# Annual DSO Performance Panel Submission

2023/24

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# A foreword from our CEO

**Phil Jones,**
President
and CEO

We are proud to be the team responsible for powering everyday life for more than eight million people across 3.9 million homes and businesses in the North East, Yorkshire and Northern Lincolnshire. Efficiently delivering a top-class service where the lights stay on and the network stays healthy has always been both a responsibility and a challenge we feel privileged to accept.

That challenge has become more significant in light of decarbonisation. Much of what that will look like is uncertain. But we do know this: whatever decarbonisation pathway materialises over the coming years, there will be a power grid at the centre of a reliable, efficient and low carbon energy system.

The work we will do on our customers behalf in the next 10-20 years is as significant as the work done in the 1950s to build the national energy network, and the thinking that was required to design it in the 1930s.

That work is already well underway, and we are already seeing significant benefits from commercial, technical and regulatory innovation. Our DSO functions are central to that drive towards the future energy system – they create the leading edge as we play our part in enabling decarbonisation in our region. We are pleased to have the opportunity to share with you the significant progress that has already been made.

The dynamics of our region frame our strategy and set the context for our performance:

- As a result of deindustrialisation in the North East, since 2005 average non-domestic consumption has dropped by over 30%. Domestic consumption has also marginally declined through energy efficiency. In Yorkshire, it's a similar story, although less pronounced.
- Socioeconomic drivers shape this story as well, with lower average incomes leading to a slower uptake of low carbon technologies in our region relative to some, and smaller relative increases to loads.
- On the other hand, we are seeing a large appetite for connecting low carbon generation and storage to the network, and these projects are seeing long lead-times due to constraints on the transmission network. However, our current connection pipeline of around 30GW is five times our current peak demand in our region and around three times the peak demand we expect to see in the 2040s. That shows us that not all of these projects are needed and, in any case, not all of them will progress. Our focus is on enabling those who can proceed as we move to a first ready, first connected approach.

"Efficiently delivering a top-class service where the lights stay on, and the network stays healthy has always been both a responsibility and a challenge we feel privileged to accept."

Our approach must be led by the people in our region – ensuring that we are prioritising the right activity to deliver what they need, when and where they need it.

We have made significant progress in supporting our region's decarbonisation journey:

- **Technical innovation:** We have been making and agreeing flexible connections offers for over two decades as we sought to provide the most efficient connections solutions for our customers. We now have over 500MW (equivalent to 500,000 homes) of generation capacity managed flexibly across four Active Network Management (ANM) zones and we have a further eight ANM zones planned in the next few years.
- One of the key features of our approach to DSO is the benefits we are accruing from the integration of our Major Connections front end processes with our other DSO functions as we shift to a first ready, first connected approach to reduce connections lead times.
  - By combining Major Connections and Flexibility as part of our integrated DSO approach it has allowed us to effectively build flexibility into our connections offers at source.
  - We have delivered 33 offers for flexible connections (over 15% of the projects affected by connections constraints) – the connections dates in those cases were brought forward by an average of six and a half years.
- Having laid the foundation for smart network solutions over the last ten years by investing in sensors, control systems, and telecommunication capabilities to enable flexible solutions when and where they are in the best interest of our customers, we are now gaining the benefits of that:
  - Our smart grid enablers investment delivered new communication capability for 860 of our major substations and 2,350 LV monitors between 2015 and 2023.
  - We are building on this cornerstone investment as we target an additional 10,000 LV monitors across our network by 2028.
- **Commercial innovation:** Through our new approach to connections queue management, which closely monitors and engages with slow-moving projects, we have released over 600MW of capacity for customers whose projects are ready to proceed.
- **Openness and transparency:** As part of our commitment to transparency and accountability we established our DSO review panel. The panel are highly experienced industry experts, and they will provide independent scrutiny and challenge to our decision-making processes, ensuring that the process of decision making takes account of all possible solutions available to us to arrive at the optimal and most cost-efficient outcome for current and future customers.
- We have opened up access to over 50 useful datasets using our new Open Data Portal. The datasets are grouped into four themes, informed by customers' needs. In just one year, the usage of that data has increased 15-fold, growing from around 600 unique users in April 2023 to 9,000 now, demonstrating the high levels of engagement that has supported the roll out of this tool.
- In support of local communities, we have established a Regional Insights team and a bespoke data-sharing platform, the 'Local Authority Portal'. These two elements are the cornerstone of our strategy to maximise the benefits of decarbonisation for the local communities we are proud to serve.

Thank you for taking the time to read about the important work we are doing in this area. We are pleased with the positive progress that we can report – but we know there is much more to come.

# DSO vision

We have been developing our DSO thinking since 2017, exploring what the transition to Net Zero looks like and what our stakeholders need from us; we set out the journey we have taken in developing our DSO strategy and plans with our stakeholders in our strategy section on Page 4. Underpinning that strategy is a clear vision for DSO at Northern Powergrid.

**DSO vision**

Our vision, developed collaboratively with our customers and stakeholders, is to deliver a smarter and more flexible energy system for our customers to decarbonise efficiently.

**DSO purpose**

Our purpose is to deliver an active and efficient energy system for the regions that we serve, to support the shift to a decentralised energy landscape and supporting our stakeholders needs:

Keeping costs low for customers by ensuring smart and flexible customer and network solutions are utilised to plan and operate our network in the most efficient and economic way.

Enabling network access for major connections customers to allow the fastest and the most economical access to our distribution network.

Ensuring we are a trusted and neutral platform through openness and transparency.

Engaging and partnering with our whole energy system user community to co-create a network development plan that meets our regions' decarbonisation aspirations and ensures a just transition.

# Our customers, our network and our region

Our DSO plan responds to the energy transition in a way that acknowledges the specific characteristics of our region, our stakeholders and our network and sets a direction that is specific to the opportunities and challenges this presents.

## The energy system transition

The energy system is changing as we transition towards Net Zero, and electricity networks are at the heart of this change. The electricity mix is featuring an increasing proportion of small scale, low-carbon generation located closer to the point of consumption leading to fluctuations in generation depending on the time of day or weather conditions.

Electricity consumption and patterns will change as consumers take up more low carbon technologies (LCTs); choosing to use electricity to power their vehicles and heat their homes, and in some cases generate and store electricity at home.

Together, these two developments create increasing demand for electricity and more intermittent supply – a mismatch that needs balancing. In response to this challenge the landscape is changing:

- Digitalisation is facilitating the wider penetration and integration of Distributed Energy Resources (DER) creating more energy flexibility in both supply and demand.
- Commercial developments such as the emergence of aggregators and local flexibility platforms are creating market signals to change supply and/or consumption patterns in response to system needs.

As part of these changes Local Authorities are expected to take a greater role in local energy planning. Powered by political ambition for Net Zero and funding from central government, these public bodies are having a greater influence on heat networks, electric vehicle (EV) charging points and large scale development of electrical heating to replace gas boilers.

These developments lie at the heart of what is driving our transition to fulfil the functions of DSO: efficiently balancing our network using both flexibility options and conventional reinforcement means, while working in coordination with a broad range of stakeholders to plan our network and ensure provision of services that benefit everyone.

## Regional dynamics

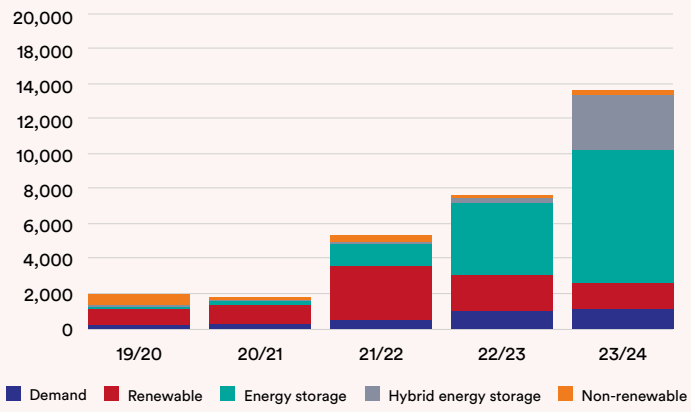
These changes are already happening in our region. We already have over 5.2GW of generation connected to our network and over the past year have seen 66,000 new EVs, 1,600 public charging stations and over 4,500 heat pumps connected to or installed on our network. At the same time, we are seeing a rising appetite for major connections, particularly renewable generation and storage (see the chart below).

The region we serve is diverse, comprising of large cities, two major ports, post-industrial and historic towns, coastal communities and vast swathes of rural areas across Yorkshire, the North East and Northern Lincolnshire. The communities we serve all have their own specific characteristics, Net Zero ambitions and local networks that have developed over the years.

The North East and Yorkshire have a strong industrial heritage. Over the last 20 years we have seen this traditional heavy industry winding down, while at the same time distributed generation has been connecting in increasingly significant numbers. As a result, by 2030 we expect to be a net exporter to the grid. Our network development planning and flexibility needs will, therefore, be different to other UK networks.

With energy consumption predicted to double by 2030, our key challenge in the short term is to use the network capacity we have as efficiently as possible, whilst creating efficient long-term plans that meet our region's needs.

### Major connections offers accepted - >1MVA



## Case study: regional variation in the uptake of flexibility services

We have jointly commissioned a research report with Electricity North West (ENWL), engaging the consultancy WSP to investigate regional variation in the uptake of flexibility services.

Through data analysis, market research, expert input and targeted stakeholder interviews they concluded that there is clear regional variation that risks becoming embedded in flexibility markets. The main findings being:

**DNO regions are not homogeneous -** Each has their own unique characteristics and issues they must manage and there are a range of regional factors driving the variation:

- Geographical - The vast majority of Northern networks' requirements are in rural areas. Reinforcement costs can be lower in rural areas and thus ceiling prices for flexibility services are lower, leading to lower participation from flexibility service providers (FSPs).
- Socioeconomical - Average incomes are lower in our regions, which will affect the uptake of LCTs that could be used flexibly. The number of plug-in EVs per 100,000 population in these regions are among the lowest in the UK and a significant majority of UK public charge points are in Southern regions (less than 15% in the three Northern regions, despite serving roughly 22% of domestic customers).
- Technical - Capacity required to meet historical industrial demand is no longer being utilised, meaning flexibility is not needed to address constraints in former industrial areas. There are more forecast headroom violations in other regions, and thus pre-fault products and availability fees, increasing the potential earnings for FSPs.
- Commercial - Lower dispatch likelihoods in Northern regions influence potential FSP earnings, making other markets more attractive. Energy System Operator (ESO) products struggle to generate participation in these Northern regions, implying regional barriers beyond the DNOs' control and suggesting that revenue potential is not the only potential blocker. Early innovation funding helped establish Southern markets, which have continued to grow with ongoing FSP engagement.

Our region has seen a lower uptake of flexibility services due to geographical, socioeconomical, technical and commercial factors.

**Flexibility providers are not embracing Northern markets -** Currently, network needs are lower in our regions, and so flexibility markets are inherently smaller. Those needs that do currently exist are concentrated in rural areas, whereas provider availability is focused in urban areas.

The pool of potential providers is smaller, due to socioeconomic factors, low LCT uptake, and urban/rural spread of requirements not aligning to providers.

**Existing regional differences could become embedded in markets -** This regional variation will remain if not addressed, minimising the opportunity for the value of flexibility to be realised in Northern markets.

The research proposes a way forward; utilising the low-risk markets in the Northern regions for small scale, time limited trials for the implementation of market facilitation measures via a DNO forum led in tandem with Northern Powergrid and ENWL.

# Our customer and stakeholder needs

Through our extensive engagement we have a clear view of what our customers and stakeholders need from us. This has helped us to shape and deliver our plans over the last year and prioritise our roadmap moving forward. They told us to:

**Collaborate and support planning**

- Engage early - They want a clear route into Northern Powergrid to discuss the "art of the possible", to find the best possible solutions at planning stages to reduce the need for participating in costly time-consuming processes which ultimately may not be successful.
- Co-create solutions - Stakeholders want to be listened to and to shape our response to their feedback.
- Share more energy data and information - Stakeholders want accessible data and expect us to take a leadership role in providing energy data to assist decision-making.
- Support local plans - Stakeholders asked us to participate in developing local Net Zero plans.
- Not underestimate the need for education and communication - Even across more mature and technically savvy stakeholder groups.

**Deliver a whole systems approach**

- Co-ordinate between DSOs and between DSO and ESO - They need a more co-ordinated and efficient energy system with consistency where possible across regions and nationally.
- Address transmission congestion and offer enhanced connections support.

**87%** of stakeholders think Northern Powergrid should be one of the leaders in the drive towards decarbonisation, using data and digitalisation to support.

**Facilitate and encourage flexibility**

- Invest in technology and automation to facilitate flexibility - Stakeholders were clear that investment in data and automation are key in maximising the future efficiency of DER utilisation in flexibility markets.
- Develop flexibility markets - Expert stakeholders suggested improving visibility of future opportunities and standardising flexibility products.

**Be open and transparent**

- Stakeholders want openness and transparency - Gives them confidence perceived conflicts of interest are managed.
- Increase transparency - To give customers and stakeholders confidence in flexibility, investment and curtailment decisions.
- Define DSO benefits - Stakeholders want clarity around the benefits of DSO and what a smarter, more flexible energy system means for them.

In addition to these overarching themes we understand that individual stakeholders have different needs driven by their own geography, their own organisational goals and dynamics and their strategic role in the value chain.

Through our personal development we have sought to better understand and capture the breadth and depth of these differences within and between our key stakeholder groups. This more granular level of insight helps us to engage with our stakeholders with a better understanding of some of the challenges they face and what is driving their needs.

# DSO strategy

**Paul Glendinning,**
Director of Energy Systems

"We have established the Energy Systems directorate to create a focal point for DSO which will collaborate with our customers and stakeholders to enable Net Zero. We will understand regional ambitions for decarbonisation and use that insight to shape our plans for network investment and market development, leveraging stakeholder insight alongside our deep understanding of our distribution network.

We have made incredible progress over the past year, creating a clear foundation for delivering a smarter and more flexible network at the pace that our region requires. We have developed our flexibility market, have significantly increased the sharing of network data and have made the largest changes in decades to enable faster network access for larger generation customers. We are dedicated to enabling Net Zero at the pace our region requires in order to keep costs as low as reasonably possible for customers."

Our DSO strategy allows us to turn our vision into practical steps that satisfy customers' and stakeholders' needs while generating significant benefits. It is rooted in the context of our customers, our region, and our network.

## Our DSO journey, shaped by customer needs

Since we began the DSO journey more than five years ago we have been engaging extensively with our customers and stakeholders about our plans; refining and adapting them to meet their needs. In addition to shaping the future with our stakeholders we made significant early investments and steps forward towards our vision ahead of the ED2 period. Our Customer-Led Network Revolution project was one of the first and most significant UK smart grid projects ever undertaken; it was a £31m four year project that generated learnings which we used to inform our DSO approach. In 2014 this led to the smart grid enablers programme, which transformed our ability to monitor, control and communicate with more than 860 major substations, giving us greater ability to control and analyse how our network is operating in real time. We also delivered and started operating ANM schemes on our network to manage constraints flexibly.

As we embarked on ED2 we made a key change to our plans. Based on the clear appetite for new network access in our region, the value that flexible connections will deliver, and the synergies with customer flexibility, we made the decision to incorporate our Major Connections business into our DSO functions.

We have continued to refine and evolve our plans through engagement with our stakeholders. As we progress, learn and mature together we have been able to discuss our plans and priorities at a more granular level as well as ensuring we are still moving in the right direction. In 2023/24 we have engaged over 1,600 stakeholders. We published our "Advancing our DSO Implementation Plan" document in 2023 and consulted our stakeholders. In the final DSO Implementation plan published in March 2024, responding to this feedback, we re-prioritised and accelerated areas of our roadmap. This included creating more focus on providing tutorials and explainers around our data, prioritising and accelerating enterprise ANM and growing our Regional Insights team.

**2018**

**DSO Emerging Thinking**

Our early thinking on how we unlock the benefits of an energy system through DSO.

**2019**

**DSO Development Plan**

An updated vision and direction for DSO as we engaged on our RIIO-ED2 plans.

**2021**

**RIIO-ED2 plan - DSO Strategy**

Our RIIO-ED2 plan set out a clear strategy for delivering system operation for our region.

**2023**

**Advancing our DSO Implementation Plan**

We engaged on our DSO Implementation Plan and sought stakeholder feedback to ensure it meet stakeholders' needs.

Stakeholder feedback

**2024**

**DSO Implementation Plan**

Our plan sets out how we will move DSO forward in 2024/25 and the actions we will deliver to meet our stakeholders' needs.

## Our DSO strategy

Our DSO strategy and implementation plan are aligned to the roles and functions set out by Ofgem, ensuring our DSO strategies, plans and performance reporting are as coherent and accessible as possible for all our stakeholders. The strategy is composed of principles, actions and enablers.

**DSO benefits**

- Investing efficiently to keep transition costs as low as possible
- Unlocking cost savings
- Maximising value of existing infrastructure
- Quicker connections
- Open revenue streams for customers

| DSO vision | Model to deliver DSO | | | | |
|---|---|---|---|---|---|
| DSO principles | Flexibility first | Whole system collaboration | Data and digitalisation | Openness and transparency | Just transition |
| DSO actions | Data capture | Analysis capabilities | Open data and joint planning | System operation optimisation | Customer flexibility |
| DSO enablers | Customer, stakeholder engagement | Digitalisation Strategy and Action Plan (DSAP) | Operating model and governance | Workplace and workforce | Innovation |

The principles within our strategy set out how we will achieve our vision, delivering a framework that shapes our approach to DSO at a strategic and everyday level:

- **Flexibility first** - Develop and deploy agnostic flexible solutions as an alternative to network reinforcement where it is economic and efficient to do so, ranging from smart network solutions to dispatchable generation and customer flexibility services. Promote and establish deep and liquid markets for flexibility alongside investment in systems and processes that enable growth in our use of flexibility as the markets mature.
- **Whole system collaboration** - Enable whole energy system solutions by engaging with the wider market on our network investment, system management, and flexibility requirements and capabilities.
- **Data and digitalisation** - Facilitate fast, efficient and optimised decarbonisation through open data, insight capability and digital tools, without losing sight of data safety and security. Invest in software and hardware that allows us to closely monitor the network, capture more relevant data and execute solutions to constraints as they materialise.
- **Openness and transparency** - Earn trust through open and transparent decision-making by publishing our investment decisions and flexibility needs and procurement results, and collaborating in joint planning with our local stakeholders.
- **Just transition** - Strive to ensure that customers are empowered to participate in a smarter and more flexible energy system, and adverse impacts on vulnerable customer groups are mitigated to make sure that no one is left behind in the ongoing energy transition.

The strategy is delivered through five groups of material actions that introduce, establish and refine the systems, processes, skills and capabilities needed to achieve our vision and fulfil our role in the energy system transition.

