SP Energy Networks | DSO

DSO Strategy for RIIO-ED2

Contents

Foreword

The energy landscape is changing fast as the way our customers generate, use, and interact with energy evolves. This means that our role – how we plan, design, and operate the network for our customers – must evolve with it. Our Distribution System Operation (DSO) strategy details how we will respond to these challenges, enabling decarbonisation targets while continuing to deliver exceptional service to our customers and communities. We will invest £185.1m in RIIO-ED2 to deliver £370m in direct customer benefits over the next 45 years and £0.5bn-1.6bn in wider system benefits by 2040.

To tackle the climate emergency and deliver Net Zero, our distribution network will enter a new era. Within a relatively short period of time, we forecast that a significant proportion of transport and heating will be electrified. We anticipate a leap in distributed generation connected to our networks, with the UK Government targeting carbon-free power generation by 2035. Coupled with the rapid rise of digitalisation, this will precipitate a revolution in how both domestic and commercial customers interact with the electricity distribution system.

These changes will result in higher distribution network utilisation, more dynamic and volatile power flows, more complexity in network operation, and a greater need for whole system coordination. This is a step-change from the historical design and usage of our networks, which were built for an era of passive, predictable consumer demand. If we do not adapt now, these changes will push the system beyond what it is designed for – leading to increased safety risk, higher costs, a poorer service for all customers, and inhibit the Net Zero transition.

This transformation provides us with opportunities. Our customers increasingly have the desire and the tools to participate in the energy system, meaning there is an ever-increasing market of flexibility service providers we can work with to solve network challenges and keep network costs efficient. Digitalisation means we can share data and better coordinate with other parties, facilitating these new solutions.

There is a clear need for a set of roles and activities to meet our customers' evolving needs, enable Net Zero, and ensure the continued safe and reliable operation of the network for all customers. These roles and activities are predominantly an evolution of existing activities; however, they will require new infrastructure and business processes. This is what DSO is to us: the set of roles, activities, and infrastructure that we plan to deliver, so that we can continue to serve our customers and communities.

We have developed a comprehensive DSO Strategy. It includes new infrastructure, such as an integrated simulation and modelling platform for our entire network (including all 48,000km of LV) so that we can make real-time data-driven planning and operation decisions, and LV monitoring at 14,102 secondary substations to increase network visibility and extend coverage from 14% to 76% of customers. It includes new DSO outputs, such as sharing outage information with gas companies and providing near-time dispatch and 'no need' notifications to flexibility providers to increase whole system efficiency. Our strategy will give us more network visibility, greater data analysis and sharing capabilities, enhanced forecasting and analytical tools, improved planning and operational coordination (not just with the ESO but also other network companies and vectors), new infrastructure to manage an increasingly complex array of network interventions, and greater use of flexibility (supported by increased data sharing, digital platforms, and transparency). It gives us the tools and capabilities we need to enable the customer-led revolution of the energy system.

We will deliver a new system architecture, new ways of working, and new interactions with customers and stakeholders. Given the extent of these changes, and the importance to Net Zero, system stability, and our customers, it is essential that our organisation is correctly structured to deliver DSO. For this reason, we have developed a new DSO functional model, responsible and accountable for delivering DSO, whilst providing transparency to stakeholders on our approach to designing and operating the network.

We are best placed to lead the delivery of DSO. We have the capability, knowledge, and experience to deliver on time and in a cost-effective way. We have strong links with our customers and communities, which means we can quickly understand and respond to their needs. Most importantly, retaining a link between DNO and DSO means there is clear responsibility for the safety of network assets that enter into our customers' homes. We have already started our DSO journey, with a strong track record, but there remains much to do. Most of the assets we install today will still be operational in 2050, and we must make meaningful progress in RIIO-ED2 if we are to deliver a safe, reliable, and decarbonised electricity system – we look forward to working with Ofgem and our stakeholders to make this happen.

Scott Mathieson

Network Planning & Regulation Director

Our Team

Scott has business accountability for DSO, leading the development of our Strategy for RIIO-ED2. He has established a team that will be responsible for implementing our strategy, some of whom are shown below:

Scott Mathieson
Director of Network Planning & Regulation

Kirsty Scott
Head of Network Intelligence & DSO Development

Iain Divers
Head of Planning & Network Development

Gareth Hislop
Head of Whole Systems

Gerard Boyd
Head of Flexibility

Mark Goudie
Acting Head of Whole System

Malcolm Bebbington
Head of Future System Strategy

Russell Bryans
System Design Manager

Matthew Jones
Net Zero Asset Manager

Nia Lowe
Head of Regulation and Government Policy

1. An introduction

We are SP Energy Networks. We own and operate the electricity distribution network in Central and Southern Scotland (our SP Distribution network), and in North Wales, Merseyside, Cheshire, and North Shropshire (our SP Manweb network). It is through these two networks of underground cables, overhead lines, and substations that we provide 3.5 million homes, businesses, and public services with a safe, reliable, and efficient supply of electricity. We will deliver DSO roles, activities, and infrastructure in RIIO-ED2 to meet our customers' evolving needs, enable Net Zero, and ensure the continued safe and reliable operation of the network in the face of seismic changes to the energy system.

Delivering DSO will bring real benefits to our customers and stakeholders and is a critical enabler to the efficient and timely delivery of Net Zero. The plans set out in this DSO Strategy are the detail behind our final RIIO-ED2 Business Plan submission to Ofgem, in which we will seek their approval to continue the investment needed to deliver these DSO roles, activities, and infrastructure for our customers. Our DSO Strategy focusses on the period from now through to the end of RIIO-ED2 (2028) but also lays the foundation for the longer term.

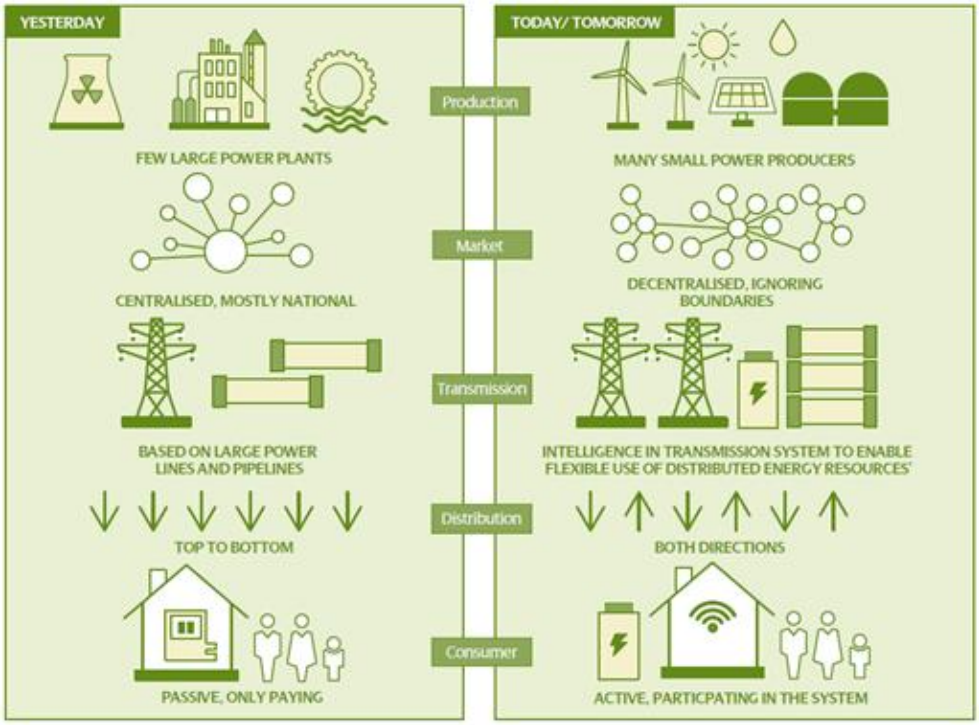

Figure 1: Energy system changes

How to navigate this document

The purpose of this document is to share with our stakeholders why we need DSO, how we will deliver it throughout RIIO-ED2, and the benefits it will bring:

- **Section 0:** why we need DSO (the changing customer needs and system challenges that drive the need for DSO) and an introduction to DSO and our DSO Strategy.
- **Section 3:** how we will deliver DSO part 1 – the infrastructure that underpins the delivery of DSO.
- **Section 4:** how we will deliver DSO part 2 – delivering a new DSO functional model.
- **Section 5:** how we will deliver DSO part 3 – the DSO outputs we will deliver in RIIO-ED2.
- **Section 6:** a section focussing on how we will proactively increase flexibility service use and support the growth of efficient, coordinated, and competitive flexibility markets in RIIO-ED2.
- **Section 7:** benefits – what our DSO Strategy means for our customers.
- **Section 8:** benefits – the quantified direct and indirect benefits case of our DSO Strategy.
- **Section 9:** how we worked with our stakeholders to develop this strategy.
- **Section 10:** deliverability – how we've ensured that we can deliver our DSO Strategy in RIIO-ED2.
- **Section 11:** a summary of this DSO Strategy.

This document is supported by a suite of Appendices, to further supplement the content.

Appendix A - Ofgem has defined three core DSO roles. These cover five main DSO activities and are described by a set of 23 DSO baseline expectations. Together, these describe the minimum level of DSO we must deliver in RIIO-ED2 – these are set out in Appendix A.

Appendix B - We map our DSO Strategy against these Ofgem requirements in Appendix B to show how we meet and exceed them.

Appendix C - Appendix C sets out our proposed performance measures, to show how stakeholders and Ofgem will be able to evaluate our progress in delivering DSO.

Appendix D - DSO is not a standalone activity; it has strong links with four other parts of our plan – these are explained in Appendix D.

Appendix E - There is discussion in industry about the correct long-term DSO institutional arrangement – Appendix E, supported by Section 4, sets out our assessment.

We are also aware that our industry contains a wide range of terminology – we have included a comprehensive glossary (Section 12) to clearly explain the terms we use within this document.

Highlights

Our DSO Strategy has three main components.

Part 1 – DSO infrastructure

We will deliver investment in DSO infrastructure:

1. **Network monitoring** – increasing network visibility to support more efficient network planning and operation. This includes deploy LV monitoring at 14,102 LV substations. This will extend monitoring from 8% to 52% of secondary substations rated at ≥200kVA, increasing coverage from 14% to 76% of customers, by the end of RIIO-ED2.
2. **Enhanced forecasting tools** – better prediction of our customers' requirements. This includes maintaining our industry-leading tools which forecast EV and heat pump uptake for every customer we serve and introducing calibration exercises.
3. **Simulation and modelling tools** – combined with enhanced forecasting to help us identify precisely where, when, and how to intervene. This includes our new ENZ Platform, which integrates four previously independent data sources (monitoring, smart meters, enhanced forecasting, and asset condition) to create a real-time, data-driven, whole network analytical platform.
4. **Scalable network management and flexibility dispatch infrastructure** – coordinates greater use of customer flexibility, automation, and smart tools to manage increasing network complexity. This includes a network wide flexibility platform, and 22 new Constraint Management Zones (CMZs) to support network operation.
5. **Operational IT and telecoms** – the network's nervous system, which most other infrastructure depends on. This includes investing £221.4m to deliver the reliable, secure, low latency operational IT and telecommunications network needed for DSO.
6. **Digitalisation and IT platforms** – the software, flexibility, and data management platforms needed for DSO. This includes our dedicated data sharing portal, enabling stakeholders to easily find the data they need.

Part 2 – a new DSO functional model

We will create a new DSO functional model within SP Energy Networks by the start of RIIO-ED2. It will have its own dedicated Director who will report to the SP Energy Networks CEO, and will be responsible and accountable for delivering DSO, including planning and network development, network operation, and market development. The DSO functional model will be supported by a DSO expert stakeholder panel.

This new DSO functional model is one measure we're taking to increase transparency and give our customers confidence that we are a neutral market facilitator. This is important – our customers, stakeholders, and service providers must have confidence in us and the markets we interact with, as their involvement is essential for enabling Net Zero, maintaining system stability, and promoting competition in service provision; customers benefit from all of these. Other measures to promote transparency include publishing information on all network constraints on the 33kV and 132kV network, including our options assessment and investment decision rationale, and externally assuring all load-related intervention decisions over £2m and publishing the findings.

Part 3 – our DSO outputs

We will deliver a comprehensive set of DSO outputs in RIIO-ED2. These describe what and how we will deliver DSO, and so how we meet and exceed Ofgem's baseline expectations. Many of these outputs are enabled by the DSO infrastructure and DSO functional model we plan to deliver.

Examples of these outputs include:

- ✓ Transparently and fairly comparing all viable network intervention options (including energy efficiency and flexibility). This includes using a linear optimisation engine to impartially assess solutions and create bespoke intervention programmes for every LV and HV network constraint.
- ✓ Outputs to support and neutrally facilitate the growth and use of efficient, competitive, and coordinated flexibility markets. This includes using network monitoring, enhanced forecasting tools, and our ENZ Platform to provide near-time 'dispatch warnings' and 'no need notifications' to flexibility service providers

and the ESO, and 'constraint warnings' to DER with constrainable connections and the ESO, so they can get ready.

- ✓ Outputs to ensure network resiliency. This includes a new annual network stress-test desktop assessment against High Impact Low Probability (HILP) events. The results of this will be shared with other network companies to promote increased energy system resilience.
- ✓ Outputs to support whole system coordination. This includes working with other network companies and vectors and providing a team of specialists (Strategic Optimisers) to partner with local authorities and regional governments to support the optimisation of network planning, design, and implementation of public EV charging and heat electrification initiatives.

We have mapped these outputs against Ofgem baseline expectations to show how we meet 15 baseline expectations and exceed 8 baseline expectations. Our DSO Strategy is detailed and wide ranging, and we have distilled these down into stakeholder-tested commitments:

1. **We will increase visibility** of our low voltage networks by delivering over 14,100 LV network monitors at large secondary substations and enhancing our use of smart meter data. This will enable us to maximise utilisation of the existing network, identify targeted areas for upgrades, and facilitate customer flexibility.
2. **We will be a neutral facilitator** of an open and accessible distribution flexibility services market during RIIO-ED2. This market will be aligned with industry best practice, utilising a range of services to meet network requirements. This will be supported by efficient dispatch processes and transparent procurement.
3. **We will deliver a DSO functional model**, responsible and accountable for delivering DSO. It will increase transparency and be supported by external assurance and stakeholder input. This will be established by the start of RIIO-ED2.
4. **We will share planning, operational, and market data** with customers, stakeholders, and market participants through our systems and an online data portal within RIIO-ED2. This will include visibility of our user-friendly short & long-term forecasts.

Benefits

Together, our DSO investments and outputs will:

- ✓ Invest £185.1m in RIIO-ED2 to deliver £370m in direct customer benefits over the next 45 years and £0.5bn-1.6bn in wider system benefits by 2040.
- ✓ Deliver the coordination, tools, and network visibility we need to safely and efficiently enable Net Zero.
- ✓ Enable increased customer participation in the energy system through efficient and competitive flexibility markets and addressing concerns about perceived conflicts of interest. This will enable the widespread use of flexibility to help create capacity and operate the network cost efficiently.
- ✓ Ensure the continued safe, reliable, and efficient operation of the distribution network and wider system by increasing coordination with the ESO and other key stakeholders.
- ✓ Deliver a better customer service and experience by helping deliver the capacity customers need when they need it, and by supporting a more timely, efficient, and simpler connections process.
- ✓ Meet 15 and exceed 8 of Ofgem's DSO baseline expectations.

Customer and stakeholder input

Our DSO Strategy is the culmination of five years of stakeholder engagement. In October 2016, we were the first in our industry to publish a DSO Vision in response to evolving customer needs and system challenges. Since then, we have worked alongside industry, government, and our stakeholders to progress this evolution in the GB energy system. Our DSO Strategy doesn't just incorporate knowledge from our own stakeholders. By

building on wider industry work such as the three TEF[1] projects, the Energy Network Association's Open Networks project, Ofgem and BEIS publications, and technological and commercial developments, we are building on a far broader base of stakeholder expertise. We worked closely with our CEG and stakeholders through the RIIO-ED2 development process. Our CEG helped shaped the content and framing of our DSO Strategy – we are grateful for their input.

Delivering our plan

We have ensured that what we are proposing within this DSO Strategy is deliverable. We have done this in a number of ways:

- **Knowledge & Experience**: Collating our internal subject matter experts, previous project experience, and our supply chain relationships in preparation for RIIO-ED2 to ensure that these investments are deliverable. This has included using our RIIO-ED1 experience and learnings from our award-winning innovation projects. Some of our key infrastructure interventions, such as network monitoring and our ENZ Platform, build on work we have already started in RIIO-ED1.
- **Plan Development**: Developing our plans with our stakeholders and supply chain, alongside our collated knowledge & experience, with supporting narrative, strategies, Engineering Justification Papers (EJPs), and Cost Benefit Analysis (CBAs).
- **Assurance & Deliverability**: Externally assuring our work with industry leading organisations, including a dedicated deliverability workstream to ensure that we can deliver our RIIO-ED2 plan.

[1] These are three projects led by distribution licensees that support the transition to DSO. The three projects are Transition (led by SSEN), Electricity Flexibility and Forecasting Systems (led by WPD), and Fusion (led by us).

2. Introducing DSO and why we need it

This section explains why we need DSO. It does this by describing the changing customer requirements that the electricity system must serve, and how these will impact the distribution network and operation of the whole system if we do not respond to them, and introduces what DSO is and our DSO Strategy.

2.1 Drivers of change

The energy landscape is changing fast as the way our customers generate, use, and interact with energy evolves. Three key trends are driving this:

- **Decarbonisation** – in response to the climate emergency, we need to achieve Net Zero greenhouse gas emissions by 2045 in Scotland and 2050 in England and Wales.[2] To deliver this decarbonisation, we need to electrify a significant proportion of transport and building heating. We also need to complete the transition of our generation mix from fossil fuel to zero carbon generation by 2035.[3] These changes will significantly increase the levels of demand and generation that we need to connect to the distribution network for our customers.
- **Decentralisation** – the volume of generation which is smaller-scale and connected to the distribution network rather than the transmission network is increasing. This decentralisation has two effects: we must find ways to accommodate more customer generation than the distribution network is currently designed for; and as traditional transmission-connected generators close the electricity system operator (ESO) has an increasing reliance on this DG and other controllable customer assets connected to the distribution network (collectively known as distribution energy resources, DER) to maintain GB system stability.
- **Democratisation & digitalisation** – means the rise of the active domestic customers (aka prosumer). Smart meters, home energy management systems, intelligent domestic and electric vehicle (EV) storage, specialist aggregators and suppliers – these are all reducing the barriers for domestic customer participation in the energy system. Democratisation has two effects: domestic customer consumption profiles are becoming less predictable and more dynamic; and we can increasingly work with many individual customers and communities, rather than just large DG or industrial customers, to source vital network and system services.

2.2 Forecasting and modelling

To better quantify these drivers and ensure we meet our customers' changing electricity needs, we forecast what their electricity requirements are going to be into the future. We do this by developing Distribution Future Energy Scenario (DFES) forecasts[4] (Section 2.2.1), and then comparing these against Net Zero compliant scenarios from the Electricity System Operator (ESO)[5] and the Climate Change Committee (CCC)[6] to develop our RIIO-ED2 investment scenarios (Section 2.2.2). We then model the impact of these scenarios on our network using enhanced forecasting and modelling tools (Section 2.2.3).

2.2.1 DFES forecasts

These are forecasts for key customer demand and generation metrics up until 2050. We develop these considering a range of sources, including UK and devolved government targets such as: Net Zero targets of 2045 for Scotland and 2050 for England and Wales; interim legislative 2030 and 2035 greenhouse gas emission reduction targets; Scottish and UK government bans on new petrol and diesel cars and vans; the UK Government Ten Point Plan, Energy White Paper, and Heat and Buildings Strategy; the Scottish Government Heat in Buildings Strategy; and the Net Zero Wales Plan.

Given the uncertainties out to 2050, we create forecasts for four main energy scenarios. These scenarios represent differing levels of customer ambition, government and policy support, economic growth, and

[2] The UK's different legislative Net Zero targets are explained in the 'Net Zero' entry in the glossary.
[3] https://www.gov.uk/government/news/plans-unveiled-to-decarbonise-uk-power-system-by-2035
[4] Our 'Distribution Future Energy Scenarios', available at: https://www.spenergynetworks.co.uk/pages/distribution_future_energy_scenarios.aspx
[5] The Electricity System Operator's '2021 Future Energy Scenarios', published July 2021. Available at: https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2021
[6] The Climate Change Committee's 'Sixth Carbon Budget', published December 2020. Available at: https://www.theccc.org.uk/publication/sixth-carbon-budget/

technology development. Our stakeholders review our forecasts and we make changes based on their well-justified feedback.

All forecast scenarios show a significant increase in the volume of customer demand and generation that we will need to serve on our distribution network. There are three areas that will change the most:

1. **The electrification of transport**: by 2030, the number of customer EVs on our distribution network could increase from 14,000 now to up to 1.8 million (1.6 million of which will charge at home). An EV can double the demand of a customer property and materially increase peak network demand.
2. **The electrification of heat**: how heat is decarbonised is a key variable, but one area of greater certainty is that off-gas grid customers will use heat pumps. In some of the high roll-out scenarios, heat pump impact on our network peak demand could be three times greater than EVs.
3. **More generation**: by 2030, the volume of customer generation we connect to our SP Manweb network could double.[7] For SP Distribution, it could triple. By 2050, we could have connected over five times more customer generation than we have to date.

The magnitude of these changes is significant and unprecedented – customer needs have not changed at this scale or rate before.

2.2.2 Using DFES, ESO, and CCC forecasts to develop RIIO-ED2 scenarios

Different forecast scenarios will have different impacts, requiring different levels of intervention. So how do we know which one to plan for? In addition to the four DFES scenarios, we create a low scenario, a baseline scenario, and a high scenario. Our RIIO-ED2 investment plan is developed to deliver the baseline scenario but must have the flexibility to be able to deliver anywhere within the low and high range (which mark the lower and upper range of credible Net Zero pathways).

These three scenarios are developed considering the range of Net Zero compliant scenarios developed by us, the ESO, and the CCC. We only consider Net Zero compliant scenarios as Net Zero is enshrined in legislation – we must deliver it. This means that in developing this scenario range we have not included the DFES or FES Steady Progression scenarios, as they do not meet Net Zero, nor the System Transformation scenarios, as they do not deliver legislated interim targets. Our approach means even the low scenario contains sufficient investment to deliver 2050 Net Zero and interim targets.[8]

Table 1 shows our low, baseline, and high scenarios for EVs, heat pumps, and distributed generation. Figure 2 shows this same information for EVs and heat pumps out to 2035 (the black line is our baseline scenario, the green band marks the low and high scenario range).

Investment scenario	Total uptake by 2028		
	EVs	Heat pumps	Generation
High scenario	1.03m	0.81m	+6.37GW
Baseline scenario	0.67m	0.37m	+4.95GW
Low scenario	0.65m	0.34m	+4.95GW

Table 1: Our RIIO-ED2 low, baseline, and high scenario

[7] Storage is defined as a type of generation, so is included within the generation forecasts.
[8] Although it wouldn't contain enough investment to meet customer needs within RIIO-ED2 where these are above the low scenario.

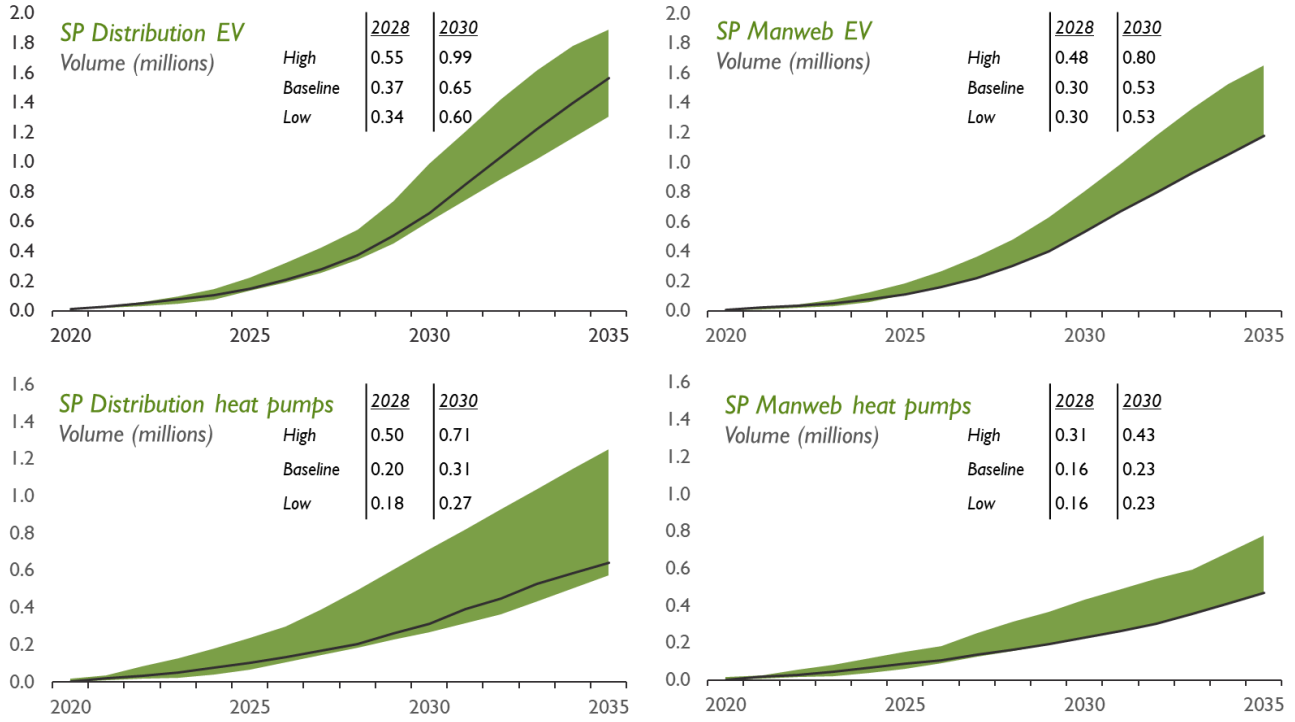

Figure 2: Our RIIO-ED2 Baseline Scenario compared to Net Zero compliant industry forecasts

Figure 2 and Table 1 show that our baseline scenario (which our baseline RIIO-ED2 Business Plan will deliver) tracks the bottom of the credible Net Zero range in SP Manweb, and marginally above in SP Distribution due to Scottish Government targets.[9] This positioning of our baseline near the bottom of the credible Net Zero range means that when we modelled the network impact of decarbonisation (Section 2.2.3) for our DSO Strategy development, the modelling outcomes represent the likely **minimum** network impact of decarbonisation.

2.2.3 Modelling the network impact of these changes

We have undertaken a comprehensive modelling exercise to quantify the network impact of these forecasts. In summary, this involves combining our stakeholder endorsed DFES forecasts, our low, baseline, and high scenarios, our new enhanced forecasting tools which predict EV and heat pump uptake for every single customer we serve (see Section 3.2), and a new network analytical platform containing a full connectivity model of our entire network (including all 48,000km of LV network). Together, these systematically identified where and when we need to intervene on our networks.

Impact 1: This comprehensive modelling showed that, despite using a baseline scenario close to the lowest credible Net Zero pathway, the volume of new demand and generation will push power flows well beyond what the distribution network is currently designed for, i.e. the network does not currently have the capacity to accommodate these changes. This impacts every voltage level: from LV[10] networks, to which the low carbon technologies (LCTs) needed for Net Zero primarily connect, to HV and EHV networks, which supply the LV networks and must accommodate increasing levels of DG. Without radical intervention to create additional capacity[11], these changes will cause thermal, voltage and fault level constraints which dangerously overload

[9] This positioning is intentional. By basing our investment plan on EV and heat pump uptake at the lower end of Net Zero compliant forecasts, we're confident that we are only asking for the minimum investment needed to enable Net Zero, as actual EV and heat pump levels are unlikely to be lower than this baseline scenario. Where actual levels are higher than this baseline scenario, we will use uncertainty mechanisms to address the difference. This approach and the use of uncertainty mechanisms means we have a robust investment plan which can adapt to our customers' needs across the range of credible Net Zero pathways, and it protects customers by making sure we have sufficient investment to enable Net Zero, but no excess allowances.

[10] LV, HV, and EHV are defined in the glossary.

[11] This can be created or managed by flexibility, smart interventions, energy efficiency, and reinforcement.

the network. These will lead to customer supply interruptions, delays in delivering customer requirements, shortening of network asset life[12], higher overall costs for customers, and possible safety concerns[13].

2.2.4 The ESO's increasing dependency and use of DER resources

There are two changes which explain the ESO's increasing dependency and utilisation of DER resources:

1. The ESO has a long-term need for services to fulfil its two operational licence obligations (system balancing and keeping transmission power flows within limits). Due to decreasing system inertia, larger potential infeed losses, a reduction in stability from synchronous generators, and a forecast increase in thermal constraints, the ESO projects their need for system services (e.g. faster frequency response for system balancing) is due to increase.[14]
2. A material proportion of the ESO's traditional service providers (transmission connected coal-fired generators) have closed.[15] In the absence of sufficient transmission-connected replacements, the main other source of service providers is distribution-connected providers (DER).

As a consequence, the ESO has an increasing need for ancillary services while, at the same time, the number of service providers connected to the transmission system are decreasing. A material proportion of some ancillary services already comes from DER[16], and the ESO is actively seeking greater DER service provision going forward.[17] This has been supported by changes to reduce barriers to DER participation in ESO service markets, such as:

- changes to allow the aggregation of DER assets, and a reduction in the minimum threshold for participating in the Balancing Mechanism from 10MW to 1MW, were introduced in 2019.
- The ESO developed a new balancing service in 2020 to specifically target downward flexibility from DER (the Optional Downward Flexibility Management Service).[18]
- Alternative routes for DER to provide reserve services are being considered as part of the ESO's Reserve Reform project.[19]
- BSC Issue Group 94 considered allowing Balancing Mechanism bids less than 1MW, with the ESO's Balancing Programme due to introduce systems to allow this by 2025.[20]

Impact 2: The ESO must be able to utilise these DER services to be able to maintain system stability. However this DER service use by the ESO affects power flows on the distribution network, and so overlaps with our responsibility to operate a safe, reliable, and efficient distribution network. At the same time, greater levels of customer demand and generation on the distribution network may create increased transmission network

[12] Significant increases in asset loading can reduce asset life and increase maintenance requirements. These both increase network costs for customers.
[13] Potential safety issues include overloading of network equipment, which could cause failure or fire. This fire risk is particularly important for LV service cables and cut-out fuses as they often run into our customers' homes. Another potential safety issue is conductor sag, which is where overhead lines are thermally overloaded, which causes them to expand and so hang lower to the ground; this reduces the safe clearance distance.
[14] The ESO's Operability Strategy Report 2021 sets out their medium-term and long-term operability requirements. Available at: https://www.nationalgrideso.com/document/183556/download. It states "inertia levels are dropping and there are larger potential losses which require faster frequency response" (page 7), and "the need for reactive power support continues to grow as the energy system decarbonises" (page 9). The ESO forecasts potential constraint costs as part of its Network Optional Assessment (NOA), which could rise from around £0.5bn/year today to between £1bn and £2.5bn/year in the 2020s. Source: https://www.nationalgrideso.com/document/194436/download
[15] In January 2008, when the Large Combustion Plant Directive came into effect, there were 20 coal power stations operational in GB; now there are only two. Of these 20, three were in our two licence areas – these have all closed. Source: https://www.powerstations.uk/coal-countdown/. The government's Digest of UK Energy Statistics (DUKES) data also shows this decline in coal and oil generation. Source (tab 5.21): https://www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-2021
[16] For example, 73 out of 90 contracts in the May 2021 Monthly Firm Frequency Response (FFR) tender came from DER providers (https://www.nationalgrideso.com/document/190986/download) and 18% of Short Term Operating Reserve (STOR) providers came from DER providers between April 2021 and 22 November 2021 (https://data.nationalgrideso.com/ancillary-services/short-term-operating-reserve-stor).
[17] The Power Responsive programme is the ESO's main forum to encourage Demand Side Flexibility (DSF) to participate in balancing services: https://www.nationalgrideso.com/industry-information/balancing-services/power-responsive
[18] This service was introduced as a result of the low demand conditions during the Covid-19 lockdown, and was active in 2020 and 2021: https://data.nationalgrideso.com/ancillary-services/optional-downward-flexibility-management-odfm1.
[19] Source: https://www.nationalgrideso.com/document/187871/download
[20] Source: https://www.elexon.co.uk/smg-issue/issue-94/

power flows which the ESO will need to manage. Without greater planning and operational coordination between the DSO and ESO, especially around DER service use and constrainable connection schemes[21], there will be increasing risk to system stability and safety, inefficient system operation, and poor use of customer money.

Increasing transmission-distribution interactivity is already having an impact on the electricity system. On 9 August 2019, a lightning strike on the transmission network resulted in the loss of 1.3GW of transmission connected generation. Shortcomings in the understanding of whole system operation by various asset owners and equipment specifiers resulted in the loss of a further 500MW of DG. This resulted in over one million customers losing supply. The record low transmission demand during Covid-19 further shows the importance of whole system coordination to ensure resilience and the ability to cope with unforeseen system needs.

2.2.5 Domestic customers increased willingness and ability to participate

There are three changes for customers' increasing participation in the energy system:

1. **Greater electricity demand:** the flexibility response individual customers can offer is increasingly material as customers' controllable demand increases with the transition to EVs and heat pumps, as well as the increasing prevalence of domestic battery storage. This means there is a greater financial reward for customers, and a greater incentive for route-to-market providers, such as suppliers and aggregators, to engage with them.
2. **Easier access to flexible services:** technology changes are enabling customer participation. Mobile phone apps, home smart hubs, smart EV chargers, and intelligent and connected energy management systems are enabling customers to participate at low cost and minimal inconvenience and enabling route-to-market providers to communicate with them.
3. **Regulatory changes**: the Smart Meter Roll out and a move to market-wide half-hourly settlement[22] will create the conditions to enable domestic customers to provide flexibility to the market and place greater incentives on suppliers to develop innovative tariffs to support this (the removal of the four-tariff supplier limit in 2016 also facilitates this). Planned changes such as BSC Modification P375[23], and changes to reduce barriers to entry to aggregators and smaller assets in balancing services[24], should also improve the scope for domestic customers to participate in providing flexibility. In the longer term, changes being considered by BEIS' Alternative Energy Markets Programme[25], Ofgem's Full Chain Flexibility[26], and potential changes to the role of the supplier[27] could further strengthen signals for domestic flexibility.

Together, these explain why customers will be increasingly able to participate in the energy system. This could include providing services to suppliers to manage market imbalance, system balancing services to the ESO, and services to us to manage distribution network constraints and outages.

This trend of increasing LV customer participation is supported by our own experience. Across autumn 2020 and spring 2021 we tendered for 454.MW of flexibility across 1,477 LV sites. The market responded by offering 556.2MW across 1,473 of those sites. This level of response would previously be unheard of; only four sites did

[21] If ANM DER is contracted to provide balancing services, they face penalties being imposed by the ESO if they are unable to deliver the service. An Network Innovation Allowance (NIA) project is considering the scope for greater coordination of ANM schemes and Balancing Services: https://www.westernpower.co.uk/innovation/projects/optimal-coordination-of-active-network-management-schemes-and-balancing-services-market

[22] Ofgem's decision to mandate market wide half-hourly settlement was published in April 2021 and places requirements on suppliers to introduce half-hourly settlement by October 2025. Available at: https://www.ofgem.gov.uk/publications/electricity-retail-market-wide-half-hourly-settlement-decision-and-full-business-case

[23] Balancing and Settlement Code Modification P375 ('Settlement of Secondary BM Units using metering behind the site Boundary Point') will go live in June 2022 and will allow a greater number of metering equipment behind the traditional 'Boundary Point Meter' to be used in balancing services. Available at: https://www.elexon.co.uk/mod-proposal/p375/

[24] Such as the introduction of aggregators in the Balancing Mechanism, and proposals to allow sub-1MW participation in the Balancing Mechanism.

[25] This programme is exploring alternative ways to send signals to domestic customers using policy and network costs. Available at: https://www.gov.uk/government/publications/alternative-energy-markets-aem-early-market-engagement/alternative-energy-markets-aem-programme-design-delivery-research-and-evaluation-proposal

[26] Ofgem's full chain flexibility programme is considering end-to-end flexibility across the energy system, and will work alongside the BEIS/Ofgem Smart Systems and Flexibility Plan. Available at: https://www.ofgem.gov.uk/energy-policy-and-regulation/policy-and-regulatory-programmes/full-chain-flexibility

[27] In 2017, Ofgem published a call for evidence about fundamental changes to the traditional 'supplier hub' model, with a view to addressing barriers to innovation and consumer protection mechanisms. Available at: https://www.ofgem.gov.uk/publications/future-supply-market-arrangements-response-our-call-evidence

not receive a tender bid. Given this response is all from LV connected providers, it is reasonable to assume that a material proportion of this will be aggregated from domestic customers.[28]

In the market more widely, there have already been a number of examples of domestic customers participating in the energy market: Octopus Energy's Agile Tariff allows domestic customers to respond to day-ahead prices[29]; in September 2020 Social Energy was awarded the first Firm Frequency Response (FFR) contract made up of domestic battery storage capacity[30]; and Flexitricity and ev.energy have partnered to register domestic EVs in the Balancing Mechanism[31].

There are also a number of recent and ongoing innovation trials that demonstrate domestic customers willingness and ability to provide flexibility: the Cornwall Local Energy Market facilitated peer to peer trading using solar PV and battery storage assets[32]; CrowdFlex will involve 25,000 households and consider their ability to optimise using EVs, heat pumps and batteries[33]; and the Shift Trail was considering different market mechanisms and customer propositions related to smart EV charging[34].

Impact 3: LV customer participation in markets will naturally affect network power flows as customers change their output in response to market signals. Without greater coordination and visibility, this can impact the network:[35]

1. Our existing network is planned and operated based on historically observed customer load profiles and behaviours. These planning principles may no longer be representative as customer behaviours change. One example is diversity, which we may no longer be able to rely on if a material proportion of customers respond to the same market signal.[36] This means that the network may not be designed to accommodate the power flows that result from some market actions.
2. In operational timescales, network power flows can become higher and more volatile where a group of customers respond to the same price signal, and appear unpredictable when we don't have visibility of the market signal to which they are responding.

The result from these two points is the same: higher power flows which can overload the network and lead to customer supply interruptions, shortening of network asset life[37], higher overall costs for customers, and possible safety concerns.

