Distribution Network Options Assessment (DNOA) Methodology

March 2024

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1 Executive Summary

Northern Powergrid are committed to delivering Distribution System Operation (DSO) functionality to ensure that our future energy network is smarter and more flexible to accommodate the needs of our customers as our region decarbonises. Our DSO team draw on insight from the network connections market and the developing flexibility market in the region; understanding where load and generation is likely to connect and considering flexibility as an alternative to conventional reinforcement.

This Distribution Network Options Assessment (DNOA) Methodology describes the systematic approach that we use to evaluate and compare different options and make informed decisions for designing and optimising our electricity distribution network to address current and future load-related network constraints.

Identifying and deploying the most efficient and effective solutions for the development of our distribution network is essential for keeping our customers' bills low. To help save costs we are committed to the use of flexibility solutions ('Flexibility First' approach[1]) to defer or avoid conventional network reinforcement solutions wherever we can demonstrate that it is the most efficient and cost-effective outcome for our network customers.

Flexibility involves the network operator procuring, ahead of time, a pre-agreed change in electricity input or output from an existing connection, also known as a Flexibility Service Provider, over a defined time period to prevent a network going beyond its capacity.

As part of our RIIO-ED2 (2023-28) Business Plan[2] we identify load related network constraints, and we deploy optimal interventions to address the predicted network capacity requirements. RIIO-ED2 is a price control period from 2023 to 2028, and (RIIO) stands for Revenue = Innovation + Incentives + Outputs while (ED) stands for Electricity Distribution. We share our transparent and robust process for planning our network and making decisions in this Northern Powergrid DNOA methodology document.

This DNOA methodology document provides an explanation of our network constraints identification process, which is primarily based on load growth predictions of our publicly accessible Best View Distribution Future Energy Scenario[3] (DFES) and network capacity assessments. Furthermore, we discuss the DNOA steps for evaluating multiple intervention options and cost-benefit analysis for each scheme. We then delve into the decision-making logic that we use to formulate the optimal network solution recommendation – the DNOA intervention decision.

Our role is to enable the net zero ambitions of those in our region by managing a network that supports growing electricity demand from low carbon technologies, whether through customer flexibility, network flexibility or adding additional capacity through reinforcement. To help inform local stakeholders' development plans to meet their net zero ambitions, we share the identified load related network constraints and our current intended network intervention decisions (the DNOA intervention decisions) in the Northern Powergrid DNOA report document.

[1] https://www.northernpowergrid.com/sites/files/assets/NorthernPowergridFlexibilityFirstPolicy
[2] https://ed2plan.northernpowergrid.com/sites/files/document-library/NPg_Business_Plan_for_2023_28
[3] https://ed2plan.northernpowergrid.com/sites/files/document-library/Scenarios_and_Investment_Planning

We have developed a common DNOA report template for reporting DNOA intervention decision outputs for each named scheme. Whilst our DNOA reports are self-explanatory and user friendly, the structure and features of our DNOA report, are outlined in this DNOA methodology document.

Our commitment to publish details of our network capacity enhancing projects through the DNOA report is outlined in our distribution system operator (DSO) strategy[4]. This is in line with the Office of Gas and Electricity Markets (Ofgem)'s ED2 guidance[5] that Network Options Assessment (NOA) is one way in which projects that resolve network needs are identified, assessed, defined and made accessible to DSO Stakeholders.

DNOA benefits

The benefits of our DNOA include transparency in our decision-making processes related to meeting future network capacity needs and our network development plans towards net zero.

By sharing the options that we intend to take forward to manage network capacity needs we ensure that our stakeholders are informed and have the opportunity to:

- Align their development plans with our net zero ambitions.
- Understand our Flexibility Service requirements and participate in the flexibility market.
- Provide feedback and input to our DNOA.

Stakeholder engagement

Underpinned by our customer centric approach and transparency, our DNOA process has included a stakeholder engagement programme prior to our DNOA publication to seek feedback relating to our DNOA process and the utility of our DNOA documents (the DNOA report document and the DNOA methodology document). We believe that this has helped us produce a well-defined and structured DNOA that is built on the user's expectations and delivers great value to our customers and stakeholders.

[4] https://ed2plan.northernpowergrid.com/sites/files/document-library/DSO_strategy

[5] https://www.ofgem.gov.uk/sites/files/2022-10/DSO Incentive Governance

2 About Northern Powergrid

Northern Powergrid is the company responsible for the electricity distribution network that powers everyday life for 8 million customers across 3.9 million homes and businesses in the North East, Yorkshire and northern Lincolnshire. These regions are served by our two licence areas - Northern Powergrid Northeast and Northern Powergrid Yorkshire.

Our electricity network spans around 25,000 square kilometres and consists of 96,000 kilometres of overhead power lines and underground cables and more than 63,000 substations, including:

- 122 large substations (42 grid supply points and 80 supply points).
- 552 primary substations.
- 63,134 distribution substations.

By providing the electricity that powers daily lives, Northern Powergrid plays a crucial role in society and contributes to economic growth in the communities that it serves.

Recognising the evolving demands in electricity usage and sustainable energy practices in line with net zero emission targets, Northern Powergrid is developing our region's electricity distribution network to meet the current and future demands of a decarbonised region, as described in our DNOA report.