Our actions are informed and shaped by the DSO principles. The progress made in delivering these actions over the first year of ED2 is the focus on this submission and will be presented in detail across later chapters.

# DSO strategy in action 2023/24

Whilst our overarching strategy has remained largely unchanged since our RIIO-ED2 business plan was submitted there are areas where we have adapted our approach and prioritised delivery based on stakeholder needs and regulatory changes.

**These include:**

- We were early (October 2022) to establish and resource our Energy Systems directorate, which has clear accountability for key DSO functions.
- The Major Connections team and associated supporting functions have been embedded within the Energy Systems directorate. This was a key change from our original plan, acknowledging the growing demand for connections in our region and the synergies between connections and DSO functions.
- We have accelerated recruitment and the upskilling of our teams in the skills needed for successful DSO delivery, with an emphasis around commercial skills, data and analytics.
- Transmission system congestion is a major issue for our customers. From a whole systems perspective we are working closely with the ESO and National Grid Electricity Transmission (NGET) around transmission congestion and reform, collaborating with them to develop solutions including delegated technical limits. We are also collaborating closely with other DNOs through the Energy Networks Association (ENA) to reform the distribution network connection queue. We have created nine new roles to address transmission congestion. We are also working with ESO to develop our 2024/25 deliverables.
- Increasing the scale, depth and breadth of our DSO engagement programme in order to gather detailed insight and be responsive to our customer and stakeholders needs.

## Stakeholder voice at the centre of our plans

Our stakeholder engagement is critical in identifying, understanding, meeting and balancing our customers' needs across the design and delivery of our DSO programme.

### Our open and inclusive engagement programme

Our DSO engagement programme is extensive, multi-channelled, and tailored to reflect the breadth and depth of the DSO programme itself and the importance of stakeholders in shaping, co-creating and participating in our work. Opposite, we set out some of our key approaches and channels.

- **Core strategic engagement** - We have engaged with over 300 stakeholders through our bi-annual regional Net Zero for the North Conference and quarterly DSO stakeholder forums. These events have allowed us to share our progress and plans and hear from our stakeholders about what they need from us.
- **Issue specific engagement** - We tailor engagement around specific issues to facilitate deeper engagement, this is outlined throughout this report.
- **Established stakeholder groups and forums** - We have engaged with over 150 stakeholders through existing and newly established groups to engage a wide range of stakeholders around DSO and Net Zero including the Stakeholder Panel, Citizens Panel, Social Housing Decarbonisation Group, Community Energy Forum and Stronger Together Partner Forum. We also conducted the third and fourth waves of the LCT tracker research which engaged around 2,500 domestic customers to monitor their attitudes to LCTs and wider Net Zero issues.
- **Regional engagement** - Our Regional Insights team engages continually with key regional stakeholders, including Local Authorities, mass LCT installers and housing authorities to understand their strategic plans (see Page 10). Over the last year we also engaged with over 400 stakeholders through six regional workshops, both online and face-to-face to gather localised insight and better understand the different stakeholder needs within the regions we serve.
- **Holistic engagement and collaboration** - To reduce stakeholder fatigue and reach as wide an audience as possible our activity includes: industry collaboration on key issues through groups like the Open Networks working groups and our joint research with ENWL; delivering joint engagement, for example working with ESO and NGET to collaborate around transmission congestion, the Open Networks stakeholder events, and our regular quarterly cross-utility forum; and engaging with Local Authorities and other regional stakeholders alongside other utilities in our region like Northern Gas Networks (NGN) and Cadent.
- **Increasing our reach** - We have been actively participating in conferences, events, panels and groups led by other organisations. For example: the NGET Pathway to Net Zero Stakeholder Workshop, the Open Innovations Open Data Showcase, the Oxford Energy Innovation Forum and the EnergyXtra conference.

## Case study: increasing our understanding through stakeholder personas

This year we have developed 11 stakeholder personas reflecting our key DSO groups. These groups are Distributed Generation and Battery Storage, Flexibility Providers, Flexibility Aggregators, Commercial and Industrial Customers, Local Government, Great Britain's System Operator, Gas Distribution Networks (GDNs) and wider utilities, Research and Insight Bodies, Community Energy, Domestic Customers and Vulnerable Customers.

We developed these personas by synthesising a wealth of existing insights from engagement reports, transcripts, and input from Northern Powergrid colleagues, and tested and refined them through one-to-one interviews with our stakeholders.

We have aggregated and abridged the personas in our DSO Implementation Plan, however there is an additional wealth of insight around their motivations, regional considerations, pain points and engagement needs that sits behind this.

There are clear similarities between some of the stakeholder groups, particularly in terms of the DSO products, data, and services they need. Nonetheless, by understanding the differentiators across and within the groups, we are able to better engage with them and tailor our support. Our 11 separate personas are already helping us to shape our DSO plans, and our delivery of products, data and services which respond to different stakeholder and customer needs.

## Case study: tailored engagement for key stakeholder groups

Whilst some stakeholder groups are already actively participating in DSO activities, others need specific tailored support to meet their levels of knowledge or distinct DSO needs. Two examples of this include:

- Social Housing Decarbonisation Group - Established in 2023 to bring together social housing representatives, the aim of the group is to discuss the common challenges they are facing in decarbonising their stock and to create a forum for regular engagement with the Regional Insights team. The small roundtable format enables in-depth discussions, shared learning and the ability for us to identify areas for improvement. In 2023 key focus of discussions has been around de-looping services, available tools and data for multiple connections and streamlining processes for this key group.
- Enabling community engagement - We regularly engage with our community energy stakeholders to increase their awareness of and encourage their participation in DSO related activities. This year 90 stakeholders attended our Community DSO consortium event, to hear about our Community DSO project and network with their peers around potential participation in the project. Partnering with Regen, we also run a regular forum to build the capacity and capability of this group covering generation, connections, demand side response and other key areas of interest. Our annual 'Net Zero Community Energy Fund' aims to build capacity and explore feasible community energy project ideas in the early 'at risk' stages of project development. It supports emerging community energy schemes with site identification, technical assessments, feasibility studies, community engagement and more. Eight successful projects were funded in 2023, enabling and encouraging Net Zero participation at a community level and helping to ensure a just transition.

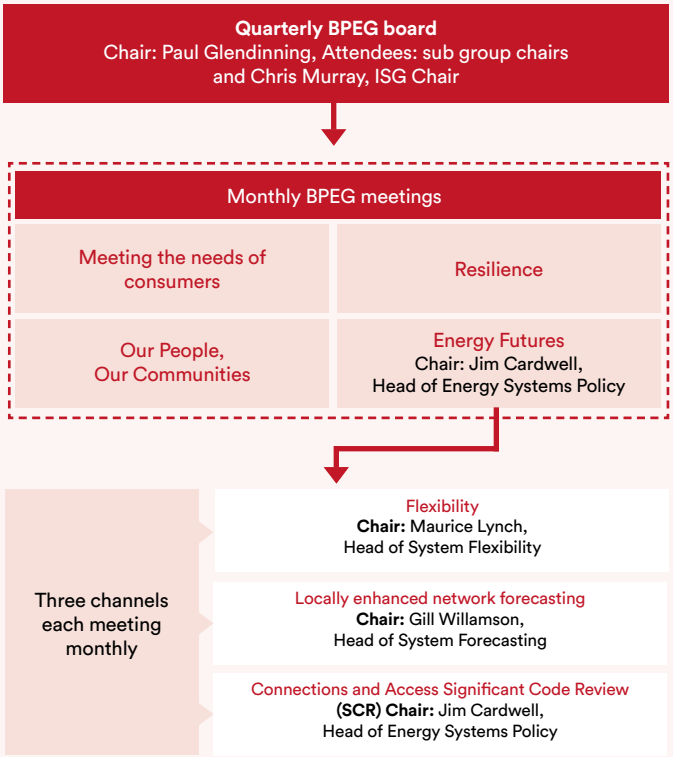
### Robust governance and challenge

To ensure that we are effectively listening and responding to our stakeholders and customers we have robust governance and processes in place. The Business Plan Engagement Group (BPEG) oversees the effective delivery of our yearly business plan, ensuring that stakeholder voice is firmly embedded within all our priorities, investment decisions and future plans.

**The BPEG role is to:**

- Ensure that the commitments we made in our business plan to stakeholders are upheld and to provide a platform for stakeholder voice to influence the prioritisation, variation and delivery of these commitments.
- Assess emerging stakeholder priorities and recommend how and when they should be addressed in annual business plans or future price controls, aligning with existing processes.
- Provide a window for the Independent Stakeholder Group (ISG) to scrutinise our delivery of the commitments in our business plan, to assess and report on the quality and scope of our stakeholder engagement and the extent to which our findings are reflected in our work.

Due to the scale, pace, depth and breadth of the engagement activity and resulting insight in the DSO area, in addition to the Energy Futures BPEG, three channel meetings have been established. Allowing us to fully review and respond to stakeholder insight; with the right colleagues in the room ensuring accountability for action. Jo Coleman, chair of the DSO Review Panel, and Graham Oakes, expert member on the ISG, observe and comment on our engagement for Energy Futures. This policy allows the ISG - which are fully integrated in the BPEG process - to observe and challenge our responsiveness to stakeholder needs at source.




## Operating model and governance

In order to create a focal point for collaboration with our stakeholders and system users, and for broader engagement with the industry, we have created our Energy Systems directorate. This has drawn together important existing functions such as Stakeholder Engagement and External Affairs and Innovation, and aligned them with the newly created DSO functions.

Importantly, we have integrated our Major Connections business within the Energy Systems directorate, recognising the intrinsic role that we have in enabling Net Zero by getting LCTs, generation, and large-scale decarbonising industry connected to our network.

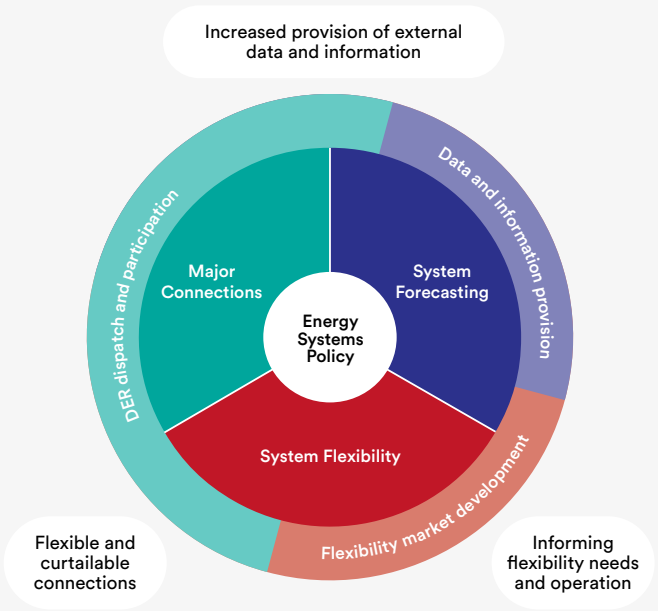
Our Director of Energy Systems has clear accountability for the DSO functions of System Forecasting, System Flexibility and Energy Systems policy and, through creating this structure, clearly separates key DSO functions from core traditional DNO functions of network reinforcement design and investment planning.

Each team plays a vital role, operating interdependently from one another to create a key business unit, equipped to effectively navigate an efficient and affordable Net Zero transition for our stakeholders and customers.

To ensure we are creating and maintaining stakeholder trust, in addition to our organisational structure we have a robust set of governance frameworks in place, supported by internal and external challenge and scrutiny of our DSO functions.

This is further explored in the 'Options assessment and conflicts of interest' section on Page 22.

### Our model to deliver on distribution system operation




**Our core teams focussed on distribution system operation are delivering on Ofgem's defined roles.**

## Workplace and workforce

Having the right people, with the right skills, in the right roles, is critical to the success of the DSO transition. This particularly rings true in the context of the transition's complexity, standing at the intersection of policy, engineering, digitalisation and market design.

We are building a team to develop and operate new systems and processes, anticipating that our Energy Systems directorate will grow to over 100 colleagues by the end of the year. This is underpinned by an explicit focus on diversity and inclusion – we are proud signatories of the 'Energy Networks Diversity, Equity and Inclusion Charter' and are committed to playing our part in building a more inclusive UK energy sector.

We continue to strengthen and grow the DSO functions, with a focus on developing the required skills and capabilities that haven't traditionally existed within network companies. In our DSO strategy we identified skills gaps in areas including: risk based decision-making; coding and scripting of power system tools; energy markets and trading expertise; and data science and analytics. Over the last year we have identified that relationship management is another key skills area required, and we have been recruiting in order to meet our stakeholders needs for collaboration, planning, education and support.

We are meeting these skills gaps through an organisational focus on recruitment and upskilling. We upskilled our existing employees through training and education, maintained existing skills with continuous development, and recruited new personnel with relevant technical, commercial, and relationship management skills. For example, we adapted our technical graduate training programme to ensure that we develop non-operational engineers that can deliver the range of DSO skills.

### Case study: developing DSO organisational capability

Throughout 2023 we have worked closely with our Science and Technology Advisory Panel and Digital Catapult, an organisation at the forefront of advancing digital technologies.

The project objective was to review our ED2 commitments, identify gaps in organisational capability and skillsets, and scope out potential innovation activities to enhance organisational capacity for DSO data capture, analytics, and energy system planning.

Examples of the project outputs were:

- **Gaps in data exploitation capabilities:** We identified where there were gaps in our technical capabilities that have allowed us to move into 2024 with no-regrets decisions on next steps on underpinning technical solutions, for example, analytics capabilities.
- **Proposed data tools:** As we began to understand the no-regrets decisions, we were increasingly able to get to grips with the toolset that will fulfil them on an enduring basis.
- **Organisational capabilities:** The Digital Catapult team observed that, with the enabling tools and training, Northern Powergrid colleagues could easily begin to use advanced analytics.

# Estimated future benefits of our DSO programme

Our DSO plans for RIIO-ED2 and beyond show significant upside for both our customers and society at large. These have already started to be realised through the work we have delivered over the past year (for more information on this, please refer to the 'Summary of DSO benefits delivered over the past year' section of our submission). Here, though, we take the opportunity to highlight the anticipated full impact over RIIO-ED2 and beyond.

We recently commissioned a 'DSO cost benefit analysis' via an independent consultancy to articulate the benefits expected to materialise. The cost benefit analysis (CBA) was developed by employing methods that are aligned with Ofgem's RIIO-ED2 CBA guidance and HMT Green Book. It is based on an assessment of the investment costs associated with central systems, people and capabilities, in addition to the ongoing incremental investment to deliver our DSO strategy and vision.

The analysis is summarised by the following headline figures (under the central CBA scenario):

| | |
|---|---|
| **£1.1bn** | A net present value (NPV) to 2040 of our DSO plan in the region of £1.1bn. |
| **£299m** | A NPV over RIIO-ED2 of £299m. |
| **£501m** | £1.59m of benefits realised in 2023/24, with a further £501m of benefits 'unlocked' (i.e. provided we continue to use our current capabilities to procure flexibility services, optimise our reinforcement, and offer flexible connections). |

**In determining the NPV figures, the following benefits of DSO have been considered:**

- **Flexibility procurement and dispatch:** The development and deployment of flexibility services, where it is economically efficient to do so, to defer network reinforcement.
- **Flexible connections:** Offering customers a faster and more efficient connection in constrained areas of the network to defer/avoid reinforcement.
- **Network visibility:** Utilisation of Low Voltage (LV) monitoring and smart meter data to provide better visibility and understanding of the LV network, enabling efficient network operation and investment planning.
- **Voltage optimisation:** The use of smart meter data to safely reduce the supply voltage that customers receive (therefore reducing energy bills and network losses).
- **Microgrids:** Enabling decentralised groups of electricity sources and loads to either operate in island mode or to connect to the local grid to improve resilience.
- **ESO cost savings:** Enabling increased competition to wider markets, helping to drive down the costs paid for services.
- **Faster connection of distributed generation:** Enabling the carbon benefits associated with accelerating the connection of renewables on the distribution network.
- **Embedded carbon savings from avoided/deferred reinforcement:** Enabling the carbon benefits associated with deferred/avoided reinforcement.

Moreover, sensitivity analysis shows that this positive case is robust (even when 20% reductions are applied to key drivers).

Crucially, our DSO plan sees us invest at a pace that is right for our network and region. Even though current flexibility procurement opportunities are limited in our network area (please refer to the 'Our customers and region' section), we are developing the processes, systems and skills to enable flexibility as load growth accelerates with significant benefits forecast to materialise over the short, medium and long-term.

# Delivering the DSO transition over 2023/24


Over the past year, we have laid a solid foundation for our DSO transition, marking a period of remarkable progress and change. DSO is driven from our Energy Systems directorate, but we take a whole company approach to delivering the functionality, drawing on our Information Systems, Engineering and Field Operations colleagues to provide an overarching transition to system operation. Our customers' and stakeholders' needs, shaped by the unique challenges and characteristics of our region, drove our actions towards facilitating a timely and cost-effective transitions to Net Zero.

This document presents an overview of our progress in delivering our DSO strategy, the impact of key achievements on our customers, stakeholders and communities and our future plans. Our activities are presented around four distinct functions that collectively form the backbone of our DSO role. The execution of each function is then organised in specific areas of focus with customers' and stakeholders' needs as well as the remit defined by Ofgem.

The delivery of DSO activities is further enhanced by synergies that we can exploit from the integration of the Major Connections function along with key DSO functions. While Major Connections is not the focus of this document, we describe the important role that this integration has in delivering optimal outcomes.

We present the significant developments under each function in its own dedicated section. For each section we begin with a summary including an overview of the impact of customers' and stakeholders' feedback in shaping key initiatives and the benefits these delivered over the past year and unlocked for the future.

Beyond our Energy Systems directorate, the DSO transition impacts our Information Systems directorate who are driving Data and Digitalisation, our Engineering directorate who are a key interface in network planning and smart solutions and our Field Operations directorate where we consider the control implications of deploying more flexibility on our network. We take a whole company approach to DSO functions, led strongly by the Director of Energy Systems and our core DSO functions.