We support and encourage customers participating in a range of markets, and we ourselves plan on making extensive use of customer flexibility in RIIO-ED2. The answer is not to stop customers participating in markets, but to ensure that we improve our visibility and coordination, and work with providers, to accommodate this change. This is to ensure that these markets operate safely, efficiently, and have visibility of any knock-on impacts and costs that market actions might cause. The true whole system cost of market actions needs to be understood as all costs are ultimately recovered from customers.

[28] We do not know the exact proportion which were from domestic customers as the majority of bids were received through aggregators.
[29] https://octopus.energy/agile/
[30] https://www.current-news.co.uk/news/social-energy-wins-first-ever-fully-domestic-ffr-contract
[31] https://www.flexitricity.com/resources/press-release/evenergy-and-flexitricity-partnership-helps-suppliers-unlock-balancing-mechanism-smart-ev-charging/
[32] The Cornwall Local Energy Market was led by Centrica and was supported by the European Regional Development Fund. Available at: https://www.centrica.com/innovation/cornwall-local-energy-market
[33] This is a collaboration between SSEN, Octopus Energy, and Ohme. Available at: https://smarter.energynetworks.org/projects/nia2_ngeso001/
[34] Shift was a collaboration between a collaboration between UKPN, Octopus Energy, ev.energy and Kaluza. Available at: https://innovation.ukpowernetworks.co.uk/projects/shift/
[35] These impacts are more likely to arise where customers are participating in non-distribution markets, as distribution market signals will be designed to benefit the distribution network.
[36] Diversity is a key planning principle. It reflects that the total peak demand from a group of customers is less that the sum of the individual peak demands, because customers naturally use electricity at different times to each other, so their individual peak demands don't all occur at the same time. This is historically observed behaviour rather than theory and is called 'after diversity maximum demand' (ADMD). All DNOs design their networks to this principle as it avoids unnecessary expenditure. However this principle will no longer hold true if a material proportion of customers in a particular area are following the same market signal – their behaviour will converge rather than diversify.
[37] Significant increases in asset loading can reduce asset life and increase maintenance requirements. These both increase network costs for customers.

2.3 Responding to the challenge – introducing DSO

There are three main challenge areas in RIIO-ED2. These changes will result in higher distribution network utilisation, more dynamic and volatile power flows, more complexity in network operation, and a greater need for whole system coordination. This is a step-change from the historical design and usage of our networks, which were built for an era of passive, predictable consumer demand. If we do not adapt to this new, more complex era for our network, these changes will push the system beyond what it is currently designed for – this would lead to higher costs and a poorer service for all customers and inhibit the transition to Net Zero.

Planning & network development

Decarbonisation is well beyond what the network is currently designed to accommodate, and it increases the interaction between the distribution network and other vectors (e.g. transport).

We must provide the capacity to accommodate Net Zero safely, efficiently, and on time.

Network operation

ESO service use affects power flows on the distribution network, and so interacts with our responsibility to operate a safe, reliable, and efficient distribution network. Our network actions can affect transmission network power flows and ESO actions.

We must facilitate the ESO's utilisation of DER services and coordinate it with our own DER service use to safeguard system stability and operability.

Market development

Our toolkit needs to encourage and support solutions from flexibility providers and market innovators – both existing and new third parties – whilst managing the more dynamic power flows and higher peak demands that could result.

We must enable these markets to grow and operate competitively, whilst safely and efficiently planning and operating the network in this new environment.

These changes also provide us with new solutions and opportunities. Our customers increasingly have the desire and the tools to participate in the energy system, meaning there is an ever-increasing market of flexibility service providers we can work with to solve network challenges and keep network costs efficient. Digitalisation means we can share data and better coordinate with other parties, facilitating these new solutions.

The case is clear: to respond to these changes and opportunities we must evolve how we plan and operate our distribution system. There is a clear need for a set of roles and activities to meet our customers' evolving needs, enable Net Zero, and ensure the continued safe and reliable operation of the network for all customers. Most of these roles and activities are evolutions of existing business-as-usual activities, whilst some are new. These roles and activities in turn require new enabling infrastructure.

This is what Distribution System Operation (DSO) is to us: the set of roles, activities, and infrastructure that we need so we can respond to these changes and opportunities and can continue to serve our customers and communities.[38]

DSO will give us more network visibility, greater data analysis and sharing capabilities, enhanced forecasting and analytical tools, improved planning and operational coordination (not just with the ESO but also other network companies and vectors), new infrastructure to manage an increasingly complex array of network interventions, and greater use of flexibility (plus data share, digital platforms, and transparency to support that flexibility). It gives us the tools and capabilities we need to enable the customer-led revolution of the energy system.

2.4 Ofgem's DSO minimum requirements

Ofgem has defined three core DSO roles for DNOs to deliver in RIIO-ED2. These cover five main DSO activities and are described by a set of 23 DSO baseline expectations. Together, these describe the minimum

[38] The Electricity Networks Association (ENA) has defined DSO as: "a Distribution System Operator (DSO) securely operates and develops an active distribution system comprising networks, demand, generation and other flexible DER. As a neutral facilitator of an open an accessible market, it will enable competitive access to markets and the optimal use of DER on distribution networks to deliver security, sustainability and affordability in the support of whole system optimisation. A DSO enables customers to be both producers and consumers; enabling customer access to networks and accessible markets, customer choice and great customer service."

level of DSO we must deliver in RIIO-ED2. These are summarised in Table 2 and set out in full in Appendix A. The activity descriptions and purposes in Table 2 come from Appendix 4 of Ofgem's Business Plan Guidance.[39]

Roles	Activity and baseline expectations	Activity purpose
1 Planning and network development	1.1 Plan efficiently in the context of uncertainty, taking account of whole system outcomes, and promote planning data availability. Contains four baseline expectations.	To ensure that DNOs' planning processes are clear, that high quality, data-driven decisions are made, and that DNOs provide stakeholders with relevant information to inform their own decision-making.
2 Network operation	2.1 Promote operational network visibility and data availability. Contains five baseline expectations.	To ensure that DNOs are able to share relevant data on network operations to stakeholders, and to ensure that DNOs have sufficient network knowledge to operate their network under safe and reliable conditions.
	2.2: Facilitate efficient dispatch of distribution flexibility services. Contains four baseline expectations.	This activity is about defining and developing system operability capabilities and the actions network companies take to operate the distribution system safely. The aim is to ensure DNOs facilitate dispatch of DER that is economic and efficient.
3 Market Development	3.1: Provide accurate, user-friendly, and comprehensive market information. Contains five baseline expectations.	To ensure that DNOs sufficiently inform stakeholders of information that will assist them in participating in, managing or otherwise engaging with markets in the long and short term. Ofgem recognises there are overlaps across other activities, but at the same time believe this information is sufficiently critical to warrant its own statement, and to also include wider information than that mentioned in prior activities.
	3.2: Embed simple, fair, and transparent rules and processes for procuring distribution flexibility services. Contains five baseline expectations.	To ensure distribution flexibility service market design leads to good competitive outcomes, including downward pressure on prices and innovative services.

Table 2: Ofgem RIIO-ED2 DSO requirements

2.5 Our DSO Strategy

We will deliver DSO in RIIO-ED2 to meet our customers' evolving needs, enable Net Zero, and ensure the continued safe, reliable, and efficient operation of the distribution network and wider energy system for all customers. There are three parts to our DSO Strategy:

1. The infrastructure needed to underpin DSO – Section 3.
2. A new DSO functional model – Section 4.
3. The DSO outputs we will deliver. These describe what and how we will deliver DSO – Section 5.

Together, these three parts give us the planning and operational tools and capabilities we need to support the growth and use of flexibility service markets, analyse and share data, enable greater transparency and competition, help us coordinate across the whole system, and enhance our ability to plan and operate a more complex system. Our DSO Strategy will deliver a network with greater flexibility and optionality to meet our

[39] Published 30 September 2021. Available at: https://www.ofgem.gov.uk/publications/riio-ed2-business-plan-guidance

customers' requirements as GB transitions to Net Zero. Our DSO Strategy focusses on the period from now through to the end of the RIIO-ED2 price control (2028) but lays the foundation for the longer term.

The remaining sections of this DSO Strategy document set out how we will deliver DSO in RIIO-ED2 and what it means for our customers. Section 11 summarises our DSO Strategy.

2.5.1 Developing our DSO Strategy

In October 2016, we were the first in our industry to publish a DSO Vision in response to evolving customer needs and system challenges. This described the whole system operating model which we thought was best suited to address these changes, and the roles and responsibilities which that involved. This was developed with stakeholder input. Since then, we have worked alongside industry, government, and our stakeholders, through the Open Networks project and other routes, to progress this evolution in the GB energy system.

Our first DSO Strategy, published in June 2020, built on this work. We used this to test our initiatives and approaches with stakeholders and our CEG. Following this input, we worked with industry to develop technical and cost models for the DSO infrastructure. This established the foundation for our investments, Engineering Justification Papers (EJPs), and associated Cost Benefit Analysis (CBAs) for our RIIO-ED2 plan.

Following the release of the RIIO-ED2 Sector Specific Methodology Determination (SSMD) in December 2020, we refined our approach, updating our DSO Strategy for draft submission to take account of updated requirements, stakeholder feedback, CEG challenges, and Ofgem defined roles and activities. Our foundational activities, narrative, and draft strategy were all externally assured for our draft RIIO-ED2 submission – providing further independent challenge and assurance. Since draft submission, we took onboard further stakeholder, Challenge Group, regulatory and government feedback to update our DSO Strategy for final submission to Ofgem – with further external assurance to support our work. This includes the final DSO baseline expectations included within the Business Plan Guidance published on 30 September 2021.

Throughout the development process, we considered our customers' evolving needs, the network challenges we must address, Ofgem's expectations, stakeholder input, and the wide range of industry and government work to date. This work includes the Open Networks project, Ofgem and BEIS publications, industry projects (including the three TEF projects[40]), and technological and commercial developments. We continue to monitor Ofgem's Significant Code Review in Access and Forward-looking charges, as this will likely impact how our customers choose to use the network.

[40] See footnote 1 on page 10.

3. Part 1: Our DSO infrastructure

There are three main parts to our DSO Strategy. This section describes the first part: our DSO infrastructure. Within each of these categories, DSO depends on infrastructure we've developed in RIIO-ED1 and new investments in RIIO-ED2.

Whilst the tools, infrastructure, and capabilities we've developed in RIIO-ED1 provide a valuable foundation, they are not sufficient by themselves to fully deliver DSO roles and activities in RIIO-ED2. Therefore for our RIIO-ED2 DSO intervention plan, we needed to establish **what** DSO infrastructure to deliver, and **where and when** we need to deliver it.

To do this, we needed to have a detailed understanding of our customers' needs and the issues specific to our network and region that need to be overcome in RIIO-ED2 and beyond. We got this understanding from developing and combining two of our RIIO-ED1 innovations.

First, through our award-winning Network Constraints Early Warning System (NCEWS) innovation project, we built a full model of all 48,000km of our LV network. We've combined it with our existing HV and EHV network models, so we now have a complete connectivity model of our entire distribution network. We hosted this connectivity model within an analytical platform – our ENZ Model (Section 3.3.1).

Second, we've developed two enhanced forecasting tools. They're called EV-Up and Heat-Up, and they use spatial, demographic, and socioeconomic data to forecast EV and heat pump uptake for every customer we serve (Section 3.2.1).

To develop our RIIO-ED2 DSO intervention plan, we entered the granular EV and heat pump forecasts into our ENZ Model (Figure 3). This assessed the entire network from customers' cut-outs all the way up to the transmission interface, for system normal and fault conditions, for multiple forecast scenarios. For many areas where the analysis showed constraints, we did this analysis for every half hour period to beyond 2030. This approach systematically identified where, when, and by how much existing network capacity would be exceeded. This modelling was intensive. Each model run analysed over 175,000 iterations per network asset. We didn't have any computers powerful enough, so we had to use cloud-based servers – each model run still took 20 hours to complete. But this approach has provided us with a more detailed view than ever before.

The outcome is that, for the first time, we accurately know the challenges we need to overcome to deliver our customers' needs and priorities. This means we can establish what DSO infrastructure to use, and where we need to deploy them in RIIO-ED2. We will deliver investment in DSO infrastructure:

1. **Network monitoring** – increasing network visibility to support more efficient network planning and operation. This includes deploy LV monitoring at 14,102 LV substations. This will extend monitoring from 8% to 52% of secondary substations rated at ≥200kVA, increasing coverage from 14% to 76% of customers, by the end of RIIO-ED2.
2. **Enhanced forecasting tools** – better prediction of our customers' requirements. This includes maintaining our industry-leading tools which forecast EV and heat pump uptake for every customer we serve and introducing calibration exercises.
3. **Simulation and modelling tools** – combined with enhanced forecasting to help us identify precisely where, when, and how to intervene. This includes our new ENZ Platform, which integrates four previously independent data sources (monitoring, smart meters, enhanced forecasting, and asset condition) to create a real-time, data-driven, whole network analytical platform.
4. **Scalable network management and flexibility dispatch infrastructure** – coordinates greater use of customer flexibility, automation, and smart tools to manage increasing network complexity. This includes a network wide flexibility platform, and 22 new Constraint Management Zones (CMZs) to support network operation.
5. **Operational IT and telecoms** – the network's nervous system, which most other infrastructure depends on. This includes investing £221.4m to deliver the reliable, secure, low latency operational IT and telecommunications network needed for DSO.
6. **Digitalisation and IT platforms** – the software, flexibility, and data management platforms needed for DSO. This includes our dedicated data sharing portal enabling stakeholders to easily find the data they need.

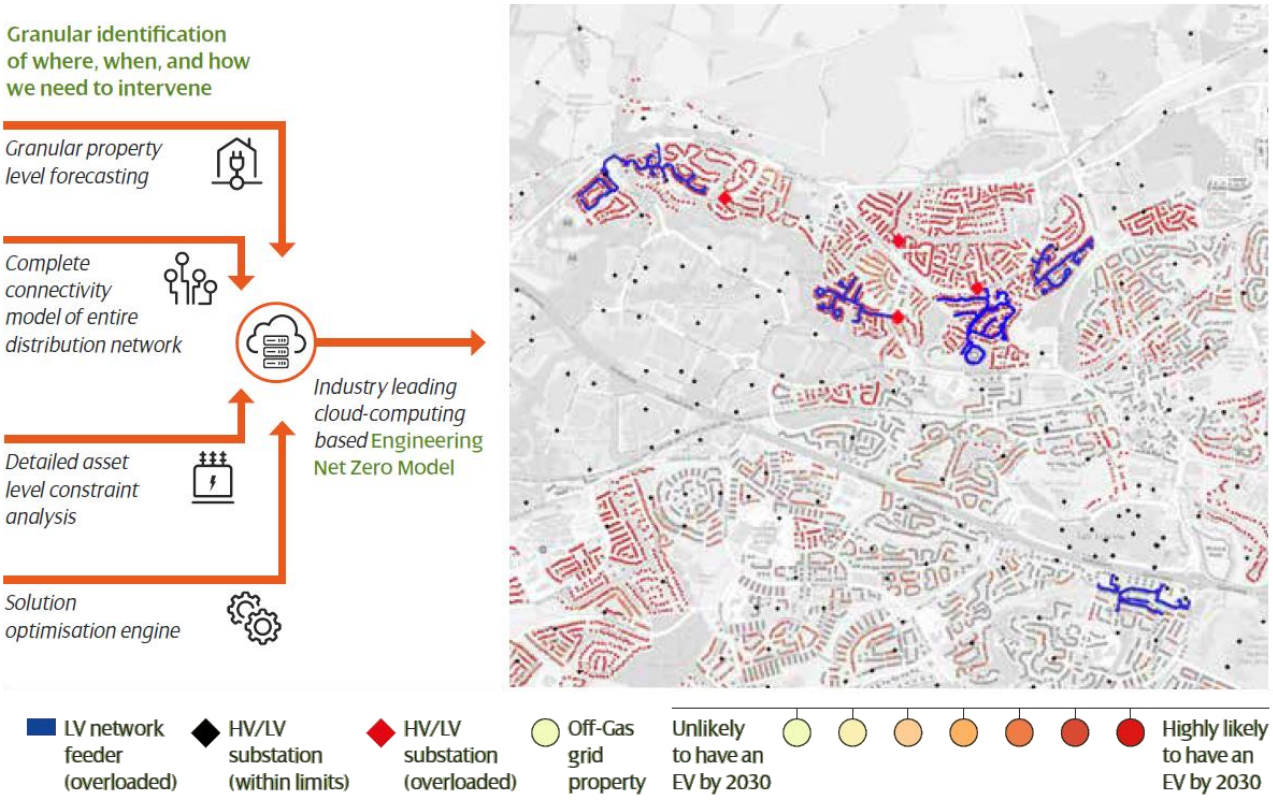

Figure 3: Enhanced forecasting combined with our ENZ Platform

3.1 Network monitoring

This infrastructure is about increasing network visibility to support more efficient network planning and operation. Benefits of network monitoring include getting more out of existing assets by being able to safely operate closer to network limits, having the visibility to support more timely and informed network investments, and enabling the use of lower cost smart interventions that need real-time network data to work, such as automation.

3.1.1 What we've delivered in RIIO-ED1

In RIIO-ED1 we delivered two main monitoring innovations that will help deliver DSO in RIIO-ED2.

Real time fault level monitoring (RTFLM) and active fault level management (AFLM): When there is a network fault, the local network experiences a 'fault current'; these are orders of magnitude higher than normal network current. Generators are a source of fault current, so the increasing levels of DG needed for Net Zero will increase prospective network fault current. Switchgear are the assets which are designed to safely isolate network faults, and so are sized to cope with a certain level of fault current. Where connecting a generator would increase the network fault current above the rating of the switchgear, we've historically needed to replace the switchgear before that generator can connect. This is expensive for the customer and delays their connection.

Historically there has been no reliable way to measure a network's prospective fault current; instead they've been calculated using computer models (governed by industry standards). Given the safety importance of switchgear, and that these models involve no measured data, this modelling involves a safety margin.

In RIIO-ED1, we developed the **world's first real-time fault level measurement** device. For the first time for any DNO, this gives an accurate real-time understanding of prospective network fault level. We combined this innovation with a network management scheme to create AFLM – another first for any DNO.

Together, these capabilities allow us to safely connect more generation customers without triggering fault level reinforcements. This is good for our generation customers, who can connect more quickly and at lower cost. It's also beneficial for our wider customer base, who pay a portion of interventions to manage fault level.

LV network monitoring: we commenced our **Enhanced LV Monitoring project**. By the end of RIIO-ED1 this will have deployed LV monitors at 2,438 secondary substations across our two licence areas. As well as the direct benefits from increased visibility at these secondary substations, this project was useful in helping us develop our RIIO-ED2 LV monitoring strategy. Specifically, this RIIO-ED1 deployment has helped us understand what LV monitor specifications we should be using and develop our supporting data systems that analyse and share LV monitoring information.

3.1.2 How we will take this further in RIIO-ED2

In RIIO-ED2 we will roll-out these RIIO-ED1 two innovations as business as usual and significantly extend their coverage.

Real time fault level monitoring (RTFLM) and active fault level management (AFLM): in RIIO-ED2 we are using RTFLM and AFLM as a business-as-usual intervention. Our load related intervention plan uses RTFLM at 38 sites and AFLM at three sites to defer the need for switchgear reinforcements. This has saved our customers £42.78m.

LV network monitoring: looking forward, the LV network is on the front line of the changing energy system. Decarbonisation means that LV customer power flows will increase, and the rise of LV customers actively engaging with markets means that power flows will become more dynamic. We also expect a surge in notifications, connection applications, and customer enquiries to connect LCTs. These changes are going to require significant investment in the network, our operational capabilities, and our internal processes. Without the data that LV network monitors deliver, this investment would be less efficient and less timely, leading to higher costs and a poorer service for our customers.

Given this, in RIIO-ED2 we will deploy LV monitoring at 14,102[41] LV substations. This will extend monitoring from 8% to 52% of secondary substations rated at ≥200kVA, increasing coverage from 14% to 76% of customers, by the end of RIIO-ED2. LV network monitors are complementary to the increasing penetration of smart meters, and customers get the greatest benefit when these two data sources are combined.

Please see our Network visibility Strategy for more information.

Spotlight: 10 reasons we need more LV monitoring in RIIO-ED2.

LV monitoring provides the data we need to deliver DSO roles, activities, and baseline expectations by:

1. Getting more out of existing network assets by safely operating closer to limits – delivering more value from assets customers have already paid for.
2. Supporting the use of lower cost smart interventions that need real-time network data to work, such as automation.
3. Making smarter and more coordinated network investments, by better knowing where, when, and how we need to intervene – pre-empting constraints, enabling decarbonisation, and reducing customer costs and disruption by making the right interventions.
4. Facilitating flexibility solutions and increasing the pool of providers and competition – helping defer more costly and disruptive interventions.
5. Responding to network faults more quickly – delivering a more reliable supply for our customers.
6. Automating LV connection offers – reducing overheads which are paid for by customers.
7. Delivering Ofgem's baseline expectations.
8. Managing network losses – reducing the cost and carbon impact of our networks.
9. Encouraging innovation, by sharing data with third parties.
10. Increasing competition in connections, by enabling ICPs and IDNOs to better serve customers.

[41] We have the capability to adapt this roll-out across the range of Net Zero compliant scenarios (Section 2.2.2). This equates to delivering LV monitoring at 13,784 secondary substations for the low scenario, and at 29,370 secondary substations for the high scenario.

3.2 Enhanced forecasting tools

This capability is about better predicting changing customer requirements, such as the growth of EVs, heat pumps, and generation. The more foresight we have about our customers' needs the more efficiently we can respond to them. Forecasting also supports flexibility markets, through using long-range forecasts to notify the market where we need support, and through near-time forecasts to send dispatch warnings to providers and the ESO, giving these parties time to prepare and respond.

Enhanced flexibility isn't just valuable in its own right; it is also needed as a key input into simulation and modelling tools (Section 3.3), and so underpins their value too.

3.2.1 What we've delivered in RIIO-ED1

In RIIO-ED1 we delivered several forecast developments that will help deliver DSO in RIIO-ED2.

- **Distribution Future Energy Scenarios:** developing these has significantly increased our ability to produce licence-wide forecasts with stakeholder input. These are invaluable for understanding the total volumes of LCT growth across our region. We update our DFES every year using the latest GB FES and stakeholder input.
- **EV-Up** and **Heat-Up:** these are two enhanced forecasting tools developed out of innovation projects. They use spatial, demographic, and socioeconomic data to forecast EV and heat pump uptake for every customer we serve. This is relevant as these are the two drivers of increasing demand.

These forecasting tools are complementary to our DFES and low, baseline, and high scenario forecasts (Section 2.2.2). The scenarios consider a range of macro factors (such as legislation and technology development) to forecast total EV and heat pump volumes across our whole licence area. EV-Up and Heat-Up show, for any scenario, how these are likely to roll-out across the network – they forecast which individual households will get them and in what timescales. Figure 4 shows the output from EV-Up. The granularity of these two tools is a step forward in forecasting capability. They have been instrumental in our ability to accurately identify every forecast RIIO-ED2 constraint and so develop a targeted and efficient RIIO-ED2 business plan. We are the only DNO to do this.

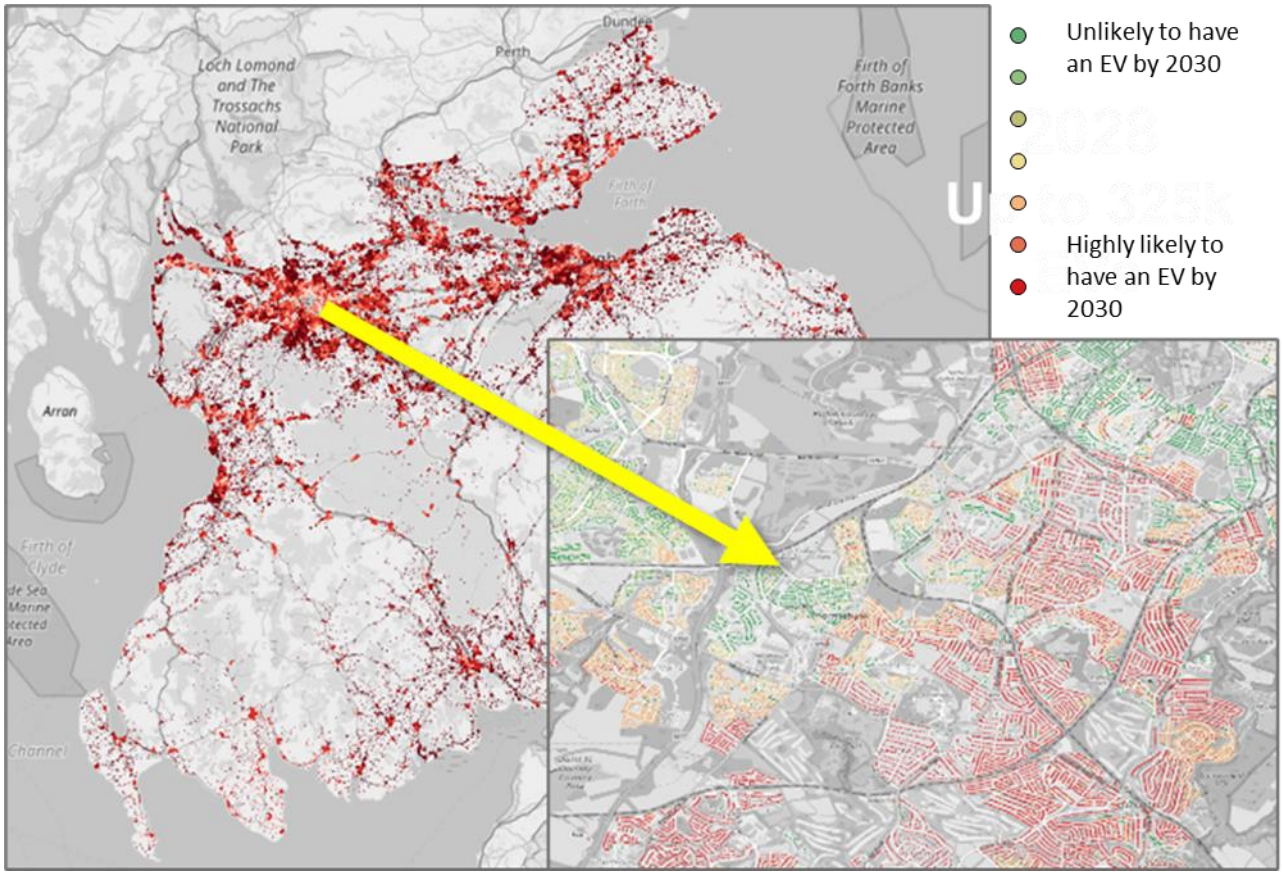

Figure 4: EV-Up forecast maps

Near-time forecasting: We have developed a near-time **PRAE** forecasting platform to give demand and generation forecasts for up to four days ahead. We use this to plan our operational actions, such as flexibility service utilisation. This has then been expanded and combined with our **Weather Normalised Demand Analytics (WaNDA) project**. This uses historical data, generation, and discretised weather data at a primary substation level, to help better understand the effects of weather on network power flows. By combining PRAE and WaNDA, we can do two things. Firstly, we can better inform operational dynamic thermal ratings, helping us get the best out of existing network assets. Secondly, our medium-term network planning (3-4 years out) is now informed by weather data. This helps us make more informed network planning decisions.

We have developed new forecasting capability through our **Charge project**, which combines transport modelling and network planning to advise local authorities where to optimally site public EV chargers.

3.2.2 How we will take this further in RIIO-ED2

We have already developed the enhanced forecasting tools we'll need in RIIO-ED1, so in RIIO-ED2 our focus is changing to keeping these tools up to date through further developments and, for EV-Up and Heat-Up, an annual calibration exercise. This will include comparing previous forecasts against the observed reality, and using this assessment to make updates.

3.3 Simulation and modelling tools

Simulation and modelling tools, when combined with enhanced forecasting, help us identify precisely where, when, and how to best intervene. This means we can make more targeted, timely, and efficient interventions, and this foresight also helps us better coordinate our interventions, resulting in less disruption for customers.

3.3.1 What we've delivered in RIIO-ED1

In RIIO-ED1 we delivered a step change in network analytical capability that will help deliver DSO in RIIO-ED2.Through our award-winning[42] **Network Constraints Early Warning System (NCEWS) innovation project**, we have built a full connectivity model of all 48,000km of our LV network. It used advanced machine learning algorithms to extract missing cable assets.

We've combined it with our existing HV and EHV network connectivity models, so we now have a complete model of our entire network, from customers' cut-outs up to the transmission network. We call this complete model our **ENZ Model**, and it means we have full analytical capability for our entire network.

By combing this with our enhanced forecasting tools, we can precisely identify where, when, and how much additional capacity our customers need. This capability benefits customers as we're able to develop targeted interventions that are tailored to their needs. We reduce the risk of over-specifying solutions (spending more than we needed to), or underspecifying solutions (not providing enough capacity).

Combined with our enhanced forecasting tools, this has been instrumental in our ability to accurately identify every forecast RIIO-ED2 constraint and so develop a targeted and efficient RIIO-ED2 business plan. We are the only DNO to do this.

3.3.2 How we will take this further in RIIO-ED2

A key theme that emerged in preparing for RIIO-ED2 is that the LV network will be on the front-line. EV chargers, heat pumps, condition-driven cut-out replacement, domestic customers actively participating in energy markets, increasing smart meter data, increasing connection applications – this is all happening at LV.

This is a seismic change, and it's why we need to do more than just increase network capacity – we need a new approach to LV network planning and operation. To enable Net Zero safely, efficiently, and on time, this new approach needs to be driven by data, integrate different systems and technologies, and increase visibility of the LV network.

To achieve this, in RIIO-ED2 we will develop our ENZ Model into a real-time simulation and modelling platform – our **ENZ Platform**. This will integrate four previously independent data sources (network monitoring, smart meters, enhanced forecasting, asset condition) with the full connectivity model of the entire network which we build for the ENZ Model. This platform will run automated power flow analysis for the entire network in real-time. This produces network analytics to tell us what is happening on the network right now, and what will happen in operational and planning timescales. This information means we can make real-time data-driven

[42] This project won the prestigious Institution of Engineering and Technology (IET) and Engineering and Technology (E&T) 'Innovation of the Year' prize in November 2019.

planning and operational decisions. We will increase its capability by deploying 14,102 LV network monitors in RIIO-ED2, in addition to the 2,438 LV monitors we delivered in RIIO-ED1.

This industry-leading approach means that we will have an integrated data and analytical system covering the entire network, considering both network loading and asset condition. This is a UK first. We will have data-driven visibility of the LV network. We can make more informed real-time operational decisions which improve the safety, reliability, and efficiency of the network for our customers. And we can better coordinate the range of load related, asset management, and DSO interventions, to reduce cost and disruption for our customers while delivering what they want. Please see Figure 5 for more information.

This platform marks a significant move forward for us as a network, and a step change for our customers.

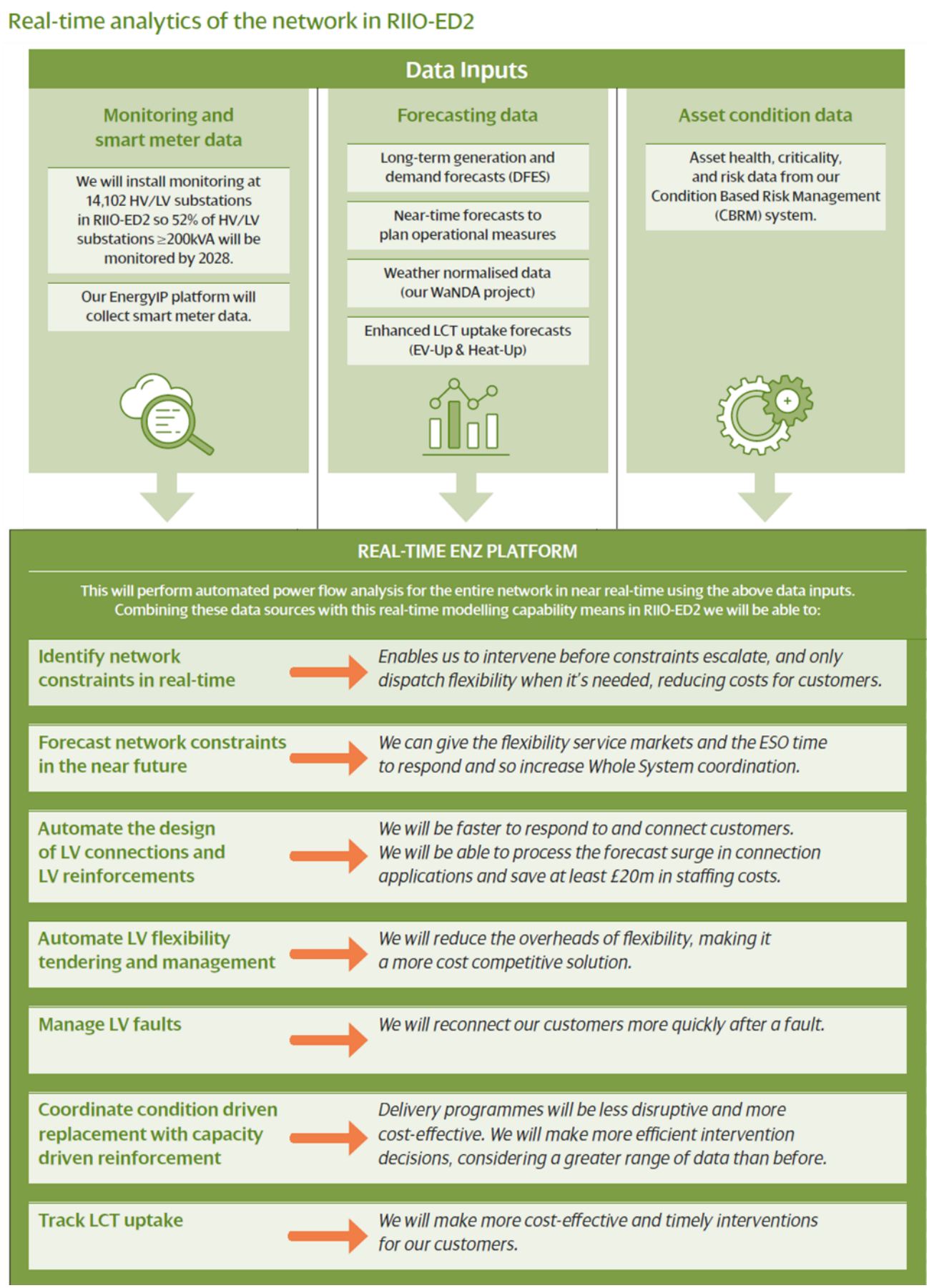

Figure 5: Our Engineering Net Zero (ENZ) Platform

3.4 Scalable network management and flexibility dispatch infrastructure

This infrastructure helps us dispatch flexibility (instructing and tracking the operation of flexible solutions) and coordinate that dispatch with the wide range of other operational actions we take to avoid network constraints. This coordination across operational actions is essential as the volume, complexity, and interactivity of them increases, and the increasingly automated nature of some of them. If we can't coordinate our actions, then we risk conflicting actions taking place, resulting in increased costs for customers; in the worst case conflicting automated systems can result in cascade trips, resulting in customer black outs. The increasing range of operational actions provides many benefits for customers, such as quicker and lower cost connections, but they must be properly managed and coordinated.

3.4.1 What we've delivered in RIIO-ED1

In RIIO-ED1 we delivered one network management scheme and one flexibility dispatch scheme that will help deliver DSO in RIIO-ED2.

- We implemented the **Flexible Power** portal with other DNOs. This portal stems from a Western Power Distribution RIIO-ED1 innovation project. It will help us automate some of the processes needed for dispatching, billing, and settling flexibility services. These platforms can facilitate the growth of the services market by clearly setting out our service requirements. They will also provide a secure mechanism for us to coordinate and communicate with our service providers.
- We are in the process of deploying wide scale **active network management (ANM)** across the Dumfries and Galloway network area. This regulates the output of DG to avoid transmission constraints – this type of coordination across transmission and distribution is a UK first. The scale and nature of this project (one of the largest of its type) provides invaluable learning for further developing constraint management zones in RIIO-ED2 and extending their functionality to coordinate a wide variety of DSO functions.

3.4.2 How we will take this further in RIIO-ED2

In RIIO-ED2 we will continue to use a third-party **Flexibility Platform** like Flexible Power – we will not develop a proprietary system inhouse. We will work with the flexibility platform provider to ensure it can:

- cater for all types of flexibility services that we may need to procure;
- be easily scalable across our entire licence area;
- all provider types can easily engage with the platform (i.e. it does not present an administrative barrier to participation); and
- that the platform and its method of communicating with providers are secure and do not present a cost barrier to participation.

In RIIO-ED2 we will deploy a new network control architecture – called **Constrained Management Zones (CMZs)** in 22 areas of the network. These will be at the heart of network operation in RIIO-ED2 and a key part of our DSO infrastructure. Please see below for more information.

CMZs – what they are and why we need them

We operate the distribution network in real-time to keep power flows within safe network limits. This involves our control team monitoring the network 24/7 and making operational interventions where needed. This network operation is becoming more complex:

- Power flows are becoming more dynamic, meaning it's harder to predict where and when they will exceed network limits and the severity of the constraint.
- There is greater whole system interactivity, especially as the ESO increasingly relies on services from distribution-connected providers.
- The toolset our control team can use is becoming bigger and more complex – some tools can only be used at certain times of day or year (e.g. voltage control), or for certain durations (e.g. flexibility services), or have knock-on effects (e.g. reconfiguration). An increasing number of customers are directly involved (flexible connections and flexibility services) and tools have varying costs.

In short, there are an increasing number of scenarios where our control team need to intervene (often at short notice), a larger and more complex toolbox of solutions, and an increasing number of parties impacted by our operational decisions – the complexity of operating the distribution network is significantly increasing.

If we are to continue to save our customers time and money by trying to get the most out of existing network capacity and offering flexible connection arrangements, rather than always reinforcing the network, we need to help our control team operate the network.

To do this, we will deploy an automated control system which coordinates and dispatches operational solutions. Using network models, live data from network monitors, and automated analysis, it can make better decisions in shorter timescales than humans can. We call these CMZs.