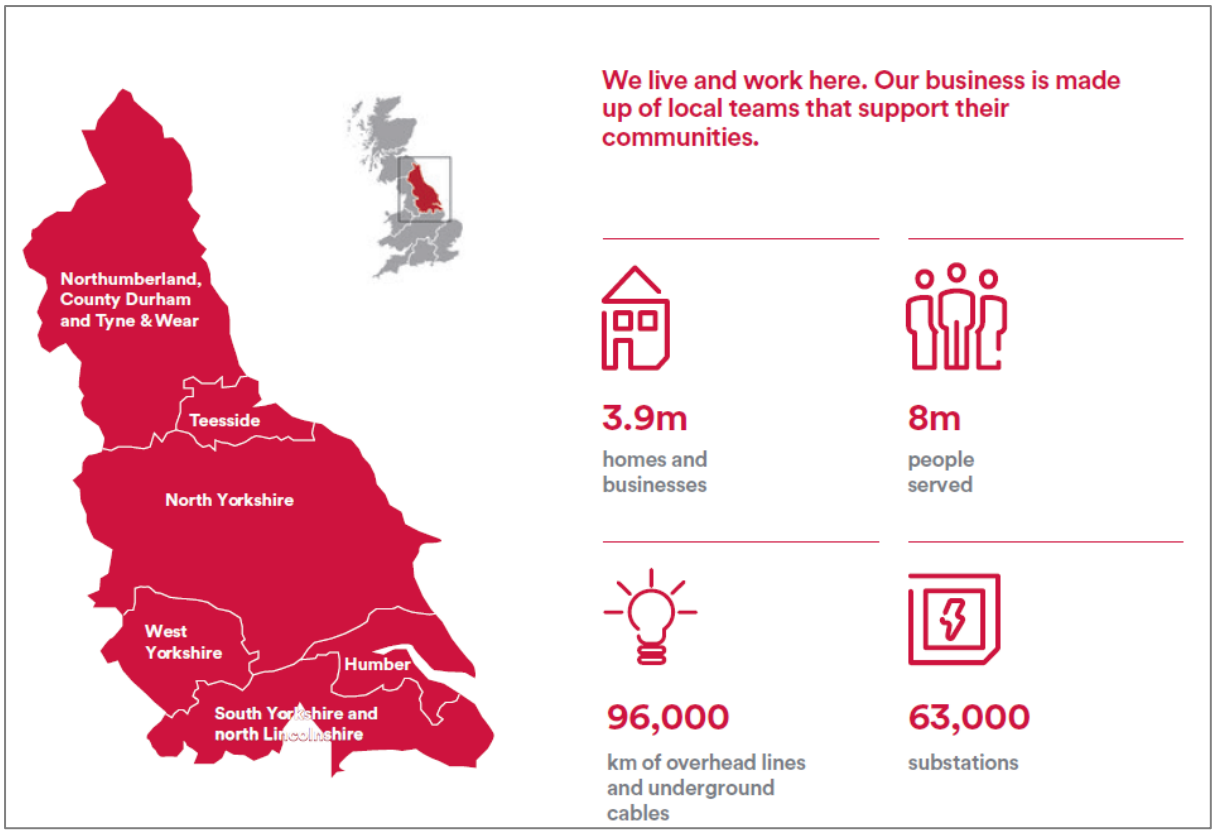

Figure 1 – Northern Powergrid Network Region and Our Business

3 Introduction

Northern Powergrid's DNOA report summarises our intended solutions to identified load related network constraints and demonstrates our commitment to 'Flexibility First' by using Flexibility Services to maximise utilisation of the network and defer conventional network reinforcement wherever appropriate. Ultimately the use of flexibility will enable us to deliver network operation and development more economically.

The DNOA process is a robust technical and economic assessment of network needs, standardised evaluation of options and comprehensive and transparent decision making. Stakeholders inputs are critical to the operation of the process and delivery of successful outcomes, ensuring that their requirements are incorporated into our capacity assessments and investments satisfy our customers needs. The DNOA report enables us to fulfil our commitments to provide our stakeholders and regulator, visibility of how we decide what is most appropriate for the development of our network. Additionally, the DNOA process provides transparency, addressing the perception of a conflict of interest in our decision making and busting the view of any bias.

Our "Flexibility First" approach

Identifying and deploying the most economic solutions for the development of our distribution network is essential for keeping customers' bills low.

Figure 2 shows our economic strategy where we first ensure that we fully utilise our existing network most efficiently by monitoring to better understand network loading before we intervene with a Flexibility First approach in advance of using conventional reinforcement where appropriate.

'Flexibility First' means that, once we have identified a load related network constraint, we consider flexible approaches before installing more assets. Flexibility Services provide additional network capacity by our customers adapting their use of electricity at critical times, such as generating when demand on our network is high and at the limit of the capacity of the existing network. We test the market to establish if sufficient service exists and the review the available price in all instances where intervention is required to provide more network capacity.

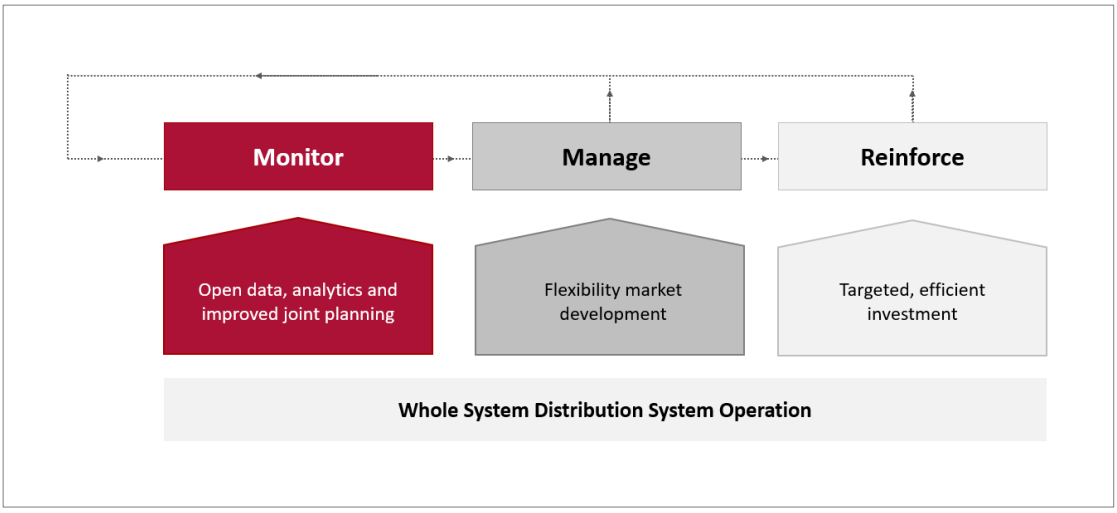

Figure 2 – Our Monitor, Manage, Reinforce approach to optimise network utilisation and flexibility

Figure 3 shows our RIIO-ED2 DSO strategy outcomes[6] built on five commitments where DSO4 and DSO5 underpin our flexibility deployment plans. Additionally, we have developed a 'Flexibility First' policy[7] to ensure that our 'Flexibility First' framework and assurance is robust, clear, evidenced, transparent, fair and auditable. This is backed by a suite of codes of practice within our organisation which our engineers follow to ensure consistency and accuracy in the implementation of flexibility as a solution to network constraints.

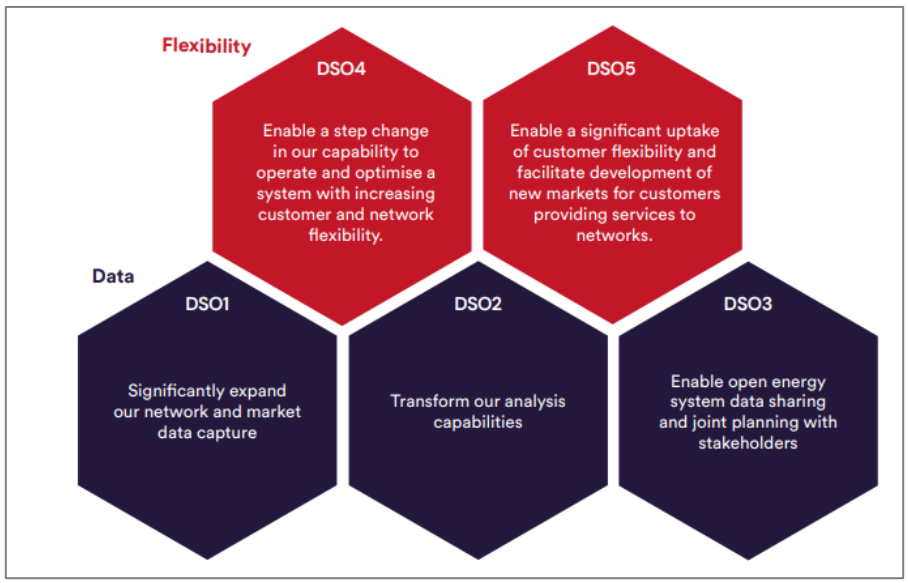

Figure 3 – Northern Powergrid's DSO strategy outcomes

DNOA reporting

Northern Powergrid's DNOA report is accompanied by this DNOA methodology as shown in Figure 4.

