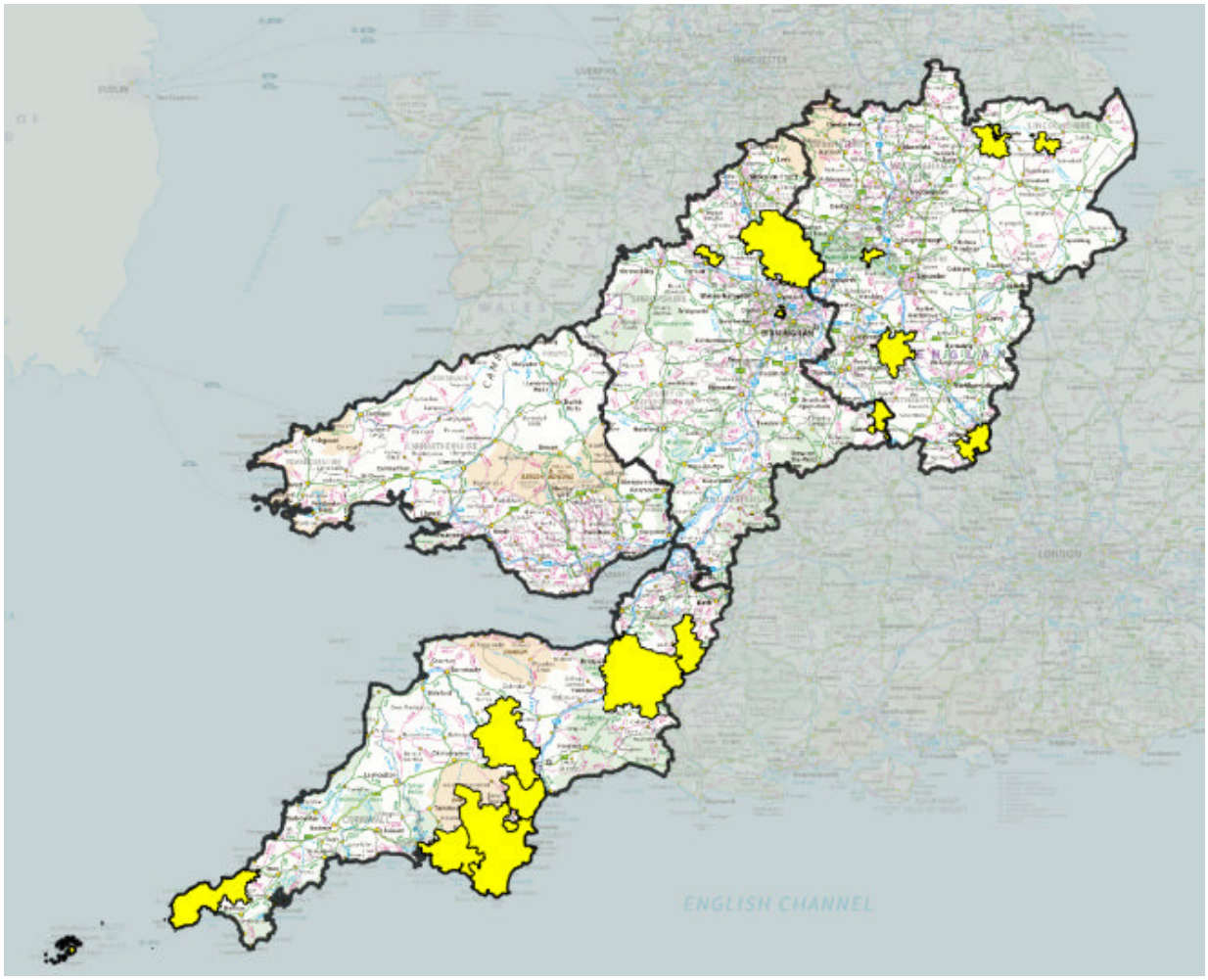
Piclo has developed and trialled the UK's first GB-wide flexibility marketplace, supported by funding from BEIS Energy Entrepreneurs Fund. WPD has displayed its flexibility requirements on the Piclo platform since November 2018. Flexibility providers with matching assets in WPD Constraint Management Zones are directed to WPD's Flexible Power site to enter procurement.

At a more local level, since July 2017, WPD has partnered on Centrica's Cornwall Local Energy Market (LEM) project, which is developing a virtual marketplace for flexibility services across the Cornwall region. The Cornwall LEM project is targeting both business and residential customers and is providing new technology solutions to enable flexibility and help unlock new revenue streams for customers.

6. System Operator in Detail – our work to develop DSO Functions

Market Development

WPD's Flexible Power website provides a map of the CMZs location, a postcode finder to allow potential suppliers to confirm their site is within the CMZ and the operational window the demand response will be required in.



The operational window details; the time of day, day of week and month of year, MW change required and a forecast of the total MWhs. Operational windows will generally be seasonal to support the constraints within the summer and winter demand peaks.

To ensure that WPD is able to stimulate market participation through multiple routes, we are enhancing Flexible Power to provide better market integration.

These actions are going to be completed during RIIO-ED1 and include:

- **Availability of geographic and postcode information for platforms to pre-qualify and validate flexibility assets (Q1 2021).**
- **Standardisation of visibility and forecasting data for hosting on flexibility platforms (implemented).**
- **Improved sources of data for asset qualification – e.g. linking MPAN to constraint managed zones (Q1 2022).**

Our System Operator Projects

Network Analysis for DSO

This project implements a set of new applications that support the increasingly complex analysis of network requirements and optioneering of solutions.

Traditionally DNOs have analysed and planned the network against set of relatively certain external parameters such as future load growth. However, the range of scenarios for future growth of electric vehicles, heat pumps and distributed energy resources means that there is a requirement to carry out multiple sets of network analysis against the range of future energy scenarios. In addition there are more network solutions available; WPD has a suite of smarter or flexibility based solutions which could be used instead, or in conjunction with, conventional network infrastructure upgrades.

We will need to increasingly carry out more technically complex studies. Such analysis, optioneering and optimisation will be supported in RIIO-ED2 by a new set of applications.