CMZ functionality and composition

The concept of automated control is not new – we delivered our first ANM in DPCR-5. However these RIIO-ED2 CMZ schemes are considerably more sophisticated and have far greater functionality than what has gone before, and will support and coordinate a variety of DSO functions:

- Active Network Management
- Active Fault Level Management (AFLM)
- Flexible Connection Management
- Flexibility Services
- Voltage Management
- Service coordination with the ESO and other DSOs

The CMZs are in three parts:

1. The Centralised ANM Operating Platform (CANMOP). This is the brain of the system that makes the decisions. It is hosted at the Kirkintilloch control room for CMZs in SP Distribution and at the Prenton control room for CMZs in SP Manweb.
2. The CMZ zone itself. This is the geographic area of network, within which participating assets and operational actions are managed by instructions from the CANMOP.
3. Customer outstations. Customers who make use of the ANM functionality will have a control unit at their site to communicate with the CANMOP.

Overlap between ANM functionality and flexibility services

ANM is a key functional component of CMZs. In the development of our DSO Strategy, stakeholders asked about the overlap of this ANM functionality with flexibility services, and whether it would limit where we sought flexibility services.

In RIIO-ED2:

1. We will tender for flexibility services to meet requirements across our network, and we will contract with them where they are the best solution to a constraint.
2. These flexibility services may be from generation, demand, or storage customers, either directly or via an aggregator.

These two statements are true across our whole network – where we use flexibility services in RIIO-ED2 is independent of the location of CMZs, and we can use flexibility services both inside and outside CMZs.

Flexibility services will be scheduled and dispatched through our third-party Flexibility Platform (we are currently using Flexible Power). This is our flexibility service scheduling, dispatch, and settlement platform, which uses an API to send the dispatch signals.

The CMZs and Flexibility Platform will coordinate with each other, to avoid any situations where they might dispatch conflicting actions (e.g. the Flexibility Platform instructing a generation increase from within a CMZ, which the CMZ then counters by instructing another ANM managed generator to reduce output).

Our CMZ infrastructure will facilitate the use of flexibility services in a greater range of scenarios by avoiding conflicting network management actions and by providing a safety net in the event of market failure. This means we can safely and confidently expand our use of flexibility services.

CMZ deployment in RIIO-ED2

In RIIO-ED2 we will deliver 22 CMZs (Figure 6).

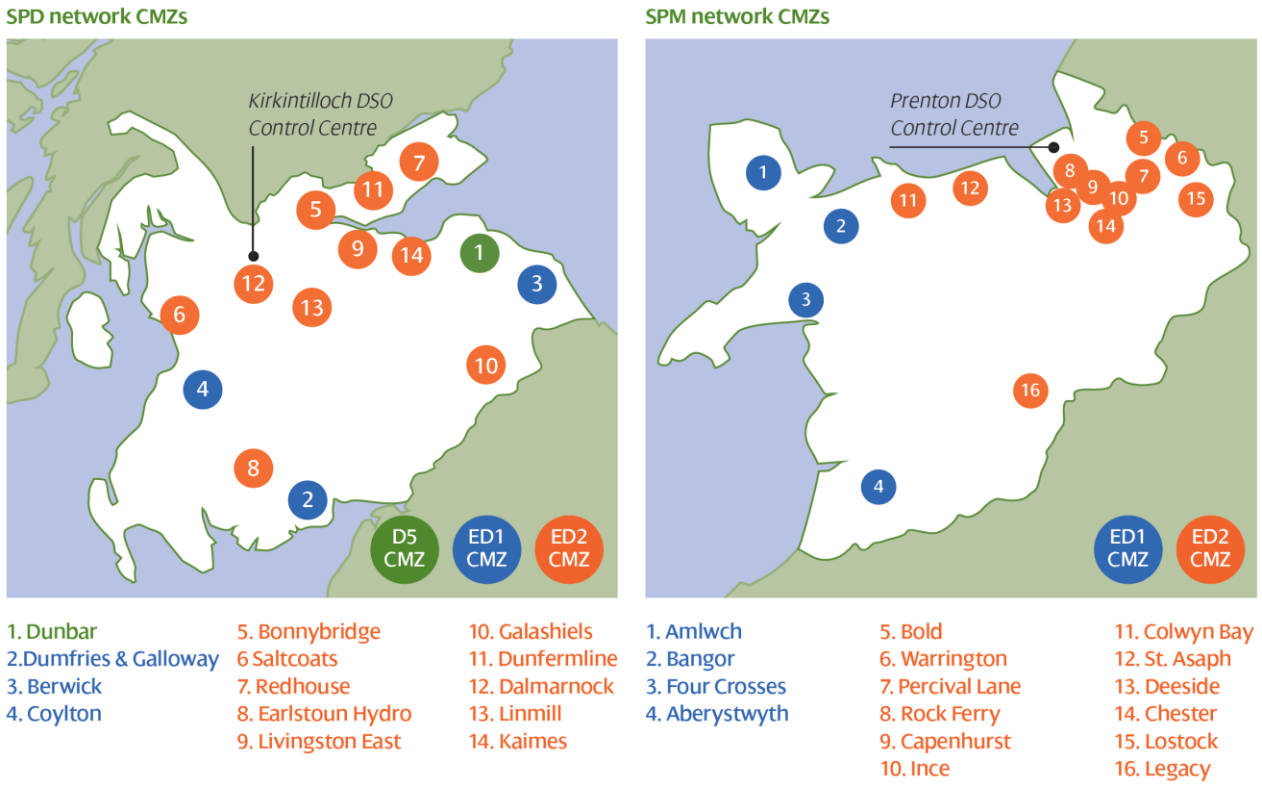

Figure 6: CMZ rollout in RIIO-ED2

The deployment order of the CMZs is determined by network need. The provisional deployment order (our current best view) is shown in Table 3. We will keep the priority order of the roll-out of CMZs under review so this order may change. If additional constrained areas arise within RIIO-ED2 we will seek to ensure the CMZ infrastructure includes the additional areas.

Licence area	Provisional CMZ deployment				
	2023/24	2024/25	2025/26	2026/27	2027/28
SP Distribution	2 Livingston, Redhouse	3 Dunfermline, Bonnybridge, Linmilll	0	2 Dalmarnock, Saltcoats B	3 Kaimes, Galashiels, Earlstoun
SP Manweb	3 Legacy, Lostock, St Asaph	2 Ince, Bold	2 Colwyn Bay, Warrington	3 Chester, Capenhurst, Deeside	2 Percival Lane, Rock Ferry

Table 3: Provisional CMZ deployment timetable

CMZ deployment and the Significant Code Review (SCR)

Given that ANM is one functionality of CMZs, and given Ofgem's SCR may reduce the numbers of customers asking for ANM connections if the final outcome is a shallow connection charging regime, a stakeholder asked us whether CMZs were still needed in RIIO-ED2.

The 22 CMZs we've identified are still required for two main reasons:

1. The ANM functionality is only one component of CMZs. They provide other functionality, most notably the essential broader role of coordinating operational actions – this need will remain regardless of the SCR outcome.
2. With regard to ANM functionality within CMZs, we still expect customers to want constrainable connections in some circumstances. For example, generation customers may want non-firm (constrainable) access on an interim basis until the wider reinforcements needed to grant them full firm capacity are complete.

3.5 Operational IT and Telecoms

Operational IT and telecoms consists of four components:

1. The telecommunications network, which communicates all data and control signals
2. Supervisory Control and Data Acquisition (SCADA) systems, which are the network monitoring and control system architectures
3. Smart systems and central data management, such as the full network connectivity and loading model developed through our Network Constraint Early Warning Systems (NCEWS) and Network Analysis and View (NAVI) innovation project
4. Network automation and monitoring.

These integrated systems and infrastructure are vital for DSO baseline requirements and accommodating Net Zero decarbonisation: increased network monitoring; collating and sharing information with third parties; smart network technologies to manage a more dynamic and interactive energy system – these all depend on safe, resilient, and cyber secure operational IT and telecoms. Our existing systems were designed for historical passive networks. While they have evolved in RIIO-ED1 to accommodate increasing levels of generation, the magnitude of the changes needed to achieve Net Zero goals in RIIO-ED2 and beyond means these systems need to undergo a more dramatic revolution.

Given this, we will materially increase our investment compared to RIIO-ED1 to £221.4m, to significantly expand these capabilities. This will enable:

- Deployment of LV monitoring at 14,102 sites, increasing coverage from 14% to 76% of customers. These help us more efficiently operate our network for our customers, by better knowing where and when to intervene, and enhance competition, by supporting our more targeted and effective use of flexibility services.
- Analysis and sharing of data across the organisation and with third parties.

  Expansion of our world leading active fault level management innovation project, which will enable renewable generation to connect quicker and at lower cost.
- Continued use of RIIO-ED1 innovations such as NCEWS, which uses advanced machine learning to estimate the specification of missing cable assets and predict network behaviour. This has enabled our ENZ Platform (page 48) as BAU innovation in RIIO-ED2 and won the prestigious IET E&T Innovation of the Year prize in November 2019.

Please see our Operational IT and Telecoms Strategy for more information.

3.6 Digitalisation and IT Platforms

Data is the key to fully unlocking the value of the network for our customers. This includes data from increased network monitoring, asset condition data, improved operational and planning data from forecasting, data from the markets we facilitate, and data from third parties (including smart meters). We will also be gathering and communicating data with far more sources, from simple network monitors to sharing whole network models with customers. So that we can effectively record, store, analyse and share data, and deliver the benefits it offers, we need to ensure we have the right digitalisation and IT platforms. These cover hardware, software, processes, IT/cyber security, and interoperability between platforms and systems.

Together, data and digitalisation underpin all network activities and wider system coordination, from allowing us to make more informed operational decisions to helping markets better understand network opportunities. These deliver benefits from the micro (predicting a cable fault and repairing it before the customer loses supply) to the macro (spurring innovation and competition in the provision of network services).

3.6.1 What we've delivered in RIIO-ED1

In RIIO-ED1 we delivered two digitalization and IT platforms that will help deliver DSO in RIIO-ED2.

- **Smart Data Integration Fabric (SDIF):** this system enables data to be collected, analysed, and shared in a consistent manner across SP Energy Networks and with external parties. A key benefit of SDIF is that it helps ensure a consistent data set, i.e. all parties are working from the same data set. SDIF supports the sharing of more complex datasets, such as whole network models.
- We digitalised our **Network Asset Management System (NAMS)** and it is now fully operational. This brings together multiple asset management stands into one integrated system. This has improved the transparency and accuracy of our asset management information, which helps support more coordinated and targeted asset management interventions. This helps keep bills lower for customers, safeguard supply reliability, and reduce disruption.

3.6.2 How we will take this further in RIIO-ED2

In RIIO-ED2 we will build on these RIIO-ED1 developments.

- We will create a dedicated data sharing portal to act as the main data gateway for customers and stakeholders. This means stakeholders will be easily able to find the data they need.
- We will deliver the digital and IT systems needed to enable the other infrastructure described in this Section 3 – our enhanced forecasting tools, our ENZ Platform, the flexibility platform, and any data sharing capabilities.

Our IT and Digitalisation Strategy and our Data Strategy set out more information.

DSO infrastructure system architecture

Ahead of RIIO-ED2, we assessed the current, planned, and future requirements of DSO using a Smart Grids Architecture Model (SGAM) Framework approach with an industry leading provider. This allowed us to take an architectural approach, creating a representation of interoperability viewpoints in a technology neutral manner, both for current and future implementations. Individual SGAM models were created to reflect each function within our CMZs, including the enablers, roles, and interfaces between each system. This is outlined in full in our DSO Infrastructure Engineering Justification Paper (EJP).

Figure 7 shows the overarching architecture. We redacted this diagram to remove the information flows from a system security perspective. The unredacted diagrams are available to Ofgem in the unredacted EJPs.

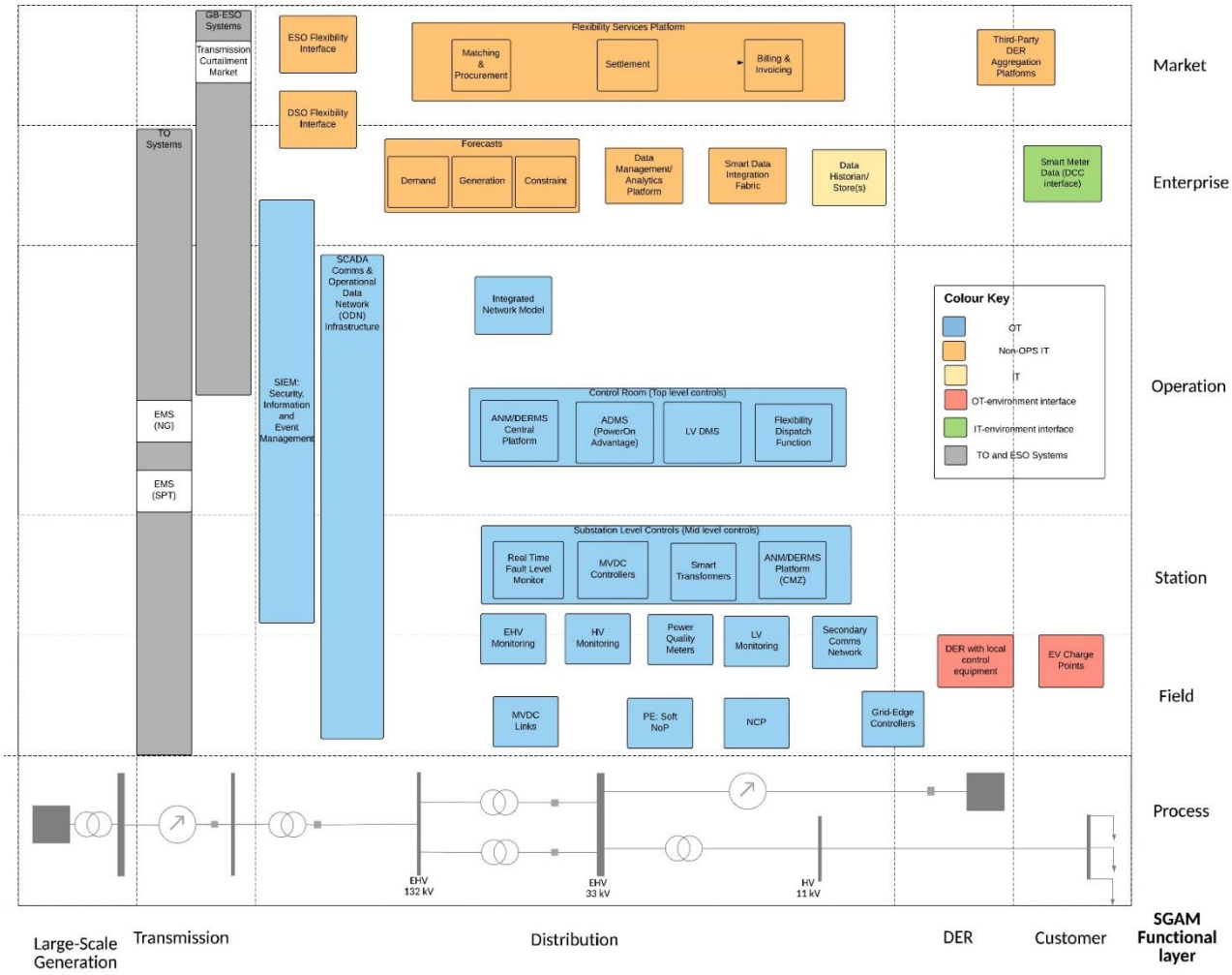

Figure 7: DSO SGAM high level architecture

4. Part 2: our new DSO functional model

There are three main parts to our DSO Strategy. This section describes the second of these: the creation of a new DSO functional model. Please see Appendix E for our assessment of different institutional arrangements.

4.1 Why a new DSO functional model

DSO involves big changes for us – changes to our activities and infrastructure, our ways of working and processes, and our interactions with customers and stakeholders. Given the magnitude of these changes, and the importance of getting it right, it is essential that our organisation is structured effectively to deliver our DSO commitments. For this reason, we will create a new DSO functional model within SP Energy Networks by the start of RIIO-ED2. It will be responsible and accountable for delivering DSO, including planning and network development, network operation, and market development. This new functional model is one measure we're taking to increase transparency, address concerns about perceived conflicts of interest, and give our customers confidence that we are a neutral market facilitator. This is important – our customers, stakeholders, and service providers must have confidence in us and the markets we interact with, as their involvement is essential for enabling Net Zero efficiently, maintaining system stability, and promoting competition in service provision; customers benefit from all of these.

4.2 What we will deliver for RIIO-ED2

We will deliver a new DSO functional model within SP Energy Networks which will fulfil the DSO responsibilities for our two distribution licence areas SP Distribution and SP Manweb. There are four key attributes of this:

1. **A DSO expert stakeholder panel.** We will create an independent panel of expert stakeholders to guide and inform our delivery of DSO through RIIO-ED2. We will seek representatives from energy suppliers, flexibility market participants, other network companies, academia, technology providers, government / local authorities, and customer representatives (including vulnerable customers). This panel is in addition to direct engagement with stakeholders. The panel's remit will be to:
    i. Challenge and advise us on the transparency and openness of our Decision Making Framework.
    ii. Monitor our progress against the DSO outputs listed in Appendix B.
    iii. Provide oversight and input to investment appraisal and data sharing processes.
2. **Transparency of intervention decisions.** Our new dedicated DSO functional model will increase transparency through:
    i. Publishing a range of information on all network constraints, initially for the 33kV and 132kV network, so that customers and stakeholders can follow each constraint from initial constraint identification through to how they are managed or resolved. This includes publishing our options assessment and intervention decision rationale.
    ii. All load-related intervention decisions over £2m will be externally assured and the results made public within 10 working days of assurance completion. We will publish supporting information (including our assessment of solutions), so our decisions are transparent.
    iii. Data share across all voltage levels, our Network Development Plan, and publishing flexibility tender results all increase network investment transparency.
3. We will maintain and comply with a **Conflict-of-Interest Management Plan**. This will be developed with stakeholder input.

We are still developing the organisational structure, but our latest thinking is that the DSO functional model will be split into seven functions which align to the three core DSO responsibilities – see Figure 8.

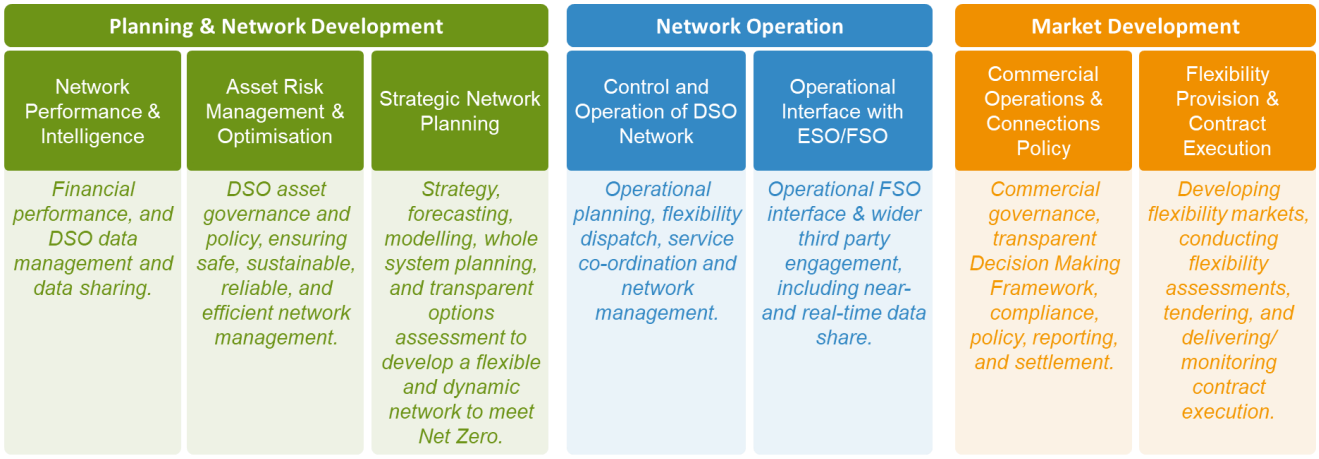

Figure 8: DSO organisational structure

4.3 Why this is the right arrangement for RIIO-ED2

Since the publication of our DSO Vision in 2016, we considered different business models for the delivery of DSO roles, activities, and infrastructure. We believe our proposed approach is the most effective mechanism for RIIO-ED2 to deliver DSO for four reasons:

1. **Clear accountability for resilience and safety** – our 3.5m business, homes, and public services enjoy a safe and reliable supply because there is a clear single responsibility for this – the buck stops with us. Given 'DNO' and 'DSO' actions interact and can cause the same issues, full legal separation would introduce uncertainty of responsibility at a time when our customers are increasingly dependent on their supply. We cannot blur responsibilities for the network that enters into people's homes. Our proposed approach retains clear responsibility for customer safety.
2. **Avoids unnecessarily increasing costs** – legal and structural changes have historically been very expensive for customers. There is already enough upward pressure on bills; we shouldn't be adding to them unnecessarily, especially with full legal separation when the benefits case has not yet been made. Our proposed approach delivers the benefits of separation of responsibility, accountability, and transparency whilst avoiding the associated costs.
3. **We must focus on Net Zero** – RIIO-ED2 is critical to achieving 2050 Net Zero as we are building the groundwork for Net Zero. Delivering wholesale legal and structural changes such as full legal separation would divert a significant amount of focus and resource at a time when we need to deliver a substantial increase in interventions, tools, and processes to enable Net Zero. Our customers and stakeholders want us to enable Net Zero – we cannot afford distractions. Our proposed approach delivers full DSO capabilities to accommodate Net Zero.
4. **Customers** – the majority of stakeholders haven't asked for full legal separation. Our customers have told us that their priorities are that we keep the lights on, keep the network safe, and keep costs efficient. Regardless of who performs these functions in the long-term, our stakeholders highlighted the importance of preventing significant divergence in system management in the short-term. Our proposed approach delivers our customers' priorities and aligns with our stakeholders' views.

The DSO functional model we have proposed is the right answer for RIIO-ED2 as it retains clear responsibility for customer safety, ensures accountability to deliver our DSO outputs, delivers the DSO capabilities needed to accommodate Net Zero, addresses concerns about perceived conflicts, promotes transparency, keeps options open for future institutional arrangements, and minimises unnecessary costs before the case for any particular future arrangement has been made. This is a 'no regrets' arrangement.

The DSO functional model that we have proposed is proportionate to meet both regulatory and stakeholder requirements. We believe that DSO will continue to evolve, and we have considered these options in a sequence rather than a range of choices for RIIO-ED2. This evolution is outlined below:

RIIO-ED1: Integrated DSO (existing model)	RIIO-ED2: DSO functional model	Post RIIO-ED2: DSO Evidence Base
Head of DSO within the DNO, with independent	Dedicated teams that will deliver accountability and	Using the evidence base from RIIO-ED2, the appropriateness of DSO measures should be

decision making on networking planning & development, network operation and market development that is affected by DSO.	board level visibility. It will have responsibility for DSO, supported by the other measures outlined in this Section 4.	assessed by Ofgem with stakeholders and DNOs. This review would include an assessment of the RIIO-ED2 evidence base, industry consultation, and benefits assessment to make sure that any changes to the DSO operating model deliver customer benefits.

5. Part 3: Our DSO outputs

There are three main parts to our DSO Strategy. This section describes the third of these: the DSO outputs that we will deliver in RIIO-ED2 and how they meet and exceed Ofgem's DSO baseline expectations. We have categorised these by the five Ofgem-defined DSO activities, and within each category we have organised the outputs thematically. This section is an abridged summary of our DSO outputs – please see Appendix B for the full list of outputs and detail on their timescales, costs, benefits, and mapping against Ofgem's DSO baseline expectations. All data sharing outputs are subject to the Open Data Triage process and Data Best Practice Guidance (please refer to our Data Strategy).

5.1 Activity 1.1: Plan efficiently in the context of uncertainty, taking account of whole system outcomes, and promote planning data availability

To fulfil this activity, we will deliver a range of outputs and supporting investments in RIIO-ED2. Together, these outputs will ensure that:

1. We make high-quality, data-driven, investment decisions that fairly compare all viable options, including flexibility and energy efficiency, and take account of whole system outcomes.
2. Our planning processes and intervention decisions are clear and transparent.
3. We will make network planning data publicly available.

Activity 1.1 DSO outputs – what we will do
We will increase visibility of the network: ✓ Investing £28.3m to deliver LV monitoring at 14,102 secondary substations. This will extend monitoring from 8% to 52% of large LV substations, increasing coverage from 14% to 76% of customers, by the end of RIIO-ED2. ✓ Investing in our infrastructure to collect smart meter data and incorporate it in our network planning tools. ✓ Where we are missing network asset information, we will continue to use artificial intelligence and predictive analytics to 'fill in the blanks'. ✓ We will work with the three gas network companies that span our two licence areas (Cadent, SGN, and Wales & West Utilities), to request information about planned maintenance outages as these can increase electricity demand. ✓ Our Network Visibility Strategy explains how we are ensuring we will deliver network monitors where they provide value and complement smart meter and third-party data.
We will use industry leading forecasting, simulation, and modelling tools to ensure we make high-quality, data-driven intervention decisions: ✓ Using enhanced tools to forecast EV and heat pump uptake for every single customer we serve and model weather effects on network power flows. ✓ Investing in our new simulation and modelling ENZ Platform which integrates forecasting data, network monitoring data, smart meter data, and asset condition data with a full power flow model of our entire network, so we can make data-driven assessments of when and where we need to intervene. ✓ Combining LV monitoring and smart meter data to identify non-technical loses. ✓ An annual calibration exercise so our forecasting, simulation, and modelling tools remain accurate.
We will make investment decisions that fairly compare all viable options, including flexibility and energy efficiency, and consider whole system outcomes: ✓ Establishing a DSO function that is responsible for network investment decisions, by the start of RIIO-ED2. ✓ Impartially selecting interventions having signalled our network needs through flexibility tenders and our Network Development Plan, and fairly compared solutions using a defined set of assessment criteria.

✓ Using a linear optimisation engine to impartially assess solutions and create bespoke intervention programmes for every LV and HV network constraint. ✓ Working with other network companies and vectors, and providing a team of specialists (Strategic Optimisers) to partner with local authorities and regional governments to support the optimisation of network planning, design, and implementation of public EV charging and heat electrification initiatives.
We will increase transparency of our end-to-end network planning process and publish network planning data: ✓ Publishing our network needs through flexibility tenders and publishing the results of those tenders. ✓ Publishing our methodology for how we value flexibility and approach energy efficiency. ✓ Publishing a range of information on all network constraints, initially for the 33kV and 132kV network, so that customers & stakeholders can follow each constraint from initial constraint identification through to how they are managed or resolved. Includes publishing our options assessment and decision rationale. ✓ Publishing our DSO Security Standard, which will explain our network planning process and the respective responsibilities of the DNO and independent DSO. ✓ All our load-related intervention decisions over £2m will be externally assured, and the results made public. ✓ Investing in the infrastructure we need to share data and how we present it, such as in heat maps and the long term development statement. ✓ We will work with stakeholders to prioritise what planning data we publish.

Table 4: Summary of our outputs against Ofgem Activity 1.1

Spotlight: using our HV and LV linear optimisation engine to impartially select solutions

When assessing what solution(s) to use for a network constraint, there are numerous variables to consider. For example, how our customers' capacity needs vary over time, how much capacity each solution adds, the lifetime of each solution, and the different capital (CapEx) and operational (OpEx) costs for each solution. This means there are a large number of different combinations and sequences of solutions for each of the thousands of forecast RIIO-ED2 constraints, and we need to impartially identify the individual optimal intervention approach for each.

To do this for HV and LV assessments, we use a mixed-integer linear optimisation engine to determine the most economic combination, sequence, and timing of solutions to meet the required level of network capacity. It does this by assessing the range of credible solutions to resolve the constraint (for example, a series of smaller smart and flexibility interventions versus a single larger reinforcement solution) and selects the combination of interventions that minimises NPV over the forecast planning horizon. So as an example for flexibility, this means it can consider flexibility as an enduring solution by itself, an enduring solution in combination with other enduring solutions, a short-term solution to defer the need for another solution, or a short-term solution in combination with other short-term and long-term solutions – different use cases are considered.

This is illustrated in Figure 9, which shows the principle of a sequence of smaller interventions being used to resolve the forecast constraints versus a single larger intervention.

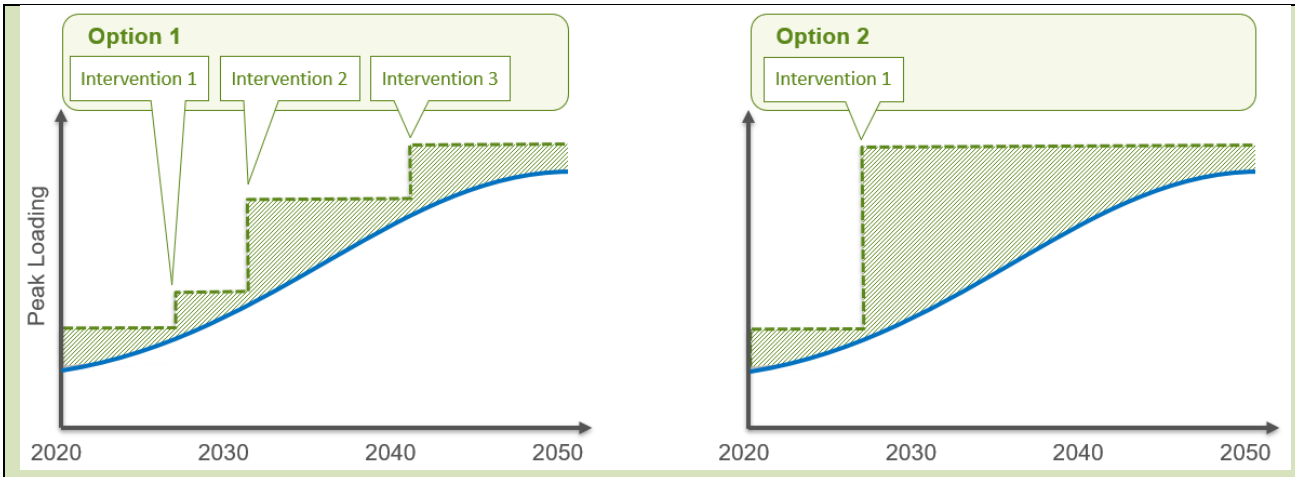

Figure 9: Optimisation of interventions and timing of solutions

The outcome is the impartial identification of the most economical combination and timing of solutions to meet the required level of network capacity – each forecast HV and LV constraint has its own bespoke intervention programme. This is a step change in modelling capability and how network solutions are identified, and ensures that we have developed an efficient investment plan. This optimization engine is built into our ENZ Model and will be carried forward into our ENZ Platform for RIIO-ED2.

We don't use the linear optimization engine to identify EHV solutions. This is because there are far fewer constraints at EHV and above, and there tend to be fewer credible solutions (due to a combination of fewer options to upgrade or reconfigure existing assets, and tougher planning barriers). This means that rather that use a linear optimiser to assess a large number of variations, we do more in depth design studies to support CBAs and technical analysis on a smaller number of credible solutions.

5.2 Activity 2.1: Promote operational network visibility and data availability

To fulfil this activity, we will deliver a range of outputs and supporting investments in RIIO-ED2. Together, these outputs will ensure that:

1. We will have the data we need to operate the network safely and reliability.
2. We will have the data and systems we need to share a range of operational information (including constraint data) with the ESO, other network operators, and stakeholders.
3. We and the ESO will have the DER data we need to increase resiliency to low-probability high impact events.

Activity 2.1 DSO outputs – what we will do
We will increase our near-time and real-time visibility of the network and our identification of network constraints:
✓ Investing £28.3m to deliver LV monitoring at 14,102 secondary substations. This will extend monitoring from 8% to 52% of large LV substations, increasing coverage from 14% to 76% of customers, by the end of RIIO-ED2.
✓ Using smart meter alarms in our control room.
✓ Investing in a real-time, data driven, network analytical platform – our ENZ Platform. It integrates near-time forecasting (PRAE) and weather data (WaNDA), LV monitoring data, smart meter data, and asset condition data with automated power flow modelling of our entire network to tell us what is happening on the network right now and what will happen in near-time.
✓ We will work with the three gas network companies that span our two licence areas (Cadent, SGN, and Wales & West Utilities), to request they send us information about short-notice and unplanned outages as these can increase electricity demand. We will use this to help identify potential constraints.

✓ Our Network Visibility Strategy explains how we are ensuring we will deliver network monitors where they provide value and complement smart meter and third-party data
We will share near-time and real-time operational data with the ESO, other network companies, and stakeholders. In addition to the operational information we already share: ✓ Investing to deliver a single portal to share data with stakeholders and customers. ✓ Investing to improve operational control room (ICCP) links with the ESO and support two-way data exchange. ✓ Sharing near time constraint warnings (predicted by the ENZ Platform), dispatch intentions, real-time constraints, historical operational data, and supporting network models with the ESO and TOs. We will also share these with customers and stakeholders, subject to any security or data protection requirements. We will comply with all Operational Data Licence requirements. ✓ We will share information on un-planned electricity outages with the relevant gas company, so they can prepare for changes in their customers' behaviour. ✓ We will work with the ESO, other network operators, and our DSO expert stakeholder panel to identify what further operational information sharing would promote efficient and safe whole system operation. ✓ Recording, monitoring, and publishing the average time taken to respond to bespoke data requests.
We will improve our network's operational resilience to low-probability high-impact events: ✓ Collating DER characteristics from asset data, contract registers, and connection applications and sharing this with the ESO. We will agree with the ESO and industry what characteristics need recording, and for what types/sizes of DER. We will update our connection application process so this is collected as standard for new DER. ✓ Conducting an annual network stress-test desktop assessment against High Impact Low Probability (HILP) events. The results will be shared with other network companies to promote energy system resilience.

Table 5: Summary of our outputs against Ofgem Activity 2.1

Spotlight: our interactivity with the gas network

Of our 3.5m customers, 2,806,293 (~80%) are domestic customers who are also served by the mains gas network (1,632,579 in SP Distribution, 1,173,714 in SP Manweb).

For these properties served by both gas and electricity, the loss of one energy vector usually increases consumption of the other. For example, a property which uses mains gas for central heating and hot water will likely switch on their electric immersion heater to heat water and use electric heaters to heat their home if they experience a gas supply interruption. Conversely this same house may increase gas consumption (e.g. using gas hobs to heat hot water rather than an electric kettle) in the event of an electricity supply interruption. This means that an outage on the gas or electricity network affects energy flows on the other network for the duration of the fault.

This relationship is not theoretical. In Falkirk on the morning of 1 December 2019, a SGN gas network governor (a pressure regulation asset) failed, leaving 9,000 customers without gas. Temperatures were below freezing. Figure 10 and Table 6 show that, during the gas network fault, electricity network demand increased by up to **2.7 times normal peak demand levels**.

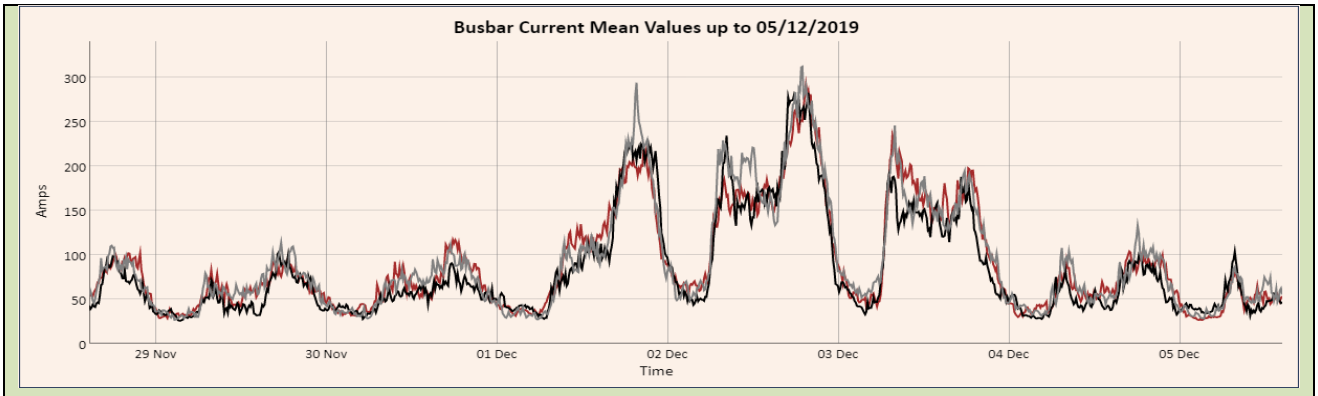

Figure 10: Busbar mean current values before and during gas network fault

Location	Normal average electricity peak demand	Electricity peak demand during the gas network fault
Cannons Way	320amps	612amps (1.9x normal peak)
Robert Burns Avenue	600amps	989amp (1.6x normal peak)
Seaforth Road	350amps	520amps (1.5x normal peak)
Quarralhall Carronshore	230amps	611amps (**2.7x** normal peak)

Table 6: LV feeder normal and post-gas fault peak demand

Fortunately existing network headroom meant our network, supported by operational measures we made, was just about able to cope.

In RIIO-ED2 we will operate our network closer to limits to accommodate increasing EV chargers and heat pumps and to get the best use out of assets that customers have already paid for. This means there will be less headroom to accommodate unusual events. This means the interaction between gas and electricity becomes more relevant and has greater potential consequences as there will be less headroom to absorb post-gas fault electricity peaks, i.e. distribution power flows will be more likely to exceed network limits than pre-RIIO-ED2 when the electricity network wasn't operated so close to limits.

For this reason, we will seek increase data sharing with the three gas utilities (Cadent, SGN, and Wales & West Utilities) that serve our customers. We would like this data exchange to cover both planned interruptions (e.g. maintenance outages) and unplanned outages. Planned outages are usually known about months in advance, so we may be able to incorporate this knowledge into our planning processes. Unplanned outages (or nearer-time planned outages) may occur without any warning, so we would incorporate knowledge of these into our operational activities. We will also increase our operational coordination during faults. For example for Falkirk, we were able to identify which areas of our network were most stressed, and so ask SGN to reconnect areas of the gas network as a priority.

We will offer to share the same data on our distribution network planned and unplanned outages back with these gas utilities.

5.3 Activity 2.2: Facilitate efficient dispatch of distribution flexibility services

To fulfil this activity, we will deliver a range of outputs and supporting investments in RIIO-ED2. Together, these outputs will ensure that:

1. Customers and stakeholders understand the scenarios in which we use flexibility, and how and why it will be dispatched.
2. We have the infrastructure needed to efficiently dispatch and settle flexibility providers. This infrastructure is scalable, isn't a financial barrier to participation, and isn't hard coded to us.
3. Flexibility markets operate efficiently and don't adversely impact network safety.