## Delivery of DSO activities

| Data and information provision | Flexibility market development | Options assessment and conflicts of interest mitigation | DER dispatch and decision making frameworks |
|---|---|---|---|
| Collecting and sharing data | Standardising flexibility products, contracts and processes | Identifying, assessing and implementing network options | Establishing the dispatch infrastructure |
| Ensuring data quality | Developing the flexibility market | Cross-sector engagement | Developing decision-making processes |
| Making data accessible | Facilitating market access | Managing conflicts of interest | Establishing DER dispatch enablers |

**Major connections**

## Key achievements over the past year

| | | | |
|---|---|---|---|
| Recognised for close collaboration and data sharing with key regional stakeholders through our Regional Insights team | Successfully procured flexibility services on all low voltage network constraints tendered, proving the use case and creating opportunities for consumers to participate in flexibility | The first DNO to establish an independent review panel, chaired by Jo Coleman, creating clear accountability to our stakeholders | Development of visibility and control and flexible connections as a solution to transmission congestion, making 33 offers reducing lead-times by six and a half years on average |
| Significant expansion of data available through the Open Data Portal, with 56 datasets available for stakeholders, driving a 15x increase in the use of our data | Deferral of £1.2m of network reinforcement through procurement of flexibility services | Published our first Distribution Network Options Assessment report and methodology, providing transparency on our decision-making process | Over 500MW of flexible connections operating on our network through ANM with minimal curtailment to generators. A further eight ANM zones are planned for delivery over the next three to six years |

# Data and information provision

## Sharing data, information and insight ...

A timely and cost-efficient transition to Net Zero is built on data. Increased flows of granular data are redefining the way we plan for the future and manage everyday activities. At the same time, the data and insights we collect and share with our customers and stakeholders are shaping their operational and strategic decision-making. We have designed and deployed a three-pronged approach to data and information provision; in this section we present our progress and achievements for each element of our delivery approach.

| Collecting and sharing data to inform decisions made by our teams and stakeholders | Ensuring data quality accuracy and completeness to support sound data-led decision-making | Making data accessible through appropriate formats and channels, identified by users |
|---|---|---|

## ... with our stakeholders to facilitate and enable their own decarbonisation activities and decision-making ...

We have proactively and extensively engaged with over 650+ stakeholders this year; to understand their requirements, and to co-develop solutions and products that meet their needs and shape our future plans.

| Customers' and stakeholders' needs | Our progress over the last year |
|---|---|
| **Share data and insights**<br>Provide our stakeholders with accessible self-service tools to access and utilise our data | — Introduced the Open Data Portal and the Local Authority Portal, co-designed with users and experts to ensure accessibility and streamline user experience |
| **Collect and share quality data**<br>Share data that our stakeholders trust and can leverage to support their own decarbonisation plans | — Published 56 open datasets - more than doubling our previous data set availability, providing raw data, meta data and intuitive models like our Distributed Future Energy Scenario (DFES) interactive visualisation tool<br>— Invested in network monitoring technology to increase and improve the data we have available, informed by stakeholder needs<br>— Developed tools, processes and systems to ensure the quality of data collected, used and shared, including our Data Triage process |
| **Help stakeholders understand and use our data**<br>Develop support to help our customers and stakeholders derive maximum value from our available data | — Established a Regional Insights team to proactively support local stakeholders in leveraging and informing the data we share<br>— Developed and delivered guides, training and workshops to support customers and stakeholders in using our data |

## ... to deliver benefits for our customers and the wider energy system.

The steps taken to develop our data and information provision have already delivered material benefits, and have unlocked key future benefits that will accrue over the coming years. These benefits include...

### Benefits delivered over the past year

The installation of 1,550 LV monitors over the past year has already delivered a benefit of over £400k by deferring unnecessary reinforcement

### Benefits unlocked by our actions

The installation of over 3,900 LV monitors to date, including those installed ahead of the RIIO-ED2 period, will lead to a further £12m in gross benefits up to 2040

£58m Local Electric Vehicle Infrastructure funding secured by stakeholders for the region by providing data to assist Local Authorities with their funding applications

### Unquantified benefits delivered by our actions over the past year

Aligning strategies, asset and investment plans to network capacity and flexibility opportunities to unlock revenue streams while generating value for the wider system

Assisting decisions on new or additional connections for generation and demand assets, lowering costs and speeding up connection timelines

Enhancing the accuracy of hyper-local scenario modelling and energy planning

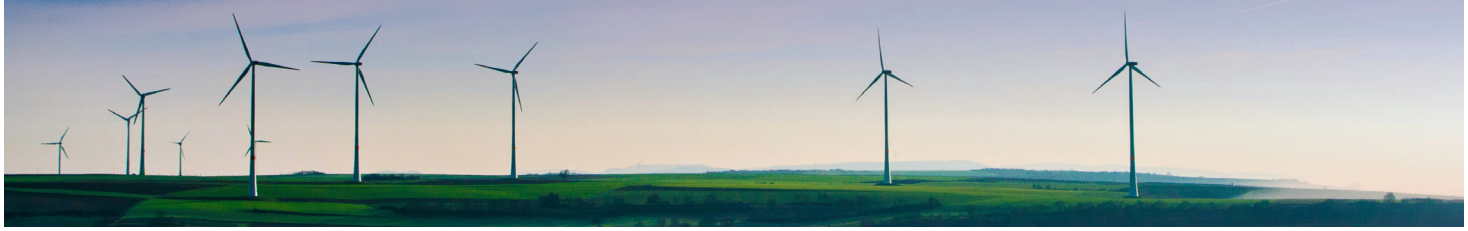
Securing funding applications for decarbonisation projects

# Case study: regional insights and data sharing

Close coordination between local and national governments, energy networks, suppliers, customers, and other key Net Zero stakeholders is essential to achieve an effective and efficient energy transition. Many Local Authorities are driving Local Area Energy Plans (LAEPs) requiring significant collaborative planning between stakeholders to agree on the long-term, cost-efficient decarbonisation in a community across all vectors of the system: heat, electricity, transport and supply.

We play a key role in enabling decarbonisation across the 36 local, unitary and county councils, six combined authorities and four Local Enterprise Partnerships we proudly serve. Recognising this role, we have built on our extensive engagement with local government over the process and established a Regional Insights team.

The Regional Insights team's role is twofold. They work closely with Local Authorities, using Northern Powergrid's knowledge of the network, loading projections, customer activity and the wider environment to inform local decarbonisation plans. They also inform our network planning teams by generating better and more comprehensive local insights, utilising evidence and data on regional decarbonisation plans. The two-way flow of data and information is critical to achieving success. This key channel of engagement also extends to key regional Net Zero stakeholders such as housing associations deploying large decarbonisation programmes and electric vehicle charge point operators deploying units in our regions.



**76%** of stakeholders agreed or strongly agreed that the Regional Insights team's engagement has been, or will be of value to them or their organisation.

**92%** of stakeholders support Northern Powergrid investing in developing the Regional Insights team in the future.

## Local Authority Portal – a tailored data-sharing platform

Given the complexity, breadth and depth of the collaboration with local government to shape and understand their future plans, and the extensive stakeholder feedback asking us for ways to share data via easy-to-use tools and processes, we established the Local Authority Portal. This tailored data-sharing platform builds on the success of our Open Data Portal.

Developed in collaboration with Local Authorities, Combined Authorities and Local Enterprise Partnerships, this portal greatly enhances the two-way data exchange with specific focusses on decarbonisation plans, local network infrastructure and connections feasibility assessments – three key concerns for these specific stakeholder groups. This tool:

- Offers a dedicated environment for secure, two-way data exchange between Northern Powergrid and each Local Authority partner separately, allowing straightforward collaboration whilst maintaining strict data security requirements.
- Provides local government with access to specific datasets in formats tailored to their specific needs – such as GIS spatial data, allowing a cross-check of proposed EV charge point connections to secondary substations. This is a dataset not currently available via the Open Data Portal and allows the identification of viable connection points for their projects.
- Gives access to guides and specialised tools designed to assist Local Authorities in designing and implementing decarbonisation plans, such as the 'LCT Connection Guides' and the 'LV Mains Quick Assessment Tool'. These guides upskill Local Authority colleagues, enabling them to interact with the DNO and their technology suppliers and installers on a more informed basis. The LV mains quick assessment tool allows them to do high-level optioneering on mass LCT rollout, providing intelligence on likely cumulative impact of the connections they are planning, and providing some insight into indicative timelines. All of this pre-application support reduces the timelines between application and delivery, by avoiding iterative conversations about incomplete information, or reducing the number of iterative applications required to build a mass LCT project pipeline that is deliverable within tight funding timescales.

## Enabling localised decarbonisation

By providing our stakeholders with powerful and tailored data products and a dedicated team, we are empowering them to design more effective and efficient decarbonisation plans tailored to the unique characteristics of their community.

This year the team have supported a raft of local stakeholders on a range of decarbonisation activity:

- In Newcastle, our teams assisted the city council in building their digital twin project which used network data provided through the Local Authority Portal to guide the development of their decarbonisation plans.
- In Bradford, our Local System Planning Engineers worked with the council to help them understand the cumulative impacts of their residential and employment land allocations on our network, and in turn assess the feasibility of their Local Infrastructure Plan.
- Across the region we trialled an approach to capturing 'Local Authority Intelligence' for our DFES. We tested new technology that automatically captures locations, sizes, and timelines for the connection of 115 potential projects across nine Local Authority regions. The scheme informed our forecasts of the specific location and details of at least 23,000 new homes, 47 large non-domestic schemes (including hydrogen, electrolysers, warehouses, factories and leisure facilities) and 2GW of generation and 350MW of battery storage. This technology means we can forecast our network needs accurately at a more localised level and influence our DFES. In turn, it can further enhance our offerings to stakeholders through a better network intervention process, facilitating quicker connections and helping our stakeholders with their planning, all with minimal effort on their part.
- We supported many Local Authorities in accessing Local Electric Vehicle Infrastructure funding, with £58m secured in the region. The team delivered a workshop to support the current year's funding applicants, sharing learning from previous successful bids.
- We actively participated in the development of the Calderdale LAEP for which we sit on the steering group shaping their government-funded decarbonisation plans.

# Case study: Open Data Portal

Stakeholders want accessible data and expect us to take a leadership role in providing energy data to assist in their decision-making. Our Open Data Portal (System Visualisation Interface) is the centrepiece of our strategy.

## Delivering an extensive and intuitive data-sharing platform

We have developed our Open Data Portal; a comprehensive online portal offering easy access to a range of our raw datasets and information in relation to planning, operational and market roles. The Portal is designed to make it as easy as possible for stakeholders to access our datasets, which are grouped according to themes and keywords. The Portal contains 40 fully open datasets (with another 16 available through registration), structured according to four themes selected based on how our stakeholders told us they align; Connecting Demand, Connecting Generation, Net Zero Future, and Network. For instance, in 'Connecting Generation', there are nine datasets, including 'heatmap data – generation', and our 'Embedded Capacity Register (ECR)' for both accepted generation and storage over, and under, 1MW. For each dataset, comprehensive data tables, and wherever possible, data maps are offered for ease of data visualisation.

> "The Open Data Portal is perfect for that [planning] as the datasets in there allow you to see what is going on regarding heat pumps, take all the info using artificial intelligence and put it together like a human, with data to back it up"
>
> - Participant at Net Zero for the North

Our Network Availability Heat Maps are also linked directly within the Portal, which indicate where network capacity exists for customers to connect new large-scale generation and demand without requiring significant network reinforcement.

We offer heatmaps covering 132kV, 66kV, 33kV, 20kV and 11kV networks across our licence areas, providing high-value information for customers to use to inform where to connect. Our extensive data provision is designed to deliver network visibility and data availability for our stakeholders.

### Open Data Portal: themes and example datasets

| | | |
|---|---|---|
| 67% | Connecting Demand | ↗ |
| 54% | Network | ↗ |
| 46% | Net Zero Future | ↗ |
| 70% | Connecting Generation | ↗ |

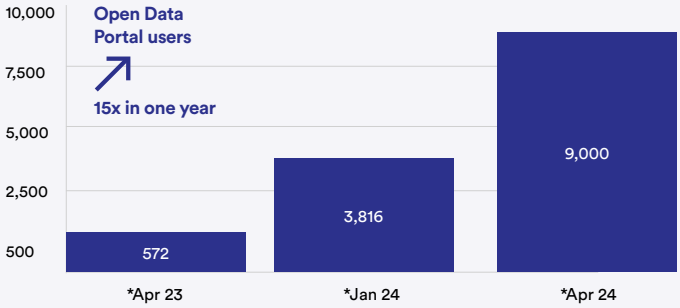
↗ Stakeholder engagement: identification with theme

Since its launch, we have seen significant traffic on the Portal. Usage has been growing rapidly over the last year in part driven by our stakeholders' increasing familiarity with the platform – the focus of our engagement and guidance – and also by our publication of a greater number of datasets which our customers have told us they want access to. We have been encouraged to see that these datasets have been making a real difference to users through direct feedback from them and proven out in the numbers, with a peak in the number of dataset downloads registering at 16,112 in July 2023.

In order to ensure the security of our data whilst still encouraging openness, we implemented a new policy requiring user registration to access certain data on our platform in January 2024. This change from allowing fully open access to requiring registration for some datasets was made after careful consideration, and aims to improve traceability around who is utilising the data we provide.

We continue to improve the accessibility of the Open Data Portal to encourage more stakeholders to access and use our information (see the 'Making data accessible' section for more information).

### Open Data Portal - unique users




*cumulative for previous three months

## User-centric design

Our DSO stakeholders have been central to the development of the Open Data Portal. From its conception, we have worked closely with Brave and Heart, a user experience consultancy, putting user experience at the forefront of development. These valuable stakeholder insights have allowed us to co-develop the platform alongside those it is meant to serve and continue driving improvement.

We co-created the Portal through extensive and varied engagement channels including; in depth interviews coupled with user shadowing so we could see and learn from the customer experience, our Stakeholder Panel, stakeholder surveys, webinars and workshops with specific stakeholder groups to further understand needs at a finer level.

Opposite are some examples of the key insights we received through engagement, and the design outcomes that they directly influenced.

> "Newcastle City Council's Net Zero team have been engaging with Northern Powergrid for many years but more recently the development of the DSO function and the Regional Insights team has significantly deepened this collaboration. The Regional Insights team has been pivotal to progressing our decarbonisation plans and how the network can be best utilised. We have engaged with the team on a number of projects spanning from our Low Carbon Neighbourhood to EV Charging Infrastructure, helping connect our team to relevant colleagues at Northern Powergrid and providing data to improve our knowledge. This has provided an excellent foundation to plan for smart local energy systems. We have also engaged with the team on trialling new ways of evaluating capacity (like the LV Mains assessment tool) and supported the development of their LCTs information pack for other Local Authorities."
>
> - Rachel Somerville, Newcastle City Council

| Stakeholders shaping our Open Data Portal | |
|---|---|
| **We heard** | **We did** |
| Users want a well-curated Open Data Portal, with good supporting documents, a powerful search function, and different data formats | Implemented a key word search function; made export available in different formats; added the option to upload methodologies and supporting docs as attachments to datasets |
| Users wanted example data at a glance before deciding to download, and geographical data contained within relevant datasets | Users have the option to view data before downloading or exporting. The Open Data Portal also creates maps for any data that contains geographical information |
| Stakeholders want to be able to save and share their work, come back to it, and learn from others | We created 'Reuse' - an Open Data Portal feature allowing users to save, reuse and share their work with others in a collaborative way. See below for further information on Reuse |
| Users were unsure how up to date data listed on Open Data Portal is (e.g., capacity accepted/ still available becomes irrelevant) | Added update times into descriptions to give stakeholders an idea of how often that information is updated |
| Users are interested to find out everything possible about specific locations in order to make informed decisions for their business and customers | Long Term Development Statement (LTDS) appendix 8 on the Open Data Portal shows level of accepted and quoted design schemes down to primary substation level |
| Stakeholders wanted information on how we are working to use metadata within the Open Data Portal | We have begun incorporating metadata into the Open Data Portal to help users of all experience levels identify datasets they are interested in |
| Users wanted 'i' information buttons to better signpost what's behind some of the terms in the Open Data Portal | Added hover over pop-ups to give definitions embedded directly within the Open Data Portal on industry terms and names |

**89%** of stakeholders said that the Open Data Portal has been or will be valuable to them or their organisation.

**91%** of stakeholders can see a use case for their organisation to use Northern Powergrid's open data in the future.

# Collection and sharing of data

We have defined clear plans and are making good progress in collecting, using and sharing data. We aspire to provide data in a raw form, along with metadata that describes its content and quality, and aim to invest to make as much of our real-time data available as possible. By providing comprehensive datasets, we ensure data neutrality and enable stakeholders to conduct their own analysis and calculations.

All of our activity is underpinned by our data vision, outlined within our Digitalisation Strategy and Action Plan (DSAP), which is built on three foundational principles mapped to Ofgem's Data Best Practice (DBP) principles:

- 'Data is an asset': we take ownership and manage data as an asset.
- 'Data is FAIR (Findable, Accessible, Interoperable, Reusable)': we make it as easy as possible for everyone to find, understand and use our data, regardless of their experience.
- 'Data is shared and trusted': we have adopted a 'presumed open' approach, meaning that we will share all our energy system data and only restrict access when issues of privacy, confidentiality or commerciality require it.

## Collecting data for enhanced decision-making

Driven by our digitalisation strategy and stakeholder feedback, we continue to identify and set up collection pathways for datasets that have the potential to enhance our decision-making and provide value to those we serve. In 2023/24 we installed over 1,550 monitors, meaning we now have a total of 3,900 monitors on our LV network. These monitors are installed on ground-mounted substations with no customer disruption and capture a wide range of parameters (e.g. phase currents, voltage, temperature) that give us unprecedented information on these assets and the wider network. Smart meters capture some of the data valuable for understanding our LV networks, and as such we have designed our LV monitor deployment programme to prioritise areas with the lowest smart meter penetration.

Combining LV monitor data with smart meter data is revolutionising our approach to investment decisions and the provision of flexibility. For example, collecting and joining these datasets enhances the analysis of LV network capacity by providing a baseline for demand forecasting, gives us the ability to identify areas with a high penetration of LCTs and high losses, and provides insight into the capability of our transformers and cables.

Unprecedented network visibility, unlocked by LV measurements and smart meter data collection, is empowering our teams to make the most efficient use of our networks. For example, by safely releasing capacity from key assets, accurately determining where and when flexibility services must be procured, and defining the efficient need for network reinforcement.

In the past year, we have made great progress towards our target of installing a further 10,000 LV monitors in the ED2 period, and we were the first DNO to publish aggregated smart meter data. More comprehensive data, joined with the growing number of smart meters (currently 47% of all meters in our region) will continue to enhance these capabilities and lead to significant customer benefits.

### Measuring the benefits of LV monitoring

The installation of 1,550 LV monitors over the past year has already delivered an undiscounted benefit of over £400k. The installation of 3,900 LV monitors to date, including those installed ahead of the RIIO-ED2 period, will lead to a further £12m+ in undiscounted gross benefits up to 2040. LV monitoring data can be used to develop a more accurate understanding of asset utilisation and can lead to a more targeted investment approach that enables reinforcement to be deferred or avoided.

Comparing the data from these monitors against conventional statistical methods of assessing utilisation such as ACE49, shows that LV monitoring has avoided interventions at 205 ground-mounted transformers for which we would have normally reinforced. Using a unit rate of £63.25k/MVA, this has enabled an undiscounted benefit of £6.5m+.