The applications will bring together time series data for measured points on the network, DER and DSR metering data and Active Network Management/Intertrip/Protection schemes data and provide the capability to assess all the requirements together to understand where there are network constraints that require additional capacity.

Stability Analysis

Traditionally, there was a large amount of inertia within the power systems, with large turbines at large power stations spinning at high speeds.

This stored energy is particularly valuable when a generator fails as the spinning reserve can make up the power lost thus maintaining the stability of the network. However, the closure of numerous coal fired and large power stations and move to more intermittent distributed energy resources with an inherent low-inertia operation. This impacts the dynamic behaviour of the grid as the amount and characteristics of the inertia is changing with more of it being connected to the distribution networks.

Distribution network operators have traditionally not had to model for stability conditions on the system, but as the energy system changes, a lower inertia power system may place additional constraints on distribution network operation. When generation meets demands and all necessary conditions such as voltage and frequency are maintained, the system is stable and balanced. However, any mismatch or excursions outside required parameters can cause generators or circuits to trip, which can then cause other issues and further trips.

The project will understand and model sub-second voltage collapse conditions and how these may drive requirements on how distribution network operation can support the voltage stability of the system.

6. System Operator in Detail – our work to develop DSO Functions

Our System Operator Projects

Planning State Estimation

State estimation is used to provide a view of the network configuration and operational status, informed by a set of measurements and data. Within a planning context it is used to determine representative characteristics of the network to allow network planning and development decisions to be made.

Increased network monitoring and new sources of data mean that there is greater scope to improve state estimation for planning purposes and also the various data sources can be used to cross-check each other and identify data anomalies.

This project will seek to merge the data streams from more accurate real-time monitoring, current/historical network configuration topologies and alternative sources of network data to improve state estimation being used in network planning.

Inconsistencies, errors and inaccuracies can be identified through the state estimation modelling and these issues can be fed back for resolution in the core systems to improve data quality and reliability.

DFES Data Architecture and Systems

Distribution Future Energy Scenario (DFES) work completed within WPD uses data from local authority and other key local stakeholders, supplements it with market information on technology roll out and allows national energy system predictions to be regionalised, informing WPD investment plans and requirements for additional network capacity.

As the importance of this data increases in identifying network needs, driving flexibility markets and having more of the data shared for third party use, a productionised data architecture needs to be adopted to ensure the DFES process is more efficient, consistent and repeatable providing information that is accurate and accessible.

DFES data architectures will need to be designed around third party access to the datasets. To enable this, there may be a requirement for performance aggregation, anonmisation or other reporting functions on this data before making it available publicly.

This project will also develop the systems to facilitate this.

7. Distribution System Operation Enablers in Detail – our work within DNO to support DSO

Planning and Network Development

On the high voltage (11kV and higher) networks, full network visibility down to Primary Substation level will allow WPD's Active Network Management systems to minimise the amount of curtailment customers are subject to while maximising asset utilisation and maintaining network security.

On low voltage networks, monitoring of Distribution Substations will ensure that network reinforcements are carried out when and where they are needed and provide the necessary data to enable "Smart" solutions to be deployed where required to further optimise asset utilisation.

In addition to providing WPD with the necessary real-time data to actively manage its network, the installed monitoring will also provide shareable data to support emerging Flexibility markets. This data can be further augmented with Smart Meter data to provide network information where monitoring is not available. We have estimated that a feeder requires 80% of customers to have smart meters fitted for it to provide a reasonable representation of the whole feeder.

To check that this estimation is correct we are comparing the smart meter data to data for the whole feeder from monitoring equipment installed at the substation. We are testing a range of densities from 60% to 100% to identify the appropriate level of density that provides a reliable indication. This will help us to refine the generic assumption used for planning and open up the opportunity for bespoke analysis for each feeder based upon its own profile.

In addition to monitoring load flows and voltages, WPD will increase its monitoring of power quality. This additional information will further facilitate the connection Low Carbon Technologies (LCTs) while ensuring the network outages resulting from excessive harmonic distortion, for example, are avoided. Full details, including costs and benefits, of WPD's approach have been published in our Sensors and Monitoring Strategy.

Data sharing in a fast and efficient way becomes key as more data sets interact. We will ensure that our planning data is made available in a standard format to increase the efficiency of data sharing. We will use the Open Networks project to ensure that our approach is coordinated with other network and system operators.

There are a range of changes that are required to improve our data management we view this as a journey where we need to track and measure our progress to ensure we continue to focus in the right areas. We have already demonstrated improvements in our data management processes through targeted project activity to understand our data sets, lineage, and business and third-party use. We recognise the need for a consistent approach to data management, delivering standardised and effective processes to share data with other network licensees and wider customers and stakeholders.

We continue to collaborate with all other network licensees through ENA to establish common data descriptions, metadata standards and approaches to sharing data to ensure that a standardised and interoperable process is taken forwards. We have demonstrated leadership in this area as the first GB DNO to share its complete asset and connectivity data, above LV, in Common Information Model (CIM) format.

7. Distribution System Operation Enablers in Detail – our work within DNO to support DSO

We have already undertaken a number of digitalisation and data enhancements aligned to these principles including adoption of the Dublin Core metadata standard; providing data in a discoverable and accessible form (e.g. information maps, guiding users to key network and supporting information); establishing data governance roles and implementing a data triage process.

Our external engagement recognises that different users have different needs and expectations of the same data.

That means that ensuring the right data is available in the right format at the right time will lead to different formats at different times to serve different users.

Customers can self-serve this data using our interactive maps and download features. The base data is also available to download for use in third party models and systems.

Improving and increasing data management acts as the backbone to drive insight both internally and externally to meet current and future system needs. Standard processes for creating, managing and handling data though a robust data governance process has been implemented and will continue to be developed; investing in solutions to improve our data quality; and ensuring we have a "single source of the truth".

Our online Data Hub is already home to many sets of network data and information. We recognise the needs of different data user types vary and therefore for each relevant dataset we commit to sharing data in three principle formats to deliver usable and valuable data to as wide an audience as possible.

Easy to use and visual data representations, such as interactive heat maps of network capacity data, provide the direct route to answers for none technical data users. Downloadable, standardised and interpretable data provide opportunities for data users to interrogate and drive their own insight and value, different to that presented in visualised representations.