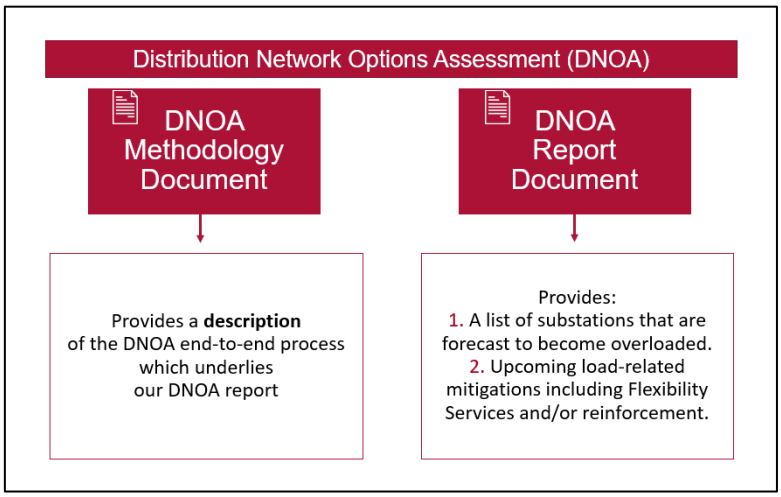

Figure 4 – DNOA documents

The DNOA report benefits our customers and stakeholders by providing information on our network development plans and requirements for Flexibility Services, empowering stakeholders with

[6] https://ed2plan.northernpowergrid.com/sites/files/document-library/DSO Strategy
[7] https://www.northernpowergrid.com/sites/files/assets/NorthernPowergridFlexibilityFirstPolicy

indication of opportunities to participate in the flexibility market. Additionally, the DNOA report provides whole system benefits by enabling more coordination with other energy vectors and electricity system organisations.

The DNOA methodology (this document) provides a detailed explanation of our end-to-end network development process which starts with load forecasting and load related needs identification, and includes the DNOA steps of flexibility analysis, reinforcement analysis and decision making, before implementation. The DNOA process is how we are making crucial business decisions and how we are prioritising flexibility to save costs.

Figure 5 shows how the DNOA report and methodology documents fit in with our other existing reports to deliver our RIIO-ED2 commitment to enable open energy system data sharing and joint planning with stakeholders (referred to as DSO3 in our DSO strategy).

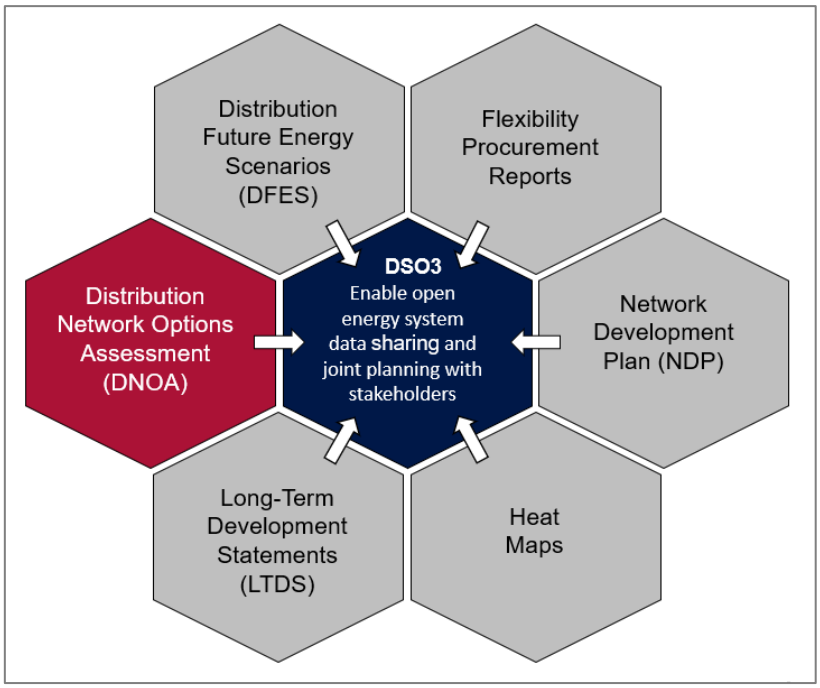

Figure 5 – DNOA report within a suite of our other network reports

4 The DNOA Process

Northern Powergrid are committed to ensuring that network capacity is available to meet our customers' needs by supporting current demand and future load on our network. As part of our end to end network development process, the DNOA process plays a vital role in determining the optimal network investments, to mitigate expected network constraints based on our Best View load growth forecast and network capacity assessments, allowing us to inform and shape our network development plans.

The DNOA process is applicable to the whole distribution network which covers Bulk Supply Points (BSPs) and primary substations and includes the Extra High Voltage (EHV) and 132kV network, and low voltage (LV) networks. Our DNOA process is tailored to each section of our distribution network with low volumes of often unique BSPs and primary substations, and high volumes for our low voltage (LV) network which comprises of often similar equipment.

There are eight steps in our simplified network development process illustrated in Figure 6, which prioritises flexibility as the optimal means of enhancing network capacity in order to defer or avoid conventional network reinforcement. The DNOA process incorporates the optioneering and decision making steps 4 to 6 shown in Figure 6.

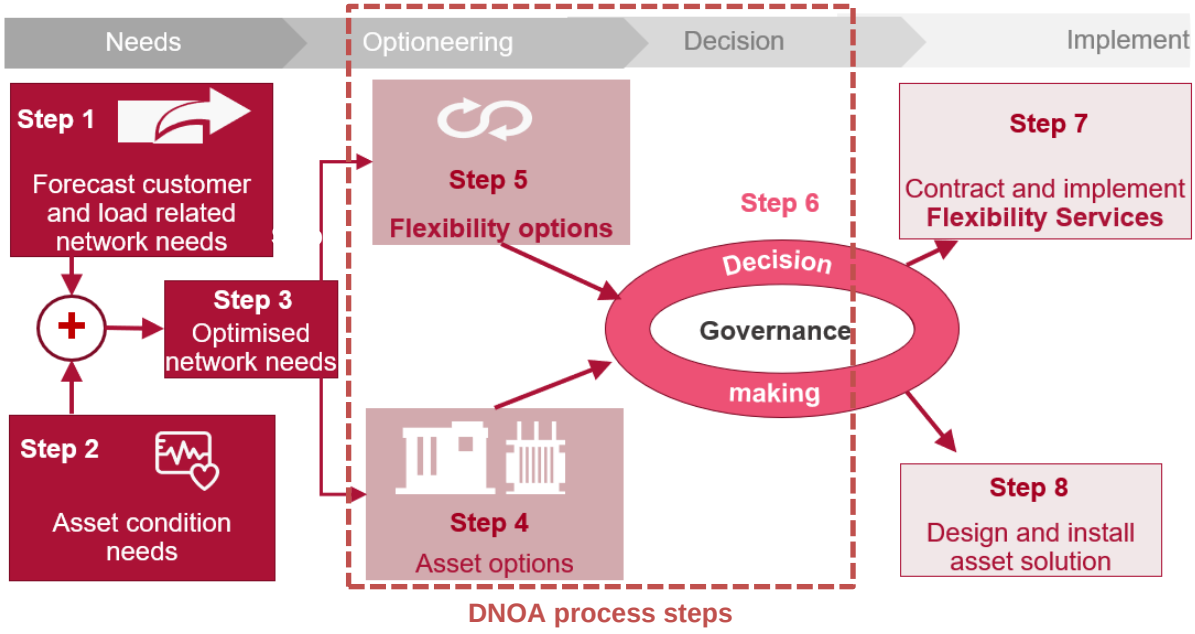

Figure 6 – DNOA process steps shown within the end to end network development process

Step 1 - Load related network needs: Involves network capacity assessments to identify overloaded parts of our network – applying our Best View DFES long-term projections and profiled accepted connections pipeline with confidence factors and diversity factors applied appropriately. We determine overloaded assets and future network needs by modelling system performance and comparing the current and future range of operation of our network assets with their capacities.

Step 2 - Asset condition needs: We evaluate the health of our assets based on the outcomes of asset condition assessments and anticipated deterioration to identify investment needs unrelated to load growth.

Step 3 - Optimised network needs: We consider other needs at overloaded sites together in order to identify areas where condition and load growth requirements overlap. Such synergies allow us to make investment efficiencies by combining the delivery of both non-load related investment from step 2 and load related reinforcement from step 1 at the same time.