Activity 2.2 DSO outputs – what we will do
We will use a transparent and efficient framework governing why and how we will send dispatch instructions – our Decision Making Framework: ✓ Covering different flexibility service types, the types and costs of supporting infrastructure customers require for each, how we determine the price we are prepared to pay for flexibility services, ESO/DSO service primacy and coordination arrangements, and when/why we will dispatch different flexibility services (including their interaction with ANM and flexible connections). ✓ Reviewed annually, considering stakeholder feedback, and published on our website. Its governance arrangements and contact details for raising issues shall be published. ✓ Our adherence to the framework shall be monitored as part of our assurance.
We will develop dispatch infrastructure that's scalable, has low user participation costs, and isn't hard coded to our own systems: ✓ Developing an internal technical standard that sets minimum interoperability standards for our systems. We will seek input from industry experts in its development and it will be published on our website. This will ensure DSO dispatch infrastructure isn't hard coded to us. ✓ Continuing to use a third-party flexibility platform for dispatch and settlement. This can be used across all distribution voltage levels and scaled up as required. It uses APIs, a low-cost method of communicating with users which doesn't give us 'hard control' of their assets. ✓ Our CMZ infrastructure will facilitate using market-based flexibility services in a greater range of scenarios by avoiding conflicting network management actions and by providing a safety net in the event of market failure. This means we can safely and confidently expand our use of flexibility services.
We will increase the efficient functioning of distribution flexibility markets: ✓ Non-exclusive flexibility service contracts as standard – providers free to offer services to other markets on the proviso they can fulfil their obligations to us and it's safe to do so. ✓ Using network monitoring, enhanced forecasting tools, and our ENZ Platform to provide near-time 'dispatch warnings' and 'no need notifications' to flexibility service providers and the ESO, and 'constraint warnings' to DER with constrainable connections and the ESO, so they can get ready. ✓ Using enhanced forecasting tools and our ENZ Platform to define service window timings more accurately. Setting shorter service windows can free up providers to operate in other markets. ✓ Initiating a DER Service Checker for the ESO. The ESO notifies us of DER service providers they use, and we'll tell them the providers maximum allowed import and export level, and any constrainable connection arrangements and planned maintenance outages that affect their availability. ✓ Lobbying for the development and implementation of GB-wide primacy arrangements (DSO:ESO) and rules to coordinate DSO and ESO distribution service dispatch. Continuing to work via the ENA on defining new flexibility service types. ✓ Supporting secondary trading of flexibility service contracts and distribution constrainable connection obligations. We will do this by publishing data, a dedicated template to gather information on the trade, and a four working day turnaround service to approve the transfer of flexibility contracts.

Table 7: Summary of our outputs against Ofgem Activity 2.2

Spotlight: near-time market notifications to increase market efficiency

In RIIO-ED2 we are committing to sending a series of near-time notifications to service providers, customers with constrainable connections, and the ESO:

- 'Dispatch warnings' will notify service providers that they are likely to receive a dispatch instruction from us in a certain service window. This gives the service provider time to prepare. We hope this foresight will ensure that services are ready when we need them, and that service providers aren't caught unaware. If this information is useful to the ESO then we can share this information with them too.
- 'No need notifications' are the opposite of 'dispatch warnings' – they notify service providers that they are very unlikely to receive a dispatch instruction from us in a certain contracted service window. This means they may be able to operate more efficiently than if they'd been on standby to provide a service instruction to us. If this information is useful to the ESO then we can share this information with them too.
- 'Constraint warnings' are notifications to customers who have a constrainable connection that we will likely need to constrain them for a certain window. By having this knowledge in advance of market gate-closure, we hope this will help the constrained generator's supplier reduce the likelihood of not balancing within the settlement period. If this information is useful to the ESO then we can share this information with them too.

We aim to send these notifications before market gate-closure for the respective settlement periods, so that the respective supplier has time to manage any resulting imbalance.

We are able to send these notifications in RIIO-ED2 by using the outputs from our PRAE T-4 day forecasting tool in our ENZ Platform. This means we can accurately forecast near-time power flows, and so determine the likelihood of needing services or constraining customers.

Given the unforeseen nature of network faults we of course won't be able to forecast every dispatch and constraint action, but these notifications will still increase the efficiency of the flexibility markets, wholesale markets, and whole system coordination. These notifications are one of the actions we're taking to support our aim of creating more efficient markets and helping service providers to participate.

5.4 Activity 3.1: Provide accurate, user-friendly, and comprehensive market information

To fulfil this activity, we will deliver a range of outputs and supporting investments in RIIO-ED2. Together, these outputs will ensure that:

1. We will have the tools we need to record and share raw data and create insights that will be useful to customers and stakeholders.
2. We will share a range of historical, near-time, real-time, and forecast data and insights with customers and stakeholders.
3. We will work with stakeholders to prioritise which data to make available.

Activity 3.1 DSO outputs – what we will do
We will deliver the infrastructure we need to record and share raw data with stakeholders and create useful insights:
✓ Investing £28.3m to deliver LV monitoring at 14,102 secondary substations. This will extend monitoring from 8% to 52% of large LV substations, increasing coverage from 14% to 76% of customers, by the end of RIIO-ED2.
✓ Investing in our capabilities so we can further process and incorporate smart meter data.
✓ Investing to maintain enhanced forecasting tools, such as those that forecast EV and heat pump uptake for every single customer we serve and model weather effects on network power flows.
✓ Investing in a real-time, data driven, network analytical platform – our ENZ Platform. It integrates near-time forecasting (PRAE) and weather data (WaNDA), network monitoring data, smart meter data, and

asset condition data with automated power flow modelling of our entire network so we can understand and share with stakeholders what is happening on the network in planning and operational timescales. ✓ Investing £221.4m to deliver the reliable, cyber-secure, low latency operational IT and telecoms that we need to collect, process, and transmit data to stakeholders. ✓ Investing in a portal to share data with stakeholders. Investing in our Smart Data Integration Fabric (SDIF) to help surface and share data across our business.
We will provide data and insights to help stakeholders participate in and assess markets, operate their existing sites, and plan new developments. In addition to the information we already publish: ✓ Historical network data: network data showing what has happened on the network, including voltages, demand and generation levels, active fault level monitoring data, losses disaggregated to substation level, and fault rates (CI and CML). ✓ Annual constrainable connection report: aggregated data on how many times customers with non-firm connections are constrained, and the volume and technology types affected. ✓ Annual flexibility market report: our actual dispatch/utilisation of contracted flexibility providers compared to their contracted service offering, and the cost and carbon impact, and the results of all tenders that year. ✓ Flexibility procurement data: publishing all flexibility bids we receive (including service type, volume bid, price bid, price paid where accepted, and carbon content of aggregated units) and our reason for accepting/rejecting the bid. ✓ Near-time and real-time operational data, such as constraint warnings and dispatch warnings, so that service providers, customers, and other network operators can get ready. ✓ Network needs: we will tender for flexibility for all viable network constraints and provide the information and site-specific price signals that participants need to make an informed bid. ✓ Investment decision data: where we intervene to manage or resolve a constraint, we will publish our options assessment and intervention decision rationale for all EHV and 132kV load-related interventions. In addition, those load-related interventions over £2m will be externally assured. ✓ Long-term forecast and planning data: what we think will happen on the network in the future and, where applicable, how we plan to respond – LTDS and NDP. All data sharing subject to data protection requirements, security concerns, or where it is not in the interest of our customers (e.g. it results in market gaming that increases overall costs for customers).
We will provide data in a way that it can be easily utilised: ✓ A main data sharing portal for data so stakeholders can easily find it. Where appropriate, we will also share data through dedicated platforms or directly from our systems. ✓ Simple APIs for sharing near-time and real-time operational data, which will be available in machine readable formats. Third-party platforms can 'plug-in' to our Flexibility Platform. ✓ A full network GIS from 132kV to LV, so that customers can map the data we publish. ✓ Put in place processes to support the publication of data that is accurate and as unbiased as reasonable, including the introduction of annually calibrating our EV-Up and Heat-Up forecasting tools.
We will work with stakeholders to regularly review the information we make available: ✓ Working with our DSO expert Stakeholder panel to prioritise what data is published first, and to agree a methodology to determine whether the customer benefits of 'high cost' data requests justify their costs. ✓ Engaging with our stakeholders annually to consult on the content, frequency, and method of data publication, and supporting metadata. ✓ Publishing and make available for stakeholder comment our strategies which related to data collection and provision (e.g. our Digitalisation Strategy and Action Plan).

Table 8: Summary of our outputs against Ofgem Activity 3.1

Spotlight: ongoing stakeholder engagement in RIIO-ED2

In RIIO-ED2 we will need to work with our stakeholders to deliver DSO, to identify what data to share and in what format to share it, and to ensure our deliver is meeting their needs. For this reason, we plan to engage with stakeholders through a number of routes in RIIO-ED2:

1. **Our DSO expert stakeholder panel.** We will create an independent panel of expert stakeholders to guide and inform our delivery of DSO through RIIO-ED2. We will seek representatives from energy suppliers, flexibility market participants, other network companies, academia, technology providers, government / local authorities, and customer representatives (including vulnerable customers).
2. **Our DSO Annual Customer Satisfaction** survey will be sent out to customers that have interacted with our DSO functional model in the previous year. We propose a common industry approach to this Customer Satisfaction survey to be developed with Ofgem, stakeholders, and other network companies.
3. **Our Strategic Stakeholder Panels** are Director-led and embedded within our annual programme of engagement. The panels have been specifically designed to be strategic in nature, to directly influence executive level decision making within SP Energy Networks, and to promote an embedded culture of engagement. Our panels continually evolve and include a diverse group of senior, independent, and knowledgeable stakeholders in attendance, including representatives such as local authorities, government, academics, industry, charities, and consumer representatives. These panels help us better understand the material issues affecting our customers and stakeholders before acting on them in a meaningful way, and ensure that stakeholder views run through all levels of our organisation from board to operational level.
4. **Our Connections Stakeholder Panels** help us to shape our connections strategic direction, confirm stakeholder connection priorities, and identify new connections themes as they emerge. Our Connections Stakeholder members are representative of our connection customers and stakeholders, ensuring that different types of connecting customers are represented by membership. Our members are prominent figures within the industry, have a detailed understanding of our connections process and bring constructive challenge. This allows us to obtain a balanced view, build our understanding of stakeholder needs and perspectives, use the panel as a 'sounding board' and generator of new ideas and opportunities for collaboration, influencing our plans and proposed improvements.
5. **Our independent Customer Engagement Group (CEG)** has provided expert challenge and input to our RIIO-ED2 Business Plan to make sure it effectively addresses the needs and preferences of our customers and stakeholders. We intend to maintain a similar level of external scrutiny and input throughout the RIIO-ED2 price control period.
6. **Our open Data Portal** is a single portal to share data with stakeholders and customers. It has been created to house all data that SP Energy Networks shares openly in the public domain. It contains a form so stakeholders can provide feedback. We will further develop the stakeholder feedback mechanism as a route for stakeholder feedback.
7. **Our online stakeholder community.** This is a database of over 260 stakeholders. In RIIO-ED2 we will continue to grow our online community as a platform for instant and pro-active engagement in between formal engagement events. Feedback from supply chain stakeholders provided support for this method of engagement throughout RIIO-ED2. To ensure we deliver against this stakeholder need, we have created an ambitious performance commitment to continue to embed digital technologies within our future stakeholder engagement strategy.
8. **Our regular programme of stakeholder workshops and events.** By embedding an annual programme of engagement across each of our strategic topic areas, we'll give stakeholders the chance to influence our decisions and assess the delivery of our plans. Stakeholders can see all engagement opportunities via an event calendar on our website and can register their interest in future events.

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

To fulfil this activity, we will deliver a range of outputs and supporting investments in RIIO-ED2. Together, these outputs will ensure that:

1. It is easier for users to participate in distribution flexibility markets.
2. These markets function well and are coordinated with the ESO. The ESO will still have direct access to DER flexibility services – we are not the commercial or dispatch route.
3. Users have confidence that we are not conflicted in our role of neutral market facilitator.

Activity 3.2 DSO outputs – what we will do
We will make it easier for users to participate in flexibility markets: ✓ Using clear and simple pre-qualification criteria for flexibility tenders that reflects that some bidders may not yet have completed sites. ✓ Keeping the cost of participation low, such as by using APIs to keep user's interface costs low. ✓ Simultaneous supporting shorter and longer contracts by allowing participants to bid for only part of a tender requirement. For example, if we need 1MW for 2 hours service windows for a 12 month period, participants can bid in with less than 1MW for a 30min service duration for a period of a few months. When all bids are received, we will stack partial tenders to meet the network requirement. This acknowledges that participants have different capabilities and want different contract lengths. ✓ Supporting secondary trading of flexibility service contracts through publishing data, a dedicated template to gather information on the trade, and a four working day turnaround service to approve the transfer of flexibility contracts. ✓ Non-exclusive flexibility service contracts – providers free to offer services to other markets on the proviso that they can still fulfil their service obligations to us and it's safe to do so. ✓ Supporting the participation of aggregators and third-party platforms by enabling them to 'plug-in' to our flexibility procurement process and making data available in machine readable formats. ✓ Sending price signals to the market (i.e. the maximum we are prepared to pay for the service) until the market reaches sufficient liquidity that these are no longer requirement, apart from where there is a strong case for price discovery. ✓ Using enhanced forecasting tools and our ENZ Platform to more accurately set service windows; shorter service windows can increase participation and free up providers to operate in other markets. ✓ We will target hard-to-reach groups with additional support to facilitate their participation in the energy system through targeted engagement. ✓ Giving users a common experience across GB by continuing to work with other network companies to use common service types and contracts.
We will increase the efficiency of market functioning and whole system coordination: ✓ Using network monitoring, enhanced forecasting tools, and our ENZ Platform to provide near-time 'dispatch warnings' and 'no need notifications' to flexibility service providers and the ESO, and 'constraint warnings' to DER with constrainable connections and the ESO, so they can get ready. ✓ Initiating a Service Checker for the ESO – providing the ESO with information on distribution-connected service providers, including their maximum allowed import and export level, planned maintenance outages affecting their availability, and constrainable connection arrangements. Subject to data protection requirements. ✓ Coordinating our Flexibility Platform with our Network Management System to avoid conflicting signals (e.g. the Flexibility Platform instructing a generation increase from within a CMZ, which the CMZ then counters by instructing another ANM managed generator to reduce output). ✓ We will coordinate with the ESO on planning our maintenance outages, so we don't remove their access to DER services at times of vital system need.

✓ Maintaining and publishing our Decisions Making Framework governing when and how we will send dispatch instructions, so that users understand the scenarios in which we dispatch flexibility. ✓ Lobbying for the development and implementation of GB-wide primacy and conflict resolution arrangements (DSO:ESO and DSO:DSO), and rules to coordinate DSO and ESO distribution service dispatch. ✓ Continuing to work through the ENA on defining new flexibility service types.
We will address concerns about perceived conflicts of interest and be a neutral facilitator of markets: ✓ A new DSO functional model with a dedicated director, responsible for network and market development. ✓ Publishing a range of data so our intervention decisions are transparent. All load-related intervention decisions over £2m will be externally assured and the results made public. ✓ Maintaining and publishing a Conflict-of-Interest Management Plan, developed with stakeholder input.

Table 9: Summary of our outputs against Ofgem Activity 3.2

Spotlight: targeting hard to reach groups with additional support

We want all customers to be able to provide flexibility services if they wish. Doing so is both directly beneficial to those customers through any service revenue they receive, and indirectly beneficial to all customers through lower distribution network costs where flexibility helps us defer more expensive interventions.

However some customer groups may find it harder to engage with flexibility markets than others. Some of these barriers may not be in our gift to resolve, but in RIIO-ED2 we would like to help these customers engage with flexibility service markets if they wish.

To do this, we will work in partnership with local support organisations to deliver community energy awareness campaigns at scale and educational outreach activities to raise knowledge and awareness of the changes coming to the energy sector and how individuals and their communities can participate and benefit. We will review our engagement, including who/how best to deliver information, throughout RIIO-ED2 and remain flexible and innovative in our approach.

This work will directly address the barriers raised by our stakeholders around:

- lack of confidence and capacity to take forward community energy initiatives;
- lack of capacity to recruit participants to take part in community energy projects; and
- the low level of understanding of the need and possibilities linked to ‘flexibility’ and DSO development.

We will work alongside local delivery partners to deliver community energy outreach events such as Community Energy Futures that go beyond high-level discussions into the step-by-step aspects of how to develop a locally tailored community energy scheme.

We will target traditionally hard to reach regions that may be less likely to have social capital or resource to engage in these solutions.

6. Using flexibility in RIIO-ED2

Many of our DSO outputs relate to proactively increasing flexibility service use and supporting the growth of efficient, coordinated, and competitive flexibility markets in RIIO-ED2. Getting this right is important to our customers who wish to participate, to us for accommodating decarbonisation, and to the ESO for maintaining system stability. This section sets out what we have done so far in RIIO-ED1 (Section 6.1) and collates all our DSO Strategy RIIO-ED2 flexibility deliverables from the previous three sections (Section 6.2).

Flexibility services are where our customers agree to actively manage their demand or generation to help us mitigate network capacity constraints. They will play a key role in helping us manage the pace of the Net Zero transition as they enable us to help manage network power flows within existing network capacity limits, so avoiding constraints. Flexibility services can be deployed more quickly than most types of reinforcement, and can help democratise and bring competition to the energy sector. They provide an agile smart means of managing our network, and are complementary to reinforcement by providing solutions where we need to act quickly or manage uncertainty.

6.1 Our RIIO-ED1 track record

We ran our first flexibility tender in March 2019, which sought 116MVA across just three network groups. Since then we have engaged with providers, worked with industry, developed internal modelling capabilities and flexibility market knowledge, and rolled out a flexibility portal (Flexible Power). The result of this work is that, in creating our RIIO-ED2 Business Plan, we were able to forecast every single likely network capacity constraint that would result across all voltage levels of our network in RIIO-ED2 and tender for flexibility services for these. So from seeking flexibility services for just three network groups in our first tender in 2019, in spring this year we were able to tender for 1.4GW of flexibility across 1,550 sites (including 1,477 LV network sites). This is a significant step forward in just two years.

The result of this spring tender is that we have been able to defer £36m of network reinforcement in RIIO-ED2 in our baseline scenario. This saving rises to £145m of reinforcement in our high scenario. Other notable highlights from RIIO-ED1 include:

- We were the first DNO to calculate and send site-specific pricing signals. Developing tender bids takes time for providers, so this helps them understand the value of the opportunity.
- We were the first DNO to tender for reactive power, creating a new service opportunity for providers.
- We have used flexibility services to provide additional network security during planned outages. For example in 2019, we contracted 24MW of flexibility service to provide network support for a few days whilst we replaced a tower on a double 132kV circuit. This flexibility service enabled us to undertake our works in a safe manner and secure supplies for customers.
- We were the first DNO to successfully deploy a fully functioning Universal Smart Energy Framework (USEF) compliant flexibility market in GB. USEF provides the basics for a unified smart energy market and helps to ensure projects and technologies are connected at the lowest cost. The deployment of the local flexibility market – located in East Fife, Scotland – is part of our £5.7m Network Innovation Competition (NIC) Project FUSION. As part of the trial, we are tendering for 4.5MW of flexibility capacity across Leuchars and St Andrews in Fife.

6.2 Flexibility in RIIO-ED2

In addition to baking in the use of 550MW of flexibility across 1,352 sites in our RIIO-ED2 load-related expenditure plan, saving our customers £36m, we will:

1. Transparently and fairly compare all viable network intervention options (including energy efficiency and flexibility). This will be supported by transparency, a DSO functional model, and external assurance.
2. Deliver a range of DSO outputs that will support the growth of efficient, coordinated, and competitive flexibility markets in RIIO-ED2 – see Figure 11.
3. Use flexibility across our entire network, not just for small schemes. For example, in the Carrington–Fiddlers Ferry group we will defer £10.5m of 132kV circuit upgrades, and at Redhouse we are able to defer replacing a 132/33kV transmission transformer, saving our customers £2.8m in exit charges. In Merseyside, we will combine flexibility with network monitoring and automation to defer replacing 10km

of the 132kV cable that runs into the centre of Liverpool – as well as deferring £9m, this avoids significant disruption for residents.

4. Where flexibility services are not yet available and we have had to assume the use of network reinforcement for forecast RIIO-ED2 constraints, we will re-tender for flexibility within RIIO-ED2 before the reinforcement starts to ensure we are using the most efficient intervention.

Figure 11: How our DSO Strategy will drive greater flexibility use in RIIO-ED2

6.3 Development of future flexibility markets

At the moment, the upside of flexibility services is shared between service providers and markets – the provider receives service revenue and the customer gets lower network costs. The potential downside risk – resulting if contracted flexibility providers don't provide the service when called upon – is primarily born by customers as

there are no penalties for non-delivery of flexibility services. This downside risk may take the form of higher network costs due to the cost of alternative actions[43], reduced network reliability if there are resulting network constraints, and in some cases reduced network safety (e.g. overloading causing conductor sag). Providers will start to have revenue reduced for repeated non-delivery, but the loss of revenue is not in proportion to the adverse impact to customers.

This risk-weighting and absence of penalties has been right so far, as it has helped to reduce barriers to flexibility market participation, which in turn has delivered benefits for customers. Looking to RIIO-ED2, there are three factors which mean this may need to be revisited:

1. **The expansion and growth of flexibility markets.** In RIIO-ED2 we are taking a range of measures (Section 6.2) to support the growth and use of efficient, coordinated, and competitive flexibility markets. We expect markets to become bigger, more liquid, and more mature. This raises the question whether this risk weighting, which was done to reduce barriers to help grow an immature market, is still needed.
2. **The increased impact to customers of non-delivery.** In RIIO-ED2, we will significantly increase our use of flexibility[44] and operate our network closer to limits to get the best use out of assets that customers have already paid for – we are increasing our dependency on flexibility services. This means that the customer impact of non-delivery will likely increase. This customer impact may further increase if other vectors (e.g. transport) are also impacted as they become more interlinked with electricity. If the customer potential downside increases we may need to take actions to fairly rebalance it between customers and providers.
3. **Alignment with transmission for whole electricity system efficiency.** A key theme of RIIO-ED2 is the need for greater whole system coordination. DER services will be used by us and the ESO, and the costs for both are ultimately recovered from distribution customers – this means we should be aiming for the most efficient DER service use across distribution and transmission. One method that may get used to determine this is the cost the service can be provided for to use and the DSO. At the moment, non-delivery of ESO balancing services incurs penalties but non-delivery of DSO services doesn't. Assuming providers price-in the cost of potential penalties to their bids, this introduces a bias to their pricing – this inhibits whole system efficiency as this bias is introduced by market processes rather than network/system operation costs.

Given these changes, we may need to work with Ofgem and stakeholders to consider what measures to take to address instances of non-delivery. This might include penalties (to align with transmission), and/or publication of non-delivery information within our annual flexibility market report to improve transparency (a DSO output listed against baseline expectation 3.1.1 in Appendix B). Any changes would need to be fair to providers and customers, overall be of net benefit to customers[45], be proportional to the impact of non-delivery, and help ensure that markets are robust and efficient. We will also take our own measures to protect customers in the event of non-delivery:

- We will record instances of non-delivery, so we can assess whether the changes above are really needed (for example if non-delivery is rare and has minimal impact).
- Our CMZ platforms can provide a safety net in the event of non-delivery, helping us to safely expand our use of services.
- We will identify areas where the risk of flexibility non-delivery would have significant consequence in term of security of supply, asset condition, and local customers – for example, in areas where there are vulnerable customers, hospitals, and other emergency response functions. We would assess the potential for establishing a backup in the event of non-delivery. Our DSO Security Standard, which will be published by the start of RIIO-ED2, will set out how we will consider non-delivery risk when planning our networks and considering security of supply.

Implementing any changes would require cross-industry collaboration, as it is important that providers benefit from a common service experience across different DSOs.

[43] And shortening of asset life if assets are repeatedly overloaded.
[44] Our baseline scenario includes the use of 550MW of flexibility, including across 1,275 LV sites.
[45] Introducing penalties which reduced market size and liquidity would be self-defeating and adversely impact customers.

7. What our DSO Strategy means for customers

Over the course of preparing our RIIO-ED2 plan, we have engaged just over 19,000 customers across a range of customer segmentation groups and stakeholders. We've used this engagement to understand their priorities for RIIO-ED2 and so inform our approach and ambition. From this, we know that our customers prioritise four main things in their electricity supply: reliability, safety, cost-efficiency, and the capacity they need to decarbonise (domestic customer especially do not want to be constrained). Section 7.1 explains how our DSO Strategy has been developed to deliver these.

7.1 Listening to their needs

We have listened to our customers' priorities when developing this DSO Strategy, and so developed our DSO Strategy according to four key guiding principles.

1. Safety

Our responsibility: Safety of our staff, customers, and the general public is our first priority and built into everything we do. We have a clear responsibility to ensure that everyone who interacts with and relies on our network is not harmed by that interaction.

How we are responding: In RIIO-ED2 we will have increasing visibility of our network through greater LV monitoring coverage and smart meter data use combined with data-driven analytics from our ENZ Platform, meaning we can safely operate the network closer to limits to get greatest value for customers. We are also improving safety by incorporating asset condition data into our main network planning and operational tool (our ENZ Platform) for the first time. Finally, our proposed new DSO functional model means that we have clear responsibility and accountability for network safety; this would not be the case with a legally separate DSO. Through these we will maintain the safe operation of our assets and the safety of anyone who interacts with our network.

2. Reliability

Our responsibility: Our primary operational responsibility is to keep the lights on for our customers – we all depend on it to enable our modern lifestyles. Looking to the future, the importance of electricity in our customers' lives will increase even further as we use it to heat our homes and power our transport. In addition, as essential system balancing services increasingly connect to the distribution network, the security and stability of the wider GB energy system is also at stake. We have a responsibility to maintain the security, resilience, and reliability of the distribution network and wider energy system.

How we are responding: This responsibility informs our approach, from a new annual network stress-test assessment and increasing coordination with the ESO and gas network companies, to incorporating asset condition data into our planning decisions and using CMZs to provide a safety net in the event of flexibility market failure. As we begin to operate the network in new ways, we must maintain the security, resilience, and reliability of the system in response to changing system characteristics, new customer operating profiles and technologies, an ever-evolving range of external factors and threats, and the risks of higher asset utilisation and greater operational complexity.

3. Customer value

Our responsibility: All electricity system and network costs are ultimately recovered from customers. We know that for some fuel poor customers, these costs can be a significant proportion of household income. We have a responsibility to serve our customers' needs, whilst keeping network costs as low as possible. The Net Zero transition must not penalise or leave behind vulnerable and fuel poor customers – it must be a Just Transition.

How we are responding: Increasing efficiency, using competition, and deploying innovation are essential tools for delivering customer value, but we plan to go further. Our approach in RIIO-ED2 means we can safely make the best use of assets we've already got, make more targeted and lower-cost interventions by knowing where, when, and how to intervene, increase investment efficiency through coordinating interventions, and allow our customers to directly participate and benefit by providing services. Our data share, new near-time notifications, and direct working with our stakeholders through our strategic optimiser role mean we can deliver more efficient Whole System outcomes.

4. Enabling Net Zero for our customers and communities

Our responsibility: Distribution networks are key to enabling Net Zero – the decarbonisation of heat and transport, and the increasing levels of renewable generation capacity, depend on distribution network capacity. We therefore have a clear responsibility to deliver the capacity this decarbonisation needs on time and at least cost to customers.

How we are responding: This responsibility has shaped our approach to DSO roles, from providing flexible connection arrangements like ANM so new renewable generation can connect more quickly, to the range of measures to encourage the growth of efficient and competitive flexibility markets so we can use flexibility in more areas to quickly provide capacity. In addition, our underpinning DSO infrastructure, like our enhanced forecasting and modelling tools, mean we have the data-driven foresight to intervene ahead of time to ensure there are no delays in connecting LCTs.

We have between two to three decades to achieve Net Zero amongst the different communities and governments we serve. In network terms, this is not a remote horizon: **the majority of the assets we install today will still be operational in 2050**. This means that our journey to deliver decarbonisation has already started.

7.2 What we will deliver for different customer groups

It is essential that the roles, activities, and infrastructure we plan to deliver meet our customers' needs. Table 10 sets out, for different customer groups, how we foresee our customer requirements evolving through to the end of RIIO-ED2, and how DSO will deliver on these requirements. We've used the four customer types developed by the Open Networks project.

Customer group	Customer requirements	How DSO delivers
All customers These requirements and benefits can apply to all four customer types described below.	**A safe network**	Greater use of network monitoring and enhanced forecasting, simulation, and modelling will allow potential safety issues to be identified earlier and mitigated. Our proposed DSO functional model means there is a single party with clear responsibility for network safety.
	A reliable supply	DSO will enable a reliable and resilient supply through improved whole system planning and operational coordination (including coordinating the optimal use of DER services for transmission and distribution needs), greater distribution asset monitoring, and a new annual network stress-test assessment against High Impact Low Probability (HILP) events.
	Cost-efficient network capacity	DSO will enable a cost-efficient supply by using a wide range of activities and infrastructure to get the best out of existing network capacity, defer the need for new network capacity, and minimise losses.
	Delivery of Net Zero	Some customers will value playing their part in delivering Net Zero and the environmental benefit which that delivers. DSO enables Net Zero to be delivered safely, on time, and in the most cost-efficient way.

Passive customer Normal demand customers with little or no interest in time of use tariffs, proactively managing consumption, or providing services. These are typically domestic or business customers on a single standard tariff. They may have LCTs, but for reasons other than energy management (e.g. they were issued an EV as a company car). Vulnerable and fuel poor customers typically sit in this category.	In the event of a loss of supply, supply is quickly restored.	Enhanced network monitoring, data and network analytics mean faults can be quickly identified. Automation means the network can automatically reconfigure itself to minimise the number of customers impacted by a fault.
	Any works (e.g. road closures to bury cables) are done with minimal inconvenience to the customer. General desire for minimal visual, noise, and environmental impact from network assets.	DSO will enable us to get the best out of existing capacity and so defer the need for new network capacity. This reduces the need for network reinforcements and new network infrastructure. Greater foresight of the need for network interventions will enable greater coordination in their delivery – we only need to touch the network once rather than making multiple visits.
Passive participant Energy conscious customer generally offsetting demand using 'off the shelf' passive 'fit and forget' systems in order to reduce their energy bills. Would likely be interested in reducing costs via time of use tariffs from their energy supplier. These are typically domestic or business customers who have invested in solar photovoltaic (PV), heat pumps, EVs, or smart appliances to reduce energy bills. Also includes customers who have a customised time of use tariff with their energy supplier.	**In addition to the passive customer's requirements:** Easy and quick process to connect LCTs such as heat pumps and EV chargers. Customers will seek to charge EVs at home, places of work, destination parking locations or on long journeys. Commercial sites with a large work force or high customer numbers (e.g. retail parks) may require bulk EV charging capacity.	DSO will enable us to get more out of existing capacity, meaning more connections and capacity can be offered to customers immediately. Enhanced forecasting (such as our EV-Up project) and modelling will give more insight into where capacity will be needed in the future; combined with the right regulatory framework, this gives more confidence to efficiently invest ahead of need, meaning that customer ambitions aren't delayed by insufficient network capacity. Coordinating transport planning and distribution network planning, such as via our Charge project, accelerates the connection of EV charging points. Working with local authorities through our Strategic Optimiser role, and coordinating transport planning and distribution network planning (such as via our Charge project), optimises the positioning and accelerates the connection of EV charging points.
Active participant Customers who have invested in generation, storage, demand side response (DSR), or other low carbon products to actively participate and earn revenue from the energy system, reduce operating costs, and reduce their carbon footprint. These customers do not have service contracts directly with network companies or the ESO, but instead participate via aggregators, power	**In addition to the passive customer's and passive participant's requirements:** A quicker connection application process. Flexible connection arrangements where this results in a quicker or lower cost connection.	Innovations have helped us reduce design time, meaning we can more quickly assess connection options for customers. Building this capability into our ENZ Platform will help us to process the forecast surge in connection applications and support a self-serve connections process where appropriate. CMZs and wide-scale operational IT and telecoms will enable customers to access flexible connection options, resulting in quicker and lower cost connections. More network monitoring and more detailed network modelling will

purchase agreements, or time of use tariffs. These are typically standalone DG, behind the meter generation/storage/DSR for peak lopping and triad avoidance, or actively participating domestic customers.		enable the network to be safely operated nearer limits, reducing the periods that flexible connections are constrained.
	Access to non-service market revenue opportunities (either directly or via an aggregator).	The DSO's role as a neutral market facilitator will enable connected customers to access a range of markets, whilst ensuring a safe, efficient, and reliable whole system.
	To earn additional revenue, these customers might enter into service arrangements with us and the ESO where this is simple and can be done via an aggregator or using an automated system to deliver the service.	DSO will deliver platforms which enable most aspects of DER service provision to be automated. This reduces the cost and administrative barrier for us and customers, helping customers access these revenue opportunities. Our flexibility platform and use of APIs will enable suppliers and aggregators to participate on behalf of their customers. A range of interventions, such as non-exclusivity clauses and enabling customers to bid for individual service windows, will reduce the barriers to participation in flexibility markets.
System service provider Customers for whom actively managing their DSR, generation, or storage to sell services to network companies and the ESO is a core activity and a key part of their business model. These customers participate via bilateral contracts, ancillary service tenders, and the balancing mechanism. Customers include asset owners, and parties which manage assets on behalf of others (e.g. aggregators).	**In addition to the requirements of the other customer types:** A range of connection options to choose from to best meet their operating model. For example, some customers might value unrestricted network access, whilst others will value a lower cost flexible connection.	Greater data provision and sharing of network models (via initiatives such as SDIF) will enable customers to better assess what a flexible connection means for them.
	Minimal barriers to providing services to us and the ESO. This includes being able to easily understand service requirements and participate in tenders.	Enhanced forecasting and modelling mean we can more accurately define our service needs. Our Decision Making Framework means customers can clearly understand when and why we dispatch flexibility, and their interaction with CMZs and constrainable connections. The common service products and contract developed under the Open Networks project will provide a common service experience across different network companies.
	A near-time (e.g. day-ahead and week-ahead) understanding of likely network capacity availability	Our T-4 day near-time PRAE forecasting tool combined with our ENZ Platform means we can accurately forecast network constraints. Platforms mean we

	and likelihood of service use.	can share this information with our customers in a secure manner.
	The ability to participate in multiple markets. Alignment of different service markets where possible to facilitate service stacking.	The DSO's role as a neutral market facilitator will enable connected customers to access a range of markets. The DSO's role coordinating the optimal use of DER services for distribution and transmission needs means that customers can participate in a range of markets without risking system stability. Non-exclusivity clauses and near-time 'dispatch warnings' and 'no need notifications' will help providers operate across multiple markets.

Table 10: How DSO delivers for our customers

8. DSO benefits case

This section sets out the quantified and qualified benefits case for DSO.

8.1 Direct benefits

Our DSO investment of £185.1m will deliver our stakeholder-endorsed DSO strategy and Ofgem's DSO baseline expectations, providing direct benefits of £370m over 45 years. In addition, to this we calculate DSO will support wider indirect benefits of between £150m-460m during RIIO-ED2 and indirect benefits of £0.5bn-1.6bn by 2040.

The direct benefits of DSO have primarily been developed using a counterfactual comparison against reinforcement using Ofgem's CBA template to consider the whole life comparison. Our approach assessed the cost benefit of the interventions against reinforcement options in areas of the network where constraints had been identified using DFES. The direct benefits case for delivering 22 CMZs alone will save our customers up to £328.4m over 45 years.

The M19 memo table is the business plan data table (BPDT) that records DSO investment. This investment is rarely solely attributable to DSO as it is often required to support several DNO requirements (e.g. LV network monitoring). Where the DSO M19 Memo table includes line items that required an Engineering Justification Paper (EJP), those have been summarized in the table below.

Please refer to the applicable EJPs and the M19 table itself for full details.

EJP Reference	Scheme Name	Benefit Contribution
ED2-LRE-SPEN-002-CV1-EJP	Flexibility Services for High Utilisation Groups	£9.15m over 45 years
ED2-NLR(O)-SPEN-001-MON-EJP	LV Network Monitoring (includes reduced CI/CML, avoided reinforcement costs, enabling smart solutions, reduced non-technical losses, and avoided excess flexibility service costs).	£32.2m over 25 years
ED2-NLR(O)-SPEN-001-DSO-EJP	Distribution System Operation (DSO) Infrastructure	£328.4m over 45 years

Table 11: Summary of our outputs against Ofgem Activity 2.1

Spotlight: case study of ANM benefits[46]

We delivered the Dunbar ANM scheme in 2012. This allowed the early connection of renewable DG that were otherwise being delayed from connecting until transmission reinforcement works were completed. The ANM scheme ran from 2012 to 2020, at which point the transmission reinforcement works were completed and so the scheme could close. Over the last five years of the scheme it allowed the additional export of over 653GWh of generation, avoiding approximately 98,000tonnes of CO_2 emissions. In addition, through the increase in generation in the local area, the scheme facilitated the creation of 56 full time equivalent jobs, provided £75,000/year of community benefit for the lifetime of the connected projects, and added £61m to the Scottish Economy - of which over £7m was in the local area specifically.

8.2 GB wider benefits

The industry-wide realisation of DSO is a key part of the transition to a smarter, more flexible energy system that accelerates the pathway to Net Zero, enables evolving customer requirements, and delivers wider economic and societal benefits. Over the course of RIIO-ED2, DSOs will take on new duties and responsibilities, in collaboration with other network users, stakeholders, customers and market participants, to unlock these benefits. The following lists the main quantitative and qualitative wider benefits of DSO, directly in relation to the role taken by DSOs, under six categories:

[46] https://www.spenergynetworks.co.uk/news/pages/innovative_network_management_supports_renewables_and_economic_growth.aspx

1. **Whole System benefits (DSO specific)**: Whole System benefits refer to the value derived from the coordination of DNOs with the ESO, gas networks, and other utilities as well as with local authorities and devolved governments to improve the efficiency and resilience of the Whole System, and to improve regional planning.
2. **Environmental benefits:** DSO and the deployment of flexibility, will contribute towards the reduction of CO_2 emissions and the protection of the environment, through tasks which enable the deployment of LCTs, DER, and reinforcement deferral or avoidance.
3. **Customer benefits:** Customer benefits refer to the direct benefits for DSO customers, through the facilitation and improvement of market services, benefits related to network connections, and direct financial impact on customers.
4. **Societal benefits:** Societal benefits link to the indirect outcomes of DSO by supporting the development of prosumers, the democratisation of energy systems, and making GB less dependent on energy imports.
5. **Economic benefits:** This category explores how DSO will support economic growth at regional and national levels, by enhancing the employment landscape and creating new job opportunities. It does this by stimulating markets, supporting new business models, and increasing the efficiency of the electricity system.
6. **Technological benefits:** Technological benefits are related to creating innovative solutions that will create learnings for GB wider industry. This ranges from the digitalisation of the energy system to the standardisation of data and processes, both of which are key enablers for DSO.

