Distribution Network Options Assessment (DNOA) Methodology

MARCH 2024 | SECOND EDITION

DSO
DISTRIBUTION SYSTEM OPERATOR

UK Power Networks
Delivering your electricity

CHAPTER 01

Executive Summary

UK Power Networks' vision is to deliver a fit for purpose electricity network for the energy transition at the lowest cost to our customers. To do that, we set up GB's first independent Distribution System Operator in 2023 with appropriate governance to ensure that recommendations on provision of future network capacity are made in the interest of all UK Power Networks customers. We were also first to set up an independent DSO Supervisory Board in 2023, as part of our operating model. As we explain below, the Supervisory Board approves investment and flexibility award decisions and provides steer with respect to the future work we undertake for our Distribution Network Options Assessment (DNOA) Methodology. Hence, our Distribution System Operator (DSO) will be at the heart of facilitating the lowest cost transition to Net Zero, whilst supporting clean economic growth. Also, we are and will continue to publish new granular data on our capacity needs and investment recommendation making throughout the RIIO-ED2 period.

In June 2023 we published our inaugural Distribution Network Options Assessment (DNOA) Methodology[1]. This set the basis for our RIIO-ED2 enduring commitment to market-test all load related[2] network needs that would otherwise lead to capital expenditure (capex).

In principle, our DNOA Methodology establishes a level playing field between network and market-based solutions on an enduring basis. Through our engagement with our DSO Supervisory Board and other stakeholders, including the Electricity System Operator (ESO), flexibility providers and other Distribution Network Operators (DNOs,) we developed further enhancements that led to our November 2023 consultation[3].

We have now integrated all these enhancements and feedback in this second version of the DNOA Methodology for the RIIO-ED2 period that sets out the governance processes that we will use to assess investment options. This document integrates all these dedicated governance processes into our **DNOA Methodology for the RIIO-ED2 period**. Through this framework we will continue to work with our Supervisory Board and deliver on our RIIO-ED2 business plan commitment to deliver up to a £410m reduction in load related expenditure through increased competition and use of flexibility. Also, it ensures that we will address issues for the Whole Electricity System and that our network is and will be optimally utilised to meet the needs of the transition towards Net Zero.

[1] https://www.ukpowernetworks.co.uk/our-company/distribution-network-options-assessment-dnoa
[2] The term often used is Load Related Reinforcement (LRR) and indicates investment to create new network capacity.
[3] https://media.umbraco.io/uk-power-networks/fnzldp2c/dnoa-methodology-enhancement-nov-2023.pdf
[4] Our stakeholders can see our RIIO-ED2 commitments here https://ed2.ukpowernetworks.co.uk/

The DNOA Methodology process

Our DNOA Methodology starts with our engagement with UK Power Networks' key stakeholders, including other parts of UK Power Networks and external stakeholders such as the Electricity System Operator (ESO), Local Authorities (LAs) and the Transmission Owners (TOs). The engagement is formalised though appropriate arrangements, including network codes and other agreements, to collate information and data that are necessary for the next steps. For example, our DSO:DNO Operational Agreement[5] shapes our engagement with the Network Planning department within UK Power Networks. More specifically, our DSO team engages regularly with both internal stakeholders, such as the DNO's Network Planning teams and external stakeholders such as the ESO, Local Authorities (LAs), other DNOs and Transmission Owners (TOs). The engagement process underpins forecasting processes that allow us to identify future system needs across our distribution network and the whole electricity system in a timely fashion.

Following a verification process, we progress to the **optioneering** phase. This entails listing and understanding all possible options that can help resolve the emerging issues. For example, we will seek to explore market-based options through flexibility services alongside other intervention options in cases of forecasted network capacity needs. In cases, where there are constraints and/or operability issues for both the transmission and distribution electricity system, we will continue to work closely with the ESO and neighbouring DNOs. This enables us to explore options such as the development of market services, coordination between control room operations and investment in new IT systems.