Step 4 – Asset options: The geographic spread and projected capacity requirements across neighbouring parts of our network means that there are normally a variety of engineering and smart solutions for resolving capacity constraints. We analyse all options, develop detailed designs and cost estimates for these various network solutions, so we can compare their technical and economic merits to identify the optimal smart or conventional asset based network solution.

Step 5 – Flexibility options: We evaluate Flexibility Service options by running procurement tenders to acquire services to either meet or reduce demand on our network. The Common Evaluation Methodology (CEM) tool[8] is used to calculate the maximum ceiling pricing for the flexibility option based on the Net Present Value (NPV) of the counterfactual conventional asset network solution option (step 4). The magnitude, frequency and duration of the necessary Flexibility Service are derived from the analysis of half hourly power flow times series data.

Step 6 – Decision-making: We analyse technical and economic aspects of conventional network solutions and flexibility options to determine the most cost-effective approach that optimises benefits for customers and the network. We apply our Flexibility First approach to address the network constraint using a flexible solution until it is no longer viable making market response a key factor in informing decisions.

Step 7 - Flexibility: If we decide that Flexibility Services are the most suitable way forward, we use the contracted Flexibility Service pricing from step 5 to operate the Flexibility Services.

Step 8 – Smart or conventional reinforcement: If we decide that a conventional asset solution is the most suitable way forward, we will deploy the network solution, but normally only when the Flexibility Services solution is no longer viable.

These steps are covered in greater detail in the following subsections.

[8] https://www.energynetworks.org/publications/on22-ws1a-p1-common-evaluation-methodology-tool-version-2.2-(25-aug-2022)

4.1 Step 1: Load Related Network Needs

The first critical step of the end to end network development process is to forecast network needs. We must ensure that network capacity is available to meet our customers' needs at the right time and in the right place.

To identify future network needs, we first forecast customer needs to form the basis of a network impact assessment to see how our network will cope with forecast demands. Therefore, we split needs analysis into two sub steps:

i. Load forecasting, and
ii. Load related network needs identification.

4.1.1 Load Forecasting

As a network operator, we recognise the inherent uncertainty surrounding the future and the low carbon technologies (LCTs) that will emerge as the mainstream over the next several decades and beyond. We understand that the landscape of LCTs is constantly evolving, and it is therefore difficult to predict with certainty which technologies will prevail. However, we are committed to embracing this uncertainty and adapting our operations to ensure that, regardless of the scenario that materialises, we can continue to provide safe, reliable, and low carbon energy, and support the adoption of various LCTs as they emerge, enabling us to contribute to a sustainable energy future.

How LCTs will contribute to meeting net zero targets by transitioning to electric vehicles and heating is unclear in terms of the rate and nature of the change. To enable us to consider the alternative ways that our region could decarbonise, we have developed a range of distributed future energy scenarios, DFES, to guide our network planning to enable net zero by 2050 across our region. From these scenarios, we have developed our Best View scenario that serves as the foundation for our network development plans and informs our investment decisions considering future customer needs.

Our DFES models a range of credible energy futures for our region and guides our network investment decisions to address any constraints arising from energy demand or generation, and ultimately supports the growth and achievement of the region's decarbonisation and net zero goals. It is important to note that these scenarios are projections, not predictions.

To forecast potential routes to net zero, we have developed the following scenarios which are portrayed in Figure 7: Northern Powergrid's Best View, Leading the Way, Consumer Transformation, System Transformation and Falling Short. Our scenarios use common names and the same building block assumptions used by other DNOs and the Electricity System Operator (ESO) to allow comparison between different DFES and the Future Energy Scenarios (FES) outcomes.

Our scenarios encompass different levels of electrification of heat and transport. Additionally, we consider the potential for alternative energy sources, such as hydrogen, to play a more prominent role in the future energies. For more detailed information on each of our energy scenarios, including assumptions and building blocks, please refer to the latest DFES Report[9].

[9] https://northernpowergrid.opendatasoft.com/pages/home/

As an enabler for reaching net zero emissions in our area, we are working hand-in-hand with local stakeholders to support their plans and ensure that our forecasts reflect local strategies. Our engagement with one another is central to the feedback loop that informs the decisions we take in our network development plans and our stakeholders' prioritisation of next steps, which together will enable regional decarbonisation. Our Regional Insights team provide insights from their engagements with local authorities and other stakeholders to input into our DFES modelling to ensure that it reflects local plans.

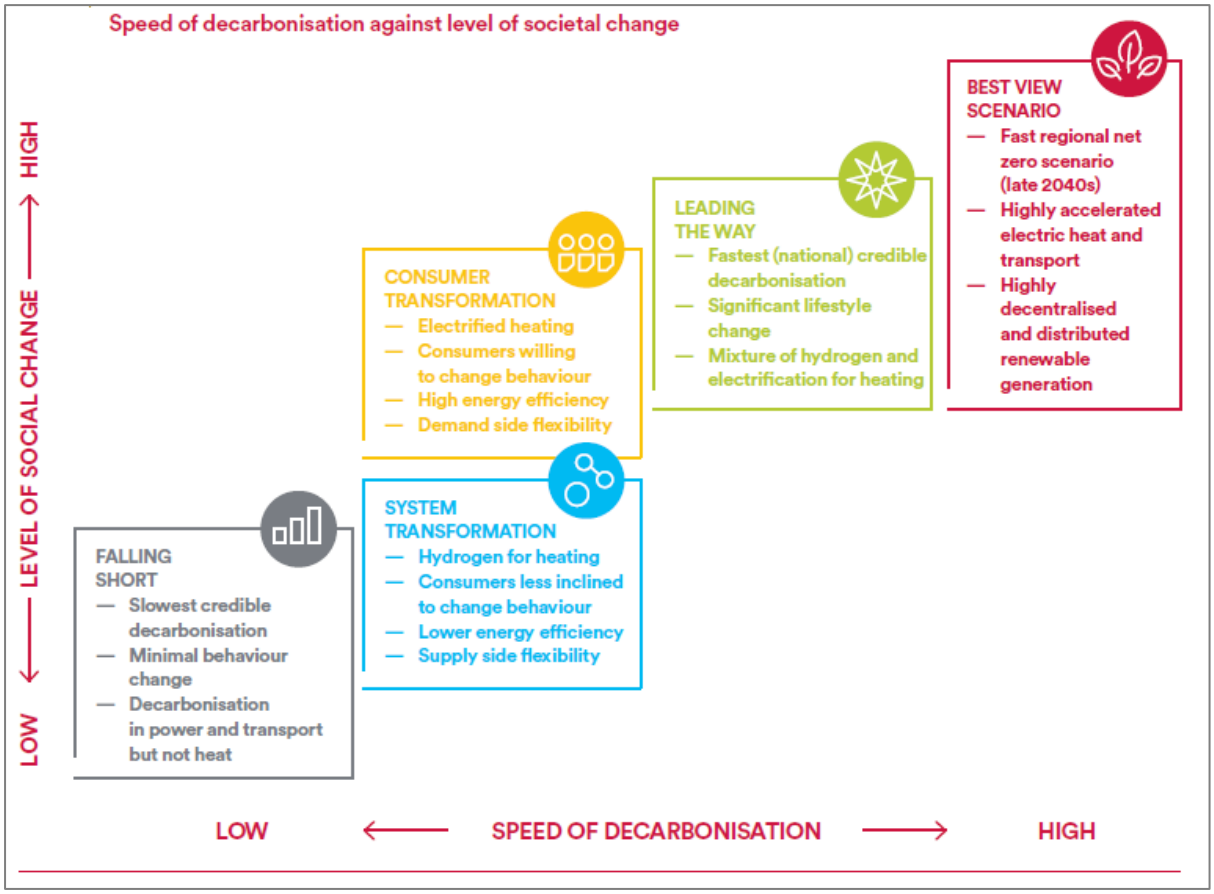

Figure 7 – DFES scenarios

Our Best View Scenario

Our Best View scenario incorporates our best and most likely view of shorter-term trends over the next 10 years, allowing us to make confident and informed investment decisions to help enable decarbonisation and energy resilience for our communities.