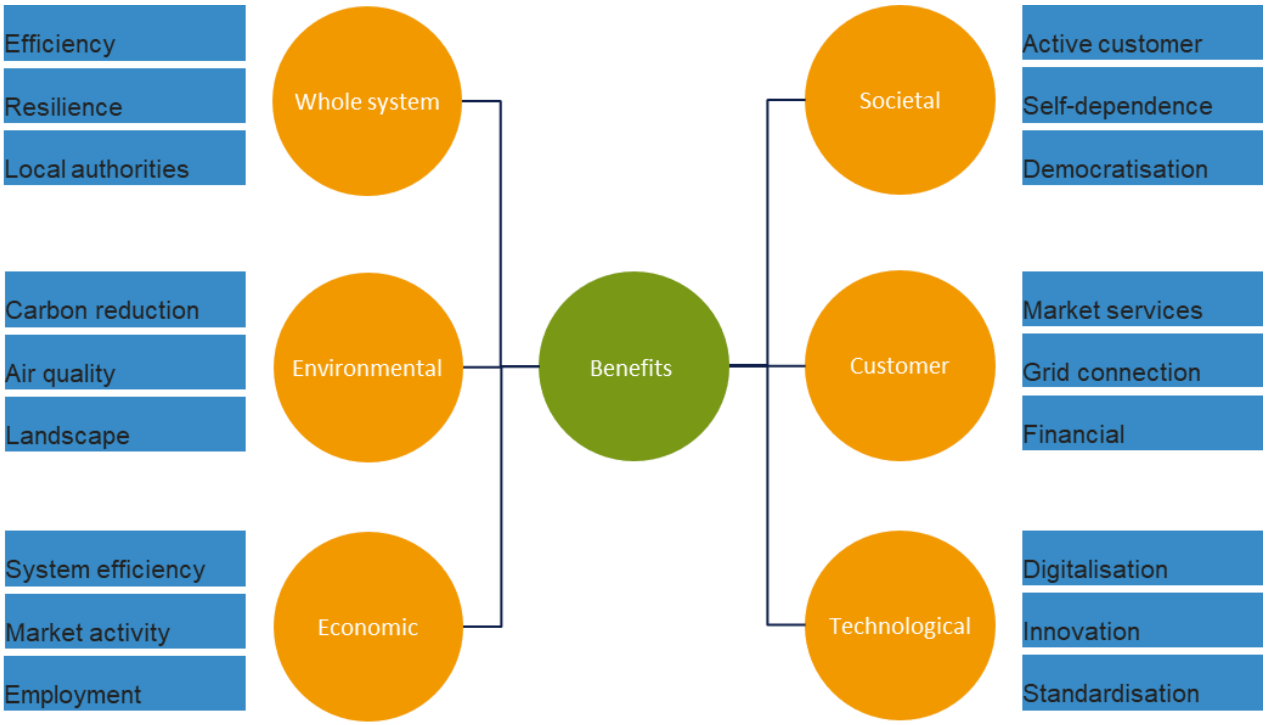

Figure 12: DSO wider benefits classification

DSO Specific Whole System benefits	Qualitative	**Whole System efficiency** DSO enables more cost-efficient Whole System outcomes through the increased coordination with the ESO. DSOs can coordinate with other DSOs, as well as with local authorities, devolved government, and other utilities through increased transparency of end-to-end network planning process, publication of planning and operational data, and continuous engagement with other organisations. DSO in general also makes energy system decarbonisation more affordable by enabling larger volumes of flexibility. (See also quantitative).
		Resilience

		Resilience of the whole electricity system will be facilitated by greatly enhanced coordination of the ESO and DSOs with regard to flexibility services, outage management, operational liaison and incident planning and management. Effective coordination can help avoid, or minimise the impact of, events such as the UK 9th of August 2019 or the 2006 European System Disturbance.[47] In turn, whole electricity system resilience improves the resilience of other sectors and critical infrastructure (including transport, water, and telecommunications).
		Support Local Authorities and devolved government DSO can enable local authorities and devolved government to improve regional development plans and strategies, meeting their environmental/carbon emissions targets, developing smart cities and other innovative concepts.
	Quantitative	DSO facilitates and accelerates the growth of flexibility mechanisms, which can deliver net cost savings of between £9.6bn and £16.7bn per year across all net zero pathways analysed by 2050.The savings predominantly come from avoidance of gas generation (CapEx and OpEx), reduced reliance on carbon producing technologies, and reduced network reinforcement based on a Whole System approach.[48]ESO-DSO coordination is a prerequisite for the realisation of this benefit.

Environmental benefits	Qualitative	**Carbon emissions** DSO accelerates GB meeting its carbon emissions targets by enabling the electrification of heat and transport, growth in DERs, and reducing the need for curtailment of renewable generation by enabling more flexibility mechanisms.
		Air quality Improved air quality is an indirect benefit of DSO. The same activities that reduce carbon emissions will also improve air quality. In addition, flexibility mechanisms, facilitated by DSO, will defer or avoid reinforcement and other engineering works, which is a cause of pollution, particularly in cities. All these activities will improve air quality by decreasing the amount of NO_x and other pollutive particulates.
		Landscape DSOs can coordinate more effectively with other utilities. In addition, the growth of local flexibility markets can lead to network reinforcement deferrals or avoidance. Minimising or avoiding these activities will lead to less construction and infrastructure, which in turn provides benefits for the protection of biodiversity and landscape and decreases disruption to customers and society.
	Quantitative	DSO can enable cost savings from the reduction of renewable curtailment, in the range of £2-2.8bn cumulatively by 2040 in present value terms, by reducing renewable curtailment costs.[49] [50] [51] [52]

[47] UCTE (2007) Final Report, System Disturbance on 4 November 2006. Available at: https://www.ceer.eu/documents/104400/-/-/b4f16360-b355-5d50-bf33-01f8a76fc95a
[48] Flexibility in Great Britain, Carbon Trust & Imperial College London, 2021. Available at: https://www.carbontrust.com/resources/flexibility-in-great-britain
[49] Renewable curtailment costs for GB in 2020 were £282m.
[50] Studies have found that demand-side flexibility can be used to reduce renewable generation curtailment by better matching demand with supply. The International Energy Agency (IEA) has found that demand response and storage could reduce the need for curtailment of renewables in the EU from 7% to 1.6% in 2040, leading to 30$MtCO_{2e}$ emissions reductions in 2040. Another study from the National Renewable Energy Laboratory (NREL) shows that renewable energy curtailment in low demand-side flexibility scenarios has a rate of 6% to 9% compared to scenarios with high demand-side flexibility with curtailment rate of 2% to 3%.
[51] IEA Study, Digitalisation and Energy, 2017 Digitalization and Energy. Available at: https://iea.blob.core.windows.net/assets/b1e6600c-4e40-4d9c-809d-1d1724c763d5/DigitalizationandEnergy3.pdf
[52] NREL Study, Electrification Futures Study: Operational Analysis of U.S. Power Systems with Increased Electrification and Demand-Side Flexibility, May 2021, Electrification Futures Study: Operational Analysis of U.S. Power Systems with Increased Electrification and Demand-Side Flexibility. Available at: https://www.nrel.gov/docs/fy21osti/79094.pdf

		DSO, alongside other investments in distribution networks which enable the energy transition, can facilitate £3.9-13.5bn of annual savings in external costs of health issues by 2040, by improving air quality.[53] [54]

Customer benefits	Qualitative	**Financial** DSO will deliver direct financial benefits and revenues to customers, mainly by supporting the growth and development of flexibility markets and services that customers can participate in. Financial benefits linked to lower network costs are discussed under the "economic benefits" section. DSO will enable flexibility payments to customers based on supporting more efficient flexibility market operation and allowing customers to directly participate in DSO services (either on their own behalf or through a market player), receiving direct flexibility payments. In addition, DSO-ESO coordination and standardisation of flexibility services will increase revenue streams for prosumers (and flexibility service providers) allowing them to offer their services in different markets.
		Network Connection We have already indicated DSO's contribution to Whole System resilience and to enabling the electrification of heat. As a consequence of these improvements, DSO can improve safety for customers by improving the reliability of critical infrastructure, by improving quality of power supply (i.e. avoiding power cuts or voltage instabilities which may damage electric systems and devices leading to injuries), and decreasing the use and reliance on residential gas.[55] In addition, DSOs will improve the connections processes by increasing availability of connection capacity and promoting flexibility projects. DSO will be an enabler of increased reliability of distribution networks, by promoting growth in DER and flexibility sources, leading to a more reliable and economic supply. All these together, alongside improved outage management, will improve the customer experience and usage of the electricity network.
		Market Services With increased data sharing, transparency, network monitoring, and continuous engagement with customers, DSO will support customers, flexibility providers, DER operators to make better use of their assets. In addition, a fully established DSO will facilitate a more efficient marketplace that allows multiple sellers and buyers to enter and exit the market readily. In practice, through improved data sharing, DSOs will function as the neutral facilitators of a marketplace that enables new products and services to be accessed by end-customers.

[53] A study from Eurelectric shows that at EU level: £34bn to £118bn annual savings for health system can be facilitated by distribution grid investment enabling energy transition. We have estimated the figure for GB based on number of connection in GB and at EU level.
[54] Connecting the dots: Distribution grid investment to power the energy transition, Deloitte for E.DSO and Eurelectric, DSO investments required for Energy Transition in Europe. Available at: https://www.eurelectric.org/connecting-the-dots
[55] In the UK gas incidents as reported by "Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)" have led to 21 fatalities from 2015/16 to 2019/20 and to 1164 non-fatalities injuries. Available at: https://www.hse.gov.uk/statistics/tables/index.htm

	Quantitative	Benefits due to reduced network downtime (economic impact from connection lost minute costs) could reach around £250m within the RIIO-ED2 period (under the assumption that 10% efficiencies will be reached by 2028).[56] [57] [58]

Societal benefits	Qualitative	**Active customer** DSO is a facilitator of active customers as it will enable participation of customers in flexibility markets, in a way that contributes to the stability and efficient operation of the electricity system. DSO will enable more local generation of energy, the development of "prosumers", and helps customers to better understand the impact of their day-to-day activities on the network.
		Democratisation of energy markets Digitalisation, data sharing, and transparency are at the heart of DSO functionality and will enable DSOs to contribute to the democratisation of energy markets.
		Self-sufficiency DSOs will help accelerate the electrification of the UK energy system, by enabling integration of renewable generation and electrification of adjacent sectors, including transportation and heating. That in turn would be expected to reduce the UK's reliance on imports of critical resources such as oil, coal, and gas.

Economic benefits	Qualitative	**Employment** DSO enables the creation of new job opportunities associated with the transition to a smarter and more flexible energy system. DSO will be a facilitator for advanced workforce performance, as part of the overall energy transition which will be delivered by a skilled workforce, trained and educated to meet upcoming challenges of the digitalised, decarbonised, and decentralised energy system.
		Market activity DSO facilitates the creation of new business models to monetize distributed generation, storage, demand response, and other flexible sources or new business models linked to the operation of flexibility platforms. Through digitalisation and standardisation of processes and data, and development of flexibility markets, DSO will play a key role in creating a business ecosystem that fosters innovation and the development, testing and implementation of new products and services.
		System efficiency DSO enables system efficiencies which bring economic benefits to society and consumers. By enabling greater visibility of the network, facilitating flexibility services, and coordination with other relevant market participants, the DSO will be a crucial component in maintaining and driving improvements in network reliability, delivering system and direct customer benefits.

[56] A project of Consolidated Edison Company of New York (Con Edison) showed that the risk of a large-scale outage will drop on average 40 to 50 percent in the city's top ten most critical networks by using smart grid technologies. Project: Consolidated Edison Company of New York, Inc. | SmartGrid.gov

[57] A trial from Florida Power & Light Company (FPL) shows that using advanced data analytics reduces SAIDI min (equivalent to CML) by 60% within 9 years. Our approach has been more conservative, suggesting 20% efficiencies over a period of 5 years.

[58] Societal, wholistic cost of 0.8£/minute lost/ customer is a reference used by European DSOs and regulators (€1/minute lost/customer). Source (page 70): https://energeia-binary-external-prod.imgix.net/LDh0tElxUz0JstiTrQqm30xsJ2Y.pdf?dl=Concept-investeringsplan+Liander+2022.pdf

		In addition, DSO can help reduce transmission and distribution network costs and customer bills by making investment decisions that are cost effective and consider a greater number of actions that can be taken. DSO will also improve the operation of flexibility markets and will enable increased market liquidity. It can do this through standardisation of processes, coordination between DSOs and the ESO, simplified processes, and lower costs which remove barriers for participation in flexibility markets. DSO enables better system planning and management, and can lead to lower non-technical losses through the use of smart meter and third-party data as well as network data (including LV monitoring data) which allows DNOs to investigate root-causes of non-technical losses.
	Quantitative	DSO will contribute to the creation of 24,000 jobs related to smart and flexibility energy systems by 2050 in the UK.[59] In addition, export potential in technology and science behind the smart systems in 2050 could be worth as much as £2.7 billion per year to the UK economy, whilst according to another study low-carbon products and services alone is expected to experience significant growth, from approximately £40-126 billion in 2015 to £0.5-1.4 trillion by 2050.[60] [61] DSO is an enabler of reduced network downtime which could lead to £250m cost savings within the RIIO-ED2 period for GB.[62] [63] [64] DSO leads to lower non-technical losses which could provide benefits in the range of £0.03bn-0.05bn within RIIO-ED2.[65]

Technological benefits	Qualitative	**Innovation** DSOs will play a key role in implementing innovative ideas to improve the operation of flexibility markets and to develop smart energy systems with the ultimate goal of benefiting customers. In addition, enhanced collaboration and coordination across DSOs and other utilities will facilitate further knowledge sharing across the industry.
		Digitalisation Digitalisation is key enabler for DSO, and future DSO functionalities will continue to require the digitalisation of the wider energy system that will benefit the wider industry and support faster and more effective (real-time) data exchange.
		Standardisation Standardisation of data and processes is a key DSO enabler and a priority for flexibility markets. As such, DSOs will pursue and deliver standardisation best practices, tools, and processes for the energy sector itself, with the potential of spill over into other sectors, such as transport.

8.3 Wider benefits of our outputs

Across the benefit categories set out above, our RIIO-ED2 DSO outputs could enable between £150m to £460mn of wider GB benefits over the course of RIIO-ED2 and between £0.5bn to £1.6bn by 2040. In addition,

[59] Ofgem and BEIS, Smart Systems and Flexibility Plan, 2021. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1003778/smart-systems-and-flexibility-plan-2021.pdf
[60] https://www.gov.uk/government/news/smart-technologies-and-data-to-future-proof-uk-energy
[61] The CCC, UK business opportunities of moving to a low-carbon economy. Available at: https://www.theccc.org.uk/publication/uk-energy-prices-and-bills-2017-report-supporting-research/
[62] See footnote 56 on page 62.
[63] See footnote 57 on page 62.
[64] See footnote 58 on page 62.
[65] BC Hydro in Canada reported a reduction of non-technical loss by 50% due to the use of smart meter data. Source: https://www.ukpowernetworks.co.uk/losses/static/pdfs/smart-meters-and-losses-best-practice-review.bbbb974.pdf
Our approach estimates a reduction by 5% to 10% of non-technical losses within RIIO-ED2.

our DSO outputs will facilitate the implementation and delivery of various qualitative benefits. We summarise these benefits below. In Appendix B we map how each DSO output contributes to GB DSO wider benefits.

DSO Specific Whole System benefits[66]	Qualitative	**Whole System efficiency** We will enable more efficient Whole System outcomes mainly driven by the coordination with the ESO, and improved forecasting and planning processes. We will also be an enabler of affordable decarbonisation towards Net Zero, by enabling larger volumes of flexibility under a whole system approach. We will increase flexibility market participation via several DSO outputs which include but are not limited to enhancing data transparency, co-optimisation and conflict management with the ESO, and non-exclusive flexibility service contracts.
		Resilience We will deliver several outputs within RIIO-ED2 which will increase resilience of the whole electricity system and in turn the resilience of other utilities. Our DSO outputs include improved planning and investment decision processes, enhanced information exchange with the ESO, avoiding conflicting network management actions, and improving communications between control rooms.
		Support Local Authorities and devolved government Our new team of Strategic Optimisers will use their network knowledge to support Local Authorities and other stakeholders across the SP Distribution and SP Manweb areas. They will provide crucial advice upfront and help develop plans for decarbonising heat. This includes Local Heat and Energy Efficiency Strategies (LHEES) in Scotland and Local Area Energy Plans (LAEPs) elsewhere.
	Quantitative	We could enable between £0.027bn to £0.1bn of benefits within RIIO-ED2 by enabling affordable Net Zero pathways, increasing the volumes of flexibility in the system and via whole system coordination. ESO-DSO co-ordination is a prerequisite for the realisation of this benefit.

Environmental benefits	Qualitative	**Carbon emissions** Through our improved forecasting, LV monitoring, facilitation of flexibility markets, and working with local authorities we will enable the electrification of heat and transport and DER growth. We will deliver several outputs which will enable DER providers to optimise their assets. We will share several datasets such as historical information, operational data, constraint reports, and will provide improved visibility. All this information will assist DER providers to optimise their resources and lead to a reduction of renewable curtailment. We will contribute to Net Zero and CO_2 targets with these outputs.
		Air quality We will indirectly contribute to air quality and health system improvements through our key role in supporting the energy transition. The same activities that reduce carbon emissions will also improve air quality.
		Landscape Through our improved forecasting, Decision Making Framework, and information exchange/coordination with other utilities we can avoid unnecessary groundwork and allow better planning (causing less disturbance to local community and protect the surroundings).

[66] This DSO specific analysis looks at indirect benefits that have been developed using a GB analysis, with a SP Energy Networks focus..

	Quantitative	We can contribute to £0.003bn - £0.016bn of wider system benefits within RIIO-ED2 by reducing the need for renewable curtailment and reducing GB's curtailment costs.
		Supporting the transition to Net Zero, we will be an enabler of improved air quality and health system benefits in the range of £0.072bn to £0.249bn within RIIO-ED2.

Customer benefits	Qualitative	**Financial** We will provide direct financial benefits (payments) to customers related to their participation in flexibility markets. We will enhance our coordination with the ESO on the provision and dispatch of flexibility services, and we will introduce the non-exclusive flexibility service contracts and accurate and short dispatch windows. These enable providers to better optimise their assets, and more efficiently engage with flexibility markets. In addition, the provision of historical information, operational data, and constraint reports will help flexibility service providers to optimise their resources and decide in which markets they want to participate, increasing their commercial return.
		Network Connection Proving better visibility of how the network operates will allow us to make more informed decisions regarding connection capacity on our network. Publishing comprehensive and comparable heat maps will provide network users with high value information about where to connect, and to inform their operations. To improve network reliability, we will improve our outage management approach, that will support shorter restoration times, using our advanced forecasting and improved network visibility capabilities. Improved forecasts may identify potential congestion at an early stage, providing more time to determine an appropriate solution, whilst network monitoring enables us to find anomalies or to anticipate these. Delivering our DSO outputs, we will avoid conflicting network management actions, provide a safety net in the event of market failure and we will enhance the coordination of both our Flexible Platform and Network Management System with conflict management and co-optimisation with the ESO.
		Market Services Our DSO outputs will support customers, flexibility providers, and DER operators to make better use of their assets. We will do this by publishing comprehensive and comparable heat maps that provide network users high value information to inform their operations, supported by enhancing our coordination with the ESO. We will also do this by introducing non-exclusive flex service contracts. We will stimulate the development of open, transparent, and competitive markets through impartial and transparent selection of interventions, including flexibility solutions, having signalled our network needs through our Network Development Plan and flexibility tenders, and fairly compared solutions using a defined set of assessment criteria.
	Quantitative	We will improve the reliability of the distribution network and deliver wider benefits to the customer and society in the range of £0.03bn.

Societal benefits	Qualitative	**Active customer** We will enable active customers by increasing their participation (directly or via a route-to-market provider such as an aggregator) in flexibility markets, sharing market information with stakeholder and wider industry, and by ongoing engagement with our customers and stakeholders.

		Democratisation of energy markets We will target hard-to-reach groups with additional support to facilitate their participation in the energy system through targeted engagement. We will use smart meter data meter and third-party data and information of customer connections/ profile, to identify and tailor our services.

Economic benefits	Qualitative	**Employment** The further development of flexibility markets, with corresponding growth in DER on the network, will support the creation of additional job opportunities in GB. This will be supported by enhanced requirements for data, analytics, and IT and telecommunication delivery from our supply chain, further supporting job opportunities.
		Market activity Our DSO, alongside other wider industry contributors, could indirectly lead to creating new business models (e.g. related to flexibility services). In addition, sharing network data with the wider industry and stakeholders may trigger new services to be developed.
		Electricity System efficiency We will improve network reliability by enhancing our outage management, modelling, and LV monitoring. These support more efficient and accurate system planning. We will reduce transmission and distribution costs due to the avoidance of network reinforcement (where technically and economically appropriate), by impartially selecting the most cost-effective & appropriate solutions/interventions throughout RIIO-ED2. In addition, network monitoring will enable us to improve our condition-based asset management and to perform network planning and congestion management more efficiently. Our enhanced forecasting capabilities will allow us to operate the network more efficiently, leading to lower costs. We will improve flexibility market operations and increase liquidity of energy markets, by impartially selecting interventions throughout RIIO-ED2, having signalled our network needs through our Network Development Plan and flexibility tenders, and fairly compared solutions using a defined set of assessment criteria. In addition, we will coordinate with the ESO and other DNOs to make flexibility markets more efficient (e.g. standardisation of processes, alignment in procurement). We will keep user participation costs low by using low-cost communication methods with users. We will reduce our non-technical losses by combining LV monitoring and smart meter data, to better identify non-technical losses.
	Quantitative	Being an enabler of the transition to Net Zero and a facilitator of more job opportunities related to smart energy and flexibility systems, we can deliver between £0.014bn and £0.062bn of benefits from the creation of new job opportunities throughout RIIO-ED2. We will improve the reliability of the distribution network and deliver wider benefits to customers and society in the range of £0.03bn. Improving our technical losses could bring benefits in the range of £0.003bn to £0.006bn throughout RIIO-ED2.

Technological benefits	Qualitative	Our contribution to the technological benefits linked to innovation, digitalisation, and standardisation are very much driven by our overall Digitalisation Strategy which is a key enabler for DSO. We will also deliver technology benefits through the standardisation of flexibility services in coordination with other DSOs and the ESO and the development of advanced modelling and forecasting tools. We can share our learnings and good practices with the wider industry and facilitate the realisation of technological benefits in other sectors and businesses.

9. Shaped by stakeholder input

Since we published our DSO Strategy in June 2020, we have engaged with our stakeholders to draw on their expertise. This section highlights some of the feedback we received, and how that has been used to guide our prioritisation and decision making when refining our plans for RIIO-ED2.

Stakeholder Feedback	Actions we took
Stakeholders wanted to see education of customers and communities included as part of our plans.	We have a dedicated Community Energy Strategy and we will align our DSO education output with the activities in this strategy.
Stakeholders wanted to see more detail on investment planning, forecasting of future energy scenarios, and network visibility.	This is covered in several areas within the broader RIIO-ED2 plan. From our DFES publication to our Network Visibility Strategy.
In discussing benefits, stakeholders mention peer-to-peer services, and the potential for SP Energy Networks to assist Local Authorities in energy planning and the benefits of smart meters.	We have included our secondary trading output, and our Strategic Optimiser to support local authorities.
Stakeholders that provided feedback on our June 2020 DSO Strategy, noted that SP Energy Networks' description of DSO activities did not align with the functions listed in Ofgem's August 2019 position paper published alongside the RIIO-ED2 Open Letter Consultation.	This has been addressed with an updated alignment to Ofgem's roles and activities from our July 2021 draft.
One stakeholder did not support the use of CLASS by DNOs.	We have not made specific investments into any CLASS projects for RIIO-ED2, and the September 2021 Business Plan Guidance noted that the regulatory treatment of CLASS has not reached a conclusion.
Stakeholders were pleased that SP Energy Networks recognises a) the lack of network monitoring on the LV network and b) the need to develop a better understanding of near-time network capacity.	We have presented an LV Monitoring Strategy for draft and will submit an updated Network Visibility Strategy for our final submission.
Stakeholders summarised some key outputs that they would like to see: • Greater LV monitoring capability. • Enhanced forecasting and modelling, especially where this delivers a better understanding of near-time network capacity and the data is shared with network users and service providers. • Improvements to data provision and digitalisation, in line with Ofgem's Modernising Energy Data guidelines • Increased transmission-distribution coordination, where this continues to enable competitive markets and the long-standing GB approach of self-dispatch and avoids the DNO acting as gatekeeper.	These have been addressed throughout our updated DSO outputs in Appendix B.

• Effective compliance programmes to avoid real and perceived conflicts of interest, included but not limited to organisational change.	
Stakeholders believe we should implement careful governance to separate decisions for the DNO business from decisions for the DSO business.	Our Decision Making Framework and DSO functional model support this stakeholder requirement.

Table 12: DSO stakeholder feedback

Table 12 does not list how we have addressed feedback from Ofgem's RIIO-ED2 Challenge Group (CG) feedback. Table 12 does not list how we have addressed feedback from our Customer Engagement Group (CEG) – this will be published in January 2022 as part of the CEG Challenge Log.

The CEG is an independent body of industry experts, whose role was to review, scrutinise, and challenge the development of our RIIO-ED2 business plan. It has done this by challenging whether our plan addresses the needs and preferences of our customers and stakeholders, and by bringing new perspectives and providing robust, constructive challenge to our decision-making.

The CEG met regularly with our senior representatives to provide this input. There was also a smaller dedicated sub-group of CEG members with more specialised knowledge on DSO who developed a close working relationship with our RIIO-ED2 DSO taskforce, and who were involved at every stage of the process. We met regularly and the CEG sub-group's perspective, feedback, and challenge has proved invaluable in shaping our DSO Strategy – they have played a fundamental role, and for that we are grateful.

The main output of the CEG is their independent report, which will be submitted to Ofgem in January 2022 following the submission of our business plan to Ofgem on 1 December 2021. To track actions and challenges raised by the CEG throughout the development of our business plan, and in accordance with the regulatory guidance, we created a challenge and action log. The log was updated on an ongoing basis, allowing the CEG members to track progress and ensure we were responding to their feedback. Although administered by the Secretariat, all challenges and actions that were responded to required explicit CEG approval before being closed.

10. Deliverability

This section explains how we will deliver our DSO Strategy and how we have ensured that it is deliverable. DSO has been a key consideration for us since our first DSO Vision in 2016. We have carefully planned for the delivery of DSO activities and infrastructure for RIIO-ED2 that will meet our customers' evolving needs, deliver Net Zero, and ensure the continued safe, reliable, and efficient operation of the distribution network and wider energy system for all customers.

We have done this by working with our suppliers and stakeholders, building on our award-winning innovation projects, and remaining close to our own subject matter experts to determine both the critical path and our ability to deliver. This following areas have all supported our deliverability approach for DSO:

- **Knowledge & Experience**: Collating our internal subject matter experts, previous project experience, and our supply chain relationships in preparation for RIIO-ED2 delivery.
- **Plan Development**: Developing our plans with our collated knowledge & experience, with supporting narrative, strategies, Engineering Justification Papers (EJPs) and Cost Benefit Analysis (CBAs).
- **Assurance & Deliverability**: Externally assuring our work with industry leading organisations, including a dedicated deliverability workstream to ensure that we can deliver our RIIO-ED2 plan.

For more information on how we have assured the feasibility of delivering DSO activities and enablers, see our Delivering our RIIO-ED2 Business Plan Strategy and Net Zero Workforce Strategy.

10.1 The delivery challenge

As demonstrated in our DSO infrastructure section (Section 3), we have significant experience of working on projects and initiatives in RIIO-ED1 that will position us for delivery in RIIO-ED2. From this, we understand some of the delivery challenges we will face and the need for resilience in our delivery. We have developed our delivery approach to help address these challenges.

Challenge	Solution
Right structure to deliver	Our new DSO functional model positions the business to deliver against Ofgem's RIIO-ED2 requirements and deliver the anticipated increase in activity during RIIO-ED2.
Increased level of activity	Our approach is designed to ensure that we provide the right investment and resource to enable delivery across multiple workstreams whilst organising ourselves in a manner that ensures our supply chain is part of the solution.
Changing regulatory environment and customer requirements	One challenge we foresee is the changing DSO environment over the course of RIIO-ED2. The nature of this changing regulatory, legislative, and customer environment is the need to be flexible and responsive to changing requirements. We have built this flexibility into our approach.

A key approach to managing delivery challenges is foresight of the key activities and infrastructure required during RIIO-ED2. This will be provided by detailed strategies, Engineering Justification Papers (EJPs), and individual programmes of work as we enter the RIIO-ED2 period.

We recognise the requirement to balance activities and infrastructure that will span the entirety of RIIO-ED2 with emerging customer and regulatory requirements. This requirement is built into our new DSO functional model and overall delivery approach. With our approach you will see consistency of approach throughout RIIO-ED2, that will also ensure that lessons learned from RIIO-ED1 are incorporated. Our aim is to ensure that the delivery of DSO activities and infrastructure for RIIO-ED2 will meet our customers' evolving needs, deliver Net Zero, and ensure the continued safe, reliable, and efficient operation of the distribution network and wider energy system for all customers.

With our DFES forecasts providing an outlook on the anticipated volumes for RIIO-ED2 that we need to accommodate, we believe resourcing and delivery cannot just be driven on an individual activity or output specific level. It also requires a holistic view across RIIO-ED2 for DSO – and we have done this with both our

infrastructure delivery, our individual strategies, and our DSO functional model. In particular, throughout RIIO-ED2 we will work with our customers and stakeholder to refine our delivery approach.

At the beginning of RIIO-ED2, we will complete a detailed review of the schedules for all proposed activities and infrastructure in order to ascertain appropriate individual delivery models, contractual approaches (that could include partnerships) and associated specifications, standards, deliverables and milestones. Following this review, we will agree an appropriate assurance review for any applicable areas. All data and information will be consolidated into a master project management schedule that we will use to allocate resource and use to plan our work accordingly.

This master project management schedule will provide opportunities to efficiently and effectively deploy our staff in response to specific requirements. The project management schedule will be reviewed and updated regularly to ensure that the required resources are available at the right place in a timely manner.

10.2 Lessons learned from RIIO-ED1

With several DSO projects underway in RIIO-ED1, we are continuously looking to capture lessons learned – not just to shape our RIIO-ED2 plan but to prepare our delivery approach. We will continue to leverage these lessons learned for the remainder of RIIO-ED1, from within SP Energy Networks and in wider industry to refine our delivery approach.

SP Energy Networks has staff with diverse experience from projects across RIIO-ED1, and our new DSO functional model is putting forward an experienced team to support the delivery of DSO in RIIO-ED2. During RIIO-ED1 we have built further supply chain relationships with technology companies, Original Equipment Manufacturers (OEMs), and start-ups to deliver innovative projects at different scales.

We have leveraged many of those relationships in the development of our RIIO-ED2 plans, supported by external assurance, and will look make full use of our supply chain to deliver RIIO-ED2.

10.3 Delivery examples

Outlined below are examples of DSO infrastructure investments with specifics on deliverability:

LV Monitoring

With the increase volumes of LCTs expected to connect to our LV network, we will install LV network monitoring at 14,102 substations in RIIO-ED2. We have developed our delivery approach using experience from our RIIO-ED1 Enhanced LV Monitoring project, and by working with manufacturers. Deliverability is supported by a dedicated Strategy, EJP, CBA, and external assurance.

Constraint Management Zones (CMZs)

In RIIO-ED2, we will deliver 22 CMZs where they're needed most. We developed our design and costs for these systems with an industry leading provider and by building on our RIIO-ED1 and DPCR5 experience. We've scaled the rollout to account for supply chain deliverability. Deliverability is supported by an EJP and CBA that were externally assured.

ENZ Platform

The ENZ Platform that we will deliver in RIIO-ED2 is an evolution of our existing ENZ Model. We have therefore developed the deliverability plan for the ENZ Platform based on our in-depth knowledge of what it has taken to deliver the ENZ Model.

Operational IT & Telecoms

Our Operational IT & Telecoms investments are a key enabler for nearly all other DSO infrastructure investments and outputs. Our Operational IT plans build upon our smart system, ANM, and AFLM experience in RIIO-ED1. We have used that experience to consider the right investment approaches and delivery models to meet DSO requirements. For Telecoms, we are already using our RIIO-ED1 supply chain partnerships which pave the way for the delivery of telecoms enhancements in RIIO-ED2.

Digital Systems and IT platforms

The delivery of our Non-Operational IT investments has been developed from our experience in RIIO-ED1 – from our forecasting and analysis capabilities that started with WaNDA and NCEWs, to the platform testing of Flexible Power, Piclo, and Project FUSION. We have combined this experience with input from solutions providers to prepare our delivery plans for RIIO-ED2.

11. In Summary

There are three major system changes in RIIO-ED2:

Decarbonisation

The demand and generation we need to accommodate on the distribution network is significantly increasing.

+0.7-1m +0.3-0.8m +4.9-6.4GW

Decentralisation

The ESO is increasingly dependent on services from distribution-connected providers (known as DER) as their need for services increases and their traditional transmission-connected providers close.

Democratisation & Digitalisation

Our customers increasingly have the desire and the tools to participate in the energy system, and can respond to an increasing number of different price signals.

These give rise to three core challenge areas in RIIO-ED2:

Planning & network development

Decarbonisation is well beyond what the network is currently designed to accommodate, and it increases the interaction between the distribution network and other vectors (e.g. transport).

We must provide the capacity to accommodate Net Zero safely, efficiently, and on time.

Network operation

ESO service use affects power flows on the distribution network, and so interacts with our responsibility to operate a safe, reliable, and efficient distribution network. Our network actions can affect transmission network power flows and ESO actions.

We must facilitate the ESO's utilisation of DER services and coordinate it with our own DER service use, to safeguard system stability and operability.

Market development

Our toolkit needs to encourage and support solutions from flexibility providers and market innovators – both existing and new third parties – whilst managing the more dynamic power flows and higher peak demands that could result.

We must enable these markets to grow and operate competitively, whilst safely and efficiently planning and operating the network in this new environment.

We must respond to these challenges – DSO helps us do this.

Our overarching purpose is to meet our customers' evolving needs, enable Net Zero, and ensure the continued safe, reliable, and efficient operation of the distribution network and wider energy system for all customers. So that we can continue to do this in RIIO-ED2 and beyond, the magnitude and impact of the system changes means there is a clear need for a set of **updated roles, activities, and infrastructure** on the distribution network – together these are **DSO**.

For RIIO-ED2, DSO has been defined by Ofgem in a set of 23 Baseline Expectations, categorised into three roles and five activities. Together, these describe the minimum level of DSO we must deliver in RIIO-ED2. These are set out in full in Appendix A.

We're making investments in infrastructure and a new business structure:

Six categories of infrastructure

1. **Network monitoring**, including extending monitoring from covering 14% to 76% of our customers.
2. **Enhanced forecasting tools**, such as our EV-Up and Heat-Up tools which forecast EV and heat pump uptake for every customer we serve – a DNO first.
3. **Simulation and modelling tools**, building on our award-winning analytical model to create a real-time, data-driven, whole network analytical platform – our ENZ Platform.
4. **Scalable network management and flexibility dispatch infrastructure**, including 22 CMZs are the heart of network operation.
5. **Operational IT and telecoms investment**, that other DSO infrastructure depend on to work.
6. **Digitalisation and IT platforms**, such as our Data portal to share data.

A new DSO functional model

- ✓ A new DSO functional model by the start of RIIO-ED2.
- ✓ Responsible for network planning and investment, flexibility procurement, and operational decisions.
- ✓ Dedicated director reporting to the SP Energy Networks CEO.
- ✓ External assurance to ensure transparency.
- ✓ External DSO stakeholder panel to inform our delivery of DSO and monitor our progress.
- ✓ The right structure for RIIO-ED2 – ensures clear accountability to deliver DSO, addresses concerns about perceived conflicts, promotes transparency, maintains clear responsibility for safety, and keeps options open for future institutional arrangements whilst minimising unnecessary costs in the meantime. This is a 'no regrets' arrangement.

These mean we can deliver a full suite of DSO outputs across three roles in RIIO-ED2, to meet and exceed Ofgem's baseline expectations:

Planning & network development

- ✓ High quality, data-driven intervention decisions that fairly compare all viable options (including flexibility and energy efficiency) and consider whole system outcomes.
- ✓ Planning processes and intervention decisions which are clear and transparent – stakeholders can follow the progress and decisions for all HV and EHV constraints.
- ✓ Network planning data made publicly available.

Network operation

- ✓ Getting more out of existing network capacity by operating closer to limits, managing technical losses, and making more use of operational interventions like flexibility services instead of reinforcements.
- ✓ Whole system operational coordination to ensure system efficiency, stability, and resilience.
- ✓ Empowering customers and flexibility providers through more data, greater transparency, and more efficient markets.

Market development

- ✓ Supporting flexibility market growth through data share, reduced barriers to participation, and enabling multiple market participation.
- ✓ More efficient flexibility market functioning through data-driven near-time and real-time notifications, operational coordination with the ESO, and a clear governing framework.
- ✓ Giving users confidence that we are a neutral market facilitator through transparency, external assurance.

This plan was created with our stakeholders

In October 2016, we were the first in our industry to publish a DSO Vision in response to evolving customer needs and system challenges. Since then, we have worked alongside industry, government, and our stakeholders to progress this evolution in the GB energy system – this DSO Strategy is the culmination of five years of stakeholder engagement.

Our DSO Strategy doesn't just incorporate knowledge from our own stakeholders. By building on wider industry work such as the three TEF[67] projects, the Open Networks project, Ofgem and BEIS publications, and technological and commercial developments, we are building on a far broader base of stakeholder expertise.

We worked closely with our CEG and stakeholders through the RIIO-ED2 development process. Our CEG has helped shaped the content and framing of our DSO Strategy – we are grateful for their input.

DSO has been a consideration for us since our first DSO Vision in 2016. We have carefully planned for the delivery of DSO activities and infrastructure for RIIO-ED2 by working with our suppliers and stakeholders, building on our award-winning innovation projects, and remaining close to our own subject matter experts to determine both the critical path and our ability to deliver.