Two-way data exchange and close regional engagement underpins our network planning approach for maximum customer benefit. Beyond network data, gathering insight on local decarbonisation plans and broader socioeconomic data ensures that our DFES factors in local plans and ambition, leading us to develop network infrastructure at the right place, at the right time.

> "It's understanding all of the issues Northern Powergrid have got as well, with transmission, legislation, work on the pipeline, all that makes up the timeline on what a development might take, its been really good to understand that and communicate it back to our investors. It's mutually beneficial because we have the ears to the ground on our level in our local area, so all the information we feed into them, it works both ways"
>
> - Stephen and Helen East Riding inward investment

## Case study - independent assurance and benchmarking

In 2024 we worked with The Open Data Institute (ODI) to benchmark our progress against their Open Data Maturity Model, helping to assess how well we publish and reuse data, and to identify areas for improvement. We continue to take forward their recommendations for further improvements.

> From our evaluation, it seems clear that Northern Powergrid is well underway to achieving their data vision, and has shown much progress over the past year. Overall, Northern Powergrid scored very highly across the key elements in focus for the open data initiative to date, and it is clear that Northern Powergrid is a strong supporter of an open and trustworthy data ecosystem in the energy sector. The organisation's strengths lie in both strong technical skills and robust approaches to data governance and management, including data privacy and protection."
>
> - Northern Powergrid Open Data Maturity assessment results

## Sharing data with customers, stakeholders and partners

Once collected, data is used widely by our team to drive long-term and immediate decision-making. Crucially, relevant data is packaged, cleaned, and shared proactively with all of our customers and stakeholders in a variety of accessible formats (discussed in the next section).

Customers and stakeholders require granular and timely data about our understanding of the network's requirements and how we plan to address them, via investments, flexibility, or whole-system solutions in the short, medium and long term. This understanding can lead to efficient decisions on investment planning, on demand and generation over the past year and participation in flexibility markets. To address this need, we share powerful datasets including:

- Distribution Future Energy Scenarios (DFES) - our DFES outlines a range of credible scenarios for the energy transition to Net Zero, based on how we expect customers to change their use and supply of electricity in the future. Our latest version, published in January 2024, takes an enhanced bottom-up approach to the model that leverages information collected from our stakeholders' and customers' plans. The DFES, available as a standalone tool on our Open Data Portal, offers a range of key parameters on technologies such as the uptake of EVs, heat pumps and domestic solar installations, and system characteristics such as battery storage capacity and peak demand growth as a percentage of substation capacity. Each parameter is provided across geographic (e.g. by substations or by Local Authorities), and temporal (every year to 2050) dimensions. The parameters we map as part of our DFES are driven by customer and stakeholder feedback and we expect to continue refining these based on what our users want and need.

  he DFES exemplifies our commitment to open data. The underlying data, information, and methodologies are thoroughly documented and presented to customers and stakeholders via an accessible GitHub repository, a dedicated webpage, and our Open Data Portal. Our projections are built on a two-way data exchange: local stakeholders provide insights into their decarbonisation plans, while our Regional Insights team shares advice and relevant data to inform the development of these plans. This collaborative approach helps us develop network infrastructure in the right place at the right time. For example, we have recently discovered that some urban primary substations will see more than a 10% increase in connected properties across the next seven years, leading us to target interventions in these areas that will deliver the necessary capacity to support our stakeholders' plans. In addition, it helps our stakeholders to model their future energy scenarios at a hyper-local level, shape Local Area Energy Planning, and support funding applications for decarbonisation projects.
- Network Development Plan (NDP) - presents details of our planned network interventions in the coming years. It provides stakeholders with insight into the available network capacities for new connections in terms of generation and demand headroom (available at supply points and primary substations) and information on key projects set for delivery for both new infrastructures to be installed and upcoming flexible services over the next ten years. Users can leverage the information provided by the NDP to inform their business strategy, and their asset and investment plans.
- Long-Term Development Statement (LTDS) - another dataset presenting our future plans and investments including geographical maps detailing 132kV and extra high voltage (EHV) systems, schematic designs detailing connectivity and operating configurations, circuit and transformer data, and fault level information. It assists existing and future customers in assessing opportunities for new and additional connections.
- Major projects pipeline lookup tool - provides our customers and stakeholders with a transparent view of capacity headroom at specific Grid Supply Points (GSPs) impacted by transmission constraints. For each supply point, the report provides an overview of the site's headroom and technical conditions (e.g. technical import/export limits) by conveniently merging a range of relevant data sources. It also provides a list of embedded generation schemes currently in the pipeline to connect to each GSP. Potential developers can use the tool to identify the GSPs providing the lowest cost and quickest generation connections. Customers with a scheme in the pipeline are provided with visibility of their position in the connections queue, along with any transmission curtailment, via their unique reference number to ensure anonymity. Existing customers can use this information to assess a range of projects within their portfolio.
- LV network data - the granular data collected by the LV monitors we are installing is enabling the development of a smarter and more flexible system in which market solutions compete with network solutions. For example, by sharing LV data such as asset ratings and network loading, we can ensure that market participants have information to anticipate where flexibility services will be needed in the future. While not a standalone dataset, the LV data being collected flows to many of the data products and services, including those listed above, that we provide for the benefit of customers and stakeholders.
- Vulnerability Visualisation Tool - a collaborative Energy Innovation Centre and Network Innovation Allowance funded project, led by NGN and Egnida Innovation with Northern Powergrid, Scottish and Southern Electricity Networks and Cadent as participating partners. We are working together to create a single touch point for measuring and assessing community vulnerability using a wide variety of public data sources which can be scored to produce filters, or mapped to create layers. Over the past year (phase two), 80+ partners from GDNs, DNOs, Local Authorities, charities and community groups have been testing the tool using their own data in the system. In 2024, the tool will be integrated into our business-as-usual activities and a free to access version of the tool will be made widely available to other third-party organisations with appropriate governance.

We are also increasingly exploring the benefits of sharing third party data, with the ECR for all GB DNOs already accessible through our Open Data Portal as one data table or to view on a single map.

## Working with customers and stakeholders to add new datasets and services

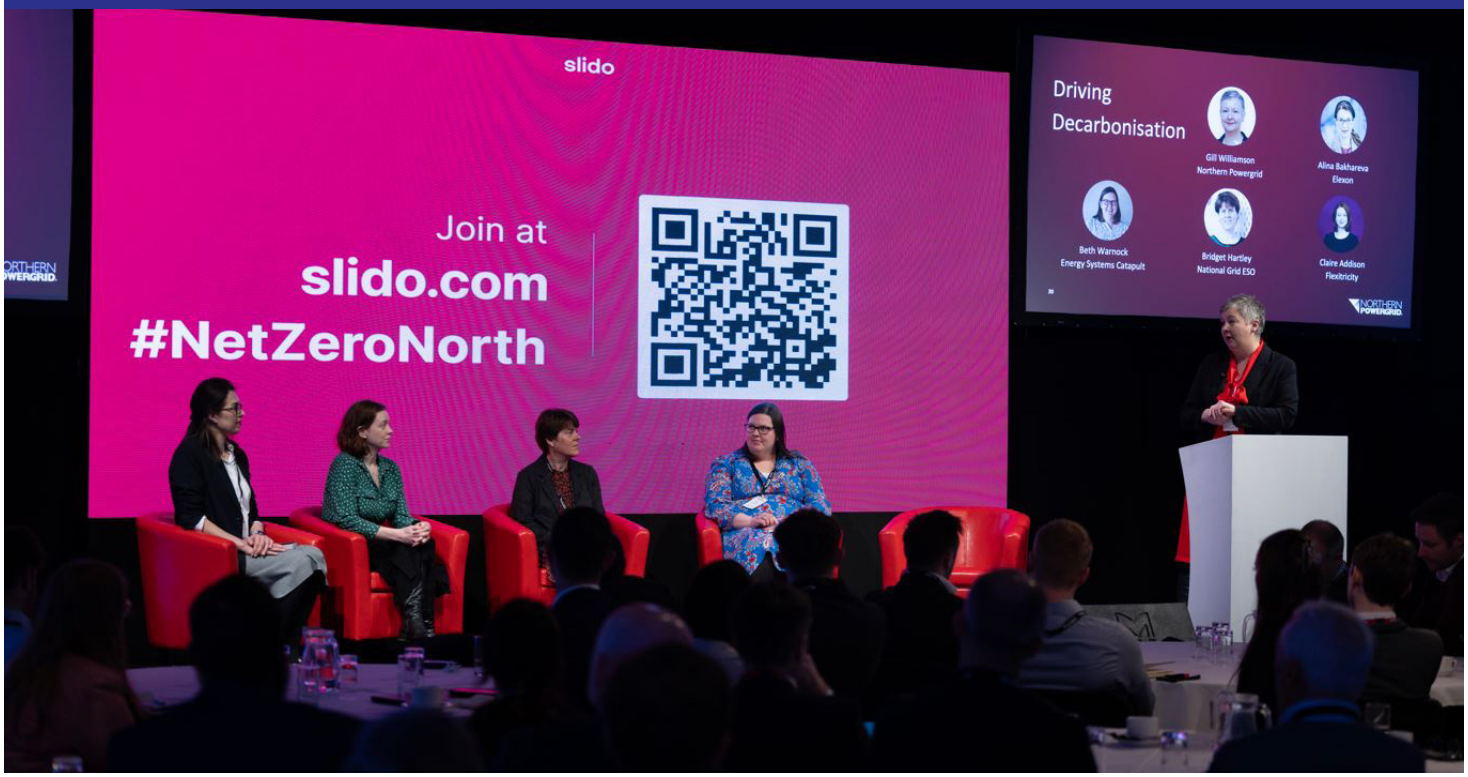
We acknowledge the importance of disseminating datasets and data products with our customers and are committed to adding value through continuous innovation.

Our Data Minimum Viable Product (MVP) initiative stands as a testament to this commitment. Through this program, we engage collaboratively with our clients to pinpoint and pilot, as MVPs, potential data projects or services. These MVPs are crafted based on the explicit needs of users and are developed in close partnership with the stakeholders they are designed to benefit. Examples include the GSP congestion data and our heatmap.

This methodology yields a tangible proof of concept, sufficient to determine the potential value addition of a data product or service. Post-consultation with stakeholders, we proceed to make an informed decision on whether to expand and further develop a project or end its lifecycle, thereby ensuring optimal resource allocation and avoiding excess expenditure.

**84%** of stakeholders said our enhanced DFES has been [or will be] valuable to them or their organisation.

# Making data accessible




## Accessibility-driven design across our data projects

One of our main focusses over the past year has been ensuring that stakeholders have access to a substantial quantity of datasets that are both visible, and presented in accessible, common formats.

To achieve this, we have made conscious design decisions across a broad spectrum of our data-sharing initiatives which have aimed to facilitate accessibility for our stakeholders.

### Open Data Portal

- Metadata is incorporated as standard into datasets, along with explainer documents and feature pages for more complex datasets, allowing users of all experience levels to find and utilise the information that they need.
- Datasets are grouped by key themes, and a keyword search function has been implemented. We have also cut the technical terminology and use plain English to simplify the experience for both expert and novice users.
- Data is presented in consistent and common formats for export, application programming interfaces (APIs), and guidance documents are provided to facilitate automatic data collection. An API guidance document is available on the Open Data Portal, and as of April 2024 we have reported 1.12m API calls.
- Our Open Data Portal allows us to have a landing information page for all our datasets, giving a description of each dataset without the jargon, along with the update frequency as well as the date the data was last updated.
- Our 'Reuse' feature allows users to save any visualisations (maps or charts) that they make with our data to their account, which they can then share via a web link, or embed the code into a webpage. Working with a personal account in this way encourages users to collect and share different data use cases, as well as strengthen their own use of the Open Data Portal. This creates a 'data community', helping all users derive value from the platform and find ways to improve it.

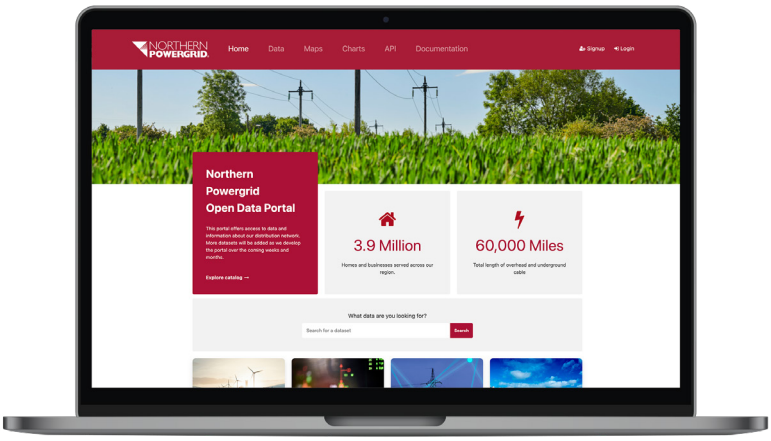
### Distribution Future Energy Scenarios (DFES)

- We have worked with Open Innovations to provide an interactive visualisation tool designed to deliver wider insights out of DFES modelling for less technical customer groups.
- We present our DFES data in two views to deliver insights based on customer groups. Both a 'Substation View', useful for stakeholders looking to connect to our network, and a 'Local Authorities View', useful for governments to understand the network in their boundaries, are published.
- The underlying data, information and methodology behind our DFES is available via an accessible GitHub repository and dedicated webpage.

### Local Authority Portal

- The Local Authority Portal provides a one-stop-shop for Local Authorities to access bespoke datasets, guides and specialised tools based on their specific needs. This includes datasets not currently accessible via the Open Data Portal.
- Education and guidance are provided via our Regional Insights team to local governments on how to access and interpret our data.

> "Northern Powergrid have the best Open Data Portal."
> - Participant at Net Zero for the North



## Our adherence to industry-wide standards

We continue to strive to align ourselves with industry-wide norms and standards to promote interoperability in data across the energy sector. As part of these efforts, when sharing data we act in compliance with the 11 core principles outlined within Ofgem's DBP guidance.

Examples of our work this year include:

- **Use common terms within data assets, metadata and supporting information:** Before making any data available to our users, we ensure that terms used within datasets are standardised to make sure they make sense to our end users. We also provide metadata as standard, along with supporting documentation for complex assets.
- **Making data assets discoverable for potential data users:** The Open Data Portal has functionality which enables data users to easily search and identify data assets, which includes access to data schema and associated metadata. The Portal is also broken down into intuitive themes, and the landing page has quick links to access the most popular datasets and our latest updates.
- **Learn and deliver to the needs of current and prospective data users:** We engage extensively with stakeholders through a variety of channels including; our Stakeholder Panel, Hackathon events, Open Data Portal webinars, a series of regional events, Net Zero for the North conference and our co-creation workshops.
- **Ensure data assets are interoperable with data assets from other data and digital services:** When choosing the method by which we would make data assets available, we opted for OpenDataSoft, the technology our Open Data Portal is based on, partly because it was being used by other licencees, promoting user experience consistency. We also provide leadership and actively participate in several industry groups to facilitate standardisation and interoperability including the Data and Digitalisation Steering Group, Data Triage Sub Group, DNO Data Self-Help Group and the Open Data Working Group.

## Collaborative efforts to facilitate open and accessible data

We collaborate and work with industry partners and experts to facilitate the sharing of open and accessible data.

This year we have:

- Committed to further align ourselves with the DBP guidelines by adopting the 15 core elements of the Dublin Core Standard, a set of metadata elements used to describe digital resources, both for ourselves and to encourage uptake across the entire industry.
- Been actively working with OpenDataSoft to implement the technical changes needed to facilitate the publication of Dublin Core metadata, and we are an active member of an ENA working group aiming to develop a DNO-wide approach to adopting this standard. Successful implementation of these guidelines will enhance user data accessibility by ensuring that essential information about digital resources is consistently structured, and retrieval is easy for data users across the energy system. We also participate in the DNO self-help open data group.
- Worked to develop the flexibility market, choosing to make our API between Piclo Flex and Flexible Power available to others.
- Collaborated with the DNOs on DSO metrics, particularly secondary networks utilisation.
- Leading the DNOs to collaborate on delivery of the LTDS Common Information Model (CIM) requirements resulting in the establishment of the Open Networks Data and Digitalisation Steering Group CIM interoperability testing subgroup.

We are utilising common platforms and collaborative approaches to drive data accessibility.

# Ensuring data quality

Data quality is central to the value of open data. The decision-making and insight that we are enabling relies on the completeness and accuracy of our data, thus data quality is a principle we hold central to our approach. This commitment will benefit our teams, our customers and stakeholders, and the energy system at large.

## Delivering data management and quality through capability and accountability

In 2022 we instigated our data accountability project. Designing the data strategy and architecture to provide us with a vision for managing data and our data stakeholders, an architecture and an operating model through which the whole organisation would come together for delivery of data requirements.

To achieve this, in 2022 we centralised the Data team and began recruitment in readiness for RIIO-ED2. In 2023 we grew this team and began to establish a Data Centre of Excellence for the organisation which has now taken the lead for all data initiatives within the DSAP. We also introduced 'data owners' within the organisation as a trial.

Owners of 'data towers' have a single point of accountability for the towers they own, ranging from asset and network operations data to the wider internal and external data we are increasingly sharing with stakeholders.

They are accountable for data management including but not limited to:

Quality standards and terminology standards

Data collection processes and technologies

Data quality management processes

Roles, skills and capabilities

Performance management criteria

Information governance

The towers work collectively to deliver these data requirements. This process allows us to build data quality into our work and learn across the business. In 2023 we completed the replacement of our asset management system and alongside this conducted an asset management data cleanse.

In addition, the cleansing of our customer data over the last year has allowed us to redefine data quality standards for our customer data, including a review of the data collection process and introducing improved data quality management processes. This paves the way for how we embed data quality regimes across other key datasets.

## The Open Data Triage process

Our commitment to data quality is most centrally expressed by our Open Data Triage process; our structured data quality assurance procedure which ensures that data is accurate and relevant for our stakeholders. This process underpins the release of any Open Data assets and meticulously evaluates potential risks associated with their publication, ensuring adherence to all relevant regulatory and legal standards.

The Data Triage process was designed firmly in line with industry recommendations, developed following guidance from the ENA's Open Data Playbook, and in consideration of the National Protective Security Authority's security-minded approach to open data.

The process is robust and begins at the system level, where we appoint 'Information Owners' who assess data for any accuracy and quality issues right from its extraction. The data then progresses to our Data team, who subjects it to a comprehensive risk assessment questionnaire. Should any concerns arise, a collaborative effort between the Data team and the Information Owner is initiated to address them, potentially through measures such as data aggregation to anonymise sensitive details.