The Best View scenario is built upon our regional understanding of national scenarios including the National Grid ESO FES and the Climate Change Commission scenarios. In addition to these national scenarios, we also consider government policies, stakeholder feedback, and regional characteristics. By incorporating these factors, our aim is to provide a well justified most likely decarbonisation route to achieve net zero in our region. This approach ensures that our Best View scenario is well-informed and takes into account a wide range of relevant factors.

4.1.2 Load Related Network Needs Identification

We design our network to be resilient in the event of equipment failure in accordance with industry standards that ensure our customers' security of supply. It is important to note that our DNOA process is focused on the analysis of load related constraints where Flexibility Services are helpful.

In our network development process, we assess how our network can cope with DFES forecasts using network impact assessments to compare power flows with network capacities. Our comprehensive power system models are used to undertake simulations that consider all aspects of power system operation including thermal parameters and fault levels.

To identify load related constraints on our network, we utilise a load forecast model that provides us with current and future demand profiles. This model takes into account various factors such as existing loading, our connections pipeline, and our DFES. By comparing the current and future demands on our network assets with their capacities, we can identify where and when our network has remaining headroom or becomes overloaded, and we need to address the network overload constraints.

4.2 Step 2: Asset Condition Needs

We sometimes need to intervene due to the condition of our equipment. Lack of investment can result in the failure of equipment leading to interruption of customer supplies and potentially safety issues.

When demand is anticipated to grow, more capacity may be incorporated into the asset condition solution often by using equipment with greater ratings.

The use of Flexibility Services is not appropriate for the mitigation of condition driven reinforcement.

4.3 Step 3: Optimised Network Needs

We identify opportunities for synergies to deliver efficiencies where load related network needs coincide with non-load related network intervention needs. In such cases we align the load-driven and non-load driven work programmes to maximise the benefits gained through delivering multiple interventions in one work programme. Non-load related network needs could include asset health requirements, coincident connections and third party works such as diversions.

Schemes do not progress through subsequent DNOA process steps if an immediate non-load related driver is identified and Flexibility Services are not a feasible solution, for example to resolve asset health or fault level needs.

4.4 Step 4: Asset Options

Once a load related network constraint has been identified, we initially design, consider and evaluate a range of suitable solutions or options to alleviate the network overload. We term this DNOA step as optioneering. The goal is to be able identify and implement optimal and cost-effective technically viable solutions to address network constraints.

The two main types of interventions to mitigate network constraints are asset-based reinforcement covered in this section and Flexibility Services covered in section 4.4. We consider various types of

smart and asset-based reinforcement interventions to mitigate network constraints, which are outlined below:

i. **Continue to Monitor:** Sometimes when there is greater uncertainty in our forecast needs, we may wait and see whether the intervention is actually required. This helps alleviate the risk of underutilisation or stranded assets if we invest too early under a range of plausible forecast scenarios.

ii. **Smart network technology:** We utilise smart solutions including real-time thermal ratings, and sensors and network communication devices to maximise network utilisation and the information available from our existing assets.

iii. **Network reconfiguration:** Temporary or permanent changes to the network topology are made to share demand across a wider network more evenly.

iv. **Enhanced network asset ratings:** We explore increasing the thermal capability of existing assets such as smart cooling of transformers.

v. **Network conventional reinforcements:** This involves replacing existing assets with new ones or installing additional assets to increase network capacity.

It is important to note that these options are not always implemented in isolation. The optimal reinforcement solution may involve a combination of different interventions.

After the optioneering process, we undertake cost benefit analysis using Ofgem's CBA tool to compare costs and decide the optimal least cost technically viable smart or conventional reinforcement solution to take forward if sufficient flexibility is not available.

4.5 Step 5: Flexibility Options

While the implementation of conventional asset options adheres to established conventional approaches for carrying out interventions such as upgrading network assets, the implementation of flexibility follows a different approach, which involves engaging the emerging flexibility market in our region.

Flexibility Services refers to the ability to adjust the amount of power generated or consumed at specific locations, at a time when we request it. We aim to enhance the management of our network in a smarter and more efficient manner by procuring Flexibility Services from owners, operators and aggregators of generation, storage and demand assets that are connected to various locations on our electricity network.

To initiate the flexibility procurement process, we first assess our Flexibility Services requirements and then invite bids from Flexibility Services providers who can meet the defined need within a predetermined ceiling price. We use standard flexibility products and a third-party procurement platform, Piclo[10], to facilitate this flexibility procurement process.

[10] https://picloflex.com/dashboard

To ensure that the implementation of flexibility as a solution to network constraints is carried out effectively, we have developed a methodology which follows several steps which include:

- assessment of flexibility requirements;
- using the common evaluation methodology (CEM) tool; and
- flexibility market engagement.

These are discussed further below.

4.5.1 Assessment of Flexibility Requirements

When assessing our flexibility requirements, we establish the specific details of flexibility magnitude and time windows on a site or scheme basis as indicated in Table 1. This information is utilised when engaging with the flexibility market for the flexibility tendering process.

Table 1 – Typical definition of flexibility requirements

Network Location	Geographic Location	Flexibility Needs	
		Magnitude	Window
Substation	Address	Maximum requirement (MW)	Months
Voltage	Postal sectors in associated supply area		Week days
			Hours

4.5.1.1 Flexibility Magnitude

To determine the magnitude of the required flexibility, we assess whether forecast demand is over the network capacity for every half an hour, and calculate the demand exceedance magnitude by using the formula below. The maximum capacity exceedance at any half hour determines the peak annual exceedance, also called the flexibility magnitude or maximum flexibility requirement.

Flexibility Magnitude = **Half-hour Magnitude** - **Network Capacity**

4.5.1.2 Flexibility Window

To determine the flexibility power requirements and time windows, we analyse the half-hourly data of the constraint over a whole year, as shown in Figure 8. We identify the number of half-hour constraint events that exceed the network capacity and take note of when the capacity exceedances occur in relation to the time of day half hour, day of the week, month, and season of the year. This analysis helps populate Table 1, which contains the necessary types of information for specifying the flexibility requirements to our Flexibility Service Providers (FSPs).

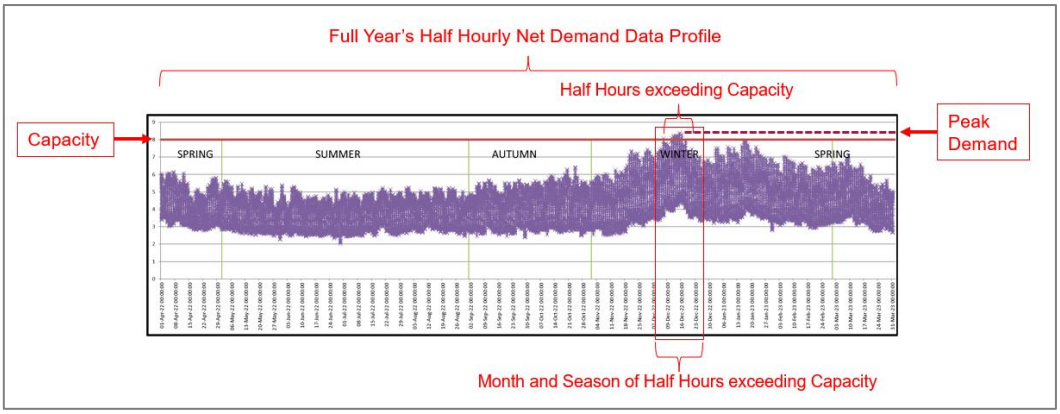

Figure 8 – Typical flexibility requirement window on a primary substation load profile

4.5.2 The Common Evaluation Methodology (CEM) Tool

Together, definition of the time windows, frequency and magnitude of the required Flexibility Services allow us to calculate the maximum amount that we could spend on Flexibility Services so that they would cost no more than the asset-based solution over the whole lifetime of the solution.