Together, our DSO investments and outputs will:

- ✓ Invest £185.1m in RIIO-ED2 to deliver £370m in direct customer benefits over the next 45 years and £0.5bn-1.6bn in wider system benefits by 2040.
- ✓ Deliver the coordination, tools, and network visibility we need to safely and efficiently enable Net Zero.
- ✓ Enable increased customer participation in the energy system through efficient and competitive flexibility markets and addressing concerns about perceived conflicts of interest. This will enable the widespread use of flexibility to create capacity more quickly and cheaply than reinforcement.
- ✓ Ensure the continued safe, reliable, and efficient operation of the distribution network and wider system by increasing coordination with the ESO and other key stakeholders.
- ✓ Deliver a better customer service and experience.
- ✓ Meet and exceed Ofgem DSO Baseline Expectations.

Our DSO Strategy gives us the planning and operational tools and capabilities we need to support the growth and use of flexibility service markets, analyse and share data, enable greater transparency and competition, help us coordinate across the whole system, and enhance our ability to plan and operate a more complex system. Our DSO Strategy will deliver a network with greater flexibility and optionality to meet our customers' requirements as GB transitions to Net Zero. Our DSO Strategy focusses on the period from now through to the end of the RIIO-ED2 price control (2028) but lays the foundation for the longer term.

Our DSO Strategy means we can continue to meet our customers' evolving needs, enable Net Zero, and ensure the continued safe, reliable, and efficient operation of the distribution network and wider energy system for all customers.

[67] These are three projects led by distribution licensees that support the transition to DSO. The three projects are Transition (led by SSEN), Electricity Flexibility and Forecasting Systems (led by WPD), and Fusion (led by us).

12. Glossary

- Active network management (ANM) – ANM schemes are monitoring and control platforms which sit above the physical network and reduce constraints by regulating the output of ANM-connected customers during times of system constraints.
- Customer – means anyone connected to our network and who depends on us for an electricity supply. This includes demand, generation, and storage sites, and Independent DNO (IDNO) networks.
- Decarbonisation – the process to reduce the amount of carbon dioxide (CO_2) and other greenhouse gas emissions by introducing new low carbon alternatives and technologies. Much of the decarbonisation strategy is based on switching carbon energy vectors (e.g. petrol and diesel for transport, and natural gas and oil for heating) to electricity, and then using renewable generation to provide zero carbon electricity.
- Decentralisation – this reflects the extent to which generation is sited closer to demand consumption (or is even undertaken by demand customers themselves) via the use of smaller-scale technologies such as solar PV and local energy storage. A less decentralised system would be characterised by fewer, larger-scale generators sited further from where the electricity is ultimately consumed (demand); a more decentralised system would be characterised by more smaller-scale generators sited closer to demand.
- Decision Making Framework – process and policy documentation that supports DSO decision making.
- Distributed generation (DG) – generation connected to the distribution network, as opposed to the transmission network.
- Distribution energy resources (DER) – means any asset that is connected to the distribution network which can change its import/export position in a controlled manner in response to a signal. DER will likely include DG, demand side response, and storage. See also 'Services'.
- Distribution Future Energy Scenarios (DFES) – DFES forecasts are detailed forecasts we publish annually for our two distribution networks. We work with an external party to determine and produce them. They cover a range of demand and generation metrics (e.g. EVs, heat pumps, different generation technologies) out to 2050. They are available at: https://www.spenergynetworks.co.uk/pages/distribution_future_energy_scenarios.aspx
- Distribution network – in England and Wales this is the overhead lines, underground cables and other network infrastructure that operate at 132kV and below; in Scotland it is the infrastructure that operates at 33kV and below. The distribution network delivers electricity from the transmission network and DG to end users (demand customers). Nearly all demand in GB is connected to the distribution network; only very large demand users (e.g. the rail network) are connected to the transmission network. Nearly all medium-scale and smaller-scale generation in GB is connected to the distribution network; typically only large fossil fuel power stations, offshore generation, and large onshore generation are connected to the transmission network.
- DSO – depending on context, means the act of distribution system operation, or the distribution system operator (the party carrying out the act of distribution system operation). From the Open Networks project, the definition of distribution system operator is:
- *"a DSO securely operates and develops an active distribution system comprising networks, demand, generation and other flexible DER. As a neutral facilitator of an open an accessible market, it will enable competitive access to markets and the optimal use of DER on distribution networks to deliver security, sustainability and affordability in the support of whole system optimisation. A DSO enables customers to be both producers and consumers; enabling customer access to networks and accessible markets, customer choice and great customer service."*
- Electricity System Operator (ESO) – the company responsible for operating the GB transmission network. They have two main operational roles: balancing the total demand and generation on the system to maintain system frequency at 50Hz, and ensuring transmission power flows remain within transmission network capability and statutory limits.

- Energy Networks Association (ENA) – a gas and electricity networks trade association. It is a key route through which flexibility service commonality across DNOs and coordination between transmission and distribution is being increased.
- Extra high voltage (EHV) – all distribution voltages greater than 22kV.
- Flexibility – the ability of a customer to change their import/export position in a controlled manner in response to an external signal. With the push towards the electrification of heat and transport, being able to flexibly utilise demand and generation will help minimise the amount of additional network capacity required, balance the system and provide system stability – these can all help reduce customer electricity bills. See also 'Services'.
- High voltage (HV) – all voltages above 1kV up to and including 22kV.
- Grid supply point (GSP) – the interface points (usually substations) between the transmission network and distribution network.
- GW – equal to 1,000 MW.
- Long term development statement – a set of documents which detail all distribution network assets from EHV up to the connection point with the transmission network. They also set out network fault levels, connected and forecast DG (excluding domestic-scale DG), and historical and forecast demand. They are published annually in November, with an interim update published annually in May.
- Low carbon technologies (LCT) – means the range of customer technologies that are needed to deliver decarbonisation. For example, EVs, heat pumps, storage, and renewable generation.
- Low voltage (LV) – all voltages up to and including 1kV.
- MVAr – mega volt amps (reactive) is a unit of reactive power. It can be useful to help manage network voltage levels. It can describe both the amount of reactive power that a user is importing (e.g. this generator is importing 1MVAr of reactive power"), and the amount of reactive power that a user is exporting (e.g. "this generator is exporting 1MVAr of reactive power").
- MW – megawatt is a unit of power (not energy). It can describe both the amount of power that a demand user is consuming (e.g. "this town's peak demand has increased by 3MW due to an increase in EVs and heat pumps"), and the amount of power that a generator is producing (e.g. "3MW of solar PV generation has been installed in this area").
- Net Zero – means the legislated target of reducing greenhouse gas emissions to net zero. For the UK, there are three Net Zero targets:
    - The UK Government has introduced the Climate Change Act 2008 (2050 Target Amendment) Order 2019. This legislation introduces a legally binding target for the UK to have net zero greenhouse gas emissions by 2050. The legislation is available at: http://www.legislation.gov.uk/ukpga/2008/27/contents
    - The Scottish Government has introduced the Scottish Climate Change (Emissions Reduction Targets) Act 2019. This legislation introduces a legally binding target for Scotland to have net zero greenhouse gas emissions by 2045. The legislation is available at: http://www.legislation.gov.uk/asp/2019/15/contents/enacted
    - The Welsh Government has introduced The Environment (Wales) Act 2016 (Amendment of 2050 Emissions Target) Regulations 2021. This introduces a legally binding target for Wales to have net zero greenhouse gas emissions by 2050. The legislation is available at: https://www.legislation.gov.uk/anaw/2016/3/contents
- Open Networks – this is a pan-industry project involving transmission and distribution network companies, the ESO, the Department for Business, Energy, and Industrial Strategy (BEIS), Ofgem, and other stakeholders. It has done much work developing DSO models, the customer experience, whole electricity system planning and distribution to transmission data exchange, and flexibility services.
- Peak demand – the point in the year, typically during the winter months, when our distribution network as a whole sees the highest demand. It is an important study condition (along with minimum demand) as it places the greatest need on network capacity – our network must be sized to accommodate peak demand.
- Primary substation – see 'Substation'.

- RIIO-ED2 – means the distribution network price control period which runs from 1 April 2023 to 31 March 2028. Before this period starts, we will agree with Ofgem the outputs we will deliver during this period, and the funding, incentives, and penalties for delivering those outputs.
- Secondary substation – see 'Substation'.
- Services (aka DER services or flexibility services) – DER can change its import/export position in a controlled manner in response to a signal. This capability can be utilised for the benefit of the network or wider system (e.g. a DER reducing their import to reduce the overall level of demand the network must supply). Where we utilise this capability, the DER is providing us with a 'service'. See also 'Flexibility' and 'Distribution energy resources'.
- SP Distribution – the distribution network operator for Central and Southern Scotland, we own and operate the distribution network at 33kV, 11kV and LV into the home.
- SP Manweb – the distribution network operator for Merseyside, Cheshire, north Shropshire, and north Wales, we own the distribution network at 132kV, 33kV, 11kV and LV into the home.
- Substation – a building or outdoor compound which contains one or more transformers and switchgear protection. The primary purpose of a substation is to change the network power flow from one voltage level to another. In a primary substation the highest voltage is EHV (primary substations are typically 33kV/11kV); in a secondary substation the highest voltage is HV (primary substations are typically 11kV/LV).
- Transmission Network – the high voltage electricity network used for the bulk transfer of electrical energy across large distances. The transmission network takes electricity from large generators (e.g. coal, gas, nuclear and offshore wind) to supply large industrial customers and the distribution network.

13. Appendix A – Ofgem DSO baseline expectations

Ofgem has defined three core DSO roles for DNOs to deliver in RIIO-ED2. These cover five main DSO activities and are described by a set of DSO baseline expectations.[68] Together, these describe the minimum level of DSO we must deliver in RIIO-ED2.

These roles, activities, and baseline expectations are set out in Table 13. All text in Table 13 is a verbatim copy from Ofgem's Business Plan Guidance.

Role	Activity	Baseline Expectation
1. Planning and network development	**1.1 Plan efficiently in the context of uncertainty, taking account of whole system outcomes, and promote planning data availability** The purpose of this activity is to ensure that DNOs' planning processes are clear, that high quality, data-driven decisions are made, and that DNOs provide stakeholders with relevant information to inform their own decision-making.	**1.1.1** 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. • We expect increased monitoring equipment to be rolled out across their network where it has demonstrable net value for network planning. 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.
		1.1.2 We expect DNOs to submit a network visibility strategy and this should cover the use of all sources of network data including direct measurement from monitoring roll-out, smart meter data, data analysis and modelling, and any other third party data sources. The strategy should explain how network monitoring for planning purposes will inform planning decisions, including the use of flexibility; clear justifications for where and when monitoring is rolled-out, including explanations of any targeting for equipment deployment; and the specifications of equipment, including detail on the data captured, frequency of polling, and the mode of communicating data. Note, companies may wish to combine this strategy with network monitoring and visibility for network operations under role 2.
		1.1.3 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 authority and devolved government plans for decarbonisation. • 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. • 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.
		1.1.4 DNOs to have in place transparent and robust processes for identifying and assessing options to resolve network needs, using competition where efficient.

[68] Appendix 4 of Ofgem's 'RIIO-ED2 Business Plan Guidance', published 30 September 2021. Available at: https://www.ofgem.gov.uk/publications/riio-ed2-business-plan-guidance

		• This should include demonstrable cross-sector[69] engagement, optioneering, and planning with sectors or vectors other than their own. • 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. 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.
2. Network operation	**2.1 Promote operational network visibility and data availability** The purpose of this activity is to ensure that DNOs are able to share relevant data on network operations to stakeholders, and to ensure that DNOs have sufficient network knowledge to operate their network under safe and reliable conditions.	**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. DNOs must take reasonable steps to access and subsequently share, including by publishing, data and operability constraint information in a timely manner.
		2.1.2 We expect DNOs to submit a network visibility strategy and this should cover the use of all sources of network data including direct measurement from monitoring roll-out, smart meter data, data analysis and modelling, and any other third party data sources. The strategy should explain how network monitoring for operational purposes will inform operational decisions, including enabling the management and delivery of flexibility services; clear justifications for where and when monitoring is rolled-out, including explanations of any targeting for equipment deployment; and the specifications of equipment, including detail on the data captured, frequency of polling, and the mode of communicating data. Note, companies may wish to combine this strategy with network monitoring and visibility for network planning under role 1.
		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;

[69] Ofgem (source: see footnote 68): "'Sector' refers to the distribution, transmission and operation of a single energy source. For example, the 'gas sector' includes the firms responsible for gas transmission, distribution, and system operation. By 'cross-sector', we refer to any licensee in one energy source sector, eg electricity, working with any licensee in another energy source sector, eg gas."

		• as recorded historic Feeder MW/MVA Utilisation and calculated headroom/footroom; and • utilisation and curtailment of areas under the control of capacity management systems such as Active Network Management systems.
	2.2: Facilitate efficient dispatch of distribution flexibility services This activity is about defining and developing system operability capabilities and the actions network companies take to operate the distribution system safely. The aim is to ensure DNOs facilitate dispatch of DER that is economic and efficient.	**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. • 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.
		2.2.2 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).
		2.2.3 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.
		2.2.4 DNOs to develop efficient, scalable dispatch instruction infrastructure and avoid proprietary systems. • 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. The application of hard dispatch controls shall be for the improved reliance on market-based mechanisms, not to the detriment of their development. 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.
3. Market development	**3.1: Provide accurate, user-friendly, and comprehensive market information** The purpose of this activity is to ensure that DNOs sufficiently inform stakeholders of information that will	**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). 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

	assist them in participating in, managing or otherwise engaging with markets in the long and short term. We recognise there are overlaps across other activities, but at the same time believe this information is sufficiently critical to warrant its own statement, and to also include wider information than that mentioned in prior activities.	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).
		3.1.2 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.
		3.1.3 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. The information must be easily accessible and navigable. We expect this includes publishing data in machine-readable formats.
		3.1.4 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. In many instances, collaboration across DNOs in engagement is expected to reduce duplication, make it easier for stakeholders to engage and avoid stakeholder fatigue.
		3.1.5 DNOs should seek to ensure the information they publish is as accurate and unbiased as reasonable (ie correct at time of publication, as close as possible to the actual value and not skewed in any direction).
	3.2: Embed simple, fair, and transparent rules and processes for procuring distribution flexibility services The purpose of this activity is to ensure distribution flexibility service market design leads to good competitive outcomes, including downward pressure on prices and innovative 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.[70] The processes should be transparent and participatory, involving other DNOs, the ESO, and current and potential distribution flexibility service providers. • 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. 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.
		3.2.2 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. 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,

[70] Ofgem (source: see footnote 68): "Standardisation of the technical parameters of the product, processes and the applicable contracts, not just in branding, with clear justification for any deviations, as well as data standards and methods for sharing this information."

		deviations from the standard should be justified with clear governance processes for managing change that should be clearly communicated. • DNOs should have clear, comprehensive and transparent mechanisms and associated commercial structures for coordinating distribution flexibility services and ESO flexibility services procurement. DNOs shall not act as the commercial route for DER accessing ESO flexibility services. 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. 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. • DNOs should consider arrangements to support DERs to provide services that meet both DNO and ESO needs.
		3.2.3 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.
		3.2.4 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.
		3.2.5 DNOs to introduce other proportionate measures, developed with robust stakeholder engagement, to identify and address actual and perceived conflicts between its DSO and network ownership roles or other business interests.[71] The introduction of such measures should enable DNOs to efficiently plan, develop and use their network, taking into account and using flexible alternatives to network reinforcement where efficient for the system, in a visibly neutral way. At a minimum, this should include demonstrable executive-level accountability and board-level visibility of key DSO decisions across the planning, operation and market facilitation functions. This should also include clear and separate decision-making frameworks, supported by independent oversight, such as external auditing, to promote transparency and enable scrutiny. Additionally, to support the justification of DNOs' proposals as proportionate, we expect DNOs to set out conflict mitigation options that were considered but not proposed, including legal separation if this is not part of the DNO's suite of proposals. As part of their justification, DNOs should include the available supporting information on the likely costs, timings and implications of these alternative options or a narration of initial views.

Table 13: Ofgem DSO roles, activities, and baseline expectations

[71] Ofgem (source: see footnote 68): "Other business interests could include services DNOs are able to provide outside of their regulated income. In February 2020, we consulted on DNOs using remote voltage control to provide the ESO with balancing services (CLASS) in RIIO-ED2. We are carefully considering the responses to this consultation and expect to provide an update in early 2022."

14. Appendix B – Our DSO Strategy mapped against Ofgem DSO baseline expectations

This appendix provides the detail of the outputs that we will deliver throughout RIIO-ED2. All data sharing outputs are subject to the Open Data Triage process (please refer to our Data Strategy). This also explains how all relevant data share will comply with Data Best Practice Guidance and to the principles of treating data as presumed open.

Please see Appendix C for our proposed performance measures, to show how stakeholders and Ofgem will be able to evaluate our progress in delivering DSO.

14.1 Activity 1.1: Plan efficiently in the context of uncertainty, taking account of whole system outcomes, and promote planning data availability

This section sets out the detail of the DSO outputs we will deliver to meet or exceed Ofgem's baseline expectations for Activity 1.1. Together, these outputs will ensure that:

1. We make high-quality, data-driven, investment decisions that fairly compare all viable options, including flexibility and energy efficiency, and take account of whole system outcomes.
2. Our planning processes and intervention decisions are clear and transparent.
3. We can increase visibility of the network and so share a wider range of network planning data.

Ofgem baseline expectations	What we will do in response			
	Our DSO outputs	Timescale	Meets or exceeds	Costs and benefits
1.1.1 (i) 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.	✓ Using and further developing our enhanced EV-Up and Heat-Up forecasting tools for network planning. These industry-leading tools assess spatial, demographic, and socioeconomic data to forecast EV and heat pump uptake for every customer we serve. These insights help us identify precisely where and when we need to invest. By better understanding our customers' requirements we can make more targeted, efficient, and timely network planning interventions. See Section 3.3 for more information.	Throughout RIIO-ED2	Meets	**Costs:** Supported by a £7.5m investment in specific DSO IT systems, that includes the development of our forecasting tools. **Benefits:** Contributes to the £328.4m direct benefit over 45 years, as reported in our DSO EJP. This does not include any of the indirect benefits that will be delivered through additional functionality and more efficient flexibility service procurement and use.

	✓ Where we are missing network asset information, we will continue to use our connectivity models, predictive analytics, and other digital tools to as much as possible address any gaps in information.			
	✓ Using and further developing our Weather Normalised Demand Analytics (WaNDA) tool. This uses historical data, generation, and discretised weather data at a primary substation level, to help better understand the effects of weather on network power flows. By inputting this to our ENZ Platform, our network planning will be informed by weather trends. This helps us make more informed network planning decisions.	Throughout RIIO-ED2	Meets	**Costs:** Supported by a £7.5m investment in specific DSO IT systems, that includes the development of our forecasting tools. **Benefits:** Contributes to the £328.4m direct benefit over 45 years, as reported in our DSO EJP. This does not include any of the indirect benefits that will be delivered through additional functionality and more efficient flexibility service procurement and use.
	✓ Investing £5.5m in our ENZ Platform. This new simulation and modelling platform integrates forecasting data (DFES, EV-Up, Heat-Up, PRAE, WaNDA), network monitoring data, smart meter data, and asset condition data with a full power flow model of our entire network, to produce detailed network analytics. This means we can make data-driven network planning assessments of when and where we need to intervene which, by utilising our DFES, incorporate stakeholder input. See Section 3.3.2 for more information.	Some base functionality in RIIO-ED1 (our ENZ Model), with further enhancements throughout RIIO-ED2	Exceeds – The ENZ Platform exceeds this baseline expectation as a key differentiator for SP Energy Networks. It is a key enabler across DSO, Load Related Expenditure, and Connections etc. No additional costs required to exceed baseline requirement.	**Costs:** Supported by a £5.5m IT investment in the ENZ Platform. **Benefits:** Contributes to £57.1m of direct benefits over 45 years, alongside other data and digitalisation activities. Contributes to £0.03bn of indirect benefits from improving the reliability of the distribution network. Delivers qualitative benefits for Whole System resilience, enabled by increased distribution network reliability.
	✓ An annual calibration exercise for our EV-Up, Heat-Up, and ENZ Platform, so our forecasting, simulation, and modelling tools remain accurate. This will include comparing previous forecasts against the observed reality.	Annually from 2025	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.03bn of indirect benefits from improving the reliability of the distribution network.

				Delivers qualitative benefits for Whole System resilience, enabled by increased distribution network reliability.
1.1.1 (ii) We expect increased monitoring equipment to be rolled out across their network where it has demonstrable net value for network planning. 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.	✓ Investing £28.3m to deliver LV monitoring at 14,102 secondary substations by the end of RIIO-ED2. This will extend monitoring from 8% to 52% of large LV substations, increasing coverage from 14% to 76% of customers, by the end of RIIO-ED2. This delivers a range of benefits, including helping us to make smarter and more coordinated network planning decisions by providing more visibility about where and when we need to intervene, and unlocking the use of smart network tools that need high quality monitoring data to work. ✓ Our Network Visibility Strategy contains analysis of the monitoring needs case, how the resulting data will be used, a comparison of monitoring and smart meter data, functional and technical specifications for the monitors, and benefits case.	Throughout RIIO-ED2 for the delivery of LV Monitoring. Network Visibility Strategy submitted for RIIO-ED2 Final Submission	Meets	**Costs:** Supported by a £28.3m investment in LV monitoring. **Benefits:** Direct benefits of £32.2m over 25 years from our EJP. Contributes to £0.03bn of indirect benefits by increasing the reliability of the distribution network. Delivers qualitative economic benefits by improving system efficiencies (reduced transmission and distribution costs, improve system planning).
1.1.1 (iii) 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.	✓ Investing in our infrastructure (including SDIF and NAVI) to collect smart meter data and incorporate it in our ENZ Platform network planning tool. This incorporation means that smart meter data will inform our planning decisions. ✓ We will combine smart meter data with LV monitoring data to identify non-technical losses. Identification of non-technical losses means we can ensure un-metered customers are identified correctly and reduce instances of theft, which all customers end up paying for.	By the end of RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. Our SDIF and NAVI investment is supported by a £5.8m investment in specific smart systems. **Benefits:** Contributes to £3.2m-6.4m of indirect benefits during RIIO-ED2 by reducing non-technical losses.

	✓ We will work with the three gas network companies that span our two licence areas (Cadent, SGN, and Wales & West Utilities), to request they send us information about planned gas network outages as these can result in increased electricity demand. We will use this to inform our network planning forecasts.			
1.1.2 We expect DNOs to submit a network visibility strategy and this should cover the use of all sources of network data including direct measurement from monitoring roll-out, smart meter data, data analysis and modelling, and any other third party data sources. The strategy should explain how network monitoring for planning purposes will inform planning decisions, including the use of flexibility; clear justifications for where and when monitoring is rolled-out, including explanations of any targeting for equipment deployment; and the specifications of equipment, including detail on the data	✓ We have a comprehensive Network Visibility Strategy. This explains how we will increase collection of network data from monitors and smart meters, how we will use that data to support network planning and operational decisions, and how data collection will enable greater data sharing with stakeholders. One output of this strategy is to ensure we deliver network monitors where they provide value and complement smart meter and third-party data.	Submitted for RIIO-ED2 Final Submission	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.057-0.13bn of wider indirect benefits during the RIIO-ED2 period, by delivering whole system efficiencies and increasing the reliability of distribution networks. Delivers qualitative benefits of whole system efficiencies, support for local authorities and devolved government and increases overall Whole System resilience. It delivers environmental benefits of decreased CO_2 emissions and landscape protection. Delivers qualitative benefits of the ESO-DSO coordination, which is a prerequisite for the realisation of the £0.057-0.13bn of wider benefits. It contributes to innovation as our leading forecasting, simulation, and modelling tools set the standard for good practice across the energy industry and the wider utilities industry.

captured, frequency of polling, and the mode of communicating data.				
1.1.3 (i) 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 authority and devolved government plans for decarbonisation.	Investing in the infrastructure and processes we need to share network planning data with the ESO, network users, and other interested parties. ✓ Investing in our single free-to-access portal to share data with stakeholders and customers. We will also share data through dedicated platforms or directly through our systems where appropriate. ✓ Continuing to use and develop our SDIF tool so we can share planning information (including whole network models) with other network companies and interested parties. ✓ Investing £221.4m to deliver the reliable, cyber-secure, low-latency operational IT and telecoms that we need to collect, process, and transmit data to stakeholders. ✓ We will put in place processes to support the publication of data that is accurate and unbiased. We will do this by following the Open Data Triage process. ✓ Our IT and Digitalisation Strategy sets out our approach to data; we are able to share appropriate data securely as part of our commitment to open data. We will report the percentage of approved datasets that are shared and aim to make 100% of the Ofgem agreed datasets available, within fixed timescales. ✓ Working with other network companies and vectors, and providing a team of specialists	Throughout RIIO-ED2	Meets for all items, expect exceeds for strategic optimisers. Strategic Optimisers represent a key component of our Whole System approach, and in the context of DSO, exceeds the baseline requirements. No additional costs required to exceed baseline requirement.	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative benefits of ESO-DSO coordination, which is a prerequisite for the realization of the £0.027-0.100bn of wider whole system benefits. It delivers societal benefits enabling active customers by giving them access to data. It delivers technological benefits as data share is an enabler for the digitalisation of the GB energy system. It supports local authorities and devolved government in planning and delivering decarbonisation. It reduces disruption by enabler utilities to better optimise infrastructure and maintenance activities.

	(Strategic Optimisers) to partner with local authorities and regional governments to support the optimisation of network planning, design, and implementation of public EV charging and heat electrification initiatives. A proposed Whole System planning function will be accountable for assimilating feedback from Strategic Optimisers and delivering Whole System solutions and outcomes in a coordinated manner with other network companies and vectors. ✓ We will work with stakeholders to prioritise what planning data we publish. We will do this by engaging with our stakeholders annually to consult on the content, frequency, and method of data publication, and supporting metadata. We will further develop our stakeholder feedback mechanism as a route for stakeholder feedback.			
	As a result of this infrastructure and these processes, we plan to be capable of sharing the following network planning data with the ESO, network users, and other interested parties: ✓ Publishing our flexibility requirements through our tenders, so that potential providers can easily understand our requirements and engage with us. ✓ Publishing a range of network planning data, including through heat maps, the Long-Term Development Statement (LTDS), Network Development Plan (NDP), and Embedded Capacity Register. ✓ Publishing a range of information on all network constraints on the 33kV and 132kV	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative benefits of the ESO-DSO coordination, which is a prerequisite for the realization of the £0.027-0.100bn of wider whole system benefits. It delivers technological benefits as data share will enable the digitalisation of the GB energy system. It supports local authorities and devolved government in planning and delivering decarbonisation. It reduces disruption by enabler utilities to better optimise infrastructure and maintenance activities.

	network, so that customers and stakeholders can follow each constraint from initial constraint identification through to how they are managed or resolved. Includes publishing our options assessment and intervention decision rationale. This will go beyond our Network Development Plan (NDP). ✓ Continue to share planning information with the ESO, such as Week 24 data. ✓ Sharing planned maintenance outages with the ESO and gas utilities if this information is of value to them. Sharing this range of planning data will support more coordinated and whole system planning, reducing overall costs for customers.			
1.1.3 (ii) 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.	✓ We are currently engaged with the LTDS working group that is undertaking an industry wide programme of works to reform the LTDS, including updated Heat Maps. This will produce a common and comparable heat map design for all GB DNOs. We will continue to work with this group and implement appropriate outputs to provide high value information to network users. Heat maps are just one data set that will help customers understand where to connect and how to optimise their operations. Please see our outputs listed against baseline expectation 3.1.1 for more examples of data sharing which will support customers in the planning stage.	Working Group to conclude in RIIO-ED1, with further development and implementation throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative customer wider benefits by supporting customers, flexibility providers, and DER operators to make better use of their assets.
1.1.3 (iii) These geographic information system datasets should be	✓ We will publish a full network GIS from 132kV to LV, so that customers can map the data we publish. We will share this and	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs.

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.	make them available so other parties can republish them independently.			**Benefits:** Delivers wider technological benefits through supporting the digitalisation of the energy system and the standardisation of data and processes.
1.1.4 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-sector[72] engagement, optioneering, and planning with sectors or vectors other than their own. DNOs should consider flexibility and promoting energy efficiency in addition to innovative use of existing network	✓ Establishing a DSO functional model that is responsible for network investment decisions. See Section 4 for more information.	By the start of RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Supports transparency of decision making and increased confidence in investment decisions.
	✓ Explaining, in our new published DSO Security Standard, how our network planning process works and the respective responsibilities of the DNO and DSO functional model. This is complementary to our Decision Making Framework and will help stakeholders understand how we plan our network.	Published by the start of RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Supports transparency of decision making and increased confidence in investment decisions.
	✓ Signalling our network needs through our Network Development Plan and/or flexibility tenders. We will tender for flexibility services for all forecast network constraints for all voltage levels that are viable for flexibility throughout RIIO-ED2. These flexibility tenders will be run at least twice a year.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.027bn-0.100bn of indirect benefits within RIIO-ED2 by increasing transparency through the Decision Making Framework for investment options and by tendering

[72] Ofgem (source: see footnote 68): "'Sector' refers to the distribution, transmission and operation of a single energy source. For example, the 'gas sector' includes the firms responsible for gas transmission, distribution, and system operation. By 'cross-sector', we refer to any licensee in one energy source sector, eg electricity, working with any licensee in another energy source sector, eg gas."

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. 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.				flexibility for appropriate constraints. Delivers qualitative benefits of whole system improved decision making, of increasing market liquidity, and increased participation in flexibility markets.
	✓ Impartially selecting interventions having fairly compared viable flexible, energy efficiency, smart, innovative, and reinforcement options. Smart options include our world-first active fault level monitoring/management, automation, enhanced ratings, statcoms, enhanced automatic voltage control, and reconfiguration. We will fairly compare viable solutions using a defined set of published assessment criteria. ✓ Using a linear optimisation engine, to impartially assess solutions and create bespoke intervention programmes for every LV and HV network constraint. This means that stakeholders can be assured that HV and LV interventions have been impartially considered on their merits.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Supports transparency of decision making and increased confidence in investment decisions.
	✓ Publishing our methodology for how we value flexibility and approach energy efficiency, so that there is transparency on these important points.	By the start of RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.027bn-0.100bn of indirect benefits within RIIO-ED2 by increasing transparency through the Decision Making Framework for investment options and by tendering flexibility for appropriate constraints. Delivers qualitative benefits of whole system improved decision making, of increasing market liquidity, and increased participation in flexibility markets.

	✓ Publishing a range of information on all network constraints on the 33kV and 132kV network, so that customers and stakeholders can follow each constraint from initial constraint identification through to how they are managed or resolved. Includes publishing our options assessment and intervention decision rationale. This will go beyond our Network Development Plan (NDP).	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Supports transparency of decision making and increased confidence in investment decisions.
	✓ All our load-related intervention decisions over £2m in RIIO-ED2 will be externally assured, and the results made public within 10 working days of assurance completion. This means stakeholders can have confidence in our decisions.	By the middle of RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** It delivers qualitative wider customer benefits by supporting customers, flexibility providers, and DER operators to make better use of their assets.
	✓ Working with other network companies and vectors, and providing a team of specialists (Strategic Optimisers) to partner with local authorities and regional governments to support the optimisation of network planning, design, and implementation of public EV charging and heat electrification initiatives. A proposed Whole System planning function will be accountable for assimilating feedback from Strategic Optimisers and delivering Whole System solutions and outcomes in a coordinated manner with other network companies and vectors.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Supports Whole System Outcomes through coordinated planning activities**.**
	✓ We will work with the three gas network companies that span our two licence areas (Cadent, SGN, and Wales & West Utilities), to request they send us information about planned maintenance outages as these	By the middle of RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs.

	can result in increased electricity demand. We will use this to inform our network planning process and assessment of interventions. See the spotlight box on page 39 for more information.			**Benefits:** Supports Whole System Outcomes through coordinated planning activities**.**

14.2 Activity 2.1: Promote operational network visibility and data availability

This section sets out the detail of the DSO outputs we will deliver to meet or exceed Ofgem's baseline expectations for Activity 2.1. Together, these outputs will ensure that:

1. We will have the data we need to operate the network safely and reliability.
2. We will have the data and systems we need to share a range of operational information (including constraint data) with the ESO, other network operators, and stakeholders.
3. We and the ESO will have the DER data we need to increase resiliency to low-probability high impact events.

Ofgem baseline expectations	What we will do in response			
	Our DSO outputs	**Timescale**	**Meets or exceeds**	**Costs and benefits**
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. DNOs must take reasonable steps to access and subsequently share, including by publishing, data and operability constraint	✓ Investing £28.3m to deliver LV monitoring at 14,102 secondary substations. This will extend monitoring from 8% to 52% of large LV substations, increasing coverage from 14% to 76% of customers, by the end of RIIO-ED2. This delivers a range of benefits when combined with our ENZ Platform, including better near-time foresight and real-time identification of network constraints.	Throughout RIIO-ED2	Meets	**Costs:** Supported by a £28.3m investment in LV monitoring. **Benefits:** Direct benefits of £32.2m over 25 years from our EJP.
	✓ Using under voltage, over voltage, loss of supply, and restored supply smart meter alarms in our control room.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.003bn-0.006bn of indirect benefits from reduced non-technical losses

information in a timely manner.	✓ Investing £5.5m in a real-time, data driven, network analytical platform – our ENZ Platform. It integrates near-time forecasting (PRAE) and weather data (WaNDA), LV monitoring data, smart meter data, and asset condition data with automated power flow modelling of our entire network to identify constraints on the network in real-time and near-time. This means we can make data-driven near-time and real-time operational decisions. See Section 3.3.2 for more information.	Some base functionality in RIIO-ED1 (our ENZ Model), with further enhancements throughout RIIO-ED2	Exceeds – The ENZ Platform exceeds this baseline expectation as a key differentiator for SP Energy Networks. It is a key enabler across DSO, Load Related Expenditure and Connections etc. No additional costs required to exceed baseline requirement.	**Costs:** Supported by a £5.5m IT investment in the ENZ Platform. **Benefits:** Contributes to £57.1m of direct benefits over 45 years, alongside other data and digitalisation activities. Contributes to £0.03bn of indirect benefits from improving the reliability of the distribution network.
	✓ Sharing near-time constraint warnings (predicted by the ENZ Platform), real-time constraints, and supporting operational data with the ESO and TOs. We will also share these with customers and stakeholders, subject to any security or data protection requirements. We will comply with all Operational Data Licence requirements. This information share will increase the efficiency of the flexibility markets, wholesale markets, and whole system coordination. See the spotlight box on page 41 for more information on the near-time notifications.	Throughout RIIO-ED2	Meets	**Costs:** Supported by a £5.5m IT investment in the ENZ Platform. **Benefits:** Contributes to £57.1m of direct benefits over 45 years, alongside other data and digitalisation activities. Contributes to £0.057-0.130bn of indirect benefits by improving the reliability of the distribution network and enabling whole system efficiencies. It delivers qualitative benefits of increasing the resilience of the whole electricity system and of other utilities.
	✓ Investing in a single portal to share data with stakeholders and customers. The Hub has been created to house all data that SP Energy Networks shares openly in the public domain. Please refer to our IT and Digitalisation Strategy and our Data Strategy for more information.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative economic benefits of system efficiency by improving flexibility

				market operations and increasing liquidity of and participation in the energy markets through data provision.
	✓ Investing £0.5m to improve existing operational control room (ICCP) links with the ESO and support two-way data exchange. Working with the ESO as it implements additional ICCP links.	Throughout RIIO-ED2	Meets	**Costs:** Supported by a £0.5m Operational IT & Telecoms investment to support enhancements to our existing ICCP links. **Benefits:** Delivers qualitative benefits of ESO-DSO coordination, which is a prerequisite for the realisation of the £0.027-0.100bn of wider whole system benefits Delivers qualitative benefits of increasing whole system resilience and resilience of other utilities, via communication with the ESO which allows us to have better visibility of risks, faults, and constraints.
	✓ We will work with the ESO, other network operators, and our DSO expert stakeholder panel to identify what further operational information sharing would promote efficient and safe whole system operation.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.057-0.130bn of indirect benefits by improving the reliability of the distribution network and enabling whole system efficiencies. Delivers qualitative benefit of increasing the resilience of the whole electricity system and of other utilities.
	✓ We will work with the three gas network companies that span our two licence areas (Cadent, SGN, and Wales & West Utilities), to request they send us	By the middle of RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs.

	information about unplanned and short-notice outages as these can results in increased electricity demand. We will use this to help identify potential constraints. We will share information on un-planned electricity outages with the relevant gas company, so they can prepare for changes in their customers' behaviour. See the spotlight box on page 39 for more information.			**Benefits:** Supports Whole System Outcomes through coordinated planning activities**.**
2.1.2 We expect DNOs to submit a network visibility strategy and this should cover the use of all sources of network data including direct measurement from monitoring roll-out, smart meter data, data analysis and modelling, and any other third party data sources. The strategy should explain how network monitoring for operational purposes will inform operational decisions, including enabling the management and delivery of flexibility services; clear justifications for where and when monitoring is rolled-out, including explanations of any targeting for equipment deployment; and the specifications of equipment, including detail on the data captured, frequency of	✓ We have a comprehensive Network Visibility Strategy. This explains how we will increase collection of network data from monitors and smart meters, how we will use that data to support network planning and operational decisions, and how data collection will enable greater data sharing with stakeholders. One output of this strategy is to ensure we are delivering network monitors where they provide value and complement smart meter and third-party data.	Submitted for RIIO-ED2 Final Submission	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative benefits of ESO-DSO coordination, which is a prerequisite for the realization of the £0.027 to £0.100bn of wider whole system benefits Delivers qualitative benefits of whole system efficiencies by improving operational optimisation. Delivers qualitative benefits for customers by increasing network visibility information which supports them to make better use of their assets. Delivers qualitative economic benefits through the stimulation of new markets, ideas, and products.

polling, and the mode of communicating data.				
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.	✓ Sharing dispatch intentions and 'no need notifications' for planned actions and supporting network models with the ESO and TOs. We will be able to identify our dispatch intentions due to the enhanced near-time data driven insights provided by our ENZ Platform. We will comply with all Operational Data Licence requirements. See the spotlight box on page 39 for more information.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative benefits of ESO-DSO coordination, which is a prerequisite for the realization of the £0.27-0.100bn of wider whole system benefits. Delivers qualitative benefits of increasing whole system resilience and resilience of other utilities, via communication with the ESO which allow us to have better visibility of risks, faults, and constraints.
	✓ Investing £0.5m to improve existing operational control room (ICCP) links with the ESO and support two-way data exchange. Working with the ESO as it implements additional ICCP links.	Throughout RIIO-ED2	Meets	**Costs:** Supported by a £0.5m Operational IT & Telecoms investment to support enhancements to our existing ICCP links. **Benefits:** Delivers qualitative benefits of ESO-DSO coordination, which is a prerequisite for the realization of the £0.27-0.100bn of wider whole system benefits. Delivers qualitative benefits of increasing whole system resilience and resilience of other utilities, via communication with the ESO which allow us to have better visibility of risks, faults, and constraints.