At the most interactive level data automatically presented to technical data users through application programming interfaces (API), focused on regular and repeatable data to, for instance, inform real-time dispatch detail for aggregators and flexibility providers.

Promote Operational network visibility and data availability

We have already established the ability to share our network information through the standard CIM format. This allows other operators and stakeholders to run their own modelling and simulations against our base network. Some outputs, such as losses recorded at substation level, will rely on third party projects such as the roll-out of Smart Meters so we will develop solutions to make use of these projects as they complete.

This visibility will cover real and reactive power, for both import (demand) and export (generation) connections. As well as ensuring the power flows on the network are monitored with high granularity, our systems will allow the energy distribution patterns to be recorded and traced. By viewing energy flows on a temporal basis, we can forecast requirements and ensure the network is pro-actively managed in an optimum way. Complex data analytical tools will be deployed to allow us to visualise and interrogate the data. We will share the results of this enhance visibility with customers, their energy suppliers and the NETSO.

Our implementation and continuing management of a Data Catalogue will provide regular and reliance single point access to trusted data in a timely and effective manner.

This will also facilitate a single self-service environment to its users that help them to find, understand, trust and manage data. Further, it will be clear to all data users within the organisation what each piece of data means, how it's collected, and how to use it effectively.

We use a common data triage process to assess the openness of data. This is applied to assess data classification and determine whether anonymisation or redaction is required to enable the data to be shared. This results in either Open, Public, Shared or Closed classification.

A summary assessment is published along with the dataset to provide stakeholders an explanation of the data classification.

Facilitate efficient dispatch of distribution flexibility services

The real-time requirement for decision making drives this activity to be completed in our Network Control Centres which have a 24/7 presence. This is already being completed as a look ahead task with the ESO but the network is managed in real time at arm's length from the NG network, with interactions based on forecasts predictions or unplanned events.

This interaction will become more real-time and detailed, with more DER instructions offering solutions to both. Automated systems and interfaces will help manage the efficient dispatch. Working across the industry through the ENA we will establish base rules for the industry in conjunction with other DNOs.

This level of standardisation will be important for the ESO. Innovation projects such as the UKPN KASM project will provide a useful basis for solutions. We already have our own acceptance and dispatch principles published on the Flexible Power website, they were developed in 2019 and will be reviewed as industry level work continues.

As systems become more detailed and interactive, rules will be set to ensure DERs can operate efficiently. It is important that rules are equitable to all network participants. These will be created transparently with stakeholder engagement through the WPD DER Owner Operator forum. Through the Midlands RDP, WPD is already working with the ESO to develop these primacy rules. Once developed they will feed into Open Networks.

WPD's flexibility contracts are aligned to the Open Networks common contract and these allow for the substitution or exchange of flexibility services, subject to WPD approval. As well as allowing for bi-lateral trades of these contracts, WPD will publish the data which will enable peer to peer markets to further facilitate this trading activity.

We will support the secondary trading of distribution flexibility services and curtailment obligations by providing relevant data. We recognise it's important that our data is presented in the same format, described in the same way and provides the same level of detail as that of other network operators.

This allows customers and stakeholders to have a consistent view of the data across the industry to support existing, new and developing markets.

Whilst interoperability of systems is important, it is also worth noting that the WPD network management tool is established, so proprietary systems are inevitable in network management. It is important, however, that these systems can manage interfaces with generic systems. We will ensure that our instruction infrastructure can communicate with third party systems.

As our use of flexibility services increases we will expand and grow our dispatch infrastructure to meet the requirements. Scalability is a key feature of our solutions. During the RIIO-ED2 period we will replace and scale our platforms as required, with work starting in 2026.

WPD has operated and scaled up Flexible Power since its early inception in 2016 as an innovation project, through to the current day, where it regularly instructs 100s of MWhs of flexibility services and has been adopted by 3 other DNOs. Flexible Power dispatch instructions are electronic initiated through open APIs, which require no proprietary hardware onsite.

Our Flexible Power systems are able to work with other systems, such as the interface to Kiwi Power. We remain open to other providers taking signals and data from systems and inputting back into them. Although our ANM systems do not provide a DSR response, we have followed the same ethos and openness.

Our PowerOn system already interfaces with ANM systems from two providers and is able to interact with other platforms.

7. Distribution System Operation Enablers in Detail – our work within DNO to support DSO

Provide accurate user friendly and comprehensive market information

We are committed to continuing to build on our significant work to date digitalising our business to ensure that we remain an efficient and effective operator of our network and deliver data and solutions in the right format, at the right time to customers and stakeholders to meet their needs and ambitions. Our core principles are and will remain improving data management, increasing network insight and operation and ensuring data is presumed open.

Data provision in a useful format is essential and we will develop systems that can integrate through API links and machine readable formats. The information must be easily accessible and navigable. We will tailor both their information provision and engagement approaches to reflect different needs of potential market participants, including groups in vulnerable situations.

Our core principles are and will remain improving data management, increasing network insight and operation and ensuring data is presumed open.

These principles ensure value is driven to all parts of the energy industry and wider, supporting the net zero transition.

Embed simple, fair, and transparent rules and processes for procuring distribution flexibility services

We do not offer a direct route to our systems, all our control instructions are via API links to third party platform providers and aggregators.

We actively encourage the emergence of this sector and will continue to offer "plug-in" solutions to remain neutral in the market. All WPD's procurement data and system need information is downloadable and processable by third parties. We have previously used CLEM, NODES and PICLO for procurement routes. **Note 3.2.2**

Through the Midlands RDP, WPD is working with the ESO to develop how the existing DSO products can serve Transmission constraint needs. This will feed into Open Networks. **Note 3.2.9**

The ESO is the key organisation for managing the wider UK network. We already interact with them when planning ahead for DNO and ESO needs. In real time there is no detailed visibility of ESO needs within the DNO environments as a standard, this is managed by exception and when events occur. Within our ANM systems we cross link WPD constraints with NG constraint signals to ensure that our own actions do not undermine the responses being called for by the ESO.