The Common Evaluation Methodology (CEM) tool[11] is an industry standard tool for cost benefit analysis (CBA) which was developed by the Energy Networks Association (ENA). We use the CEM tool to set maximum prices when assessing the feasibility of utilising Flexibility Services as a means to defer network reinforcement and determine the most economic and efficient solution for addressing network constraints. By using the CEM tool, we ensure consistency and transparency in our flexibility decision-making process.

The CEM tool, along with its comprehensive user guide[12] available on the ENA website, allows us to compare counterfactual costs based on the net present value (NPV) of conventional network reinforcement options and generate a ceiling price for procuring Flexibility Services.

The CEM tool considers the whole life cost of each option. By considering the whole life cost of each option, the CEM tool ensures that the chosen solution meets the long-term load growth requirements and aligns with the long-term needs of our customers.

4.5.3 Flexibility Market Engagement

We engage with the flexibility market through the signposting and tendering processes. Typically, where the constraint occurrence year is within the next two years, we tender, and when constraints occur 3 years or more in the future, we signpost the requirements. Flexibility Services may be provided by any customer in the region who can modify their energy consumption and/or production of energy, whether already connected to the network or considering a new connection.

Where we have signposted customers who may be able to provide Flexibility Services to Northern Powergrid, they can contact us via our website[13]. We then follow up to discuss the opportunities,

[11] https://www.energynetworks.org/publications/on22-ws1a-p1-common-evaluation-methodology-tool-version-2.2-(25-aug-2022)
[12] https://www.energynetworks.org/publications/on22-ws1a-p1-common-evaluation-methodology-(cem)-and-tool-v2.1-user-guide-(14-jan-2022)
[13] https://www.flexiblepower.co.uk/locations/location/northern-powergrid

technical capabilities, and the technical requirements for them to become a Flexibility Service provider. Updates are provided about current and future tender opportunities as soon as they are launched.

Our DNOA report lists the sites where we anticipate that we will need Flexibility Services and the areas where we are likely to procure Flexibility Services in areas of our region with future constraints.

4.6 Step 6: Decision Making

The decision-making step of our DNOA process allows us to identify and implement appropriate measures to mitigate identified potential network overload constraints. Figure 9 shows our DNOA intervention decision making process based on the following outcomes: signposting, flexibility, flexibility and reinforcement, and reinforcement.

The CEM CBA tool is utilised in our decision-making process, where the option with the lowest expected costs is considered optimal. This approach helps us make informed decisions and prioritise cost-effective solutions. The availability of Flexibility Services through the market at or below the maximum price determined using the CEM tool determines whether flexibility is an effective solution to resolve the constraint.

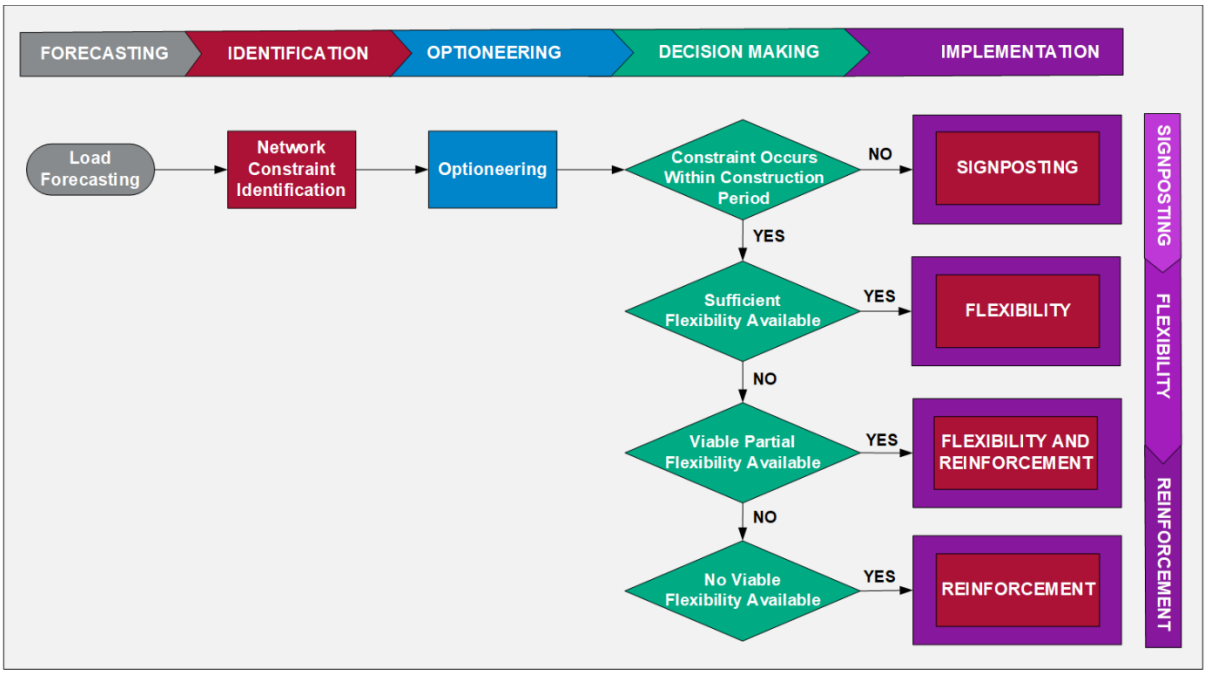

Figure 9 – DNOA intervention decision making process

- **Signposting** refers to the open call made to the flexibility market listing potential parts of the network that may require Flexibility Services in three or more years.

- **Flexibility** refers to the DNOA intervention decision of deploying Flexibility Services to alleviate network constraints. Flexibility Services are whereby customers can actively manage their demand or generation to help avoid network constraints. Total flexibility procured amount is confirmed once we have entered into contracts with a flexibility service provider to provide energy to meet peak demand, or to lower consumption during peak hours.

- **Reinforcement** refers to the provision of additional network capacity to alleviate network constraints through smart and conventional reinforcement such as replacing existing assets with new ones with a greater rating or installing additional assets to increase network capacity. Reinforcement is triggered when insufficient flexibility has been identified in the market with the option to delay or cancel reinforcement part of the way through when sufficient flexibility becomes available. Reinforcement is also triggered when the construction lead time of the reinforcement solution is equal to the remaining time predicted until load growth becomes unmanageable.

- **Flexibility and Reinforcement**: In some cases, a combination of flexibility and conventional reinforcement may be necessary if flexibility alone is insufficient to meet anticipated growth in peak demand. Partial flexibility procurement can be used to manage constraints during reinforcement works and stimulate the market to create liquidity.

4.7 Steps 7 and 8: Implementation

Once the DNOA process has identified the appropriate solution(s) to mitigate the network constraint, the implementation process begins, which involves flexibility and/or reinforcement.