	✓ We will work with the ESO, other network operators, and our DSO expert stakeholder panel to identify what further operational information, that can be shared in a timely manner, that would promote efficient and safe whole system operation.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.057-0.130bn of indirect benefits by improving the reliability of the distribution network and enabling whole system efficiencies. Delivers qualitative benefit of increasing the resilience of the whole electricity system and of other utilities.
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.	✓ In addition to the DER information we already share through the Embedded Capacity Register and other sources, we will collate DER characteristics from asset data, contract registers, and connection applications and sharing this with the ESO. We will agree with the ESO and industry what characteristics need recording, and for what types/sizes of DER. We will update our connection application process, so this is collected as standard for new DER. We will request the reciprocal exchange of DER characteristics from the ESO where they already hold this information.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.003bn-0.016bn of indirect benefits by sharing DER information with the ESO which would optimise use of assets and reduce curtailment. Delivers qualitative benefits of increasing whole system resilience and resilience of other utilities, via the communication with the ESO. Delivers qualitative environmental benefits by smoothing the connections processes for DER and enabling DER growth. Delivers qualitative customer benefits of improving connection processes and customer services, by updating the application processes for new DER.

	✓ Conducting an annual network stress-test desktop assessment against High Impact Low Probability (HILP) events. The findings will be shared with the ESO, TOs, and other DNOs to promote energy system resilience. The first test will take place in 2023.	Throughout RIIO-ED2	Exceeds – to support the resilience of our systems and processes. No additional costs required to exceed baseline requirement.	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.03bn of indirect benefit by improving the reliability of the distribution network. Delivers wider benefits of improving whole electricity system resilience and the resilience of other utilities
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	✓ Sharing near time constraint warnings (predicted by the ENZ Platform), dispatch intentions, real-time constraints, historical operational data, and supporting network models with the ESO and TOs. We will also share these with customers and stakeholders, subject to any security or data protection requirements. We will comply with all Operational Data Licence requirements. This information share will increase the efficiency of the flexibility markets, wholesale markets, and whole system coordination. See the spotlight box on page 41 for more information on the near-time notifications.	Throughout RIIO-ED2	Meets	**Costs:** Supported by a £5.5m IT investment in the ENZ Platform. **Benefits:** Contributes to £57.1m of direct benefits over 45 years, alongside other data and digitalisation activities. Contributes to £0.057-0.130bn of indirect benefits by improving the reliability of the distribution network and enabling whole system efficiencies. Delivers qualitative benefit of increasing the resilience of the whole electricity system and of other utilities.
	In addition to the operational information we already share, we will share the following data so to help customers and stakeholders understand how our network operates: ✓ Sharing historical network data with appropriate parties: network data showing what has happened on the network, including voltages, demand and generation levels (utilisation levels), active fault level monitoring data, and fault rates (CI and CML). For	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers whole system benefits of enabling improved decision making for the wider industry. Delivers qualitative customer benefits of improved connection

headroom/footroom; and • utilisation and curtailment of areas under the control of capacity management systems such as Active Network Management systems.	areas of the network that have monitors, we will calculate network losses disaggregated to substation level. We will use this information to model losses in the areas of the network that don't have monitors. We will share this information as it develops over RIIO-ED2. To give commonality across GB, we propose working through the Technical Losses Working Group, which includes Ofgem, to define how we share it. ✓ Annual constrainable connection report: aggregated data on how many times customers with non-firm connections are constrained, and the volume and technology types affected. ✓ Annual flexibility market report: our actual dispatch/utilisation of contracted flexibility providers compared to their contracted service offering, and the cost and carbon impact, and the results of all tenders that year. ✓ Sharing information on planned and unplanned outages with the relevant gas utility where this information is of value to them. See the spotlight box on page 39 for more information. ✓ Sharing planned and unplanned outages with the ESO where this information is of value to them.			processes (users can inform their decision where to connect and their operations). Delivers customer benefits of improved market services, supporting them to make better use of their assets.
	✓ We will work with the ESO, other network operators, and our DSO expert stakeholder panel to identify what further operational information sharing would promote efficient and safe whole system operation.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.57-0.130bn of indirect benefits by improving the reliability of the distribution network and enabling whole system efficiencies. Delivers qualitative benefit of increasing the resilience of the whole electricity system and of other utilities.

	✓ Investing in a single portal to share data with stakeholders and customers. The Hub has been created to house all data that SP Energy Networks shares openly in the public domain. Please refer to our IT and Digitalisation Strategy and our Data Strategy for more information.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative economic benefits of system efficiency by improving flexibility market operations and increasing liquidity of flexibility markets through data provision.
	✓ Investing £221.4m to deliver the reliable, cyber-secure, low-latency operational IT and telecoms that we need to collect, process, and transmit data to stakeholders.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Benefits reported within the Op IT and Telecoms Strategy.
	✓ We will support stakeholder requests for bespoke data outputs where this is cost effective and appropriate to do so. We will work with our expert DSO Stakeholder panel to develop a fair methodology to assess these requests.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits** Delivers qualitative benefits of improved customer service.

14.3 Activity 2.2: Facilitate efficient dispatch of distribution flexibility services

This section sets out the detail of the DSO outputs we will deliver to meet or exceed Ofgem's baseline expectations for Activity 2.2. Together, these outputs will ensure that:

1. Customers and stakeholders understand the scenarios in which we use flexibility, and how and why it will be dispatched.
2. We have the infrastructure needed to efficiently dispatch and settle flexibility providers. This infrastructure is scalable, isn't a financial barrier to participation, and isn't hard-coded to us.
3. Flexibility markets operate efficiently and don't adversely impact network safety.

Ofgem baseline expectation	What we will do in response			
	Our DSO outputs	Timescale	Meets or exceeds	Costs and benefits
2.2.1 (i) 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.	✓ We will develop and use a transparent and efficient framework governing why and how we will send dispatch instructions – our Decision Making Framework. This will cover different flexibility service types, the types and costs of supporting infrastructure customers require for each, how we determine the price we are prepared to pay for flexibility services, ESO/DSO service primacy and coordination arrangements, and when/why we will dispatch different flexibility services (including their interaction with ANM and flexible connections). It is one of the measures we are taking to promote coordination and interoperability between markets.	By the start of RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.099-0.349bn of indirect benefits which will enable whole system outcomes through coordination with the ESO, make decarbonisation more affordable using flexibility services, and improve air quality (avoidance of engineering work, enablement of electrification). Delivers qualitative whole system benefits of improved resilience, environment benefits, and contributes to CO_2 targets via the deployment of flexibility. Delivers economic benefits, improves flexibility market operations, and increases market liquidity.

2.2.1 (ii) 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.	✓ Our Decision Making Framework will include rules for coordinating dispatch between ESO and DSO, to reduce the risk of conflict, inefficiencies, and impacts to system operation. It would be advantageous if these were rules common to GB, so we will lobby for the development and implementation of GB-wide primacy arrangements (DSO:ESO) and rules to coordinate DSO and ESO distribution service dispatch. We will deliver outputs, listed against other baseline expectations, that will enable DER to better participate in multiple markets. These include non-exclusive flexibility contracts as standard and near-time notifications which increase the efficiency of the flexibility markets, wholesale markets, and whole system coordination. See the spotlight box on page 41 for more information on the near-time notifications.	By the start of RIIO-ED2	Exceeds – working to create a GB-wide approach for coordination to reduce barriers to market participation. No additional costs required to exceed baseline requirement.	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative benefits of ESO-DSO coordination, which is a prerequisite for the realisation of the £0.27-0.100bn of wider whole system benefits.
2.2.2 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).	✓ Supporting secondary trading of flexibility service contracts and distribution constrainable connection obligations. We will do this by publishing data, a dedicated template to gather information on the trade, and a four working day turnaround service to approve the transfer of flexibility contracts.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers wider benefits for customers through participation in multiple energy markets, mainly driven by enabling secondary trading.

2.2.3 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.	✓ The first draft of our Decision Making Framework will be prepared in RIIO-ED1. It will be designed using industry best practice and from learning from the TEF projects (footnote 1 on page 10 explains what these are).	By the start of RIIO-ED2 for the first draft of the Decision Making Framework	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Supports transparency of decision making and increased confidence in investment decisions.
	✓ Our Decision Making Framework will be reviewed annually considering stakeholder feedback, and published on our website. Its governance arrangements and contact details for raising issues shall be published.	Throughout RIIO-ED2 for further development.	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Supports transparency of decision making and increased confidence in investment decisions.
	✓ Our adherence to the Decision Making Framework shall be monitored as part of our assurance approach. This means that stakeholders can have confidence that we are complying with it.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Supports transparency of decision making and increased confidence in investment decisions.
2.2.4 DNOs to develop efficient, scalable dispatch instruction infrastructure and avoid proprietary systems. 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	✓ Our Decision Making Framework will cover the different types of flexibility services and when and how they're used (including their interaction with ANM and flexible connections). This will include the clear types of dispatch instructions.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Describing the flexibility services and their functionality will deliver economic benefits of more efficient flexibility service procurement and use, and by increasing market participation.
	✓ Developing an internal technical standard that sets minimum interoperability standards for our systems. We will seek input from industry experts in its development and it will be published on our website. This will ensure DSO dispatch infrastructure isn't hard-coded to us.	By the start of RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to wider indirect benefits of £0.027bn-0.100bn by increasing flexibility volumes (due

different dispatch instructions should be well-justified. Definitions of these circumstances should be developed with input and cooperation from network users. The application of hard dispatch controls shall be for the improved reliance on market-based mechanisms, not to the detriment of their development. 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.				to lower barriers to participation in flexibility markets). Delivers wider qualitative economic benefits; user-friendly DSO dispatch infrastructure will lower barriers for participation in flexibility markets and will increase their liquidity.
	✓ Continuing to use a third-party flexibility platform for scheduling, dispatch, and settlement. This can be used across all distribution voltage levels and scaled up as required. It uses APIs, a low-cost method of communicating with users which doesn't give us 'hard control' of their assets.	By the start of RIIO-ED2	Meets	**Costs:** Supported by a £7.5m investment in specific DSO IT systems, that includes the delivering of a Flexibility Platform. **Benefits:** Contributes to the £328.4m direct benefit over 45 years, as reported in our DSO EJP. This does not include any of the indirect benefits that will be delivered through additional functionality and more efficient flexibility service procurement and use. Contributes to wider indirect benefits of £0.027bn-0.100bn by increasing flexibility volumes (due to lower barriers of participation in flexibility markets). Delivers wider economic benefits improving flexibility market operations. It increases participation in the flexibility markets by decreasing user participation costs.
	✓ Our CMZ infrastructure will facilitate using market-based flexibility services from a greater number of providers by supporting customers with constrainable connections to participate. Our CMZ infrastructure will also support avoiding conflicting network management actions and provide a safety net in the event of market failure. This means we can safely and confidently expand our use of flexibility services	Throughout RIIO-ED2	Exceeds – supporting customers with constrainable connections to participate in flexibility markets.	**Costs:** Supported by a £54.14m investment in Operational DSO Infrastructure, that includes the development of CMZs. **Benefits:** Contributes to the £328.4m direct benefit over 45 years, as reported in our DSO EJP. This does

	in these CMZ areas. See Section 3.4.2 for more information on CMZs and their link with flexibility services.		No additional costs required to exceed baseline requirement.	not include any of the indirect benefits that will be delivered through additional functionality and more efficient flexibility service procurement and use. Contributes to £0.03bn of indirect benefits from improved network reliability (coordination with the ESO). Enables wider indirect benefits for the whole system by increasing whole electricity system resilience, by avoiding conflicting network management actions, and providing a safety net in the event of market failure. Enables wider financial benefits for the customer by expanding the use of flexibility markets and economic benefits driven by efficiencies in the flexibility markets.
	✓ Continuing to work via the ENA on defining new flexibility service types which are common across GB. This commonality helps users participate in flexibility markets by reducing any specific knowledge required to offer flexibility services in individual regions.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative customer benefits by supporting the standardisation of market experience using industry standard products and services.
Other	✓ Non-exclusive flexibility service contracts as standard – providers will be free to offer services to other markets on the proviso they can fulfil their obligations to us and it's safe to do so.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.103-0.365bn of indirect benefits by enabling more efficient whole system outcomes, enabling the deployment

				of flexibility services and in turn making decarbonisation more affordable. It supports reduced curtailment, and improves air quality by enabling more flexibility on the network (i.e. growth of DER, electrification of heat and transport, avoidance of reinforcement). It contributes to financial customer benefits through market participation and economic benefits by promoting market liquidity**.**
	✓ Using network monitoring, enhanced forecasting tools, and our ENZ Platform to provide near-time 'dispatch warnings' to flexibility service providers and the ESO, and 'constraint warnings' to DER with constrainable connections and the ESO, so they can get ready. This information share will increase the efficiency of the flexibility markets, wholesale markets, and whole system coordination. See the spotlight box on page 41 for more information on the near-time notifications.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.061-0.146bn of indirect benefits by enabling more efficient whole system outcomes, enabling the deployment of flexibility services and in turn making decarbonisation more affordable and reducing curtailment. It contributes to financial customer benefits through market participation and economic benefits by supporting market liquidity.
	✓ Using enhanced forecasting tools and our ENZ Platform to define service window timings more accurately. Setting shorter service windows can increase participation and free up providers to operate in other markets. See Section 3.2 for information on our enhanced forecasting tools and Section 3.3.2 for information on our ENZ Platform.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.103-0.365bn of indirect benefits by enabling more efficient whole system outcomes, enabling the deployment of flexibility services and in turn making decarbonisation more

				affordable and reducing curtailment, and improving air quality by enabling more flexibility on the network (i.e. growth of DER, electrification of heat and transport, avoidance of reinforcement). It contributes to financial customer benefits through market participation and economic benefits by supporting market liquidity**.**
	✓ Initiating a DER Service Checker for the ESO. The ESO can notify us of DER service providers they use or plan to use, and we'll tell them the providers maximum allowed import and export level, and any constrainable connection arrangements and planned maintenance outages that affect their availability.	By the middle of RIIO-ED2	Exceeds – providing easy exchange of data with the ESO, to understand key network characteristics of assets they use. No additional costs required to exceed baseline requirement.	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.03bn of indirect benefits from improved network reliability. Delivers qualitative benefits of ESO-DSO coordination, which is a prerequisite for the realisation of the £0.27-0.100bn of wider whole system benefits. It contributes to qualitative benefits of increased resilience of the electricity whole system and delivers economic benefits through cost efficiencies on system planning and management

14.4 Activity 3.1: Provide accurate, user-friendly, and comprehensive market information

This section sets out the detail of the DSO outputs we will deliver to meet or exceed Ofgem's baseline expectations for Activity 3.1. Together, these outputs will ensure that:

1. We will have the tools we need to record and share raw data and create insights that will be useful to customers and stakeholders.
2. We will share a range of historical, near-time, real-time, and forecast data and insights with customers and stakeholders.
3. We will work with stakeholders to prioritise which data to make available.

Ofgem baseline expectation	What we will do in response			
	Our DSO outputs	**Timescale**	**Meets or exceeds**	**Costs and benefits**
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). 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.	**All data sharing subject to Open Data Triage process (please refer to our Data Strategy).** ✓ Historical network data: network data showing what has happened on the network, including voltages, demand and generation levels, active fault level monitoring data, network topography, and fault rates (CI and CML). For areas of the network that have monitors, we will calculate network losses disaggregated to substation level. We will use this information to model losses in the areas of the network that don't have monitors. We will share this information as it develops over RIIO-ED2. To give commonality across GB, we propose working through the Technical Losses Working Group, which includes Ofgem, to define how we share it. ✓ Annual constrainable connection report: aggregated data on how many times customers with non-firm connections are constrained, and the volume and technology types affected. ✓ Annual flexibility market report: our actual dispatch/utilisation of contracted flexibility providers compared to their contracted service offering, and the cost and carbon impact, and the results of all tenders that year. ✓ Flexibility procurement data: publishing all flexibility bids we receive (including service type, volume bid,	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.061-0.146bn of indirect benefits within RIIO-ED2 linked to sharing data which enables ESO-DSO coordination, reduction in curtailment costs, and improvement of system resilience. ESO-DSO coordination is a prerequisite for the realisation of these benefits. It also delivers financial benefits to customers through increased market participation and supporting them to optimise their assets. It delivers economic-market benefits by increasing liquidity of flexibility markets (data sharing and transparency increases confidence and participation in the markets). It delivers environmental benefits on the basis of reducing emissions

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).	price bid, price paid where accepted, and carbon content of aggregated units) and our reason for accepting/rejecting the bid. ✓ Near-time and real-time operational data, such as constraint warnings and dispatch warnings, so that service providers, customers, and other network operators can get ready. ✓ Network needs: we will tender for flexibility for all viable network constraints and provide the information and site-specific price signals that participants need to make an informed bid. ✓ Investment decision data: where we intervene to manage or resolve a constraint, we will publish our options assessment and intervention decision rationale for all EHV and 132kV load-related interventions. In addition, those load-related interventions over £2m will be externally assured and the results made public within 10 days of assurance completion. ✓ Long-term forecast and planning data: what we think will happen on the network in the future and, where applicable, how we plan to respond – LTDS and NDP. ✓ A full network GIS from 132kV to LV, so that customers can map the data we publish. ✓ Any other data required to comply with licence conditions.			through increased flexibility on the system.
	✓ Investing £28.3m to deliver LV monitoring at 14,102 secondary substations by the end of RIIO-ED2. This will extend monitoring from 8% to 52% of large LV substations, increasing coverage from 14% to 76% of customers, by the end of RIIO-ED2. This will increase the amount of data we are able to record and so share with stakeholders.	Throughout RIIO-ED2.	Meets	**Costs:** Supported by a £28.3m investment in LV monitoring. **Benefits:** Direct benefits of £32.2m over 25 years from our EJP. Contributes to £0.03bn of indirect benefits by increasing the reliability of the distribution network.

				Delivers qualitative economic benefits by improving system efficiencies (reduced transmission and distribution costs, improved system planning).
	✓ Investing £221.4m to deliver the reliable, cyber-secure, low latency operational IT and telecoms that we need to collect, process, and transmit data to stakeholders.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Benefits reported within the Op IT and Telecoms Strategy .
	✓ Investing in our Smart Data Integration Fabric (SDIF) and NAVI systems to help surface and share data across our business.	Throughout RIIO-ED2	Meets	**Costs:** Investment included within our overall Data & Digitalisation investment. Our SDIF and NAVI investment supported by a £5.8m investment in specific smart systems. **Benefits:** Benefits reported within the IT and Digitalisation Strategy and the Data Strategy.
3.1.2 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.	✓ Engaging with our stakeholders annually to consult on the content, frequency, and method of data publication, and supporting metadata. We will further develop our stakeholder feedback mechanism as a route for stakeholder feedback.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative technological benefits by enabling the standardisation of processes and data.
	✓ Wherever possible, we will work consistently and in coordination with other network licence holders in the development of our strategies.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative technological benefits by enabling the standardisation of processes and data.

	✓ Working with our DSO Expert Stakeholder panel to prioritise data outcomes that deliver results early and incrementally, and to agree a methodology to determine whether the customer benefits of 'high cost' data requests justify their costs.	Panel in place for the start of RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers customer benefits of improved market services, supporting them to make better use their assets.
	✓ Publishing and making available for stakeholder comment our strategies which related to data collection and provision (e.g. our Digitalisation Strategy and Action Plan).	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers customer benefits of improved market services, supporting them to make better use their assets.
3.1.3 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. The information must be easily accessible and navigable. We expect this includes publishing data	✓ Engage with our stakeholders annually to consult on the content, frequency, and method of data publication, and supporting metadata. We will further develop the stakeholder feedback mechanism on as a route for stakeholder feedback.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers customer benefits of improved market services, supporting them to make better use their assets.
	✓ A single data sharing portal for data, so stakeholders can easily find it. Where appropriate, we will also share data through dedicated platforms. ✓ Working collaboratively with other network companies to deliver Whole System data approaches.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative technological benefits by enabling standardisation of processes and data.
	✓ Simple APIs for sharing triaged near-time and real-time operational data, which will be available in machine readable formats. Third-party platforms can 'plug-in' to our Flexibility Platform.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to wider indirect benefits of £0.027bn-0.100bn by increasing flexibility

in machine-readable formats.				volumes (due to lower barriers of participation in flexibility markets). Delivers wider economic benefits of improving flexibility market operations and increasing participation in flexibility markets by decreasing user participation costs.
	✓ Publishing a full network GIS from 132kV to LV, so that customers can map the data we publish. We will share this and make them available so other parties can republish them independently.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefit:** Contributes to wider whole system benefits, improving decision making processes for customers. Contributes to wider customer benefits by enabling them to optimise use of their assets**.**
3.1.4 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. In many instances, collaboration across DNOs in engagement is expected to reduce duplication, make it easier for stakeholders to engage	✓ Working to industry best practice and common approaches, including through collaborative initiatives such as the ENA Open Networks Projects, to reduce stakeholder fatigue in the development of approaches for information provision and engagement. Where reasonable, we would also seek to tailor this to meet individual requirements.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers wider benefits for the industry by enabling digitalisation and standardisation of data and processes.
	✓ The layout of our Data Portal and the considered use of metadata will enable stakeholders to quickly find the data and level of detail they need.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative economic benefits of system efficiency by improving flexibility market operations and increasing liquidity of and participation in the energy markets through data provision.

and avoid stakeholder fatigue.	✓ We will target hard-to-reach groups with additional support and information to facilitate their participation in the energy system through targeted engagement and education initiatives. This will primarily be delivered through our Zero Carbon Communities – Awareness Raising and Outreach initiative.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative economic benefits of system efficiency by improving flexibility market operations and increasing liquidity of and participation in the energy markets through data provision.
3.1.5 DNOs should seek to ensure the information they publish is as accurate and unbiased as reasonable (ie correct at time of publication, as close as possible to the actual value and not skewed in any direction).	✓ We will ensure that data assets are of a quality that is sufficient to meet the requirements of data users. For example, we will implement digitalisation systems like SDIF that minimise the need for human/manual processing of data as this can be a source of introducing errors. Please refer to our Data Strategy.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers customer benefits of improved market services, supporting them to make better use their assets.
	✓ Our new annual calibration exercise for some of our forecasting and modelling tools will help ensure that the information they produce is accurate.	Annually from 2025	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.03bn of indirect benefits from improving the reliability of the distribution network. Delivers qualitative benefits for Whole System resilience, enabled by increased distribution network reliability.
Other	✓ Investing in our SDIF and NAVI systems so we can process and incorporate smart meter data. ✓	Throughout RIIO-ED2	Meets	**Costs:** Supported by a £5.8m investment in specific smart systems. This does not include the investment in smart meter data capture or enabling Distribution Management System (DMS) investments.

				Benefits: Delivers customer benefits of improved market services, supporting them to make better use their assets.
	✓ Investing to maintain enhanced forecasting tools. These will help deliver insights, such as likely areas of future intervention, that are of value to flexibility markets. See Section 3.2 for more information.	Throughout RIIO-ED2	Meets	**Costs:** Supported by a £7.5m investment in specific DSO IT systems, that includes the development of our forecasting tools. **Benefits:** Delivers customer benefits of improved market services, supporting them to make better use their assets.
	✓ Investing in a real-time, data driven, network analytical platform – our ENZ Platform. It integrates near-time forecasting (PRAE) and weather data (WaNDA), network monitoring data, smart meter data, and asset condition data with automated power flow modelling of our entire network so we can understand and share with stakeholders what is happening on the network in planning and operational timescales. See Section 3.3.2 for more information.	Some base functionality in RIIO-ED1, with further enhancements throughout RIIO-ED2	Exceeds – The ENZ Platform exceeds this baseline expectation as a key differentiator for SP Energy Networks. It is a key enabler across DSO, Load Related Expenditure and Connections etc.	**Costs:** Supported by a £5.5m IT investment in the ENZ Platform. **Benefits:** Contributes to £57.1m of direct benefits over 45 years, alongside other data and digitalisation activities. Contributes to £0.03bn of indirect benefits from improved reliability of the distribution network.

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

This section sets out the detail of the DSO outputs we will deliver to meet or exceed Ofgem's baseline expectations for Activity 3.2. Together, these outputs will ensure that:

1. It is easier for users to participate in distribution flexibility markets.
2. These markets function well and are coordinated with the ESO. The ESO will still have direct access to DER flexibility services – we are not the commercial or dispatch route.
3. Users have confidence that we are not conflicted in our role of neutral market facilitator.

Ofgem baseline expectation	What we will do in response			
	Our DSO outputs	Timescale	Meets or exceeds	Costs and benefits
3.2.1 (i) 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.	✓ Giving users a common experience across GB by continuing to work with other network companies to use and further develop common service types and contracts. This process will have stakeholder input. This commonality helps users participate in flexibility markets by reducing any specific knowledge required to offer flexibility services in individual regions.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers indirect economic benefits by increasing participation in flexibility markets through common and standardised processes which lower participation barriers for market participants.
	✓ Maintaining and publishing our Decision Making Framework governing when and how we will send dispatch instructions, so that users understand the scenarios in which we dispatch flexibility.	By the start of RIIO-ED1	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.099-0.34bn of indirect benefits by enabling whole system outcomes thought coordination with the ESO, making decarbonisation more affordable through the use of flexibility services, which improves air quality (avoidance of engineering work, enablement of electrification). Delivers qualitative whole system benefits of improved resilience,

				environment benefits and CO_2 targets via deployment of flexibility, and economic benefits of improving flexibility markets and increasing their liquidity and participation.
3.2.1 (ii) 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. 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.	We will deliver a number of outputs which will enable as wide participation in distribution flexibility markets as possible: ✓ Supporting the participation of aggregators and third-party platforms by enabling them to 'plug-in' to our flexibility procurement process and by sharing data in machine readable formats. ✓ Using clear and simple pre-qualification criteria for flexibility tenders that reflects that some bidders may not yet have completed sites. ✓ Non-exclusive flexibility service contracts – providers free to offer services to other markets on the proviso that they can still fulfil their service obligations to us and it's safe to do so. ✓ Simultaneous supporting shorter and longer contracts by allowing participants to bid for only part of a tender requirement. For example, if we need 1MW for 2 hours service windows for a 12 month period, participants can bid in with less than 1MW with 30min service durations for a period of a few months. When all bids are received, we will stack partial tenders to meet the network requirement. This acknowledges that participants have different capabilities and want different contract lengths. ✓ Supporting secondary trading of flexibility service contracts through publishing data, a dedicated template to gather information on the secondary trading to set appropriate parameters, and a four working day turnaround service to approve the transfer of flexibility contract.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to wider indirect benefits of £0.027bn-0.100bn by increasing flexibility volumes (due to lower barriers of participation in flexibility markets) and enabling whole system efficiencies. Delivers wider economic benefits improving flexibility market operations and increasing participation in the flexibility markets by decreasing user participation costs.

	✓ Keeping the costs of participation low by using APIs to send dispatch signals. Targeting hard-to-reach groups with additional support to facilitate their participation in the energy system through targeted engagement and education initiatives. This will primarily be delivered through our Zero Carbon Communities – Awareness Raising and Outreach initiative			
3.2.2 (i) 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	✓ Simultaneous supporting shorter and longer contracts by allowing participants to bid for only part of a tender requirement. For example, if we need 1MW for 2 hours service windows for a 12 month period, participants can bid in with less than 1MW with 30min service durations for a period of a few months. When all bids are received, we will stack partial tenders to meet the network requirement. This acknowledges that participants have different capabilities and want different contract lengths. ✓ Where we deviate from established frameworks, this will be justified with clear governance processes for managing any required change and this will be clearly communicated with the appropriate parties.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers wider economic benefits improving flexibility market operations and increasing participation in the flexibility markets.

innovation and dynamic competition. 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.	✓ Using enhanced forecasting tools and our ENZ Platform to more accurately set service windows; shorter service windows can increase participation and free up providers to operate in other markets.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers wider economic benefits improving flexibility market operations and increasing participation in the flexibility markets.
3.2.2 (ii) DNOs should have clear, comprehensive and transparent mechanisms and associated commercial structures for coordinating distribution flexibility services and ESO flexibility services procurement. DNOs shall not act as the commercial route for DER accessing ESO flexibility services. 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	✓ We will continue to build upon our established processes in RIIO-ED1 (such as our procurement statements and support Flexibility documentation), alongside our Decision Making Framework to support clear, comprehensive and transparent approaches for coordinating flexibility services. This will also include dispatch parameters.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers wider economic benefits improving flexibility market operations and increasing participation in the flexibility markets.
	✓ Non-exclusive flexibility service contracts – providers free to offer services to other markets on the proviso that they can still fulfil their service obligations to us and it's safe to do so.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.103-0.365bn of indirect benefits by enabling more efficient whole system outcomes, enabling the deployment of flexibility services and in turn making decarbonisation more affordable. It supports reduced curtailment, as well as improving air quality by enabling

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. 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.				more flexibility on the network (i.e. growth of DER, electrification of heat and transport, avoidance of reinforcement). It contributes financial customer benefits through increased market participation and economic benefits by supporting market liquidity**.**
	✓ Using network monitoring, enhanced forecasting tools, and our ENZ Platform to provide near-time 'dispatch warnings' to the ESO, and 'constraint warnings' to DER with constrainable connections and the ESO, so they can get ready. This information share will increase the efficiency of the flexibility markets, wholesale markets, and whole system coordination. See the spotlight box on page 41 for more information on the near-time notifications.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.061-0.146bn of indirect benefits by enabling more efficient whole system outcomes, enabling the deployment of flexibility services and in turn making decarbonisation more affordable and reducing curtailment. It contributes to financial customer benefits through market participation and economic benefits by supporting market liquidity.
	✓ We will coordinate with the ESO on planning our maintenance outages, so we don't inadvertently remove their access to DER services at times of vital system need.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.03bn of indirect benefits by improving the reliability of distribution network. Delivers qualitative benefits of ESO-DSO coordination which contributes to the realisation of £0.027-0.100bn benefits within RIIO-ED2.

	✓ Initiating a Service Checker for the ESO – providing the ESO with information on distribution-connected service providers, including their maximum allowed import and export level, planned maintenance outages affecting their availability, and constrainable connection arrangements. Subject to data protection requirements.	By the middle of RIIO-ED2	Exceeds – providing easy exchange of data with the ESO, to understand key network characteristics of assets they use.	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.03bn of indirect benefits by improving the reliability of distribution network. Delivers qualitative benefits of ESO-DSO co-ordination which contributes to the realisation of £0.027-0.100bn benefits within RIIO-ED2. It contributes to qualitative benefits of increased resilience of the electricity whole system and delivers economic benefits through cost efficiencies on system planning and management.
	✓ Lobbying for the development and implementation of GB-wide primacy and conflict resolution arrangements (DSO:ESO and DSO:DSO), and rules to coordinate DSO and ESO distribution service dispatch.	Throughout RIIO-ED2	Exceeds – working to create a GB-wide approach for coordination to reduce barriers to market participation.	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative benefits of ESO-DSO coordination, which is a prerequisite for the realisation of the £0.27-0.100bn of wider whole system benefits. Delivers qualitative benefits of increased whole electricity system resilience.
	✓ Investing £0.5m to improve existing operational control room (ICCP) links with the ESO and support two-way data exchange, to increase operational coordination.	Throughout RIIO-ED2	Meets	**Costs:** Supported by a £0.5m Operational IT & Telecoms investment to support enhancements to our existing ICCP links. **Benefits:** Delivers qualitative benefits of ESO-DSO coordination, which is a prerequisite for the

				realisation of the £0.027-0.100bn of wider whole system benefits Delivers qualitative benefits of increasing whole system resilience and resilience of other utilities, via communication with the ESO which allow us to have better visibility of risks, faults, and constraints.
3.2.2 (iii) DNOs should consider arrangements to support DERs to provide services that meet both DNO and ESO needs.	✓ Lobbying for the development and implementation of GB-wide primacy and conflict resolution arrangements (DSO:ESO and DSO:DSO), and rules to coordinate DSO and ESO distribution service dispatch.	Throughout RIIO-ED2	Exceeds – working to create a GB-wide approach for coordination to reduce barriers to market participation.	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers qualitative benefits of ESO-DSO coordination, which is a prerequisite for the realisation of the £0.27-0.100bn of wider whole system benefits. Delivers qualitative benefits of increased whole electricity system resilience.
	✓ Non-exclusive flexibility service contracts as standard – providers free to offer services to other markets on the proviso they can fulfil their obligations to us and it's safe to do so.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.147-0.457bn of indirect benefits by enabling more efficient whole system outcomes, enabling the deployment of flexibility services and in turn making decarbonisation more affordable. It supports reduced curtailment, as well as improving air quality by enabling more flexibility on the network (i.e. growth of DER, electrification of heat and transport, avoidance of reinforcement). It contributes financial customer benefits through increased market

				participation and economic benefits by supporting market liquidity**.**
3.2.3 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.	✓ Supporting secondary trading of flexibility service contracts through publishing data, a dedicated template to gather information on the secondary trading to set appropriate parameters, and a four working day turnaround service to approve the transfer of flexibility contract. This will enable us to justify appropriate parameters in which secondary trading can take place for operability purposes.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers wider economic benefits improving flexibility market operations and increasing participation in the flexibility markets.
3.2.4 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.	✓ Using clear and simple pre-qualification criteria for flexibility tenders that reflects that some bidders may not yet have completed sites. We will deliver a range of other outputs which will enable simple and cost-efficient participation in markets – these are listed against baseline expectation 3.2.1 (ii). We will share a range of new network data which will help potential providers identify opportunities to participate – these are listed against baseline expectation 3.1.1.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers wider economic benefits improving flexibility market operations and increasing participation in the flexibility markets.
3.2.5 DNOs to introduce other proportionate measures, developed with robust stakeholder engagement, to identify and address	✓ We will deliver our new DSO functional model responsible for delivering, including network planning and investment decisions. This includes responsibility for making decisions about flexibility use and flexibility market development.	From the start of RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Supports transparency of decision making and increased confidence in investment decisions.

actual and perceived conflicts between its DSO and network ownership roles or other business interests.[73] The introduction of such measures should enable DNOs to efficiently plan, develop and use their network, taking into account and using flexible alternatives to network reinforcement where efficient for the system, in a visibly neutral way. At a minimum, this should include demonstrable executive-level accountability and board-level visibility of key DSO decisions across the planning, operation and market facilitation functions. This should also include clear and separate decision-making frameworks, supported by independent oversight, such as external auditing, to promote transparency and enable scrutiny. Additionally, to support the justification of DNOs' proposals as proportionate, we expect DNOs to set out conflict mitigation options that	✓ We will publish a range of information on all network constraints on the 33kV and 132kV network, so that customers and stakeholders can follow each constraint from initial constraint identification through to how they are managed or resolved. Includes publishing our options assessment and intervention decision rationale. This will go beyond our Network Development Plan (NDP). ✓ All load-related intervention decisions over £2m will be externally assured and the results made public within 10 working days of assurance completion. We will publish a range of information, including on flexibility procurement, to ensure that our intervention decisions, are transparent. This increased data share will be enabled by investments in infrastructure. This data share and infrastructure is listed against baseline expectation 1.1.3 and 3.1.1.	From the middle of RIIO-ED2	Exceeds – this external assurance is over and above the baseline requirement in supporting transparency.	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Supports transparency of decision making and increased confidence in investment decisions.
	✓ We will maintain a Conflict-of-Interest Management Plan, developed with stakeholder input. ✓ The first draft of our Decision Making Framework will be prepared in RIIO-ED1. It will be designed using industry best practice and from learning from the TEF projects (footnote 1 on page 10 explains what these are). ✓ Our Decision Making Framework will be reviewed annually considering stakeholder feedback and published on our website. Its governance arrangements and contact details for raising issues shall be published.	End of RIIO-ED1 for the first draft of the Decision Making Framework. Throughout RIIO-ED2 for all other outputs	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Supports transparency of decision making and increased confidence in investment decisions.

[73] Ofgem (source: see footnote 68): "Other business interests could include services DNOs are able to provide outside of their regulated income. In February 2020, we consulted on DNOs using remote voltage control to provide the ESO with balancing services (CLASS) in RIIO-ED2. We are carefully considering the responses to this consultation and expect to provide an update in early 2022."

were considered but not proposed, including legal separation if this is not part of the DNO's suite of proposals. As part of their justification, DNOs should include the available supporting information on the likely costs, timings and implications of these alternative options or a narration of initial views.				
Other	✓ We will send site-specific price signals when we tender for flexibility services (i.e. the maximum we are prepared to pay for the service) until the market reaches sufficient liquidity that these are no longer requirement, apart from where there is a strong case for price discovery.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers wider economic benefits improving flexibility market operations and increasing participation in the flexibility markets.
	✓ We will coordinate our Flexibility Platform with our Network Management System to avoid conflicting signals (e.g. the Flexibility Platform instructing a generation increase from within a CMZ, which the CMZ then counters by instructing another ANM managed generator to reduce output). This helps flexibility markets develop safely. See Section 3.4.2 for more information on the link between flexibility markets and network management infrastructure.	From the middle of RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Contributes to £0.03bn of indirect benefits from improving the reliability of the distribution network.
	✓ An Annual Customer Satisfaction survey will be sent out to customers who have interacted with our DSO functional model during the previous year. We propose a common industry approach to this Customer Satisfaction survey to be developed with Ofgem, stakeholders, and other network companies.	Throughout RIIO-ED2	Meets	**Costs:** Included within our costs for the enabling systems and associated support costs. **Benefits:** Delivers wider customer benefit through an improved DSO customer experience.

15. Appendix C – Performance measures

As the DSO Strategic Delivery Incentive (SDI) is still in collaborative development with Ofgem, we have proposed a performance measure for each baseline expectation where appropriate.

We have intentionally proposed high level performance measures so that the same performance measure can be used for similar baseline expectations. This adds simplicity whilst ensuring that key deliverables are tracked. Our proposed approach also acknowledges that not all baseline expectations are suitable for performance measures (for example, those that are binary requirements such as publishing a Decision Making Framework).