WPD helped support the development of work around the stackability assessment of DSO flexibility products and their interaction with ESO flexibility services. The industry standard products implemented by WPD enable both transmission and distribution needs to be met. Contracts put in place by WPD also provide no barriers to serving whole electricity system needs.

We will investigate the additional arrangements that are required to support DERs and the ESO in a more real time automated basis. **Note 3.2.10**

We are committed to making sure that our data is both discoverable and searchable, this means more than ensuring WPD specifically and ensuring that we continue to collaborate with wider industry to ensure that data, irrespective of organisation, has the same meaning, format and description (metadata and data dictionaries). We continue to collaborate with all other network licensees through ENA to establish common data descriptions, metadata standards and approaches to sharing data to ensure that a standardised and interoperable process is taken forwards. We have demonstrated leadership in this area as the first GB DNO to share its complete asset and connectivity data, above LV, in Common Information Model (CIM) format.

Presuming our data to be open goes beyond making it available through our systems and services. Our role is to enable data to be harvested, housed and utilised irrespective of specific access point. Our implementation of APIs and Client URLs will ensure that this is available and appropriate. Our ENA wide work on the creation of an energy digital system map for GB has demonstrated our commitment to and the availability of our data to serve this purpose. **Note 3.2.11**

Our Distribution System Operation Projects

Project – Improved Network Monitoring and Power Flow Sensing

The last decade or so has seen a very significant change in the nature of connections to the distribution network. Historically, generation was dominated by large, mostly fossil-fuel powered thermal power stations connected to the transmission system at 275/400kV. Power was transferred from the transmission system to consumers via distribution system Grid Supply Points (GSPs) at 132kV and down, ultimately, to 415V (LV).

Building a network to cope passively with new potential peaks and possible reverse power flows would be very costly and inefficient. However, many of the new LCTs being installed offer their own opportunities to mitigate their impact – for example battery storage systems and electric vehicles can be used to "soak up" excess generation in order to reduce levels of reverse power flow, while incentives in the form of price signals can encourage customers to modify their consumption patterns in order to reduce peak levels of demand. Such adoption of "smart" technologies to actively manage load will have significant benefit to costs, reliability, and security of supply.

WPD will aim for 100% visibility of its 11kV and higher voltage networks by ensuring that directional power flow measurements are available at all of its Primary substations. All new substations now require the necessary instrument transformers and transducers. In total, approximately £35m will be spent by the end of the RIIO-ED2 price control period, with substations prioritised according to need – those within active ANM zones and/or with significant alternative connections as well as areas of the network being supported by DSR (flexibility) contracts.

While also beneficial to WPD in optimising its network design and reinforcement activities, the largest benefit is likely to be to the industry (and society) as a whole, with the value of generation that would benefit from new connection agreements estimated at £123m across the WPD network.

Project – Automated Data Mastering Solution

Throughout the business a level of automated data mastering, which is the central storing of data in a single location and sharing it, routinely, with other related systems. In to RIIO-ED2 and beyond there is a need to further increase this level of data mastering and implement increased automation, supporting our transition to a single source of data.

This will deliver operational, flexibility and performance improvement through the provision of improved quality, completeness and volume of relevant data internally and externally to enable optimised and new connection and flexibility services.

Given the evolving needs of customers and stakeholders, robust and validated data sets are required to deliver operational, planning and maintenance efficiency for customers and internal stakeholders alike. It also enables our human, processes and technological systems to operate effectively by delivery our business objectives.

Master data management (MDM) is a technology-enabled discipline in which business and IT work together to ensure the uniformity, accuracy, stewardship, semantic consistency and accountability of the enterprise's official shared master data assets. Master data is the consistent and uniform set of identifiers and extended attributes that describes the core entities of the enterprise including customers, prospects, citizens, suppliers, sites, hierarchies and chart of accounts.

Utilising modern approaches to ensure this consistency between systems is crucial in achieving our business goals and ensuring that data can be easily accessed, shared and utilised throughout the organisation and externally, enabling the effective operation of DSO services.

This project will facilitate multiple outcomes with a number included below:

- **Common Information Models (CIM) available internally and externally to drive consistent understanding over assets and connectivity to improve operations.**
- **Enabling single source of truth data to enable LV to EHV self-serve design functionality improving connections and flexibility service provision.**
- **Automated data sharing such, such as in ICCP format to National Grid and other DNOs.**

7. Distribution System Operation Enablers in Detail – our work within DNO to support DSO

Our Distribution System Operation Projects

Project – Time Series Historian Analysis System

Much effort during RIIO-ED1 has been spent on increasing the reliability, quality and dependability of our time series data within our systems and we have shared a significant element of this in real-time.

RIIO-ED2 is the right time to ensure the same is true of time series data between systems, such as our Advanced Distribution Management System (ADMS), smart metering and low voltage (LV) monitoring data; this will ensure that we can both maximising the value of our time series data internally to further optimise short and long term planning and operational decision making as well as providing increased granularity of real-time data to customers and stakeholders to support improvements in their planning, operational and flexibility decisions.

We recognise that customer and stakeholder needs are dynamic. We also recognise that to deliver excellent customer service, societal, environmental and system reliability we must create value for money throughout our decision-making processes. Using high quality, high resolution and confident data sets.

As we increase the amount of data regarding customers, assets and operations this future capability, namely to make timely decisions with high levels of confidence becomes ever more important and providing that to customers to do the same. As does our ability to contextualise and govern high volume data sets, ensuring that high quality data is informing our decisions processes. In order to facilitate the next step change in our journey to make more informed, more confident and more assured operational decisions we are looking to develop the capture, collation and utilisation of time series data from across our various systems.

This project will facilitate multiple outcomes with a number included below:

- **Real-time and historic time series data available openly to at least primary substation level and LV where appropriate.**
- **Enabling real-time flexibility data for scheduling and settlement purposes.**
- **Facilitating a fully enabled flexibility management system.**
- **Optimisation of integrated DNO and DSO operational systems.**

Project – Open Cloud Data Platform

Our work to date enabled us to be the first DNO to make an online data catalogue available, providing access to our datasets in a common location, with standardised definitions and descriptions to ensure the data is usable and interoperable.