Our Flexibility First approach means that we consider flexibility approaches before reinforcing the network. The economic strategy for flexibility implementation, if sufficient Flexibility Services are achievable, would be the deployment of flexibility to allow full deferral of investment. Or part deferral where we can only defer investment for a shorter period, such as from early in the RIIO-ED2 period to mid RIIO-ED2.

Smart and conventional reinforcement solutions are triggered when insufficient Flexibility Services are available from the market to cater for the load growth. Once a constraint has been identified, we design the reinforcement solution ready to initiate the works when we reach this trigger point for smart and conventional reinforcement.

5 Decision Making Governance and Transparency

We are committed to implementing a full suite of assurance activities to give stakeholders confidence that the Flexibility First policy and DNOA processes are being operated effectively and as described.

In the Openness and Transparency section of our RIIO-ED2 business plan, we recognised the importance of these Flexibility First activities. In addition, we made a commitment to retain the Customer Engagement Group (CEG)[14] on an enduring basis to independently scrutinise our business plans, fulfilment of our commitments and to oversee the stakeholder engagement plan.

We have established a DSO Review Panel (DRP) as a subgroup of the CEG to fulfil the Company's DSO strategy initiative 3.32, which included a commitment to making its decisions transparent via a stakeholder panel who could comment on and challenge major investment decisions.

The purpose of the DRP is to provide independent scrutiny and challenge of our decision-making process (including financial, technical, economic, and environmental) and the associated outcomes to ensure that:

a. Decisions on the selection between flexible and conventional asset-based solutions are in line with the Company's published policies; and
b. The selections are just and inclusive so that no customers are left behind.

As a subgroup of the independent CEG, the scope of the DRP is to operate independently from both the Company and Ofgem, to appraise a sample (of its own choice) of DSO network development decisions and report publicly on its observations.

[14] Now known as Independent Stakeholder Group, ISG

6 The DNOA Report

We have developed a common DNOA report template that enables us to present and share data on a consistent basis and report on our DNOA intervention decision outputs for each named scheme. The main features of our DNOA reports are explained below as guidance for users.

Figure 10 shows our typical DNOA report structure and the specific information it presents for a specific scheme.

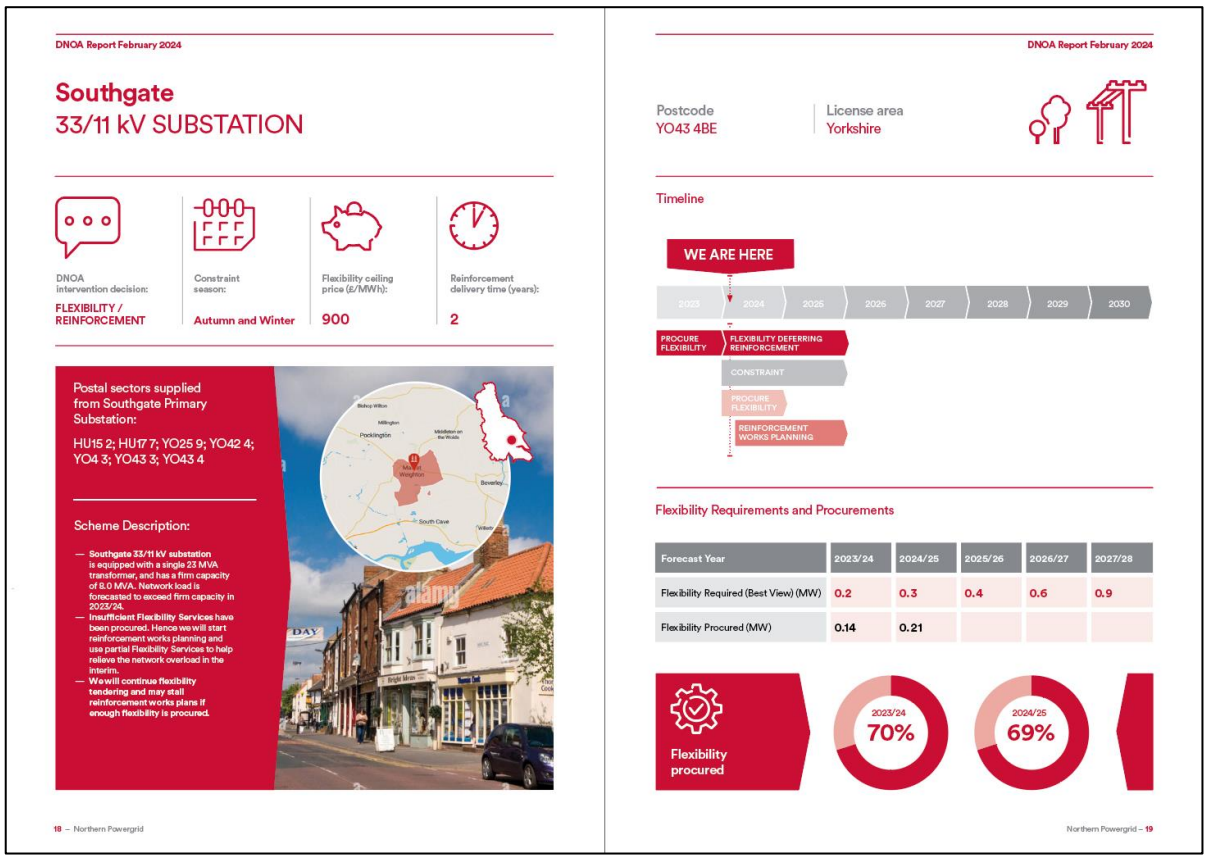

Figure 10 – Northern Powergrid's DNOA report template

Scheme Description: Each of our DNOA reports includes a background of the scheme/constrained site which includes location of intervention; existing network ratings; reason for carrying out the DNOA; and outline of the DNOA intervention decision.

In providing the information in our DNOA reports, it is important to recognise that the outlined schemes and activities are based on the most up to date information that we have available. The data may change in future years due to a range of factors including:

- Existing or new customers changing their capacity requirements (for example cancelling or increasing the agreed capacity).
- Annual load forecasting updates indicating different dates of constraints occurring.
- Future new customer connections resulting in increased network capacity.
- Revised asset condition assessments indicating intervention may not be necessary.
- Flexibility procurement not providing sufficient capacity.

Map: Shows a red pin drop indicating location of the constrained substation and the area it serves shaded in red.

DNOA intervention decision: This displays our DNOA intervention decision from the following range of options: signposting; flexibility; flexibility and reinforcement; reinforcement.

Constraint season: The season that the network constraint occurs.

Flexibility ceiling price: The maximum price taken to market for tendering Flexibility Services.

Postal sectors supplied from substation: The last number of each post sector listed is the first character of the second part of the postcode. For example, DN14 7 means all DN14 7xx postcodes and HG4 5 means all HG4 5xx postcodes.

Flexibility procured: The amount flexibility procured to date as a percentage of the required flexibility.

Reinforcement delivery time: The time to complete reinforcement works. It is worth noting that changes to the expected reinforcement completion timeline may occur owing to operational and logistics reasons.

Timeline graphic: This displays a chronological arrangement of the scheduled scheme progress events in the order of their occurrence. A complete range of scheme progress statuses is signpost, procure, flexibility, reinforcement works and reinforcement, as shown in Figure 11. The graphic would normally show that once the constraint has occurred, it may exist until reinforcement works are completed. This is because the inherent load growth that is flattened by flexibility persists until a permanent solution such as reinforcement is completed.