Securing the Executive team's endorsement is the final step before data release, guaranteeing that senior-level oversight acts as the ultimate safeguard for quality assurance. The Triage process is pivotal in providing datasets that are accurate unbiased and that mitigate risks for Northern Powergrid and its stakeholders. Through this process we have already seen improvements to data quality in 2023. When developing our heatmaps we identified areas for data quality improvement in terms of our EHV feeding area map and worked with Open Innovations to improve the shape files for the areas fed by our primary substations which fed into the Open Data Portal and our visualisations for DFES.

Beyond internal process, we publish an embedded contact form on the Open Data Portal. Users have the ability to submit enquiries or feedback, facilitating ongoing engagement with our data team. This open channel ensures that any post-publication quality issues can be swiftly addressed, and user feedback can be acted upon promptly.

**Extraction**

— Raw data extraction from Northern Powergrid systems

**Information owners**

— Information owners assess and highlight any risks associated with data quality

**Data team**

— Data team conducts the open data risk assessment

  — Data is considered against our risk appetite outlined in Company Policy on risk management

  — Data is put through our internal risk assessment matrix (23 questions, nine categories)

**Risk mitigation**

— Data team works with Information owners to mitigate any risks or data issues

**Executive approval**

— Executive team approval sought before publication of data asset

# Data and information provision forward plans

Moving forward we will:

— Keep the Open Data Portal up to date and develop new features to allow users across the energy system to unlock maximum value from it. We have developed a roadmap based on stakeholders' and customers' feedback which outlines our current plan for the datasets, features and capabilities we aim to publish in the first half of 2024; we will continually review this through ongoing engagement.

— Add our developing Digital Twin to the Open Data Portal in the coming year and update in waves until its final delivery in 2026. With both LV and HV models of the network included, this £7.3 million planned investment will give us the ability to trial new concepts without physically committing resources to them, and our key DSO stakeholders unprecedented access to our network information. We will build on our learning from Autodesign, launched in 2020, a digital twin of our LV network which allows customers to carry out their own upfront assessments and make more informed choices about how and when to connect, whilst calculating pre-budget estimates.

— Find further user-friendly solutions for Local Authorities to share data with us that minimise the effort required from their teams to align with our system requirements. We are working on a solution to capture data on regional decarbonisation plans directly from collateral already available to local stakeholders, reducing resource and potential human error.

— Respond to feedback from the Local Authority Portal users to incorporate the Local Authority Portal into the Open Data Portal, offering more streamlined access to the tool.

— Expand upon the data gathered for 2023 DFES, through a phased methodology for engagement, data transfer and high-level analysis across multiple local government levels and other key partners for 2024.

— Add to our grouping of datasets according to theme by including groupings according to personas. Categorising our data into user personas will enable people to easily find the datasets most relevant to their needs and interests.

— Publish the Common Information Model, representations of our network later in 2024 as part of the LTDS reform. We will build on the initial CIM model of our network equipment to add further data to increase users utility through their ability to model future states and conditions to gain comprehensive insights into network operation.

— Continue to refine our analysis of the big data associated with LV monitor measurements, aggregated smart meter data and statistical modelling using whole energy and half hourly metered data. The results of our innovation project exploring the application of LV monitoring in network planning will be incorporated to ensure that we use data appropriately to inform decisions on where and when to intervene.

— Remain committed to our ongoing efforts to ensure data quality, continuing to embed our data accountability model through the Data Centre of Excellence and delivering key DSO and related projects with data quality at their core.

— Replace all our legacy design tools with more advanced software in 2024. Enabling improvements in analysis for Northern Powergrid and our data users.

**93%** of stakeholders think that our work to develop digital twins of our network will be beneficial.

**92%** of stakeholders think that our work to deliver tutorials and explainers, helping them to get greatest value from our available data will be beneficial.

# Flexibility market development

## Developing flexibility markets...

Flexibility solutions hold the key to a timely and cost-efficient transition to Net Zero. Along with flexible connections, covered in the 'DER dispatch and decision making frameworks' section of this document, developing the market for flexibility services is the central pillar of our strategy to unlock the benefits of flexibility for the energy system. We have designed and deployed a four-pronged approach to develop flexibility markets in our region; in this section we present our progress and achievements for each element of our delivery approach.

| | | | |
|---|---|---|---|
| Executing an accessible and efficient flexibility procurement approach | Standardising flexibility products, contracts and processes to reduce barriers to entry | Exploring innovative solutions to develop new markets and strengthen existing ones | Facilitating market access via close engagement with Flexibility Service Providers (FSPs) |

## ... by addressing customer needs and reflecting the timing of regional needs...

Over the past year we made decisive progress in developing flexibility markets in line with current regional dynamics, while setting foundations that will enable a greater use of flexibility services as our networks' needs evolve. The specific actions and investments we made were deeply influenced by our customers' and stakeholders' needs.

| Customers' and stakeholders' needs | Our progress over the last year |
|---|---|
| **Support market participation**<br>Proactively support FSPs in maximising participation by providing guidance, information and simplifying the end-to-end tendering process | — Established an engagement programme and delivered 45 events to increase FSP participation in flexibility tenders<br>— Employed standardised flexibility contracts in line with the ENA Open Networks Project<br>— Brought forward our plans to establish a flexibility market platform, adopting Piclo Flex in order to provide a convenient portal to participate in flexibility services<br>— Developed and shared an API to streamline the dispatch and settlement of flexibility<br>— Pre-qualified FSPs and their assets ahead of competition windows |
| **More flexibility opportunities**<br>Generate more opportunities for the procurement of flexibility increasing the frequency of enders and developing both existing and new markets | — Tendered for flexibility at 24 sites, comprised of 14 primary and 10 secondary substations<br>— Made provisions to be the first DNO who will run three tenders per year<br>— Explored a range of flexibility solutions including voltage optimisation, and independent energy communities |
| **Increase visibility**<br>Increase the visibility of flexibility needs and align these to flexibility procurement | — Published a Flexibility Services Procurement Statement to provide FSPs with visibility on our plans<br>— Published heatmaps and other stakeholder-driven datasets (e.g. postcode and geospatial data on competition zones) to provide more granular detail on our flexibility needs<br>— Published our flexibility strategy for the year ahead indicating to our flexibility markets how we will engage with them and the services we expect to be procuring |

Reflecting some areas of limited export capacity on our network and a wider limitation to export capacity to the transmission network, an essential dimension of our focus on flexibility over the past year is centred on flexible connections. Beyond the significant progress in developing markets for flexibility services presented in this section, we are managing over 500MW of flexible generation connections on our network, and are driving forward significant work to utilise these solutions more widely. These are playing a key role in helping us manage our network - please find more information about these activities in the 'DER dispatch and decision making frameworks' section.

## ... to deliver benefits for our stakeholders and the wider energy system.

The steps taken to develop flexibility markets have already delivered material benefits while unlocking future benefits that will realise over the coming years. These benefits include...

### Benefits delivered over the past year

Successfully deferred £1.2m worth of reinforcement costs

Operating the Boston Spa Energy Efficiency Trial (BEET) over the past year has saved 15,000 participants an estimated of £28 each

### Benefits unlocked by our actions

Unlocked a further £7.9m (present value) in avoided reinforcement costs to 2040

Delivering everyday balancing voltage optimisation across our network is expected to save our customers £20m and 15,000 $tCO_2e$ annually by the end of ED2

Our provision of balancing services to ESO through voltage optimisation will generate net benefits of £40m

### Unquantified benefits delivered by our actions over the past year

Increased visibility and ease of access to our future grid plans through our DSO events, flexibility newsletters, webpages and webinars

Increased customer participation in the flexibility service market by conducting trials and testing innovative solutions, for example the Community DSO project

Closer ties with industry players by leading work to explore and propose a joint network forum to support implementation of the Market Facilitator

# Executing targeted, accessible and efficient flexibility procurement

## Our Flexibility First Policy

Our dedication to unlocking the value of flexibility is published in our Flexibility First Policy. We are committed to deploying flexibility solutions in preference to network reinforcement wherever possible.

These solutions include Flexibility Services, Flexible Connections, and Network Flexibility. We have a robust code of practice in place, discussed below, which we use to ensure that when we deploy flexibility services instead of conventional reinforcement, we do so in a way which is economically efficient for us and our customers.

In practice, Flexibility First amounts to us signalling our commitment to developing and deploying flexibility across our licence area wherever we can, setting ourselves up for a future in which DERs play a more significant role in the energy mix.

The Policy also gives FSPs the confidence they need to plan ahead in anticipation of strong demand for their services, helping develop the flexibility markets that our future network needs.

**Flexibility First is being achieved through the operation of decision-making frameworks aligned to the following core principles:**

### Technical rigour

Our flexibility needs are informed by technically rigorous systems and processes which ensure we tender for services that meet our network's needs.

### Transparency

Our policies, processes, frameworks and outcomes are transparent to allow stakeholders to understand our decisions.

### Efficiency

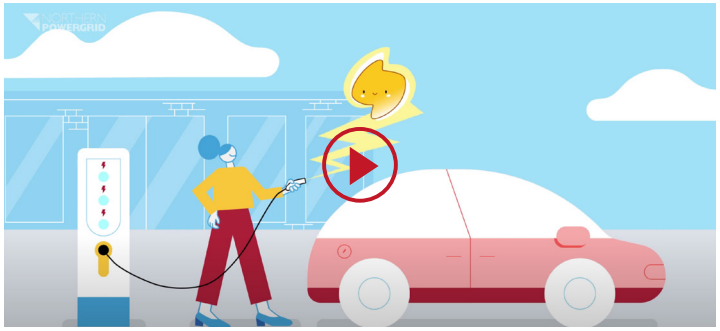
Our decision-making frameworks are designed to deliver efficiency for our network and customers in both the optioneering of solutions, and the call-off of services when required.

### Standardisation

Our frameworks for decision-making are standardised to reduce access barriers and provide consistency for our participants.

### Assurance

We are committed to a full range of assurance activities, giving stakeholders confidence we are operating effectively.



## Flexibility services procurement process

Following our commitment to Flexibility First, our Flexibility Services Procurement Statement plays a significant role in transforming our intentions to action.

The statement aims to provide stakeholders with visibility of our flexibility plans and support them in getting involved to turn these into action, while providing the transparency that we think is central for getting the flexibility market moving.

By signalling our plans for flexibility, we communicate our ambition to grow the flexibility markets in our region and give FSPs the confidence they need to plan ahead and participate in our tendering process.

**The statement includes:**

- Our requirements for flexibility services, and how we will procure them.
- Stakeholder engagement plans to communicate to a wider audience the opportunities for participation in the flexibility market.
- Information on our flexibility procurement process.
- Signposts to our other key network data publications that inform our plans.

As stated in our Procurement Statement, our flexibility procurement processes are summarised as follows:

### 1. Confirmation of network constraints

Using our forecasting, network impact assessments and enhanced monitoring processes, we confirm the presence of constraints on our network. For instance, our Southgate substation, which was flagged to exceed firm capacity in 2023/24.

### 2. Assessing viability of flexibility

Using the industry standard Common Evaluation Methodology (CEM) tool, in combination with our internal Code of Practice on deploying flexibility products we assess the economic and technical viability of procuring flexibility to defer reinforcement on parts of our network subject to constraints.

### 3. Advertising of our flexibility requirements

Having confirmed the viability of flexibility services we list our flexibility requirements on Piclo Flex. The platform allows us to efficiently manage the registration of prospective FSPs and their assets and is a convenient interface for FSPs to competitively submit bids.

### 4. Engaging with flexibility market

We run a scheme of engagement throughout the year to facilitate FSP involvement. Crucially, prior to and throughout every tender round, we conduct webinars to raise awareness with our FSPs, and we have engaged in outreach explaining how stakeholders can get involved in our tenders.

### 5. Tenders and contracts

We are the first DNO to commit to three competitive flexibility service tenders a year, in Spring, Summer and Autumn, facilitating the broadest range of potential FSP participation as possible. Our contracts are based on the latest version (three) of the Industry Standard Contract for flexibility services.

### 6. Communicating results in DNOA

Options assessment plays an essential role in ensuring our decisions are transparent, consistent and are in the best interests for our customers. Following the outcome of our flexibility contracting, we publish any flexibility decisions in our DNOA Report. For more information, please refer to Page 23.

## Flexibility procurement over the past year

In 2023/24, we **tendered for over 15MW of flexibility service capacity across 24 sites**: 14 primary and 10 secondary substations.

Tendering flexibility at the secondary level is a significant development that breaks new ground. Our assessment of actual demand indicated that our previous assumptions about the impact of EV chargers on the demand profile overestimated both the prevalence of overnight charging, and an anticipated depressive effect on demand at peak hours caused by suppliers' pricing strategies. We concluded that further intervention was needed to ensure adequate capacity at our secondary substations and, in line with our Flexibility First policy, we set out to procure flexibility to defer network reinforcement.

The tendering of flexibility on the LV network was supported by the deployment of LV monitoring, further described in the 'Data and information provision' section. The increase in network visibility of LV power flows that our installations facilitated allowed us to significantly reduce the risks and uncertainties associated with the use of flexibility services at this level of the network.

Our approach to flexibility procurement in ED2 is aligned with the ENA Open Networks Project's standardisation of products, procurement processes and contracts.

### Sustain product procured by year in MW in 2023/24

| Zone | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 |
|---|---|---|---|---|---|
| Primary substation zones | 0.21 | 0.54 | 0.02 | 0.02 | 0.00 |
| Secondary substation zones | 0.02 | 0.14 | 0.00 | 0.00 | 0.00 |
| **Total procured** | **0.23** | **0.68** | **0.02** | **0.02** | **0.00** |

Flexibility contracted over the past year has already generated significant benefits for our customers. We awarded a contract to GWE Biogas for the provision of 1.4MW of flexibility from February 2023 to November 2024, meeting the total need tendered for at this primary substation. Under this contract, GWE Biogas agrees to increase generation at its renewable gas plant during a specific time window. This successful tender has allowed us to defer £1.1m worth of reinforcement costs.

Our close engagement with FSPs has given us insight into blockers that can impact their participation in flexibility tenders. Key insights gained include:

- An appetite from FSPs to use other products beyond Sustain, in order to better utilise their assets.
- Our flexibility services requirements are geographically located in areas without a high penetration of FSP assets.
- In order to engage in distribution flexibility the value proposition must be better, allowing FSPs to earn from ESO and DSO markets simultaneously or simply increasing the value of DSO contracts.
- The contractual terms of the ENA standard contract v2.1 did not meet all FSPs expectations and were a barrier in some cases.

Moving forward, we are committed to working closely with flexibility providers, the industry and wider stakeholders to overcome these barriers and continue to increase participation in flexibility markets.

On Page 21 we present our comprehensive FSP engagement programme and the outputs that are driving towards the removal of these blockers.

# Standardising flexibility products, contracts and processes

Standardisation is an important element in the development of the flexibility market. Driving standardisation is also important to our stakeholders in order to create a fair, competitive and transparent market. Over the past year, we have made significant progress in standardising flexibility products, contracts and decision-making processes to set the foundations for flexibility market development.

## Standardising flexibility products and contracts

We have built standardisation into every stage of our procurement process- in our products, our platforms, and our contracts.

### i) Flexibility products

Our procurement of flexibility services has been in line with the industry-standard Flexibility Products produced through the ENA Open Networks Project. A new set of flexibility products has been developed as part of the project; we will be procuring based on these new products in our next tender in 2024. The new products we will procure are set out below:

| Flexibility Products | → | New Flexibility Products |
|---|---|---|
| Sustain | | **Peak Reduction** |
| Secure | | **Scheduled Utilisation** |
| Dynamic | | **Operational Utilisation** |
| Restore | | **Operational Utilisation with Variable Availability** |

Driven by our current network needs, we are currently focussing on longer-term planning to utilise peak reduction capacity to defer conventional reinforcement. Moving forward, we are actively adopting the new flexibility products at all locations across our network, and in the upcoming spring tender we will be procuring the Scheduled Utilisation product to defer network reinforcement and alleviate constraints in a more dynamic way. In the later tenders in 2024, we may introduce additional flexibility products as we start to seek flexibility for additional use cases:

- Demand turn-up to manage generation constraints.
- Acceleration of connection dates for new connection customers.
- Risk management support for planned outages on our network.

We will actively communicate our procurement direction to our FSPs and inform our interest of procuring additional flexibility products through our stakeholder engagement and the annual Distribution Flexibility Services Procurement Statement.

### ii) Flexibility platforms

We utilise Piclo Flex, a flexibility platform used by many DNOs, to run the competitive bidding process for our flexibility needs. We originally planned on developing a proprietary platform for our flexibility procurement over ED2, but opted against it to maximise the benefits that stem from cross–platform familiarity for our FSPs. Utilising the Piclo Flex platform doubled the number of FSPs we had successfully pre-qualifying for our tenders. We also use Flexible Power to dispatch our flexibility services, a platform which offers an API and CSV functionality for dispatch and settlement, discussed in greater detail in the 'DER dispatch and decision making frameworks' section of this document.

To streamline the end-to-end procurement and dispatch process, we developed a bespoke API to connect between the two platforms, developed as part of our flexibility procurement with GWE Biogas. We will continue to make choices to facilitate ease of participation for flexibility providers as this relatively new area continues to grow.

### iii) Flexibility contracts

We utilise the ENA's Standard Agreement for procuring flexibility services in our contracts with FSPs. The Open Networks project advocates for standardisation across 80% of flexibility contracts, allowing 20% to remain non-standardised. This approach delivers the benefits of contract standardisation, while permitting deviation wherever necessary to drive participation and encourage flexibility uptake.

We have utilised the standardised ENA flexibility contract for our procurement in 2023/24, and we have ensured none of our flexibility contracts contain exclusivity clauses, a practice we will maintain as we progress with future transactions. In light of Open Networks guidance on standardisation, we amended the ENA contract on only one occasion to cater to unique provider requirements and promote flexibility uptake. This minor contractual change allowed us to facilitate a successful agreement with a major aggregator. As we move forward, all of our contracts will continue to adopt the most recent version (version three) of the industry standard.

## Standardising flexibility in decision-making processes

In addition to standardising our flexibility products and contracts, we developed a consistent and transparent approach to our flexibility procurement process and decision-making. As discussed in further detail in the 'Options assessment and conflicts of interest mitigation' section on Page 22, we have established and adhered to comprehensive internal processes for determining the viability of flexibility services against alternative options for addressing network needs.

Our standardised decision-making process utilises the industry standard CEM tool to conduct CBA on flexibility options, helping us make investment decisions and weigh up flexibility over network reinforcement, in a consistent way and in line with the rest of the industry.

# Exploring innovative solutions to develop flexibility markets

Our ambitions to deliver flexibility extend beyond procuring flexibility services. We have actively deployed flexibility solutions aimed at system optimisation on a much wider scale, and have robust forward plans to continue to do so as ED2 progresses. With schemes on our current network including demand-side response, voltage control mechanisms, smart connection agreements, and ambitious collaborative projects in the works with other industry players, we have been working hard to innovate, trial, and implement flexibility solutions which are focussed on optimising the efficiency of our entire network.