Our current network operations and future operation plans are reliant on robust, reliable and transparent data to continue delivering exceptional services. Sharing this data through a secure, interactive Open Cloud Data Platform will provide benefit to customers and stakeholders to be make more informed decisions.

Delivering on the net zero overarching governance, changes are required to both energy usage and delivery, as well as, more imperatively, to ensure that the data that drives these changes is effectively utilised. Building on our initial data portal, the implementation of an Open Cloud Data Platform will enable the ability to share datasets quicker, reduce the risk of data errors through the reduction in the requirement for human interaction and developing and implementing a framework embedded in a cloud architecture.

This improved method of providing data to the customers will unlock opportunities for new processes to be developed, resulting in there being an expansion in the services and network activities that are facilitated.

This project will facilitate multiple outcomes with a number included below:

- **All data centrally accessible and described consistently ensuring it is standardised and interoperable from asset information to operational data to ensure open and fair flexibility services.**
- **Historic and database level data accessible to meet the needs of a wide range of user types.**

Project – Internal Data Platform

Implementation of an Internal Data Platform to provide a centralised process for data systems to transfer data, which staff can trust and utilise across different systems and environments to continue to move away from a decentralised, historic knowledge-based culture and ensure that we deliver a data centric approach as an organisation.

Linked to automated data mastering the central storage and utilisation of data will be a critical step in meeting future DSO requirements and accessing benefits.

At the same time, it will enable a move to probabilistic-based asset and network operation. It will ensue that the business is set for the future, enabling more effective decision making, and overall trust within the business regarding the accuracy and validity of data used in these decisions.

This solution is fundamental to delivering multiple outputs as described above as well as outcomes, such as:

- **DFES Data Architecture and Systems.**
- **Planning State Estimation solution implemented.**
- **Network Analysis for DNO and DSO functionality.**
- **Enabling real-time flexibility data for scheduling and settlement purposes.**
- **Facilitating a fully enabled flexibility management system.**
- **Optimisation of integrated DNO and DSO operational systems.**

8. Governance Arrangements

Governance arrangements for the development of flexibility services

WPD's governance arrangements for the development of flexibility services include extensive stakeholder engagement, publication of information and standardisation across the industry. WPD has a strong track record of responding to customer requirements and developing new processes and arrangements. Innovation projects have been influential in the evolution of flexible services, resulting in development in active network management and procurement/deployment of flexibility.

Flexible Power, our flexibility product, was developed through the ENTIRE innovation project where we engaged stakeholders throughout the process and have since sought to make Flexible Power a standard for flexibility across all DNOs.

We continue to engage with stakeholders taking on their feedback and evolving flexibility contracts and operational arrangements.

We have been procuring flexibility services since 2018 and have the largest contracted amount of flexibility provision which is offsetting the need for conventional reinforcement.

We are transparent about the needs of the network with the data that we publish about Constraint Management Zones, transparent about pricing structures, transparent about contractual arrangements and transparent about how we will dispatch flexibility.

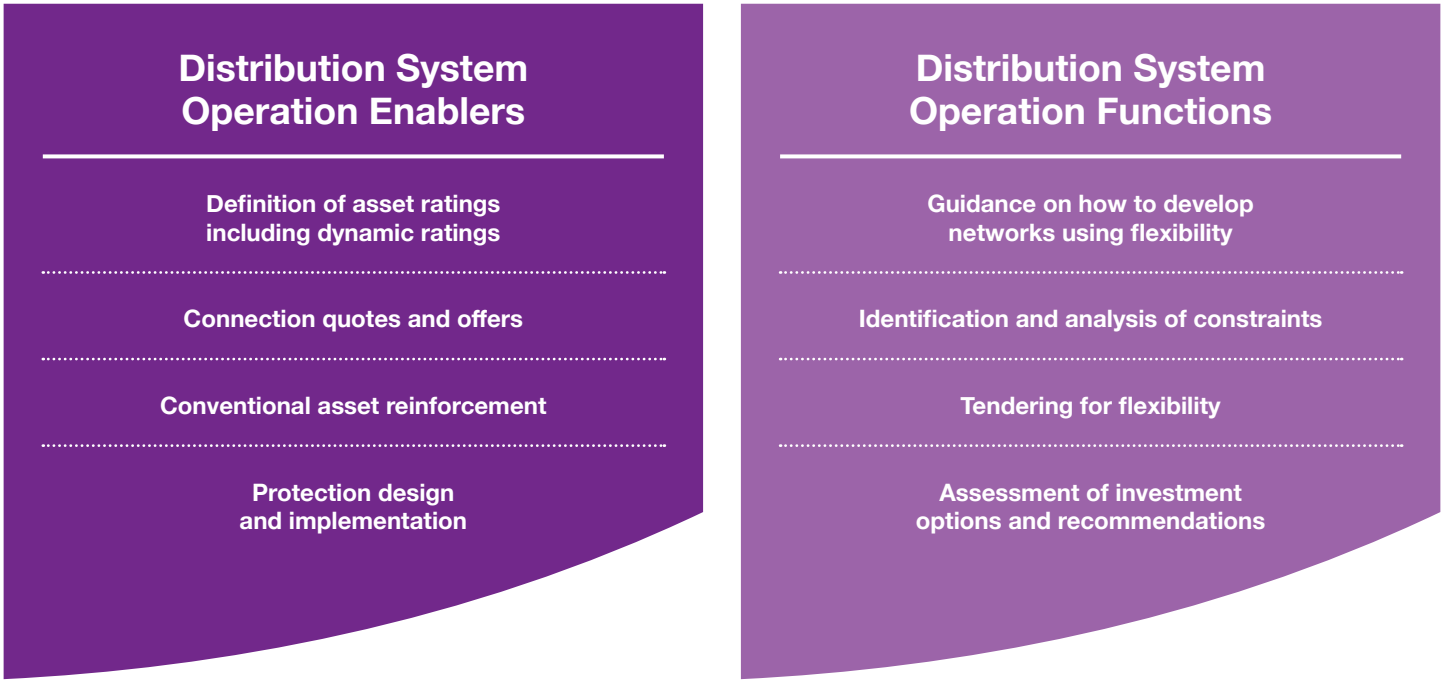
As flexibility markets develop in RIIO-ED2 for capacity constraints, network access, network design or commercial arrangements we will continue to develop processes to ensure that we will provide neutral facilitation of those markets.