Baseline Expectation	Potential Performance Measure
1.1.1 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. • We expect increased monitoring equipment to be rolled out across their network where it has demonstrable net value for network planning. 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.	**DSO - ODI** **Name of Performance Measure:** Network Monitoring **Measurement Meets:** Metric to assess the progress of LV network monitoring rollout. Performance of licensee in rolling out LV network monitoring. **Evidence for Meets:** Assessed on the number of LV monitors installed on the distribution network. This is assessed against the level within the Business Plan. Where deviation occurs the licensee needs to specify reasons for deviation e.g. the CBA didn't balance. **Frequency:** Reported annually **Evidence for exceeds:** Clear licensee is progressing with network monitoring rollout and by end of RIIO-ED2 period 80% (or greater) progress to plan.
1.1.2 We expect DNOs to submit a network visibility strategy and this should cover the use of all sources of network data including direct measurement from monitoring roll-out, smart meter data, data analysis and modelling, and any other third party data sources. The strategy should explain how network monitoring for planning purposes will inform planning decisions, including the use of flexibility; clear justifications for where and when monitoring is rolled-out, including explanations of any targeting for equipment deployment; and the specifications of equipment, including detail on the data captured, frequency of polling, and the mode of communicating data. Note, companies may wish to combine this strategy with network monitoring and visibility for network operations under role 2.	No ongoing performance measure required as there is no in-period delivery requirement. This is a requirement of the business plan submission and so compliance will be subject to the BPI.
1.1.3 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 authority and devolved government plans for decarbonisation. • As part of this, we expect DNOs to liaise with their network users to collate and share data, to publish comprehensive and comparable heat	**DSO - ODI** **Name of Performance Measure:** Data **Measurement Meets:** Metric to determine the level and ambition of licensees in relation to committing to sharing data, ensuring that data is open source and available to industry, and embedding a data and insights driven approach to business decisions. Metric assesses the percentage of approved and agreed upon datasets that are shared and available

maps that provide network users high value information about where to connect, and to inform their operations. • 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.	to industry. Should report on stakeholder input into the process. **Evidence for Meets:** Licensees are assessed on the number of datasets shared against the total number of Ofgem agreed datasets at mid-point and at end of price control. The list is to be agreed by licensees and Ofgem. **Frequency:** Metrics reported annually. Assessed at mid-point and end of period. **Evidence for exceeds:** 100% Ofgem and licensee agreed datasets available and shared and according to timeline agreed at working groups.
1.1.4 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-sector[74] engagement, optioneering, and planning with sectors or vectors other than their own. • 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. 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.	**Name of Performance Measure:** Decision Making Framework **Measurement Meets:** Qualitative assessment of processes for assessing network options. **Evidence for Meets:** Published process and adopting industry best practice (e.g. approaches like the Common Evaluation Methodology) **Frequency:** Assessed at mid-point and end of period. **Evidence for exceeds:** All load-related intervention decisions over £2m will be externally assured and the results made public. Qualitative assessment of the development of the ENZ Model so forecasting, simulation, and modelling.
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. DNOs must take reasonable steps to access and subsequently share, including by publishing, data and operability constraint information in a timely manner.	**DSO - ODI** **Name of Performance Measure:** Data **Measurement Meets:** Metric to determine the level and ambition of licensees in relation to committing to sharing data, ensuring that data is open source and available to industry, and embedding a data and insights driven approach to business decisions. Metric assesses the percentage of approved and agreed upon datasets that are shared and available to industry. Should report on stakeholder input into the process. **Evidence for Meets:** Licensees are assessed on the number of datasets shared against the total number of Ofgem agreed datasets at mid-point and

[74] Ofgem (source: see footnote 68): "'Sector' refers to the distribution, transmission and operation of a single energy source. For example, the 'gas sector' includes the firms responsible for gas transmission, distribution, and system operation. By 'cross-sector', we refer to any licensee in one energy source sector, eg electricity, working with any licensee in another energy source sector, eg gas."

	at end of price control. The list is to be agreed by licensees and Ofgem. **Frequency:** Metrics reported annually. Assessed at mid-point and end of period. **Evidence for exceeds:** 100% Ofgem and licensee agreed datasets available and shared and according to timeline agreed at working groups.
2.1.2 We expect DNOs to submit a network visibility strategy and this should cover the use of all sources of network data including direct measurement from monitoring roll-out, smart meter data, data analysis and modelling, and any other third party data sources. The strategy should explain how network monitoring for operational purposes will inform operational decisions, including enabling the management and delivery of flexibility services; clear justifications for where and when monitoring is rolled-out, including explanations of any targeting for equipment deployment; and the specifications of equipment, including detail on the data captured, frequency of polling, and the mode of communicating data. Note, companies may wish to combine this strategy with network monitoring and visibility for network planning under role 1.	No ongoing performance measure required as there is no in-period delivery requirement. This is a requirement of the business plan submission and so compliance will be subject to the BPI.
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.	**DSO - ODI** **Name of Performance Measure:** Data **Measurement Meets:** Metric to determine the level and ambition of licensees in relation to committing to sharing data, ensuring that data is open source and available to industry, and embedding a data and insights driven approach to business decisions. Metric assesses the percentage of approved and agreed upon datasets that are shared and available to industry. Should report on stakeholder input into the process. **Evidence for Meets:** Licensees are assessed on the number of datasets shared against the total number of Ofgem agreed datasets at mid-point and at end of price control. The list is to be agreed by licensees and Ofgem. **Frequency:** Metrics reported annually. Assessed at mid-point and end of period. **Evidence for exceeds:** 100% Ofgem and licensee agreed datasets available and shared and according to timeline agreed at working groups.
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.	**DSO - ODI** **Name of Performance Measure:** Data **Measurement Meets:** Metric to determine the level and ambition of licensees in relation to committing to sharing data, ensuring that data is open source and available to industry, and embedding a data and insights driven approach to business decisions. Metric assesses the percentage of approved and

	agreed upon datasets that are shared and available to industry. Should report on stakeholder input into the process. **Evidence for Meets:** Licensees are assessed on the number of datasets shared against the total number of Ofgem agreed datasets at mid-point and at end of price control. The list is to be agreed by licensees and Ofgem. **Frequency:** Metrics reported annually. Assessed at mid-point and end of period. **Evidence for exceeds:** 100% Ofgem and licensee agreed datasets available and shared and according to timeline agreed at working groups.
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; and • utilisation and curtailment of areas under the control of capacity management systems such as Active Network Management systems.	**DSO - ODI** **Name of Performance Measure:** Data **Measurement Meets:** Metric to determine the level and ambition of licensees in relation to committing to sharing data and ensuring open source and available to industry and embedding a data and insights driven approach to business decisions. Metric assesses the percentage of approved and agreed upon datasets that are shared and available to industry. Should report on stakeholder input into the process. **Evidence for Meets:** Licensees are assessed on the number of datasets shared against the total number of Ofgem agreed datasets at mid-point and at end of price control. The list is to be agreed by licensees and Ofgem. **Frequency:** Metrics reported annually. Assessed at mid-point and end of period. **Evidence for exceeds:** 100% Ofgem and licensee agreed datasets available and shared and according to timeline agreed at working groups.
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. • 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.	**Name of Performance Measure:** Decision Making Framework **Measurement Meets:** Qualitative assessment of processes for assessing network options. **Evidence for Meets:** Published process and adopting industry best practice (e.g. approaches like the Common Evaluation Methodology) **Frequency:** Assessed at mid-point and end of period. **Evidence for exceeds:** All load-related intervention decisions over £2m will be externally assured and the results made public. Qualitative assessment of the development of the ENZ Model so forecasting, simulation, and modelling.

The rules should be transparent, objective, and promote whole system efficiencies.	
2.2.2 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).	**DSO - ODI** **Name of Performance Measure:** Data **Measurement Meets:** Metric to determine the level and ambition of licensees in relation to committing to sharing data and ensuring open source and available to industry and embedding a data and insights driven approach to business decisions. Metric assesses the percentage of approved and agreed upon datasets that are shared and available to industry. Should report on stakeholder input into the process. **Evidence for Meets:** Licensees are assessed on the number of datasets shared against the total number of Ofgem agreed datasets at mid-point and at end of price control. The list is to be agreed by licensees and Ofgem. **Frequency:** Metrics reported annually. Assessed at mid-point and end of period. **Evidence for exceeds:** 100% Ofgem and licensee agreed datasets available and shared and according to timeline agreed at working groups.
2.2.3 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.	**Name of Performance Measure:** Decision Making Framework **Measurement Meets:** Qualitative assessment of processes for assessing network options. **Evidence for Meets:** Published process and adopting industry best practice (e.g. approaches like the Common Evaluation Methodology) **Frequency:** Assessed at mid-point and end of period. **Evidence for exceeds:** All load-related intervention decisions over £2m will be externally assured and the results made public. Qualitative assessment of the development of the ENZ Model so forecasting, simulation, and modelling.
2.2.4 DNOs to develop efficient, scalable dispatch instruction infrastructure and avoid proprietary systems. • 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. The application of hard dispatch controls shall be for the improved reliance on market-based mechanisms, not to the detriment of their	**Name of Performance Measure:** Infrastructure Assessment **Measurement Meets:** Qualitative assessment of rollout of dispatch infrastructure. **Evidence for Meets:** Assessed on the installation and development of dispatch infrastructure on the distribution network. This is assessed against the Business Plan. **Frequency:** Assessed at mid-point and end of period.

development. 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.	**Evidence for exceeds:** Development of dual routes for dispatch infrastructure to support a broader range of customers. Qualitatively assessed.
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). 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).	**DSO-ODI** **Name of Performance Measure:** Developing & Progressing Flexibility **Measurement Meets:** To assess the flexibility market volume, we will report annually on the volume of flexibility tendered for versus the forecast flexibility, with a proposed target of 60%-80%. This will be assessed at the mid-point and end of period. **Evidence for Meets:** Delivery Report **Frequency:** Metrics reported annually. Assessed at mid-point and end of period. **Evidence for exceeds:** 80%-100% of tendered vs. forecasted flexibility needs **DSO - ODI** **Name of Performance Measure:** Data **Measurement Meets:** Metric to determine the level and ambition of licensees in relation to committing to sharing data and ensuring open source and available to industry and embedding a data and insights driven approach to business decisions. Metric assesses the percentage of approved and agreed upon datasets that are shared and available to industry. Should report on stakeholder input into the process. **Evidence for Meets:** Licensees are assessed on the number of datasets shared against the total number of Ofgem agreed datasets at mid-point and at end of price control. The list is to be agreed by licensees and Ofgem. **Frequency:** Metrics reported annually. Assessed at mid-point and end of period. **Evidence for exceeds:** 100% Ofgem and licensee agreed datasets available and shared and according to timeline agreed at working groups.
3.1.2 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.	**DSO - ODI** **Name of Performance Measure:** Data **Measurement Meets:** Metric to determine the level and ambition of licensees in relation to committing to sharing data and ensuring open source and available to industry and embedding a data and insights driven approach to business decisions. Metric assesses the percentage of approved and agreed upon datasets that are shared and available

	to industry. Should report on stakeholder input into the process. **Evidence for Meets:** Licensees are assessed on the number of datasets shared against the total number of Ofgem agreed datasets at mid-point and at end of price control. The list is to be agreed by licensees and Ofgem. **Frequency:** Metrics reported annually. Assessed at mid-point and end of period. **Evidence for exceeds:** 100% Ofgem and licensee agreed datasets available and shared and according to timeline agreed at working groups.
3.1.3 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. The information must be easily accessible and navigable. We expect this includes publishing data in machine-readable formats.	**DSO - ODI** **Name of Performance Measure:** Data **Measurement Meets:** Metric to determine the level and ambition of licensees in relation to committing to sharing data and ensuring open source and available to industry and embedding a data and insights driven approach to business decisions. Metric assesses the percentage of approved and agreed upon datasets that are shared and available to industry. Should report on stakeholder input into the process. **Evidence for Meets:** Licensees are assessed on the number of datasets shared against the total number of Ofgem agreed datasets at mid-point and at end of price control. The list is to be agreed by licensees and Ofgem. **Frequency:** Metrics reported annually. Assessed at mid-point and end of period. **Evidence for exceeds:** 100% Ofgem and licensee agreed datasets available and shared and according to timeline agreed at working groups.
3.1.4 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. In many instances, collaboration across DNOs in engagement is expected to reduce duplication, make it easier for stakeholders to engage and avoid stakeholder fatigue.	**DSO - ODI** **Name of Performance Measure:** Data **Measurement Meets:** Metric to determine the level and ambition of licensees in relation to committing to sharing data and ensuring open source and available to industry and embedding a data and insights driven approach to business decisions. Metric assesses the percentage of approved and agreed upon datasets that are shared and available to industry. Should report on stakeholder input into the process. **Evidence for Meets:** Licensees are assessed on the number of datasets shared against the total number of Ofgem agreed datasets at mid-point and at end of price control. The list is to be agreed by licensees and Ofgem. **Frequency:** Metrics reported annually. Assessed at mid-point and end of period.

	Evidence for exceeds: 100% Ofgem and licensee agreed datasets available and shared and according to timeline agreed at working groups.
3.1.5 DNOs should seek to ensure the information they publish is as accurate and unbiased as reasonable (ie correct at time of publication, as close as possible to the actual value and not skewed in any direction).	**DSO - ODI** **Name of Performance Measure:** Data **Measurement Meets:** Metric to determine the level and ambition of licensees in relation to committing to sharing data and ensuring open source and available to industry and embedding a data and insights driven approach to business decisions. Metric assesses the percentage of approved and agreed upon datasets that are shared and available to industry. Should report on stakeholder input into the process. **Evidence for Meets:** Licensees are assessed on the number of datasets shared against the total number of Ofgem agreed datasets at mid-point and at end of price control. The list is to be agreed by licensees and Ofgem. **Frequency:** Metrics reported annually. Assessed at mid-point and end of period. **Evidence for exceeds:** 100% Ofgem and licensee agreed datasets available and shared and according to timeline agreed at working groups.
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.[75] The processes should be transparent and participatory, involving other DNOs, the ESO, and current and potential distribution flexibility service providers. • 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. 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.	**Name of Performance Measure:** Flexibility Process **Measurement Meets:** Qualitative assessment of the processes and procedures associated with Flexibility markets. **Evidence for Meets:** Assessed on alignment with LO requirements that already exist for flexibility. **Frequency:** Follows LO frequency requirements.
3.2.2 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	**Name of Performance Measure:** Flexibility Process **Measurement Meets:** Qualitative assessment of the processes and procedures associated with Flexibility markets.

[75] Ofgem (source: see footnote 68): "Standardisation of the technical parameters of the product, processes and the applicable contracts, not just in branding, with clear justification for any deviations, as well as data standards and methods for sharing this information."

innovation and dynamic competition. 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. • DNOs should have clear, comprehensive and transparent mechanisms and associated commercial structures for coordinating distribution flexibility services and ESO flexibility services procurement. DNOs shall not act as the commercial route for DER accessing ESO flexibility services. 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. 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. • DNOs should consider arrangements to support DERs to provide services that meet both DNO and ESO needs.	**Evidence for Meets:** Assessed on alignment with LO requirements that already exist for flexibility. **Frequency:** Follows LO frequency requirements.
3.2.3 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.	**DSO - ODI** **Name of Performance Measure:** Data **Measurement Meets:** Metric to determine the level and ambition of licensees in relation to committing to sharing data and ensuring open source and available to industry and embedding a data and insights driven approach to business decisions. Metric assesses the percentage of approved and agreed upon datasets that are shared and available to industry. Should report on stakeholder input into the process. **Evidence for Meets:** Licensees are assessed on the number of datasets shared against the total number of Ofgem agreed datasets at mid-point and at end of price control. The list is to be agreed by licensees and Ofgem. **Frequency:** Metrics reported annually. Assessed at mid-point and end of period. **Evidence for exceeds:** 100% Ofgem and licensee agreed datasets available and shared and according to timeline agreed at working groups.
3.2.4 Market support services, such as pre-qualification, credit-checking and settlement must enable simple and cost-efficient participation in	**Name of Performance Measure:** Flexibility Process

markets. DNOs should enable, and never prevent, the opportunity for third parties to provide these services where they could do so more efficiently.	**Measurement Meets:** Qualitative assessment of the processes and procedures associated with Flexibility markets. **Evidence for Meets:** Assessed on alignment with LO requirements that already exist for flexibility. **Frequency:** Follows LO frequency requirements.
3.2.5 DNOs to introduce other proportionate measures, developed with robust stakeholder engagement, to identify and address actual and perceived conflicts between its DSO and network ownership roles or other business interests.[76] The introduction of such measures should enable DNOs to efficiently plan, develop and use their network, taking into account and using flexible alternatives to network reinforcement where efficient for the system, in a visibly neutral way. At a minimum, this should include demonstrable executive-level accountability and board-level visibility of key DSO decisions across the planning, operation and market facilitation functions. This should also include clear and separate decision-making frameworks, supported by independent oversight, such as external auditing, to promote transparency and enable scrutiny. Additionally, to support the justification of DNOs' proposals as proportionate, we expect DNOs to set out conflict mitigation options that were considered but not proposed, including legal separation if this is not part of the DNO's suite of proposals. As part of their justification, DNOs should include the available supporting information on the likely costs, timings and implications of these alternative options or a narration of initial views.	**Name of Performance Measure:** Decision Making Framework **Measurement Meets:** Qualitative assessment of processes for assessing network options. **Evidence for Meets:** Published process and adopting industry best practice (e.g. approaches like the Common Evaluation Methodology) **Frequency:** Assessed at mid-point and end of period. **Evidence for exceeds:** All load-related intervention decisions over £2m will be externally assured and the results made public. Qualitative assessment of the development of the ENZ Model so forecasting, simulation, and modelling. **Name of Performance Measure:** DSO Transparency **Measurement Meets:** Process, structures, and approaches that support the transparency of licensees' decision making. **Evidence for Meets:** Qualitative assessment of the delivery of our licensees functional model. **Frequency:** Assessed at mid-point and end of period.

[76] Ofgem (source: see footnote 68): "Other business interests could include services DNOs are able to provide outside of their regulated income. In February 2020, we consulted on DNOs using remote voltage control to provide the ESO with balancing services (CLASS) in RIIO-ED2. We are carefully considering the responses to this consultation and expect to provide an update in early 2022."

16. Appendix D – Interdependencies

DSO is not a standalone activity; it has strong links with four other parts of our plan:

1. Our load related investment plan
2. Our connections plan
3. Our Whole Systems strategy
4. Our data and digitalisation plan

16.1 Load related expenditure: Engineering Net Zero

Our Load Related Expenditure (LRE) plan sets out how we will deliver in RIIO-ED2 the capacity our customers need. The LRE plan depends on capabilities that we are delivering as part of DSO, for example greater flexibility use to defer reinforcement, enhanced forecasting and modelling so we better know where and when to intervene, and CMZs to coordinate operational capacity interventions. DSO expands our toolbox of solutions – LRE uses some of that toolbox to provide the capacity our customers need.

16.2 Connections

Our Connections Strategy outlines our approach to the connections experience for our customers and how we will manage the forecast increase in connection requests that will be required to facilitate Net Zero.

The DSO investments that we make will help support our approach to Connections. They will allow us to deliver a more timely, efficient, and simpler connection process for our customers, including self-serve solutions.

16.3 Whole Systems

DSO will allow us to further develop a coordinated Whole System approach through better data sharing with stakeholders, data-driven network planning that considers Whole System outcomes, and flexibility market and operational coordination with the ESO. We have worked together internally and with our stakeholders to develop our Whole System approach for RIIO-ED2.

16.4 Data and Digitalisation

Data and digitalisation are key enablers for our entire business plan for RIIO-ED2. We have worked collaboratively to leverage SP Energy Network wide investments to support DSO specific investments such as forecasting, modelling, flexibility platforms, and data sharing capabilities.

17. Appendix E – Assessment of DSO institutional arrangements

In preparing our DSO Strategy, we considered the best institutional arrangement to deliver the DSO roles, activities, and infrastructure that our customers need. Section 4 sets out our proposed arrangement of a DSO functional model. It will have its own dedicated Director who will report to the SP Energy Networks CEO, and will be responsible and accountable for delivering DSO, including planning and network development, network operation, and market development. The model will be supported by a DSO expert stakeholder panel.

This new DSO functional model is one measure we're taking to increase transparency and give our customers confidence that we are a neutral market facilitator. This is important – our customers, stakeholders, and service providers must have confidence in us and the markets we interact with, as their involvement is important for enabling Net Zero, maintaining system stability, and promoting competition in service provision; customers benefit from all of these. Other measures to promote transparency include publishing information on all network constraints on the 33kV and 132kV network, including our options assessment and investment decision rationale, and externally assuring all load-related intervention decisions over £2m and publishing the findings.

This appendix sets out our assessment which informed this proposed arrangement: Section 17.1 summarises our assessment of the different institutional arrangements, and Section 17.2 explains why a direct comparison to transmission arrangements is not appropriate.

17.1 Options assessment summary

There are three broad institutional arrangement options for DSO:

1. **A fully integrated DSO/DNO – 'no change'.** In this option, the staff delivering DSO are spread throughout the DNO business. There is no single division of the business responsible for DSO, and so little accountability for delivery. This option represents little change from where most DNOs are today.
2. **A DSO** functional model **within the DNO – 'the no regrets approach'.** This approach means there is a clear responsibility for delivering DSO, yet they can still work closely to coordinate interventions and share high cost infrastructure such as control rooms. This offers many of the advantages of full separation whilst avoiding the costs and keeping options open for the future.
3. **A full legally separated DSO – 'wholly separate'**. This would be a separate business, entirely and wholly separate from the DNO. There could be no sharing of staff, systems, or infrastructure. We haven't differentiated between a DSO owned by the same holding company as the DNO and one with different owners as both involve full separation between DNO and DSO.

Assessment criteria	Fully integrated DSO/DNO	DSO functional model within DNO	Full legally separate DSO
Safeguarding safety – our first priority	Green – there is a single organisation responsibility for safety.	Green – there is a single organisation responsibility for safety.	Red – no clear single responsibility for safety of the network that goes into customers' homes.[77] This is especially relevant as customer demand increases, meaning these assets could be overloaded, presenting a fire risk.
Cost to implement institutional arrangement	Green – the major costs associated with separation (e.g. new control room,	Green – the major costs associated with separation (e.g. new control room,	Red – duplication of resource such as new control room,

[77] A 2015 report from Amprion highlighted the European risks from the separation of System Operator (SO) and Asset Owner (AO) responsibilities where the "consistent and unique responsibility for the grid is disrupted" from conflict SO and AO action and a lack of clear accountability. Available at: https://iea.blob.core.windows.net/assets/imports/events/153/Lehmkoester.pdf. This also highlighted that previous separations of the AO and SO at transmission were subsequently reversed in Italy, Hungary, and Poland.

	infrastructure, systems etc.) are avoided.	infrastructure, systems etc.) are avoided as they are shared.	infrastructure, support staff.[78] [79]
Accountability to deliver DSO	Red – no single clear accountability or responsibility for delivering DSO.	Neutral – dedicated director reporting to the CEO, so clear accountability and responsibility for delivering DSO.	Green – dedicated DSO business so clear accountability and responsibility for delivering DSO.
Ability to deliver the volume of interventions required for Net Zero	Neutral – there are no barriers to the coordination needed between DSO planning/operational staff and DNO field staff, yet there is no clear responsibility for the DSO outputs needed to enable delivery (e.g. enhanced forecasting tools, greater flexibility use etc.).	Green – there is clear responsibility to deliver the DSO outputs needed to support Net Zero, and no barriers to the coordination needed between DSO planning/operational staff and DNO field staff.	Red – the coordination between DSO staff and DNO field staff to deliver the volume of interventions needed for Net Zero is greatly inhibited as there would be no shared systems or workspaces. Delivering full separation would divert a significant amount of focus and resource at a time when we need to deliver a substantial increase in interventions, tools, and processes to enable Net Zero. There are also recruitment issues for control room staff – these are highly specialised roles and already hard to fill without every network licensee creating an additional control room.
Transparency of decision making	Neutral – decisions and supporting data can be shared, but this structure will likely lack a separate decision making governance and external assurance. No clear accountability to deliver the DSO data sharing outputs, which are key to promoting transparency.	Green – this structure accommodates separate governance with director responsibility, and external assurance. There is clear accountability to deliver the DSO data sharing outputs, which are key to promoting transparency.	Green – this structure accommodates separate governance with director responsibility, and external assurance. There is clear accountability to deliver the DSO data sharing outputs, which are key to promoting transparency.

[78] Legal and structural changes have historically been very expensive for customers. A 2001 study by the Institute of Fiscal Studies (https://ifs.org.uk/fs/articles/0036a.pdf) found the cost of the 1990s Liberalisation of Regional Electricity Companies (RECs) cost to be £1.1bn (1995 prices) nationally. After an RPI conversion this would be circa £2bn today. There is already enough upward pressure on bills; we shouldn't be adding to them unnecessarily, especially with full legal separation when the benefits case has not yet been made.

[79] In 2018, Ofgem set funding for the ESO to separate from National Grid at £49.3m for one-off costs and an enduring £9.1m/year. This was when the ESO was already at an advanced stage of maturity with limited overlap in day to day roles / activities with the TO. DNOs/DSOs are far more integrated than the TO and ESO were at time of separation, and so would likely face significantly greater capital allowances.

Addressing perceived conflicts of interest	Red – there is no separation between DSO and DNO decisions.	Neutral – this would likely address concerns for most stakeholders about perceived conflicts of interest. This can be upgraded to **green** through RIIO-ED2 with targeted measures, e.g. strong governance, an independent expert stakeholder panel, intervention decisions the responsibility of the DSO functional model, external assurance of load-related intervention decisions, and more data share to improve investment transparency.	Green – this would likely address stakeholder concerns about perceived conflicts of interest.
Optionality	Green – it keeps all future options open until the evidence case for an enduring decision has been made.	Green – it keeps all future options open until the evidence case for an enduring decision has been made.	Red – it is possible to reverse this decision but it is unlikely as the costs of separation are not recoverable.[80] We therefore shouldn't do this until the case for this option is unequivocally made.
Summary	Not preferred – there are too many risks to delivering DSO and not enough transparency and accountability.	Preferred – this delivers the great majority of the advantages of full separation whilst avoiding the downsides and the expense.	Not preferred – this option has merits, but safety and Net Zero deliverability are major concerns. The most expensive without being the best.

The DSO functional model we have proposed is the right answer for RIIO-ED2 as it retains clear responsibility for customer safety, ensures accountability to deliver our DSO outputs, delivers the DSO capabilities needed to accommodate Net Zero, addresses concerns about perceived conflicts, promotes transparency, keeps options open for future institutional arrangements, and minimises unnecessary costs before the case for any particular future arrangement has been made. This is a 'no regrets' arrangement.

17.2 Comparing DSO to ESO

In considering whether the asset owner (DNO) and system operator (DSO) should be separated, it is natural to look to the transmission system arrangement. At transmission the system operator has been legally separate from the asset owner since April 2019. We do not consider that this makes a representative comparison for distribution for three main reasons set out below and summarised in Figure 13.

In addition to these three main reasons, it is noteworthy that the evidence case for separation at transmission was far more substantive: the existing SO functions stem from the privatisation of the Central Electricity Generating Board (CEGB) in 1990. Therefore the evidence base for further separating ESO and TO (as being considered under Ofgem's FSO workstream) comes from decades of experience and evidence.

In contrast, initial DSO activity in GB has only taken place in RIIO-ED1, and even then that is not the full range of DSO which will be delivered in RIIO-ED2. RIIO-ED2 represents the first price control to fully support DSO

[80] Previous separations of the AO and SO at transmission were subsequently reversed in Italy, Hungary, and Poland. Available at: https://iea.blob.core.windows.net/assets/imports/events/153/Lehmkoester.pdf

activity on the distribution network, and so should be used to gather evidence rather than make changes before it has been given a chance to yield insights as to its operation.

17.2.1 Safety

We are responsible for the network that goes into customers' homes and business. This is not the case for transmission, which is operated at safe distances from customers.

What this means: given 'DNO' and 'DSO' actions interact and can cause the same safety issues, full legal separation (like at transmission) would introduce uncertainty of responsibility for the network that enters into people's homes. We cannot blur responsibilities for the network that enters people's homes

17.2.2 Planning complexity

Compared to distribution, there are very few transmission reinforcement projects in development at any one time, and little interaction between the projects. In contrast, we will be delivering tens of thousands of network interventions in RIIO-ED2, many of which needed to be coordinated with each other for four reasons: to keep costs efficient, to ensure we can deliver the volumes (by sharing overheads across multiple interventions), to reduce disruption to customers (e.g. by touching the network once), and to make sure that the additional capacity is ready for when our customers need it.

What this means: successfully delivering such a volume of coordinated interventions requires input from multiple teams spread across the DNO and DSO. Fully separating these teams into separate organisations would inhibit the coordination that's needed to efficiently and successfully to deliver these connections and interventions needed by our customers, and so also Net Zero. Fully separating these teams only works where the volume of interventions are low, such as at transmission.

17.2.3 Operational complexity

The transmission system is built to a higher security standard (set by the Security and Quality of Supply Standard) than distribution, meaning there is more redundancy in the event of a fault. In addition, there are fewer transmission faults, a mature services market to respond to system disturbances, and more optionality to respond to faults given the national nature of transmission (you can resolve a problem with a service delivered hundreds of miles away). This distribution network is very different: it is designed with less redundancy, has greater number of faults (a longer network more exposed to external factors), the distribution services market is immature, the network is highly localised (a DSO flexibility service in one street may not solve a problem in the next street), and customers are more likely to be directly impacted.

In summary, at transmission faults are rare and there is lots of contingency, at distribution faults are common and there is far less contingency.

What this means: fixing faults at distribution usually requires both operational (DSO) and field (DNO) actions. We need our DNO field teams and DSO operational teams to be able to work hand-in-hand to effectively respond to faults to minimise the time our customers are off-supply. If we push these teams further apart and inhibit their coordination (as would be the case in full legal separation) then we risk reducing reliability at the same time as our customers become more dependent on their supply as they decarbonise.

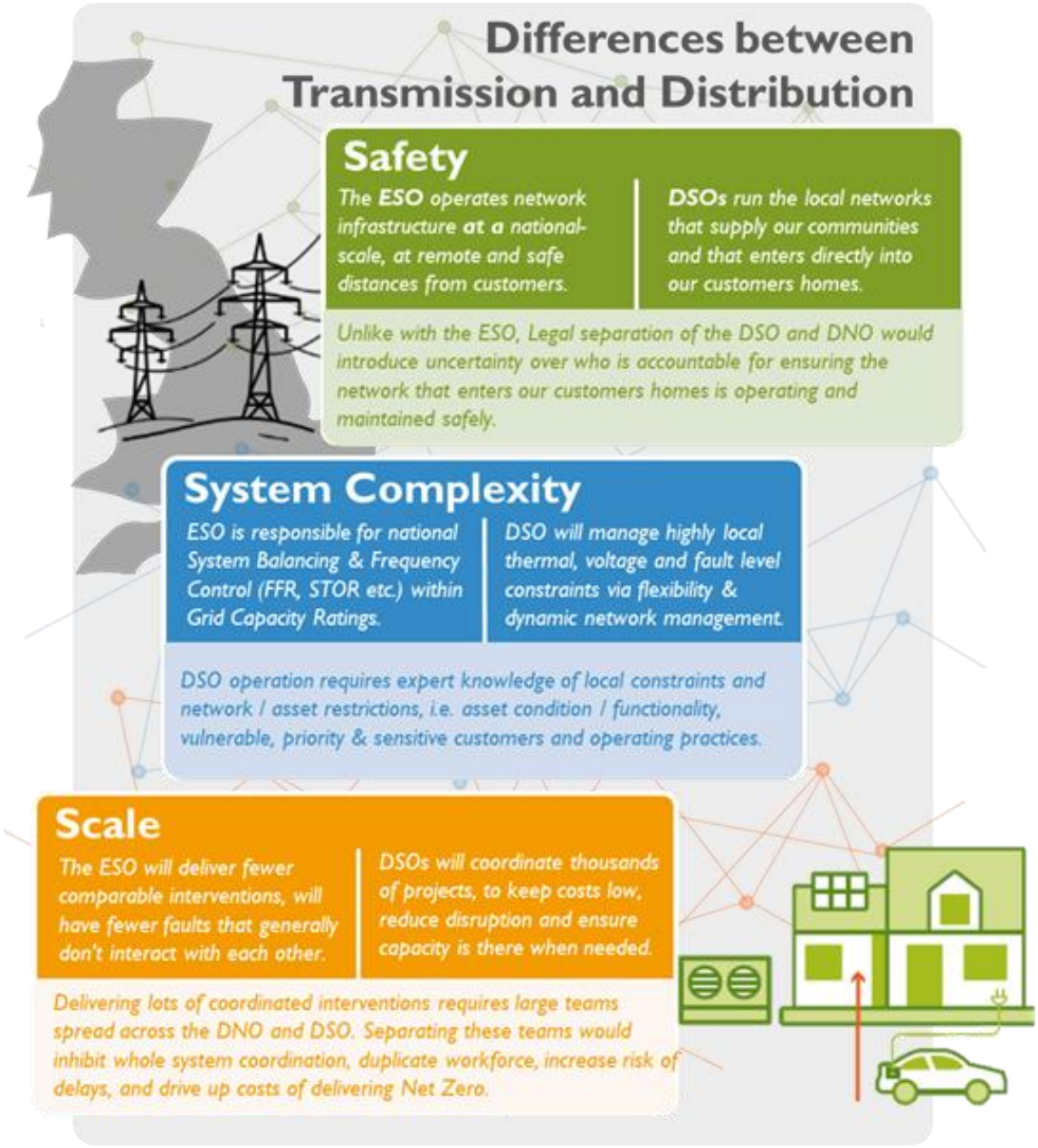

Figure 13: DSO ESO comparison

18. Appendix F – Specific CLASS deliverables

Paragraph 4.23 of Ofgem's Business Plan Guidance requires us to set out as appropriate:

- Specific deliverables associated with CLASS, e.g. number of primary substations and total MW of available response
- Costs of investing in CLASS, i.e. both CapEx and OpEx
- Intended use(s) of CLASS, e.g. managing peak demand on a DNO's own network or supporting the ESO to manage frequency and system security
- Assumptions on how CLASS is expected to be remunerated in RIIO-ED2, e.g. through directly remunerated services (DRS) category 8

Given the ongoing regulatory uncertainty regarding CLASS in RIIO-ED2, we are not proposing any CLASS specific outputs or expenditure in RIIO-ED2.

19. Appendix G – DSO EJP and M19 Overview

Our DSO Strategy outlines the roles, activities, and infrastructure that we plan to deliver, so that we can continue to serve our customers and communities. They include more complex planning solutions, smarter and scalable network operation infrastructure, being a neutral facilitator of an open and accessible Distribution Energy Resources (DER) services market, and coordinating DER services to deliver a safe, efficient, and reliable whole system. These must be delivered at a pace that meets our customers' needs.

This Appendix is intended to supplement our DSO Strategy with an overview of RIIO-ED2 specific cost information from the DSO M19 Business Plan Data Table (BPDT), and summarise the DSO Infrastructure Engineering Justification Paper (EJP) that has been cost reported in Ofgem's M19 template.

19.1 ED2-NLR(O)-SPEN-001-DSO-EJP Overview

The DSO consists of a series of roles, activities and infrastructure that will enable SP Energy Networks to more actively manage its systems and deliver new and enhanced projects and services to our customers. In RIIO-ED1 there were a series of initiatives and requirements regarding DSO. These activities mainly focused on flexibility and ANM. For RIIO-ED2, the requirements and baseline expectations have changed significantly. Our DSO Infrastructure EJP covers specific elements of the required DSO infrastructure that are not justified elsewhere in the RIIO-ED2 plan. These specific elements are required to support the roles, activities, and infrastructure within this DSO Strategy and the baseline expectations as defined by Ofgem within the Sector Specific Methodology Determination (SSMD) and the September 2021 Business Plan Guidance.

Our engineering strategy for RIIO-ED2 is to deploy all necessary DSO infrastructure including the centralised CMZ platform(s) and all network / field infrastructure. Deployment will be prioritised in RIIO-ED2 based on capacity requirements calculated based on our Distribution Future Energy Scenario (DFES) forecasts. The DSO infrastructure will build on the infrastructure developed during RIIO-ED1. A list of network locations has been established for the deployment of CMZs for RIIO-ED2, based on network analysis underpinned by the DFES. The DSO infrastructure across our IT and operational telecoms estate is required to support existing RIIO-ED1 commitments and additional DSO outputs that will be required during RIIO-ED2.

The EJP summarises:

- £54.14m of investment into CMZ infrastructure and some supporting Network Management System (NMS) investments in CV11 - OP IT and Telecoms.
- £7.51m of investments into enabling C4 and C13 Non OP IT and Telecoms that supports analytics, forecasting, flexibility platforms, and market platforms.

19.2 DSO Memo (M19) Overview

The memo table for DSO (M19) extracts costs from various areas of the overall RIIO-ED2 plan. The BPDT areas that M19 utilises are summarised below:

- **Load related:** extracts from CV1 and CV2 for flexibility related expenditure for the primary and secondary network.
- **Non-load:** extracts from CV11 with OT related investments. This includes LV monitoring, CMZ infrastructure, NMS investments, apportioned investments into primary and secondary telecommunications, and Real Time Systems (RTS) tools.
- **Non-op CapEx:** extracts from C4 for IT related investments to enable and support DSO functionality. This includes analytics, forecasting, flexibility platforms and market platforms. This also includes our smart system investments that includes apportioned investments into our Integrated Network Model (INM), NAVI system and Smart Data Integration Fabric (SDIF).
- **Closely Associated Indirects (CAIs):** extracts from C9 for CAIs covering resources required to deliver DSO roles and activities as defined within the DSO Strategy.
- **Business Support Costs:** extracts from C12 and C13 for Business Support Costs covering resources required to deliver DSO roles and activities as defined within the DSO Strategy.

Each licence (SP Distribution and SP Manweb) has their own respective M19 table; Table 14 shows the combined summary.

BPDT Area	Licence Summary	Unit	RIIO-ED2 DSO investment					Total RIIO-ED2
			2024	2025	2026	2027	2028	
Total DSO	SPD	£m	17.0	17.4	18.8	20.3	20.3	93.8
	SPM	£m	16.5	17.5	18.4	19.7	19.3	91.3
	Total DSO	**£m**	**33.5**	**34.9**	**37.2**	**40.0**	**39.6**	**185.1**

Table 14: M19 BPDT summary

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