## Demand side response

Demand-side response (DSR) mechanisms are designed to encourage energy consumers to modify their consumption patterns in response to incentives or supply conditions, helping balance grid constraints without the need for greater energy flows. We previously explored an innovative project trialling peak shaving (where customers are encouraged to reduce energy consumption during peak demand periods to alleviate network constraints) in 2019, in a collaborative effort with Newcastle University and GenGame.

The project explored gamification as a way to drive consumer DSR, with over 2,000 customers competing for cash prizes by turning off their appliances during periods of high demand. Our findings were highly promising, with individual reductions of up to 4.9kW being made, and an average power reduction of 11% registered across households.

Following this encouraging test case for consumer DSR on our network in 2019, consumer flexibility has become more common place through flexibility aggregators and energy suppliers. We have successfully procured flexibility services from aggregators such as Equiwatt and Octopus to address constraints on our LV network, helping us manage it in a smarter and more efficient way, while enabling our customers to participate in the energy transition whilst saving on their bills.

## Voltage optimisation and capacity reduction

We have also been exploring flexibility services in the context of voltage optimisation to manage our network 'downstream' at the customer level, and 'upstream' to provide balancing services to the ESO for efficiency. Voltage control allows us to free additional capacity while lowering customers' energy consumption, leading to bill savings and system carbon savings. At the same time, it allows us to offer balancing services to the ESO.

### Measuring the benefits of voltage optimisation and capacity reduction

Our BEET project trials voltage optimisation in a highly innovative way to maximise efficiency on our network. We have rolled out bespoke 'BEET – Boxes' across the trial area, Boston Spa and Wetherby, which utilise smart meter data to optimise network voltage. By analysing data outputs, these BEET - Boxes allow us to safely turn network voltage up and down to manage grid capacity. We are actively evaluating the results of BEET to identify ways we can deploy this for everyday balancing across the whole network, and ultimately across the country.

We estimate that BEET has helped each of the 15,000 households and businesses in the trial area to save on average £28 in annual energy bills, and cut their yearly $CO_2$ emissions by 20kg. If rolled out nationally, this everyday balancing could help reduce UK household energy bills by up to £770m, and cut up to 1.1 million $tCO_2e$ each year – the equivalent to taking up to 200,000 petrol cars off the road.

We are also aiming to deploy voltage optimisation, similar to the Customer Load Active System Service (CLASS) deployed by ENWL, to provide balancing services to the ESO.

With voltage optimisation, the control of reactive power can provide voltage services. These services are delivered through existing assets, such as transformers, and thus do not require significant capital investment and can be provided at a low marginal cost. If implemented, we expect the provision of such services will lead to a NPV of £40 million.

We are commencing our trials in 2024 to provide balancing services to the ESO, which will determine the performance, the potential mitigations, the likely cost of subsequent rollouts, and the commercial viability of such services. With our customers at the forefront of our decision-making process, we will strike a balance between maximising customer savings and providing services to the ESO, devising a solution that will provide the maximum benefit to all parties.

## Community DSO

Community DSO is our flagship innovation project delivered with £14.5m secured from the Ofgem Network Innovation Competition. It aims to test the potential of flexibility on a highly localised scale – at the consumer level – by testing the concept of the independent 'energy community'.

The vision for this project is to introduce hierarchical 'cells' across the LV network to create Smart Local Energy Systems (SLES) that will enable generation and demand from low carbon technologies (LCTs) to be managed as effectively as possible at a granular level. This will, in turn, flatten the peak demand across the existing network to reduce the strain and mitigate the need for intensive reinforcement works.

We expect to host a series of four trials with up to 1,000 homes and businesses participating across distinctly different community archetypes within our operating area. The trials will demonstrate how local energy optimisation can interface with and support new ways of managing electricity networks, whilst empowering communities to develop and manage local energy schemes for the benefit of members. In year one the team has been mobilised, the Project Steering Board and Project Stakeholder Advisory Committee established, and we have published our Initial Design Report sharing year one research and analysis on the back of extensive engagement and collaboration. We have recently initiated the tender for trial one, seeking to award four consortiums a total of £3.2m.

The project will deliver a framework for integrating smart local energy systems, which will contribute to the creation of localised, community-level flexibility services. This will include elements of technical and commercial standardisation, to ensure that the model is scalable and manageable. We will also deliver a toolkit specification to provide communities with tools and processes that they can use to plan and operate their own smart local energy systems. We believe that the community will play a larger and larger role in network operation as DSO progresses, and the insights drawn from this project will be crucial not only for our licence areas, but for the UK energy system as a whole. In addition to the technical benefits that this project will deliver for managing our network, it will also generate important learning on how the energy transition can be fully inclusive and ensure all customers benefit.

**15,000**

We estimate that BEET could help each of the 15,000 households and businesses in the trial area.

**£770m**

BEET could help reduce UK household energy bills by up to £770m.

**1.1m $tCO_2e$**

BEET could help cut up to 1.1 million $tCO_2e$ each year – the equivalent to taking up to 200,000 petrol cars off the road.

## Market Facilitator

It is crucial that we develop flexibility markets not only within our licence areas, but nationwide.

In collaboration with ENWL and WSP, we previously presented evidence to Ofgem demonstrating that markets in Northern England experience significant barriers to the uptake of flexibility services, with a noticeable lag between our regions and other DNOs (see Page 3).

While we are taking significant steps in developing flexibility through ED2, and have ambitious plans to develop the market, we have to acknowledge the needs-based reality of our region.

Current volumes of tendered and contracted flexibility across DNOs are thus only partly representative of network effort, with network needs, and regional barriers to service provision, playing a clear role.

Given our unique position of serving a region facing relatively few constraints, and with barriers in place to wider uptake of flexibility, Northern Powergrid and ENWL are proposing to develop a joint network forum to tackle this regional disparity while simultaneously testing and developing solutions for future market integration of flexibility services.

Whilst Ofgem are developing their thinking around the scope and purpose of the Market Facilitator role, we believe a joint network forum, led by the Northern DNOs, will provide strong opportunities for all parties to:

- Test the principles of Market Facilitation in the low-risk environment of the Northern markets.
- Avoid inefficiencies in the development and roll-out of the final form of the Market Facilitator by testing throughout development.
- Ensure that solutions are fit for purpose for the whole of GB and drive FSP interest and participation in currently under served regions.

# Facilitating market access by engaging flexibility service providers

## Enabling participation through engagement

Our engagement programme is designed to minimise the barriers to effective participation in our flexibility markets, increase awareness of flexibility opportunities, increase knowledge for potential FSPs and drive participation in the management of our network. We designed and delivered a targeted programme of two-way engagement throughout the regulatory year, conducting over 70 events, including 50 bilaterals with FSPs, and engaging over 550 people.

**Some key examples of engagement enabling, encouraging and increasing participation include:**

- Accessible information and regular updates through our regular newsletters, along with our Flexibility Services webpage. These offer important updates on our plans, access to recordings and summaries of past events, and notifications about important upcoming dates. We also send regular reminders to our stakeholders to keep them informed beyond the standard procurement statements and website updates.
- Flexibility competition support beginning with the procurement statement which outlines our plans and tender requirements at the very start of the year to provide customers with visibility on our requirements, and clarity on our plans. We then host a range of engagement to provide further detail and opportunities for discussion or clarification including:
  - Webinars, following the announcement of our tender requirements, our Flexibility team outline in detail the participation process for our FSPs. A live demonstration and Q&A with representatives from Piclo ensures that barriers to participation are minimised.
  - Virtual surgeries and bi-lateral meetings, we met face-to-face with 50+ FSPs this year.
  - Aggregator days – in London and York to make the engagement as accessible to as wider group of stakeholders as possible.
  - Post-tender surveys to identify areas for process and participation improvements in future tender rounds.
- Promoting flexibility through our wider engagement to build awareness and capability for future participation. We promote and discuss flexibility at our wider DSO events like our Net Zero for the North conference, regional workshops, quarterly DSO forums, community energy forums and Regional Insights team engagement. Through this, we have reached and received feedback from energy suppliers, third-party aggregators, customers with demand, generation or storage capacity, Local Authorities, and community energy schemes, all of whom are interested in participating in flexibility in the future.
- Promoting flexibility opportunities through regional and national events. We have participated in seven industry conferences as speakers and to network with larger audiences, and build awareness.
- Working with industry players to develop and facilitate market access to flexibility. We consistently participate in central industry platforms, most recently playing a significant role with the ENA in the development of the nine new Open Networks flexibility products. Our proposed role as advisory panel in the establishment of a Market Facilitator, in collaboration with ENWL, promises to continue and expand our industry efforts to encourage the wider development of flexibility markets across the sector. The proposed role will see us hosting implementation trials for new flexibility processes and working with Ofgem and the proposed Market Facilitator body to host ideas on our network, feeding back data and providing the understanding needed to bring the industry closer to markets which are accessible, fair, and standardised.

# Flexibility market development forward plans

Developing the flexibility market in our region is a priority, enabling us to continue to deliver flexible solutions for our network constraints, central to the future management and optimisation of our grid and the delivery of benefits to our customers.

**Moving forward we will:**

- Deliver three flexibility tenders a year, maximising the number of opportunities to participate.
- Collaborate with the ENA Open Networks Flexibility Products Technical Working Group, using the new industry-standard Flexibility Products from 2024 onwards.
- Procure the new 'Scheduled Utilisation' product to defer network reinforcement, in our 2024 Spring Tender. We are also pursuing tenders at 17 LV sites, up significantly from the ten we sought in 2023. In total, we are seeking to procure 5.1MW of flexibility service capacity to meet 1.7GWh in energy requirements from our domestic industrial and commercial customers.
- Select communities and appoint delivery consortia to commence our first Community DSO trials.
- Seek to lead a joint network forum to carry out implementation trials for the Market Facilitator role.
- Enable secondary trading and curtailment obligations for our customers as we anticipate the future local energy markets can develop to accommodate for peer-to-peer trading using the local distribution network.
- Undertake work alongside collaborators in order to identify and implement solutions to stackability of DSO and ESO flexibility services - avoiding conflicts and allowing FSPs to trade in both markets.
- Develop nearer real-time forecasting enabling us to procure and dispatch Operational Utilisation and Variable Availability products.

# Options assessment and conflict of interest mitigation

## Assessing and selecting network options fairly and transparently...

Our Flexibility First policy, to deploy flexibility services wherever feasible and economic, sets the overall principles for our options assessment process. We must carefully and fairly assess a range of options, including flexibility services, smart solutions, conventional network reinforcement, and energy efficiency solutions. Considering the coexistence of our DSO and DNO roles, the range of options that exist in addressing constraints can give rise to perceived conflicts of interest. Demonstrating that these potential conflicts do not impact our decision-making and that our number one priority is to do the right thing for our customers and stakeholders is essential. We have introduced and implemented a three-tiered approach to assess and select the optimal options – these are presented in this section.

| | | |
|---|---|---|
| Identifying, assessing and implementing network options to maximise customer and stakeholder benefits | Engaging stakeholders across sectors to enhance options assessment and identify whole system solutions | Utilising internal and external governance and assurance to establish confidence in our decision-making |

## ... by working closely with customers and stakeholders ...

This year, we have laid a robust foundation by implementing a range of tools, processes, systems, and internal governance measures. Our initiatives were informed by the feedback from our customers and stakeholders.

| Customers' and stakeholders' needs | Our progress over the last year |
|---|---|
| **Transparency in options assessment**<br>Set out and publish a clear approach that Northern Powergrid will use to assess and select the options to address network constraints, transparently and via standardised approaches | — Established a robust, stakeholder-driven Distribution Network Options Assessment (DNOA) methodology and published a report outlining the outcomes resulting from its application on our Open Data Portal to ensure full accessibility for all stakeholders<br>— Employed the industry-wide CEM tool to assess options based on a CBA that follows standardised rules |
| **Managing conflicts of interest**<br>Stakeholders want openness and transparency to give them confidence in our decision-making | — Created an Energy Systems directorate to establish a DSO unit with clear accountability and formalised a detailed DSO-DNO relationship<br>— Introduced internal and external assurance and challenge of our investment decisions - this includes the creation of an expert DSO review panel that will provide independent scrutiny of investment decisions, ensuring our decision-making is in line with our policies |

## ... to maximise the benefits of our DSO role for customers and the wider energy system.

Our focus on new systems, processes and methodologies is leading us to better decision-making that allows us to address network constraints in an optimal way for customers. Be it via flexibility services that defer network reinforcement, or cost-efficient reinforcement options, we will make the right decision for our customers. Critical to an efficient transition, decision-making is an enabler to greater benefits which are quantified and presented in other sections of this document.

### Unquantified benefits delivered by our actions over the past year

| | | | |
|---|---|---|---|
| The DNOA Methodology leads to the delivery of solutions that minimise costs for customers while unlocking the Net Zero transition | New governance arrangements increase market confidence in the neutrality and fairness of our decision-making, leading to more developed and liquid flexibility markets | Cross-sector engagement with utilities and heavy industries have led to identification of whole system solutions that minimise overall system costs | Laid the foundations for operational efficiencies stemming from a clear definition and demarcation of roles |

> "Our network planning and investment planning strategy is centred around making the most efficient decisions for our customers; viewing all drivers for investment alongside one another allows us to take advantage of synergies to make the most economical choices over the long term. My Engineering directorate works closely with the System Forecasting and System Flexibility DSO functions in order to manage risk and drive optimum customer outcomes."
>
> - Mark Nicholson, Director of Engineering

# Identifying, assessing and implementing network options

Identifying and implementing the most cost-efficient options to address our network constraints is essential for keeping customer bills low, whether solutions come in the form of flexibility services, network reinforcement or energy efficiency. While we are committed to utilising flexibility wherever possible, we nonetheless recognise the value of having a balanced range of network options to consider. We are serious about addressing our load-related constraints in a way which always puts our customers first, and about choosing the options that maximise their benefits overall. It is crucial that we have a fair, consistent and transparent process in place for choosing between our options for addressing load-related constraints.

Rising to this challenge, this year we have developed and published our first DNOA. Available to all stakeholders in an accessible PDF format via our Open Data Portal, the DNOA represents our most significant step yet in ensuring the fair and transparent identification, assessment and selection of optimal network options. Our DNOA is comprised of a methodology and a biannual report.

The 'DNOA Methodology' outlines the process we utilise in identifying network constraints and selecting the optimal solution, and summarises the comprehensive technical and economic assessment to determine which network options are best for our customers. The DNOA Report describes on a case-by-case basis the outcomes of recent decisions (guided by our DNOA Methodology) for areas of our network subject to constraints, and will be published biannually.

Our DNOA provides our customers with the confidence that our network choices are made with their interests at heart. By utilising industry-standard processes and tools, our stakeholders can be sure that our options selection process is thorough and aligned with industry norms.

## A clearly defined and accessible DNOA Methodology

The DNOA Methodology sets out a structured, transparent and consistent approach to evaluating options to address network constraints. Covering both our primary and secondary networks, it plays a central role in determining how we best address network needs.

Outlined in our published DNOA Methodology, the options assessment process applies once we have identified network constraints, derived from our DFES projections and network capacity assessments. In this section, we outline the key stages of our process, which unfolds in three sequential stages:

| | |
|---|---|
| 1) Identifying network needs | — Load-related needs (DFES, connections pipeline)<br>— Asset condition needs (condition assessments)<br>— Optimising network needs (potential synergies) |
| ↓ | |
| 2) Optioneering | — Conventional network reinforcement<br>— Network flexibility solutions<br>— Customer flexibility services |
| ↓ | |
| 3) Decision - making and implementation | — Determining most cost-effective approach (CEM)<br>— Implementation (contracting or construction) |

### Step 1: Identifying network needs

Forecasting network needs is the first step of our end-to-end network development process; this is primarily driven by forecasting load-related needs and for efficiency is then assessed alongside broader non-load-related criteria including the health of our assets and network reliability.

We recognise that there is inherent uncertainty surrounding the future, and around the pace of uptake of LCTs. We embrace this uncertainty and are committed to developing an efficient, safe and reliable network regardless of the future scenario that emerges. To enable us to consider the many ways our region could decarbonise, we have developed our DFES (further described on Page 13) to guide our network planning.

Using our DFES projections along with information on our connections pipeline, our existing loading, and asset condition assessments, we utilise load forecast modelling to identify detailed future demand profiles for all points across our network.

Our incorporation of the Major Connections team within the Energy Systems directorate allows us to consider load-related reinforcement alongside connections-based reinforcement and thus assess our network options more holistically.

By comparing network demand with our asset capacities, we can identify when and where our network will become overloaded, and thus where we need to intervene to alleviate constraints. As a final stage of this initial step, we seek to 'optimise' our constraints by looking for synergies to deliver load-related network needs alongside non-load-related interventions. Through this optimisation process, we are able to align load-driven and non-load-driven work programmes to maximise efficiency, delivering multiple interventions in one.

### Step 2: Optioneering

Once network constraints are identified, we evaluate the use of flexibility services and asset reinforcement options to determine the most viable option from an economic and technical standpoint. For both options, our approaches are as follows:

**Flexibility services approach**

We explore flexibility options by following a consistent three-step approach:

1. Assessment of flexibility requirement: We establish the specific details of the required flexibility magnitude and window on a site or scheme basis and use these to engage with the market and in tendering.
2. Common Evaluation Methodology (CEM tool): The CEM tool is an industry standard product which helps us to apply a consistent approach to valuing flexibility and comparing with alternatives. The tool calculates the maximum amount we can spend on flexibility so that the NPV of flexibility services is cheaper than or equivalent to the NPV of asset solutions, ensuring that flexibility 'costs no more' than conventional reinforcement.
3. Market engagement: We engage with the flexibility market with our signposting and tendering process, detailed further in the earlier 'Flexibility market development' section. Flexibility can be provided by any customer who can modify their energy consumption or production, whether already connected to the grid or considering new connection.

**Conventional and smart reinforcement options**

We explore the following network asset solutions:

— Continue to monitor: Where there is significant uncertainty in our forecast needs, we may wait to see whether intervention is needed, utilising existing monitoring capability, or deploying specific monitoring equipment to gather more granular data. This minimises the risk of stranded or underutilised assets if we invest too early.

— Smart network technology: Solutions such as real-time thermal ratings, sensors and network communication devices to maximise network utilisation and information from existing assets.

— Network reconfiguration: Temporary or permanent changes to our wider network topology, moving load between assets to achieve more efficient overall utilisation of our network. This frees up capacity by sharing demand across our network more evenly.