This insight from WPD work has also enabled WPD to be influential within common arrangements across the industry that have been developed through ENA Open Networks.

WPD supports greater commonality across the industry, so that customers and flexibility providers have clarity and consistency irrespective of which network operator they are dealing with.

Governance arrangements for independence of decision making

To determine the most economic investment on the network which will deliver the required outcomes, WPD uses the DNOA process which recommends an investment option based on the profiled capital and operational expenditures of a range of technically viable possibilities. DNO activities are undertaken by the Network Design function which defines how assets are installed, maintained and repaired, including defining the applicable capacity ratings which can be delivered by those assets.



The DSO function is responsible for understanding how the system operates and identifying the potential capacity shortfalls or network limitations that require additional investment. It develops the flexibility products suited to meeting those system constraints and ensures sufficient information is published so that distribution flexibility markets can be established.

The DSO function will assess the different investment options identified and make recommendations based on published criteria. The resulting recommendations will also be published to ensure transparency and enable scrutiny.

Should the investment recommendation be to use flexibility, then the DSO will procure flexibility services through the market to meet those system needs. If the investment recommendation is to use conventional reinforcement, the DSO function will instruct the DNO function to commence conventional network build.

The decisions made leading to the recommendations will be subject to audit to ensure compliance with the agreed processes.

APPENDIX X

Role 1: Planning and network development

1.1 DNOs to define and develop enhanced forecasting, simulation and network modelling capabilities, with processes in place to drive continual improvement to meet network and user needs.

1.2 We expect increased monitoring equipment to be rolled out across their network where it has demonstrable net value. We expect demonstrable value to include a rigorous presentation and analysis of needs and use of data for networks and non-networks parties, well-established functional and technical specifications, and cost-effectiveness analysis. DNOs should also explore all reasonable options to use data from third parties, including harnessing smart meter data subject to data sharing agreements, to improve their simulated forecasting.

1.3 DNOs to have in place standard and effective processes for sharing network planning information with other network licensees, including the ESO, network users and other interested parties, for example to enable innovation and support the development of local government plans for decarbonisation.

1.4 As part of this, we expect DNOs to liaise with their network users to collate and share data, to publish comprehensive and comparable heat maps that provide network users high value information about where to connect, and to inform their operations.

1.5 These geographic information system datasets should be available for download or for access independently of DNO websites (for example, via Web Map Service server connections). Ofgem-led reforms to the LTDS will seek to licence minimum standards against these improvements.

1.6 DNOs to have in place transparent and robust processes for identifying and assessing options to resolve network needs, using competition where efficient. This should include demonstrable cross-sector45 engagement, optioneering, and planning with sectors or vectors other than their own.

1.7 DNOs should consider flexibility and promoting energy efficiency in addition to innovative use of existing network assets and traditional reinforcement. The process of identifying options should include engaging with other network licence holders and current and prospective network users. Options must be fairly compared against one another, with flexibility used where it is economic and efficient compared to investing in traditional reinforcement or technological solutions.

1.8 We expect a consistent approach for valuing flexibility, taking into account the option value it provides in the context of uncertainty. DNOs must ensure transparency in their approach to allow scrutiny of decision-making.

Role 2: Network operation
Activity 2.1: Promote operational network visibility and data availability

2.1.1 DNOs to improve network visibility and identification and sharing of operability constraints, including publishing this data to help avoid conflicting actions being taken by other network and system operators.

2.1.2 DNOs must take reasonable steps to access and subsequently share, including by publishing, data and operability constraint information in a timely manner.

2.1.3 DNOs to provide the ESO with information across timescales about the DER it is planning to instruct to dispatch. Data should include contracted parties, availability and information on scheduled and unscheduled utilisation. Sharing this information in a timely manner should enable the ESO to identify which DER are available for its own needs and improve the ability of DER to stack value across markets.

2.1.4 DNOs to gather sufficient information on DER characteristics and parameters to provide information and inform decisions to secure against events that could lead to disconnection of DER.

2.1.5 DNOs to make available operational data that supports network users and other relevant stakeholders to make better decisions about how to use the network. Data should be readily available in agreed and common data formats.

This could include, but is not limited to:

- Working network configuration data
- Losses recorded at substation level
- Outages both planned and unplanned
- As recorded historic Feeder MW/MVA Utilisation and calculated headroom/footroom
- Utilisation and curtailment of areas under the control of capacity management systems such as Active Network Management systems.

APPENDIX X

Activity 2.2: Facilitate efficient dispatch of distribution flexibility services

2.2.1 DNOs to have and regularly review a decision-making framework for when DER are instructed to dispatch in real-time. The decision-making process, including alternatives considered, should be transparent. This should promote coordination across services (including curtailment as part of non-firm connection agreements and ESO flexibility services), maximise liquidity, avoid market fragmentation and ensure dispatch results in the best outcome for the whole system; this includes service provision to the ESO and other distribution networks.

2.2.2 As part of this decision-making framework, there must be rules in place for coordinating dispatch instructions for DSO and ESO flexibility services. This could be through primacy rules or more comprehensive optimisation processes that better enable stacking of revenues for DER. The rules should be transparent, objective, and promote whole system efficiencies.

2.2.3 The DNOs shall facilitate secondary trading of distribution flexibility services and curtailment obligations. In this context, facilitating means providing the relevant operational data, ensuring the DNO has processes in place to collect the relevant data about the trade, and making the operational parameters clear (and justified in the context of network reliability and efficiency).

2.2.4 DNOs to introduce clear processes for the design, development, and communication of the decision-making framework. These should include transparent and participatory processes for stakeholder input.

2.2.5 DNOs to develop efficient, scalable dispatch instruction infrastructure and avoid proprietary systems.

2.2.6 We expect clear definitions of different types of dispatch instruction for distribution flexibility services and transparent rules about when and in which markets they should be used. Circumstances for different dispatch instructions should be well-justified. Definitions of these circumstances should be developed with input and cooperation from network users.