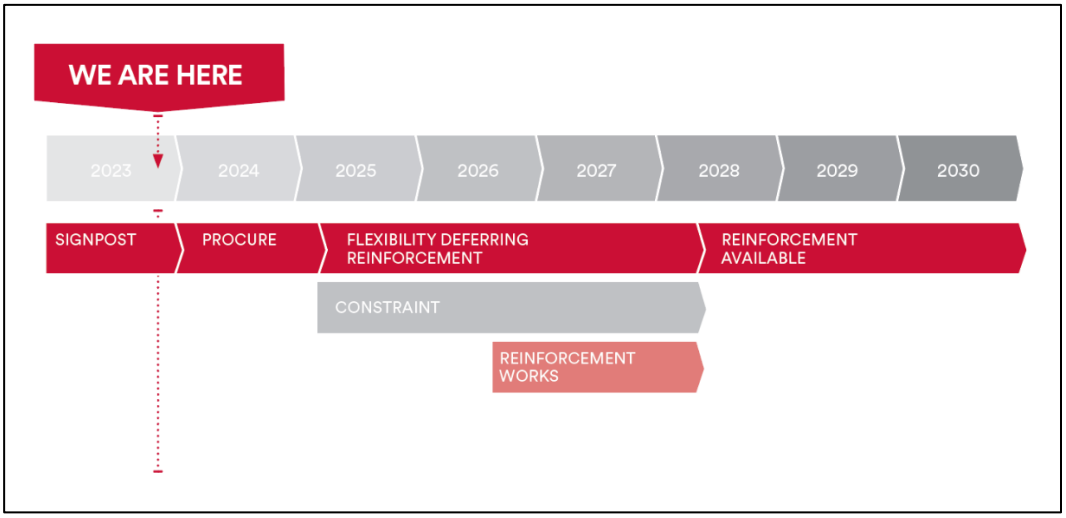

Figure 11 – Example of sufficient Flexibility Services procured in the first tender round

Figure 11 shows an example of when enough Flexibility Services are procured in 2023, so the procure phase stops when the flexibility starts deferring reinforcement. In some cases, the procure phase may overlap with the flexibility and reinforcement works phases. This is depicted in Figure 12 where procurement is continued owing to insufficient Flexibility Services having been procured initially.

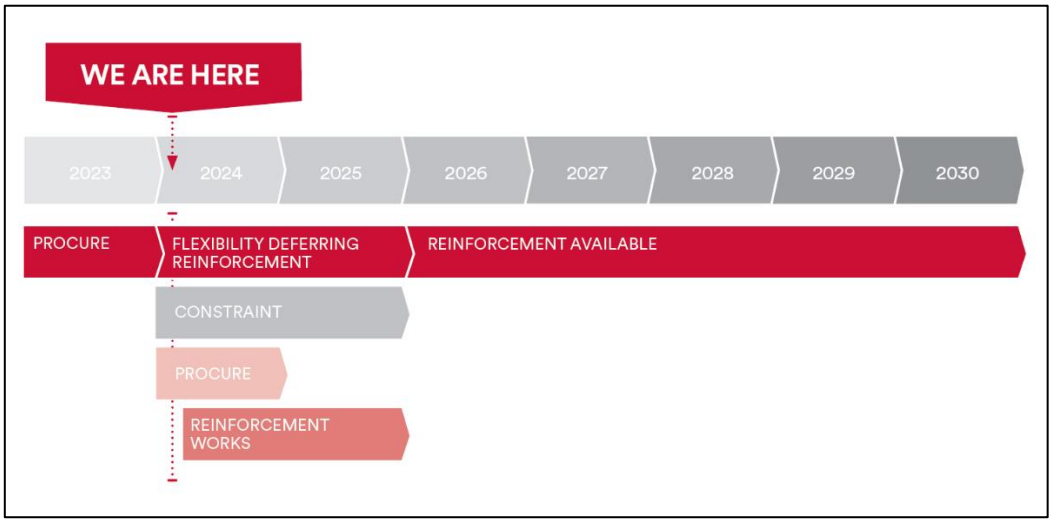

Figure 12 – Example of continued procurement due to insufficient Flexibility Services procured in the first tender round

7 Annual DNOA Reporting Timeframe

To ensure stakeholders are kept up to date throughout the year, we aim to publish the Northern Powergrid DNOA report at least twice a year on our Open Data Portal. We aim to align our DNOA report publication with the availability of associated inputs - our DFES, network assessment results and flexibility tender results – all of which feed into our DNOA process. However, our DNOA publication timeframe is subject to change as our processes evolve or as we incorporate stakeholder feedback in order to provide timely, valuable information.

8 Other Reporting Documents

Our DNOA aims to help us prioritise flexibility and deliver our RIIO-ED2 load related expenditure economically and efficiently. The DNOA report is therefore focussed on the identified RIIO-ED2 load related network constraints at our primary substations and Bulk Supply Points.

Across the business there are other network interventions that also provide additional network capacity that are outside the scope of our DNOA reporting as outlined below.

LV Flexibility Services

We have recently expanded our opportunities for engaging in flexibility markets to manage constraints on the secondary network (LV network) and have had success in deploying flexibility to manage our LV network constraints. We also term this secondary flexibility.

The reporting of LV network capacity is currently outside the scope of our DNOA reporting as we have aimed to align with the Licence Condition clause 25B.3 requirement for DNOs to cover the "11kV network and above" in producing their network development plans. Thus, the flexibility procurements covered in our current DNOA report are those driven by the need to manage constraints at our BSPs and primary substations.

However, we are considering the inclusion of the reporting of secondary flexibility, that is, where we have deployed flexibility to manage LV network constraints, in our future DNOA reports.

Nevertheless, our Distribution Flexibility Procurement Outcomes Report which includes secondary flexibility is available on our Flexibility Services[15] web page. Further information about where we are procuring secondary flexibility is available on our website[16].

Non-load Driven Schemes

Our DNOA report is focused on the analysis of load related constraints where Flexibility Services are helpful. Non-load related interventions such as asset condition and fault level that provide additional network capacity are reported in our other network reporting documents such as Long-Term Development Statements (LTDS)[17] and Network Development Plan (NDP)[18], which all help our stakeholders with securing new network capacity or assessing the availability of renewable energy capacity for their short – and- medium term decarbonisation planning and forecasting.

[15] https://www.northernpowergrid.com/flexibility-services
[16] https://www.flexiblepower.co.uk/locations/location/northern-powergrid/where-we-are-procuring
[17] https://www.northernpowergrid.com/Long-Term Development Statement
[18] https://www.northernpowergrid.com/sites/files/2022-04/Network Development Plan

9 Feedback

Northern Powergrid is committed to a customer-centric approach, openness, and transparency. We believe that the value of our DNOA process and report is defined by our stakeholders. As part of our DNOA process, we would like to interact and hear from our customers and stakeholders regarding our DNOA.

Your feedback on our DNOA helps us to continually improve.

- Get in touch with our System Forecasting team opendata@northernpowergrid.com

Some of the areas that we would like feedback from our customers and stakeholders are outlined below.

- Is the DNOA report useful and informative?
- What can be done to increase its value?
- What is missing from the DNOA documents?
- Is the DNOA report format user friendly?

10 Glossary

BSP Bulk Supply Point

CBA Cost Benefit Analysis

CCC Climate Change Commission

CEM Common Evaluation Methodology

DFES Distribution Future Energy Scenarios

DNO Distribution Network Operator

DNOA Distribution Network Options Assessment

DSO Distribution System Operation

EHV Extra High Voltage

ENA Energy Networks Association

ESO Electricity System Operator

FES Future Energy Scenarios

FSP Flexibility Service Provider

LCTs Low Carbon Technologies

LTDS Long Term Development Statement

LV Low Voltage

Ofgem Office of Gas and Electricity Markets

NDP Network Development Plan

NPV Net Present Value

RIIO Revenue = Innovation + Incentives + Outputs