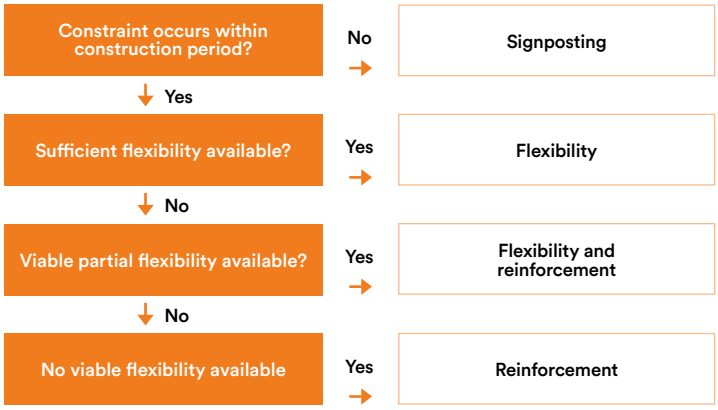
— Enhanced network asset ratings: Increasing the thermal capacity of existing assets with smart solutions to increase network capacity, reliability and efficiency.

— Conventional network reinforcement: Replacing existing assets or installing additional assets to increase network capacity.

Asset solutions are not always implemented alone, as the optimal engineering solution is often a combination of different hard asset options as listed above. Similarly, a flexibility solution may not be implemented as the sole solution – where we can only partially procure our flexibility needs there can be an optionality benefit in partial flexibility procurement. This allows us to continue to develop the reinforcement scheme whilst avoiding the constraint in the short term, allowing us to see how load growth and asset utilisation materialise.

### Step 3: Decision-making and implementation

Having outlined the range of possible network solutions, we assess which is the most cost effective in our final DNOA stage – decision-making and implementation. Deciding between our possible network options is the crucial stage of the DNOA process, as it materialises benefits for our customers and stakeholders. We have adhered to our dedicated 'DNOA intervention decision-making process' to ensure that the choices we have made through ED2 have been optimal for our network:




Our preferred options have followed the clear order outlined in the decision tree. We assess the options available through the CEM tool to make our final decision. This approach helps us make informed decisions, steering us toward the most economical solutions while still giving precedence to flexibility over conventional reinforcement. Implementation of the optimal solution is the closing step of the DNOA process, where we either contract with FSPs on the flexibility market, or design and construct physical network solutions. We are also participating in the ENA CEM working group and are actively assisting with the enhancement of the CEM tool.

A robust assurance process, discussed in greater detail on Page 26, has helped ensure that we've operated effectively and in line with this DNOA process, and that our investment decisions have been made in the best interests of our customers and region.

## Publishing the outcomes of our investment decisions: DNOA Report

Alongside the DNOA Methodology, we have also released the DNOA Report on our Open Data Portal. This document is central to facilitating the transparency of our investment choices and updating stakeholders on the progress of our network development. In our first report, we use a common template to report the interventions decided upon for seven primary substations that would soon become overloaded:

- For both Crowle and Southgate, we are utilising flexibility to relieve immediate network capacity needs whilst we move ahead to plan conventional reinforcement works. 0.33MW of flexibility has been procured between both substations to date and we will continue to tender for services, potentially allowing us to defer the conventional reinforcement if further flexibility is procured.
- For the remainder of the substations (Holme Upon Spalding Moor, Kirkburn, Martongate, Monkseaton, and Ripon), we are outlining our flexibility requirements for the future, and 'signposting' our interest in procurement over the next 2-3 years to prepare for flexibility tenders.

Our flexibility needs are open on our website, where any interested customers and prospective FSPs are encouraged to contact us. As we look ahead to continued refinement of our future DNOA, we are proactively searching for stakeholder input for advice on how best to communicate our investment decisions.

We have published our first Distribution Network Options Assessment report providing the outcome of investment decisions for seven of our primary substations, demonstrating a clear evidence base and giving our stakeholders clarity.


### The DNOA: addressing perceived conflicts of interest

Our approach to assessing network options was supported by comprehensive stakeholder engagement. The objective of our engagement was to gather ideas on how to best design this process to maximise customer benefits while promoting confidence in our decision-making. Key events included:

- DSO Quarterly Forum - We gathered feedback on DSO decision-making principles to understand what matters most to our stakeholders.
- Transparency in Network Planning webinar - During this dedicated session we discussed and sought challenge on our proposed DNOA Methodology and Report.

Beyond gathering detailed feedback that materially shaped the DNOA we recently published, it became apparent that a robust options assessment methodology, and the transparent publication of its implementation, were essential to enhance our openness to our stakeholders and to give them confidence in our processes.

More broadly, we believe this stakeholder support evidences the solidity of our approach, reinforcing confidence in our decision-making, and we look forward to working with them to refine and expand this in the coming years.

# Cross-sector engagement to explore options and solutions

Achieving Net Zero in our region necessitates a whole-system approach to decarbonising energy-intensive sectors such as transport, heating, and industry; the optimal solutions may involve a blend of solutions.

Over the past year, we have continued to work closely with a wide range of stakeholders to design whole systems solutions to meet our customers' needs while addressing regional barriers to Net Zero.

As described in the 'Data and information provision' section, our Regional Insights team engages extensively with the Local Authorities in our region, thus playing a central role in turning local engagement and insight into tailored solutions and actions across energy vectors. Examples include:

- The team is working with Transport for the North alongside a range of regional authorities on a mass roll-out of EV charging facilities, and is also supporting the West Yorkshire Combined Authority on determining the least cost decarbonisation pathway for public transport in the region. Specifically, they are assisting with understanding and deriving insights from our network data so that informed decisions can be made during their Bus Depot Rationalisation project.
- The team is currently involved with the Dalton Industrial Estate Decarbonisation project, where they are helping develop a holistic plan of action to ensure cost-effective decarbonisation of all energy vectors across the whole site.

Beyond this, we proactively engage with other utility providers to help support our stakeholders from a whole-systems standpoint. Our quarterly Cross Utility Forum, where we engage with gas, water and telecom utilities, is a central catalyst behind this collaboration. By driving cross-sector collaboration, we are able to explore how our distribution network can help our region achieve its decarbonisation goals faster, and more efficiently.

| Sector | Case studies |
|---|---|
| Water utilities | Engaging with Yorkshire Water and Northumbrian Water to assess the potential to provide flexibility services through managing pumping stations in constrained locations. We are currently conducting feasibility studies with them to determine any potential to provide flexibility services by turning down or up these stations to relieve constraints, as opposed to conventional reinforcement. |
| Gas utilities | Collaborating with NGN on their Regional Energy Systems Modelling Strategic Innovation Fund discovery project. Seeking to address the whole system network planning and utilisation challenge to encourage faster and cheaper network transformation, this project is central to helping deliver our customers' needs at the lowest possible cost. Further collaborative innovation work is in the pipeline with NGN, for example with their Scunthorpe Hydrogen Town Project. We are planning to undertake analysis to explore the multi-vector impacts of the transition to hydrogen by evaluating the impact that this will have on our network, aiming to provide unique insights to our stakeholders which are only possible with these cross-sector partnerships. Furthering our collaboration with NGN, we published a charter presenting enduring principles for how we will support Local Government in developing LAEPs. The charter sets out our joint commitments that range from supporting a single integrated conversation between networks and Local Government, the open sharing of data and the openness to a range of different pathways to Net Zero. |
| Heavy industries | Engaging with British Steel, along with the North Lincolnshire Council, to assess the feasibility of replacing its two blast furnaces in Scunthorpe with an electric arc furnace (EAF) as a push to manufacturing green steel in the region. We have been working with them to understand the network requirements of the EAF and following a detailed optioneering process, requiring engagement with NGESO and the government, we have been able to issue a detailed connection offer which will allow the connection of the EAF at Keadby GSP. Currently British Steel are reviewing the connection offer and we are awaiting acceptance of the contract. |

We are also working on a major, truly whole systems project alongside NGN, Newcastle University, Northumbria Waters and Siemens - the Integrated Transport Electricity and Gas Research Laboratory (InTEGReL) project in Gateshead.

This test-bed facility aims to identify and explore synergies between the electricity, gas and transport sectors, exploring innovative new technologies for whole energy systems development to ultimately help deliver customer needs at the lowest cost and maximum efficiency. We are incorporating our MicroResilience project as part of InTEGReL, an initiative aimed at finding commercially viable improvements to network resilience via the deployment of microgrids.

Microgrids are local energy grids on the LV network which operate normally while connected to the wider grid, but have the capability to disconnect and operate autonomously when an outage happens on the HV network. The InTEGReL project will provide an opportunity for future-proofing our microgrid strategy by assessing its impact within the context of the whole energy system, helping facilitate our planned rollout of our initial two microgrids by 2025.

# Managing perceived conflicts of interest

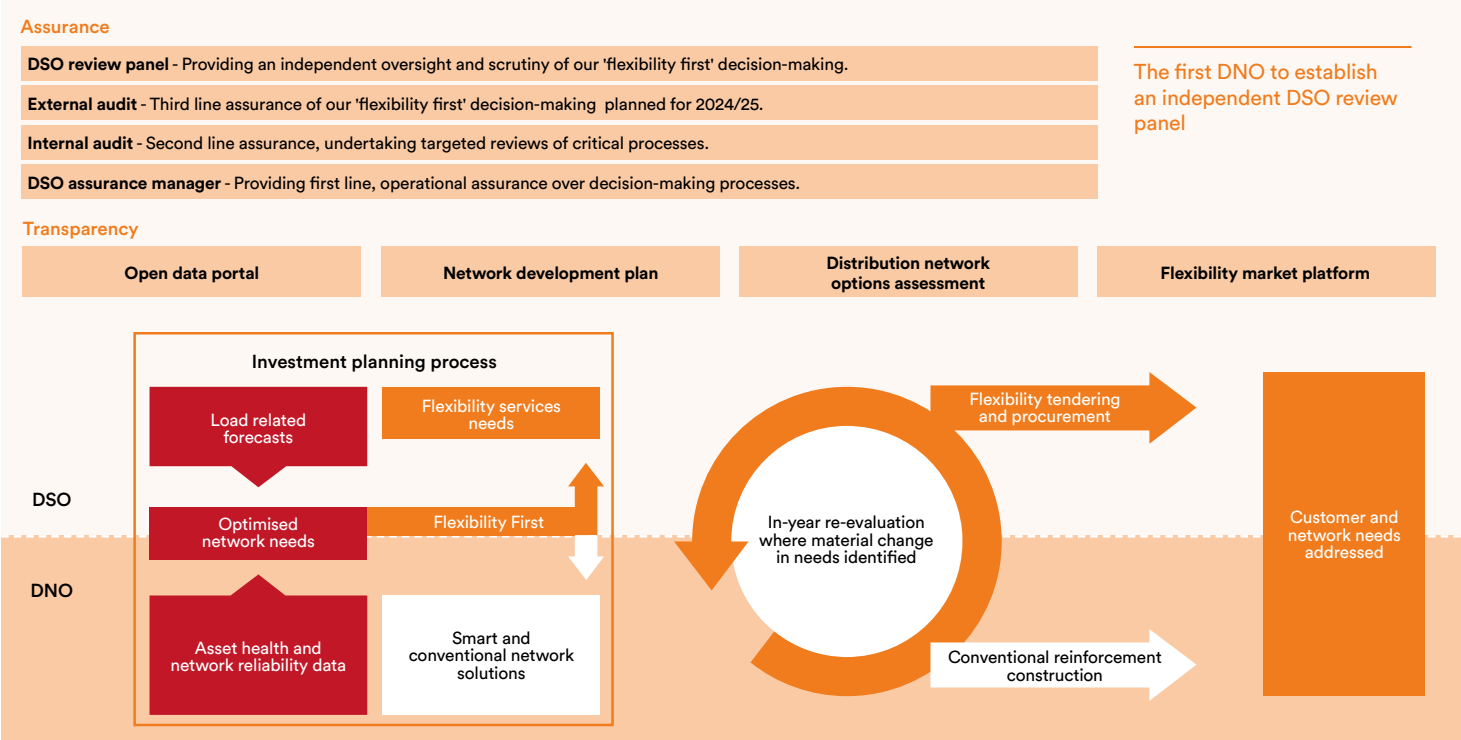
## We acknowledge the perceived conflicts of interest between our functions, particularly with the role we expect to play in developing flexibility markets and procuring services versus making investment decisions to build new network assets.

This year we have taken bold steps and made fundamental changes to the structure of our organisation, implementing new assurance processes to segregate our business functions and independently scrutinise our business processes and investment decisions.

The key steps we have taken to promote confidence in our decision-making described in further detail throughout the section, include:

- Providing clear accountability and separation of duties for our DSO functions from conventional functions within our DNO business structure, a decision driven by the high synergies of keeping DSO within the existing DNO business and justified by CBA and independent recommendations.
- Incorporating a suite of new assurance measures, including appointing a DSO assurance manager, implementing internal audits, and planning an imminent external audit.
- Establishing a DSO review panel to scrutinise our processes and investment decisions.

The diagram below provides an integrated view of how (i) a structured assessment process in the form of the DNOA (presented above) with clear roles, responsibilities and hand-over points between our DSO and DNO functions, along with (ii) a structured package of assurance checks and (iii) radical transparency provided by our data tools and platforms leads to a cost efficient transition to Net Zero that will maximise benefits for our customers and stakeholders.



## Introducing new governance arrangements to mitigate perceived conflicts while maximising customer value

Our DSO governance arrangements have been informed by a thorough assessment of different options. An assessment considered the merits and limitations of different approaches to separation and while we identified some likely benefits of full legal DSO separation, we saw these benefits as being largely offset by significant associated costs coming from losses to business synergies and accountability.

Our operating model addresses the DSO-DNO relationship by placing responsibility for flexibility markets in the Energy Systems directorate, which centralises the majority of DSO functions and houses our DSO business unit, with responsibility for asset-based solutions sitting within the Engineering directorate. This creates Executive-level accountability for System Forecasting, System Flexibility and DSO Policy, separated from the DNO function of Network Planning and Investment.

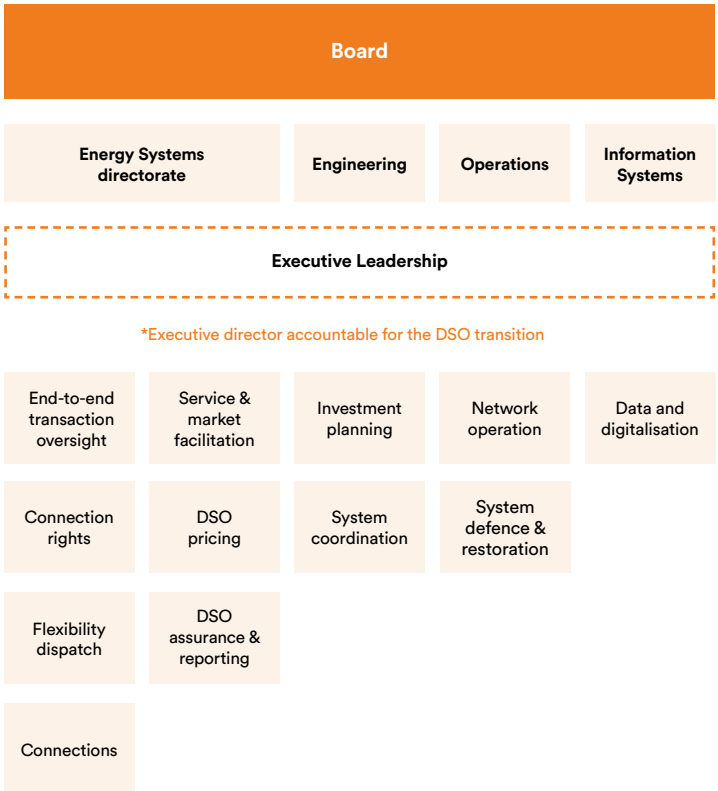
Our DSO unit sits within the Energy Systems directorate and manages our commercial and market solutions, and is responsible for changing the way we ask our customers to use our systems to resolve our network constraints. For example, it leverages flexibility or curtailable connections to increase our network efficiency, increasing capacity to prevent load-driven bottlenecks. Our DNO side is focussed on network assets, and drives network investments to address constraints.

This is a key step in addressing the perceived DSO-DNO conflict of interest, building confidence in the potential participants in these new market arrangements and ensuring we have the systems and processes in place to support efficient and technology-neutral decision-making across planning, operation and market facilitation functions, and that this is clearly and transparently communicated to our stakeholders and customers.

Our board maintains direct visibility of the new DSO-DNO relationship and the changes we are introducing to ensure transparent decision-making. In the first quarter of 2024 the board received a detailed update highlighting our progress in this space.

This model leads to an effective and efficient DSO transition at the least cost for our stakeholders. This view is supported by the independent assessments we commissioned, which suggests that separation delivers maximum value for our stakeholders by striking a balance between the synergies stemming from greater DSO-DNO coordination while ensuring transparent decision-making driven by the formal separation of duties.

As a combined entity, we are uniquely placed to leverage the inherent synergies between system and network operation within our business, while ensuring there is clear accountability and oversight of activity within each branch. One of the unique benefits enabled by this structure is the ability to view connection driven reinforcement alongside load-related reinforcement; this allows our teams to make decisions that optimise the network for all users.




## Internal and external assurance and challenge for our DSO function

Building on the separation of functions and the formalisation of a new organisational structure for DSO functions, we have introduced internal and external assurance to ensure the transparency and fairness of our investment decisions.

To further our internal assurance, we have introduced a new DSO assurance manager who is responsible for auditing compliance across DSO, monitoring progress and external reporting, facilitating an independent audit of investment decision-making processes and publishing the results. The work is being supplemented by internal audits and an upcoming planned external audit, and will be subjected to oversight and scrutiny by the CEO, the Board and our parent company.

We have also established our DSO review panel (DRP) which is responsible for providing independent scrutiny of our investment decisions and ensuring our decision-making is in line with our published policies. We were the first DNO to successfully launch such a panel. In June 2023, it was decided to incorporate the DRP as a subgroup of our ISG – previously named the Customer Engagement Group – a choice made to maintain strong links between these panels and establish overlap in membership.

In August we appointed our chair, Jo Coleman, and we recruited the remaining members between October and December. The panel is composed of cross-functional energy experts, with skills ranging from technical engineering, flexibility, whole systems, and consumer vulnerability.

The panel brings a wealth of in-depth insight on issues ranging from network engineering and data to policy, systems thinking and consumer vulnerability. In April 2024, the DRP published their first Annual Report, which focuses on their work to scrutinise and evaluate the Flexibility First decision-making framework, including key network development business processes and how they underpin Flexibility First decisions.

Specifically, the panel has reviewed the following:

- End-to-end network development process, including flexibility options evaluation.
- Results from the CEM tool, LV flexibility value calculations and the 2023 autumn flexibility tender sites, ceiling prices and results.
- Method of the assessment of forecasting customer and network needs, which includes the DFES, network constraints, impact analysis, NDP, DNOA and quantification of flexibility services required.
- The Engineering Justification Papers for parts of the network being considered for flexibility or reinforcement due to load-related issues.
- Critiqued a report for a CBA of Northern Powergrid DSO function undertaken by external consultants.
- Observed and provided feedback on relevant external engagement webinars, including Transparency in Network Planning, 2023 DFES and Flexibility Services Strategy 2024.