2.2.7 The application of hard dispatch controls shall be for the improved reliance on market-based mechanisms, not to the detriment of their development.

2.2.8 Capabilities in network operations, for example in dispatch instructions and associated system architectures shall not be hard coded to the DNO. These must be developed so that they can be cost effectively assigned to another party in future, if this is needed.

Role 3: Market development
Activity 3.1: Provide accurate, user-friendly and comprehensive market information

3.1.1 DNOs collate and publish as much relevant data and information as reasonable that will help market participants identify and value opportunities to provide network services to DNOs and take market actions that support efficient whole system outcomes. Relevant data and information include planning and operational data (such as that set out in Activity 1.1 and 2.1).

3.1.2 This should be provided with sufficient lead times to enable wider participation in distribution flexibility services markets. It also includes information on historic and future distribution flexibility services market actions. This should include tender results, prices bid and paid, the carbon content of aggregated units, how often DER is dispatched (and volumes) and other actions taken by the DNO (with anonymisation as required), including curtailment as part of non-firm connection agreements. The information should include all requirements set out in licence conditions to support DER to identify revenue opportunities. This increases the accessibility of tendering for distribution flexibility services for flexibility providers (while also taking account of DNOs flexibility needs).

3.1.3 DNOs should, with stakeholder input, develop robust strategies for how they will collate and publish more helpful information, wherever possible consistently and in coordination with other network licence holders, and communicate this clearly.

3.1.4 DNOs should regularly and actively engage with market participants to understand what data and information is helpful to support market development. While there will be minimum legal requirements set out in licences, we expect DNOs to use their stakeholder engagement to consider the most effective format and frequency of publishing that data to ensure it is user-friendly.

3.1.5 The information must be easily accessible and navigable. We expect this includes publishing data in machine-readable formats. DNOs should, where reasonable, tailor both their information provision and engagement approaches to reflect different needs of potential market participants, including groups in vulnerable situations.

3.1.6 In many instances, collaboration across DNOs in engagement is expected to reduce duplication, make it easier for stakeholders to engage and avoid stakeholder fatigue.

3.1.7 DNOs should seek to ensure the information they publish is as accurate and unbiased as reasonable (i.e. correct at time of publication, as close as possible to the actual value and not skewed in any direction).

APPENDIX X

Activity 3.2: Embed simple, fair, and transparent rules and processes for procuring distribution flexibility services

3.2.1 DNOs to have clear processes in place for developing and amending distribution flexibility services products, contracts, and qualification criteria, that are, wherever possible, standardised. The processes should be transparent and participatory, involving other DNOs, the ESO, and current and potential distribution flexibility service providers.

3.2.2 DNOs should also coordinate and engage with third party platform providers, who can offer system value by providing new routes to market and driving whole system outcomes. DNOs should not prevent the emergence of this sector and should enable third party platforms to 'plug-in' to DNOs' flexibility procurement processes.

3.2.3 Products and contracts should be adaptive to reflect prevailing system needs, type, and availability of flexible resources. The objective of these processes is to enable as wide participation in distribution flexibility services markets as possible.

3.2.4 DNOs should identify the optimum combination of longer and shorter term lengths of markets and contract lengths reflecting the network need. Needs should be neutrally defined, to allow for a range of flexibility providers to participate. This will help improve market liquidity and the opportunities for innovation and dynamic competition.

3.2.5 Individual decisions and frameworks for deciding market timeframes and contract lengths should be transparent, informed by stakeholders and justified as being the most economic and efficient solution. Notwithstanding, deviations from the standard should be justified with clear governance processes for managing change that should be clearly communicated.

3.2.6 DNOs should have clear, comprehensive and transparent mechanisms and associated commercial structures for coordinating distribution flexibility services and ESO flexibility services procurement.

3.2.7 DNOs shall not act as the commercial route for DER accessing ESO flexibility services.

3.2.8 Transparent (and possibly tripartite) commercial agreements may be required to reflect the potential effects of DER dispatch on distribution system operability and the role of DNOs in setting dispatch parameters (as set out in Activity 2.1 and 2.2). These agreements should remove exclusivity clauses as far as possible, including with regard to non-firm connections.

3.2.9 Coordination on dispatch parameters should enable a closer to real-time understanding of what DER needs to be armed and available for a particular service, and what can be available to provide other services.

3.2.10 DNOs should consider arrangements to support DERs to provide services that meet both DNO and ESO needs.

3.2.11 DNOs should make available the necessary data to enable secondary trading, for example capacity and other peer- to-peer trading. Enabling includes defining, communicating and justifying the parameters in which these trades can take place for operability purposes.

3.2.12 Market support services, such as pre-qualification, credit-checking and settlement must enable simple and cost-efficient participation in markets. DNOs should enable, and never prevent, the opportunity for third parties to provide these services where they could do so more efficiently.

3.2.13 DNOs to introduce other proportionate measures, developed with robust stakeholder engagement, to identify and address actual and perceived conflicts between its market development and network ownership roles or other business interests. Measures to address might include ring-fencing of particular teams and external auditing of objectivity in addition to measures that promote transparency and enable scrutiny.

APPENDIX Y

WPD Ref	Activity Description	Already in place	Due during RIIO-ED1	Planned in RIIO-ED2
1.1	DNOs to define and develop enhanced forecasting, simulation and network modelling capabilities, with processes in place to drive continual improvement to meet network and user needs			x
1.2	We expect increased monitoring equipment to be rolled out across their network where it has demonstrable net value. We expect demonstrable value to include a rigorous presentation and analysis of needs and use of data for networks and non-networks parties, well-established functional and technical specifications, and cost-effectiveness analysis. DNOs should also explore all reasonable options to use data from third parties, including harnessing smart meter data subject to data sharing agreements, to improve their simulated forecasting			x
1.3	DNOs to have in place standard and effective processes for sharing network planning information with other network licensees, including the ESO, network users and other interested parties, for example to enable innovation and support the development of local government plans for decarbonisation		x	
1.4	As part of this, we expect DNOs to liaise with their network users to collate and share data, to publish comprehensive and comparable heat maps that provide network users high value information about where to connect, and to inform their operations		x	
1.5	These geographic information system datasets should be available for download or for access independently of DNO websites (for example, via Web Map Service server connections). Ofgem-led reforms to the LTDS will seek to licence minimum standards against these improvements			x
1.6	DNOs to have in place transparent and robust processes for identifying and assessing options to resolve network needs, using competition where efficient. This should include demonstrable cross-sector45 engagement, optioneering, and planning with sectors or vectors other than their own	x		
1.7	DNOs should consider flexibility and promoting energy efficiency in addition to innovative use of existing network assets and traditional reinforcement. The process of identifying options should include engaging with other network licence holders and current and prospective network users. Options must be fairly compared against one another, with flexibility used where it is economic and efficient compared to investing in traditional reinforcement or technological solutions			x
1.8	We expect a consistent approach for valuing flexibility, taking into account the option value it provides in the context of uncertainty. DNOs must ensure transparency in their approach to allow scrutiny of decision-making	x		
2.1.1	DNOs to improve network visibility and identification and sharing of operability constraints, including publishing this data to help avoid conflicting actions being taken by other network and system operators	x		
2.1.2	DNOs must take reasonable steps to access and subsequently share, including by publishing, data and operability constraint information in a timely manner		x	
2.1.3	DNOs to provide the ESO with information across timescales about the DER it is planning to instruct to dispatch. Data should include contracted parties, availability and information on scheduled and unscheduled utilisation. Sharing this information in a timely manner should enable the ESO to identify which DER are available for its own needs and improve the ability of DER to stack value across markets		x	
2.1.4	DNOs to gather sufficient information on DER characteristics and parameters to provide information and inform decisions to secure against events that could lead to disconnection of DER			x
2.1.5	DNOs to make available operational data that supports network users and other relevant stakeholders to make better decisions about how to use the network. Data should be readily available in agreed and common data formats			x
2.2.1	DNOs to have and regularly review a decision-making framework for when DER are instructed to dispatch in real-time. The decision-making process, including alternatives considered, should be transparent. This should promote coordination across services (including curtailment as part of non-firm connection agreements and ESO flexibility services), maximise liquidity, avoid market fragmentation and ensure dispatch results in the best outcome for the whole system; this includes service provision to the ESO and other distribution networks			x

APPENDIX Y

WPD Ref	Activity Description	Already in place	Due during RIIO-ED1	Planned in RIIO-ED2
2.2.2	As part of this decision-making framework, there must be rules in place for coordinating dispatch instructions for DSO and ESO flexibility services. This could be through primacy rules or more comprehensive optimisation processes that better enable stacking of revenues for DER. The rules should be transparent, objective, and promote whole system efficiencies		x	
2.2.3	The DNOs shall facilitate secondary trading of distribution flexibility services and curtailment obligations. In this context, facilitating means providing the relevant operational data, ensuring the DNO has processes in place to collect the relevant data about the trade, and making the operational parameters clear (and justified in the context of network reliability and efficiency)			x
2.2.4	DNOs to introduce clear processes for the design, development, and communication of the decision-making framework. These should include transparent and participatory processes for stakeholder input			x
2.2.5	DNOs to develop efficient, scalable dispatch instruction infrastructure and avoid proprietary systems	x		
2.2.6	We expect clear definitions of different types of dispatch instruction for distribution flexibility services and transparent rules about when and in which markets they should be used. Circumstances for different dispatch instructions should be well-justified. Definitions of these circumstances should be developed with input and cooperation from network users	x		
2.2.7	The application of hard dispatch controls shall be for the improved reliance on market-based mechanisms, not to the detriment of their development	x		
2.2.8	Capabilities in network operations, for example in dispatch instructions and associated system architectures shall not be hard coded to the DNO. These must be developed so that they can be cost effectively assigned to another party in future, if this is needed	x		
3.1.1	DNOs collate and publish as much relevant data and information as reasonable that will help market participants identify and value opportunities to provide network services to DNOs and take market actions that support efficient whole system outcomes. Relevant data and information include planning and operational data			x
3.1.2	This should be provided with sufficient lead times to enable wider participation in distribution flexibility services markets. It also includes information on historic and future distribution flexibility services market actions. This should include tender results, prices bid and paid, the carbon content of aggregated units, how often DER is dispatched (and volumes) and other actions taken by the DNO (with anonymisation as required), including curtailment as part of non-firm connection agreements. The information should include all requirements set out in licence conditions to support DER to identify revenue opportunities. This increases the accessibility of tendering for distribution flexibility services for flexibility providers (while also taking account of DNOs flexibility needs)			x
3.1.3	DNOs should, with stakeholder input, develop robust strategies for how they will collate and publish more helpful information, wherever possible consistently and in coordination with other network licence holders, and communicate this clearly	x		
3.1.4	DNOs should regularly and actively engage with market participants to understand what data and information is helpful to support market development. While there will be minimum legal requirements set out in licences, we expect DNOs to use their stakeholder engagement to consider the most effective format and frequency of publishing that data to ensure it is user-friendly	x		
3.1.5	The information must be easily accessible and navigable. We expect this includes publishing data in machine-readable formats. DNOs should, where reasonable, tailor both their information provision and engagement approaches to reflect different needs of potential market participants, including groups in vulnerable situations			x
3.1.6	In many instances, collaboration across DNOs in engagement is expected to reduce duplication, make it easier for stakeholders to engage and avoid stakeholder fatigue		x	
3.2.1	DNOs to have clear processes in place for developing and amending distribution flexibility services products, contracts, and qualification criteria, that are, wherever possible, standardised. The processes should be transparent and participatory, involving other DNOs, the ESO, and current and potential distribution flexibility service providers	x		

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3.2.4	DNOs should identify the optimum combination of longer and shorter term lengths of markets and contract lengths reflecting the network need. Needs should be neutrally defined, to allow for a range of flexibility providers to participate. This will help improve market liquidity and the opportunities for innovation and dynamic competition	x		
3.2.5	Individual decisions and frameworks for deciding market timeframes and contract lengths should be transparent, informed by stakeholders and justified as being the most economic and efficient solution. Notwithstanding, deviations from the standard should be justified with clear governance processes for managing change that should be clearly communicated	x		
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