In its first report, the Panel has found that participation in our flexibility tenders is aligned with regional dynamics, characterised by high capacity headroom to accommodate demand growth. Furthermore, they have concluded that our first flexibility tender process though the Piclo market platform has resulted in enough flexibility procured to avoid triggering any load-related asset interventions, in line with our Flexibility First commitment. Looking ahead, the Panel made recommendations that we are actively considering and implementing.

We are working with the panel to design a scope of future review for the next year, including:

- The regulatory framework which sets the drivers of Northern Powergrid's investments and Flexibility First policy, including the use of the CEM tool for comparing the benefits of flexibility against asset-based solutions.
- The results and implications of the DSO CBA undertaken.
- The impact of procuring of flexibility services on customers.
- The process of baselining customer demand in contracted flexibility services.
- Methodology for calculating LV flexibility services demand and price ceiling.
- An internal audit on the Flexibility First decision-making.

For more information on the DRP Annual Report, please visit the DRP website.

# DER dispatch and decision making frameworks

The dispatch of DER and the respective decision-making processes are core to the effective delivery of the DSO transition – these represent the critical juncture where our tools, systems, processes and capabilities are put into action to generate benefits for our customers and stakeholders.

Our present approach to dispatch is shaped by our current network requirements and the nature of the services that we employ to efficiently address these requirements. In particular, the contrast between more ample headroom to accommodate demand growth, and the relatively limited availability of export capacity is driving how we dispatch DER on flexibility services or flexible connections.

### Dispatch of flexibility services

Flexibility services are currently utilised to address network constraints as an alternative to network reinforcement. The 'Sustain' flexibility service is contracted with a specific dispatch schedule defined ahead of time. As such, a merit order of dispatch is inherently embedded in our procurement decision based on factors that include availability, cost, technical viability and carbon intensity. This approach is a proportionate approach to meet the relatively limited requirements for flexibility services we currently have.

### Dispatch of flexible connections

We have deployed ANM in areas of our network where the connection of DER is causing network constraints. ANM monitors the network in real-time and once a threshold has been reached will curtail flexible connections according to the merit order based on a Last In First Out (LIFO) basis, implemented via a predefined prioritisation stack. This is an effective, economic and measured solution to the challenge we currently face - individual ANM zones with four or less connections with no wider interactivity.

We also operate simple, single customer flexible connections where a wide area ANM isn't required. These have been developed historically where it is the most efficient option for our customer and our network. Curtailment instructions are dispatched when a predefined network status occurs.

The dispatch of flexibility services is made possible by the visibility of DER information we have established over the past year. In line with our requirements, we leverage a static repository of data, built through our existing network connections data and through market development, and our FSP engagement programme.

We are capturing more dynamic data through the operation of our flexibility services on our network that will be utilised in future developments of our merit order. This information includes size, capacity, and location; where a generator is connected at the primary level or above, we can also access live data on the DER power output.

We have developed systems and processes to capture and report data on flexible connection curtailment dispatch in line with the Access Significant Code Review requirements for curtailable connections, further adding to our capability.

## Our vision for DER dispatch

Our vision is to operate a scalable, efficient and interoperable architecture, supported by transparent and robust decision-making frameworks that aligns to the level of complexity that our network needs. Effective dispatch will depend on a wide range of capabilities that impact every aspect of our DSO function, from communication systems and real-time monitoring to enhanced forecasting of generation/demand and power system modelling. We understand that the development of these capabilities takes time and as such we are developing the systems and processes needed to take us up the maturity scale ahead of need.

Our journey towards this vision is ultimately shaped by key principles that reflect the outcomes we wish to deliver for all stakeholders through the implementation of DSO:

- Provide a reliable and resilient network, minimising supply interruptions for customers, whilst minimising curtailment actions on generators.
- Plan effectively to deliver a reliable, safe and optimised distribution system.
- Be a neutral market enabler to catalyse customer and supplier interaction.
- Operate the whole system to minimise costs to customers and overall carbon emissions.

We apply these principles on a whole system basis. As flexibility increases across our distribution network and the transmission network there is an increasing need to coordinate services and avoid dispatch conflicts.

## Developing enablers and capabilities

In order to develop our approach to dispatch and decision-making and form a clear road map to raise our maturity, we have undertaken two key projects within the year in collaboration with the Energy Systems Catapult:

- **DSO control** - A deep dive and analysis of the systems and capabilities that we will require to fully enable DSO, resulting in a gap analysis and prioritisation that has informed our future roadmap. The project highlights that not all of the capabilities will be required in the same timeframe, and sets out the likely triggers that will create a clear need before being started. We identify opportunities for innovation projects to support the development of future DSO capabilities. The development of data, ANM, day ahead forecasting and power system analysis modelling capabilities are being progressed immediately. The development of these capabilities will support system operation, facilitate flexibility services being dispatched at day ahead and meet the requirements for curtailable connections.
- **Dispatch merit order framework** - A roadmap for developing our dispatch merit order system, considering how flexibility service and flexible connections will interact and applying evolving industry best practice. The project highlights that our distribution network is not as constrained as some; therefore, the proposed strategy is to progressively develop the dispatch merit order capability sufficiently ahead of the anticipated needs arising. The development of the merit order and required data additions to allow nearer to real-time flexibility services dispatch is explored, and subsequently how flexibility services and flexible connections dispatch may be integrated in the future.

In order to keep pace with the emerging needs of our network and customers, we have set the foundation for several critical enablers which will enhance our dispatch capabilities and bring us closer to our vision. Key examples include:

- Progressing the establishment of an Inter-Control Centre Communications Protocol (ICCP) link with the ESO.
- Exploring key factors and criteria that must be considered to construct an appropriate merit order, learning from approaches across the industry and cutting-edge innovation projects (e.g. BiTraDER) to scope the optimal solution for our customers and region.
- Establishing the data and system architecture necessary to forecast network requirements, in order to dispatch flexibility to respond to these needs in near real-time and support whole system efficient optimisation, particularly with ESO.
- Specifying interim technical solutions for visibility and control that allow for the monitoring and curtailment of generators impacting the transmission-distribution boundary.

These enablers optimally position us, adapting our DER dispatch capabilities to meet our region's evolving needs during the transition to Net Zero.

# DER dispatch and decision making frameworks forward plans

Increasing DER connected and more constrained network

| | **In place**<br>Operating | **In development**<br>1-2 years | **Foundational thinking**<br>>2 years |
|---|---|---|---|
| **Context and needs driving maturity level** | Solutions in place address today's network needs – localised constraints that are all geographically dispersed on our network, with few DERs participating in solutions | Solutions being developed to address growing numbers of distributed generators connecting to our network creating export constraints to the transmission network - enterprise ANM will provide a scalable and efficient solution to growing constraint management needs | Highly flexible system leads to complex power flows through the interaction of customer flexibility, flexible connections and network flexibility, driving the need for a unified DERMS system and whole system integration, optimisation and dispatch |
| **DER dispatch infrastructure** | **Flexibility services dispatch →**<br>Simple flexibility services dispatch infrastructure | End to end pre-contract through to dispatch flexibility services infrastructure | Simple flexibility services dispatch infrastructure |
| | **Flexible connections dispatch →**<br>Standalone ANM zones managing flexible connections on local constraints<br>Some manual management of curtailable connections | Enhanced enterprise ANM delivering unified solutions with central management | |
| | **Forecasting and scheduling capability →** | Enhanced data capture and forecasting to enable week ahead and subsequently day ahead dispatch | Sophisticated whole-system modelling including post event data validation and iterative forecast model development |
| | **Communications links →** | ICCP link to ESO allowing management of Transmission-Distribution interactions | |
| **Decision-making frameworks** | **Flexibility services dispatch →**<br>Flexibility services dispatch decisions made as part of procurement decision-making, with merit order based on availability, technical feasibility, cost, carbon intensity | Flexibility services to be dispatched in nearer to real time requiring consideration of additional factors in merit order: ramp rate, duration of storage, provider capacity, storage charge status | Greater use of flexibility services and flexible connections leads to greater interaction on the network, requiring decision-making frameworks that considers avoidance of over-curtailment versus flexibility services |
| | **Flexible connections dispatch →**<br>Flexible connections curtailment dispatch based on ICCP principles | Enhanced decision-making framework considering interaction of flexible connections with the transmission network | |

## Dispatching flexibility over the past year

We have made significant progress in moving towards our vision by dispatching and settling flexibility services via our Flexible Power platform to effectively address our network's current needs. Our flexible connections have continued to be managed effectively via our ANM systems, resulting in minimal curtailment for those connected generators.

### Flexibility services

We have made considerable progress in dispatching flexibility services over the first year of ED2. We held two flexibility tenders, offering opportunities at 10 LV sites and three HV sites in our most recent Autumn 2023 procurement. Discussed in greater detail in the 'Flexibility market development' section we successfully operated three flexibility services contracts for a combined total of 1.5MW capacity, operating on the Sustain product over winter 2023/24 which allowed us to defer reinforcement on our network.

We use the Flexible Power platform for the settlement of our flexibility services contracts. By making use of predetermined service windows for each site, for example between 16:00 and 20:00 for our LV sites, the platform allows us to automate the settlement process and through an API interface, or CSV upload, where FSPs upload meter readings which allows us to monitor and measure the service delivered against that contract.

Flexible Power assesses the flexibility delivered against the flexibility capacity contracted, calculates the payment due and generates the relevant invoices - this reduces the administrative burden for us and our FSPs.

The collection of dynamic data regarding the actual delivery of flexibility services against contracted dispatch windows offers us valuable insight to inform future developments of our decision-making process. Availability, ramp rate and capacity to deliver the service will all impact our real-time merit order.

As described above, the merit order for dispatch is embedded in the procurement stage for the Sustain product, due to its nature of predetermined dispatch schedules. In our options assessment process, we consider the availability, technical feasibility, cost, location and carbon intensity of FSP assets in order to decide who to contract with.

The importance of effective dispatch infrastructure and decision-making frameworks for flexibility services will grow as flexibility becomes a more widespread solution to address our network needs. In preparing to manage the dispatch of DERs on shorter timeframes, foundational work is being undertaken to define the requirements of our Distributed Energy Resources Management System (DERMS).

DERMS will enable optimised, proactive network management, encompassing the appraisal, provision, procurement, dispatching and settlement of flexibility services through customer assets. Utilising expanded data and analytics capabilities, DERMS will mitigate network constraints on a close to real-time basis, in a more highly integrated way utilising both flexibility services and flexible connections for efficiency.

The transition to DERMS, timed around the evolving needs of our region, will represent an evolution from Flexible Power in organising DER dispatch to address our network needs.

Over 500MW of flexible connections operated on our four ANM zones with minimal curtailment to generators.

Flexible connections offering reduced lead-times by six and a half years on average.

### Flexible connections

We utilise ANM to manage flexible connections in constrained areas of our network. We are currently operating four ANM zones, where the connection of DER is causing network constraints either on our network, or on the transmission network. Comprising 12 connections with 500MW of generation between them, these ANM zones operate as control systems, monitoring the network in real-time for potential capacity breaches.

If a set limit is reached, real-time dispatch instructions are sent out to curtail DER instructing them to reduce their output, and if one fails to curtail within the timeframe set, the ANM is able to physically disconnect it from the network.

This allows us to make the most of the existing network capacity safely and reliably, whilst allowing maximum distributed generation to connect.

## Case study: connecting more generators, more quickly

### Reforming the connection process

One of our distinctly regional challenges is the lack of export headroom to the transmission system. Our major connections pipeline of accepted projects totals more than 800 projects and around 30GW. Of this, 26% is impacted by transmission system congestion and this could rise by a further 20% when network impact is assessed. The worst affected customers are seeing connection lead times of more than 10 years.

There are clear links between the number of generators connected to our network and the potential to procure flexibility services. Fully realising these synergies is the key driver behind our efforts to cut down on the queue. As part of our Energy Systems directorate, our Major Connections team have been implementing a range of smart, flexible solutions to get generators connected faster and at lower costs:

- **Reforming the connection queue:** By terminating stalled projects, shifting from first come first serve to a 'readiness' approach, we recycle capacity in the queue.
- **Implementing flexible connections:** By utilising non-firm, curtailable connections and delegated technical limits, we have accelerated connections to enable them to connect an average of six and a half years early.
- **Re-evaluating capacity modelling:** By improving our modelling of the assumed impact of how much capacity will be needed to accommodate a new connection, we have increased our network headroom and reduced inaccuracies previously preventing connections.

We have reduced the issue of transmission congestion on our network, helping facilitate the transition to a cleaner energy system for our region by allowing our innovative projects move ahead of schedule. As an example, the Tees Valley Combined Authority has been spearheading the development of a carbon capture energy recovery facility in Teesside.

The £300 million project aims to meet the council's ambitions of sending zero waste to landfill, servicing up to 1.5 million people, while simultaneously generating up to 49.9MW of electricity; enough to power 60,000 homes. In 2022, the project stalled after required transmission reinforcement works pushed its grid connection date back to 2031, we have now been able to present a revised grid connection offer and get the project back on track.

Flexible connections expected to generate a benefit of £381m over ED2 (undiscounted).

### Working with the industry to introduce flexible connections

Flexible connections are now an important option for our largest connections customers. These balance a cost-effective and faster avenue to connection with the risk of some curtailment. Many of the accepted schemes in the pipeline to connect to our network are on a flexible connection solution.

Supported by the integration of our Major Connections team within our Energy System directorate, we have made great strides forward in utilising flexible connection approaches to address lead-times associated with Transmission network access. We have made 33 offers for flexible connections under the technical limits scheme, reducing lead times for 1.5GW of generation by an average of six and a half years.

The utilisation of flexible connections as a solution to transmission connection lead-times is a testament to our industry collaboration. Over the past year, we have worked closely with industry stakeholders through the Strategic Connections Group to develop solutions that unlocked faster connections via non-firm connections. This included both the development of technical solutions to provide visibility and control of generators on our network, as well as the commercial framework through which generators can access flexible connections. We have engaged with our customers on these rapid developments through the year with a series of webinars and more information hosted on our website.

The capacity of generation seeking to connect to our grid continues to grow, and flexible connections remain the solution of choice for applicants looking for quicker agreements. To accommodate this increasing volume of flexible connections, we have three additional planned ANM schemes in the pipeline, bringing our network total to seven zones by 2025/26. Our upcoming Enterprise ANM scheme aims to fulfil this future network need.

Our ambition is to integrate our existing ANM schemes into this single solution. As curtailment of DER is more interdependent and is needed in higher volumes at shorter timeframes, we will move away from hard-coding our prioritisation stack to more dynamic decision-making.

# Summary of DSO benefits delivered over the past year

## A new approach to identifying, tracking and measuring benefits

| | | | |
|---|---|---|---|
| **1** Define KPIs to track and set periodic targets | **2** Define the benefits of each unit of the KPIs via HMT Green Book methods | **3** Design systems and processes through which KPIs can be collected frequently and efficiently | **4** Kick off the delivery of the initiative |
| **8** Complete the delivery of the initiative and produce an evaluation of the impact, alongside lessons to improve future benefit measurement | **7** Adjust benefit measurement and the delivery plan, if/as required, informed by the impact of the initiative | **6** Continuously measure the benefits of units delivered to date and conduct additional research to test the accuracy of the method and underlying assumptions | **5** Collect KPIs via defined methods and track progress against delivery targets |

We are committed to guide the development of our DSO journey based on careful consideration of the benefits our activities generate today and in the future. Our ability to identify, track and measure the outcomes of our actions is essential to achieving this ambition - over the past year, we have trialled a new, structured eight-stage approach to manage this process. While we are in the early stages of the DSO journey, we expect that this process will be effective in generating the insight our teams need to shape delivery plans that maximise benefits for our stakeholders.

## Overview of benefits delivered in 2023/24

Our DSO activities over the past year have provided immediate benefits for our customers while unlocking future value. Many of these benefits are presented qualitatively throughout this document. Moreover, there are many additional benefits that cannot be directly quantified due to the 'enabling' nature of our actions, removing blockers and providing opportunities for other parts of the energy system to generate value for themselves, customers and society at large.

This section provides an overview of benefits quantified by an independent third party. We have chosen to quantify measurable benefits that have already generated significant impact for customers or have unlocked substantial future benefits. Where actions are still enabling in nature we note these as qualitative benefits.

Other customer and system benefits, not included in our central CBA, conducted by an independent third party include:

- We estimate our BEET project has saved £28 per year and reduced $CO_2$ emissions by 20kg for the 15,000 participating in the trial. If rolled out nationally, this could save £770m annually for customers in the form of lower bills and avoid 1.1m $tCO_2e$.
- If rolled out, providing balancing services to ESO could generate a NPV of £40m.

| | Flexible services | LV monitoring | Flexible connections |
|---|---|---|---|
| **Realised benefits** Benefits generated over the past year | Benefits to the customer base of deferred network reinforcement at primary and secondary substations<br>**£1.18m** | Benefits to the customer base of deferred and avoided reinforcement driven by a better understanding of asset utilisation<br>**£407k** | Benefits to the customer base and connections customers of deferred and avoided reinforcement driven by offering flexible connections in constrained areas of the network - please note this includes investments made in establishing ANM schemes in the RIIO-ED1 period |
| **Unlocked benefits*** Benefits that will be realised to 2040 by actions taken over the past year with no further investment | **£7.9m** | **£12m** | **£481m** |
| **Key assumptions** | — Flexibility services defer 100% of the investment for five years<br>— The proportion of primary sites suitable for flexibility increases at a rate of 0.5% per year<br>— Percentage of constraints addressed through secondary flexibility is 1% growing to 5% by the end of ED2, gradually growing until reaching 15% in 2040 | — Monitors prevent reinforcement and additional investment on 10% of the LV feeder volume, and 15% of the ground mounted distribution transformer volume<br>— Assumptions are based on previous research conducted by Northern Powergrid | — During ED2, 50% of the investment costs avoided through flexible connections are deferred and 50% are avoided indefinitely<br>— Post ED2, 80% investments are deferred and 20% are avoided indefinitely |

*Discounted present value

Our DSO initiatives over the past year have generated £1.6m in immediate benefits for our customers and stakeholders, and are projected to unlock additional benefits exceeding £500m through 2040.

## Our benefits measurement driving our plan

We are actively using our benefits tracking to influence our planning, ensuring that our forward plan and approach to DSO delivers the greatest value for our stakeholders. A great example of this is our inclusion of our Major Connections business within our DSO. As shown in the table above, independent modelling of benefits conducted over the past year has suggested that flexible connections will unlock great value for our region, due to the large numbers of distributed generation and storage connections being requested. Aligning Major Connections within DSO allows us to leverage synergies between flexible connections and flexibility services in order to enable access to the network faster, and with as little curtailment as possible.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