Subsequently, we proceed with evaluating all options against fundamental parameters, such as their costs, the time required to deliver the solution, associated risks and the benefits that will be accrued for our customers going forward. The **approval** includes comprehensive scrutiny of the recommendation, supporting evidence, assumptions used and investment costs. More specifically, our Supervisory Board will review operational data, forecasts and the costs of the options proposed for awarding flexibility contracts and/or network reinforcement recommendations. Also, it relates to external joint steering groups with other operators that oversee whole system programmes of work, such as the Regional Development Programmes. The final step is to proceed with the **implementation** of the approved option.

Figure 1 below summarises our DNOA Methodology for network needs across our distribution network and the whole electricity system.

Continuous Internal & External Engagement

Need identification	Optioneering	Evaluation	Recommendation	Approval	Implementation
We use our forecasting systems and other relevant sources of information to identify the network issue.	This involves listing all available options – e.g. flexibility services, network interventions.	We evaluate all options consistently against key criteria – e.g. we use the ENA's Common Evaluation Methodology to compare flexibility services with reinforcement options.	We submit to the relevant board, e.g. our Supervisory Board our proposal with all the relevant evidence for their approval.	Our Supervisory Board will scrutinise the recommendation and the supporting evidence. Following the satisfactory review, the Supervisory Board, or the relevant external joint steering group, approves the optimal recommendation.	Subsequently, we proceed with implementing the approved recommendation.

Figure 1 Our DNOA Methodology as a high-level process

[5] 1011184-UKPN-DSO-Operational-Agreement-FINAL-1.pdf

Tailoring the DNOA Methodology to our customers' needs

Our DNOA Methodology is applicable across different types of needs we face in developing and operating our network. Therefore, we use a set of basic parameters to identify these needs. These parameters relate to the nature of the issue, the voltage of the affected network assets, the associated costs and the timelines required to deliver solutions. Hence, we have established a group of DNOA processes as outlined above for the following network issues:

- **Issues across the wider electricity system –** Other network and system operators, such as the ESO and neighbouring DNOs are facing network and operability challenges. Also, this work relates to our collaboration with Local Authorities and our support in establishing their respective Net Zero transition plans. The Network Options process allows us to collaborate effectively with them to identify and deliver innovative solutions that deliver benefits across a wider spectrum of customers. For example, our work with the ESO through our SPN Regional Development Programme has already facilitated the connection of approximately 1GW of renewable generators in the SPN, without increases in the cost of ESO ancillary services to manage the transmission network. Additionally, it allows our connected customers to access additional revenue streams.

- **Capacity needs to accommodate additional demand at High and Extra High Voltage –** We use our long-term forecasting system to identify future capacity needs due to the increasing load from demand customers on our High and Extra High Voltage network over RIIO-ED2 through annual iterations. Our DNOA Methodology allows us to market test these needs and recommend the least cost option to resolve these. This also includes an additional process for reviewing and approving schemes of low value (i.e. below £1.5m) that aim to facilitate predominantly new connections. This process allows our customers to access additional revenue streams through their participation in our flexibility markets.

- **Capacity needs to accommodate additional demand at Low Voltage –** We use our forecasting system to establish a profile of load across our Low Voltage network. Subsequently, we aim to procure flexibility in the areas where additional capacity is needed and it is economic to provide it through flexibility. This process facilitates the uptake of Electric Vehicles and other Low Carbon Technologies, such as residential batteries that are crucial in the electrification of transport and heating, whilst only increasing network capacity where necessary. Also, it helps end consumers reduce their electricity bills.

- **Capacity needs for additional generation and battery storage connections –** The transition to Net Zero necessitates the connection of additional low carbon generation in network areas that are already exporting electricity. The increasing volume of new generation and storage connections will require us to evaluate the investment needs in a more dynamic way than previously. We have developed a process that enables the evaluation of the investment options to provide increased access to existing generators and future generation and battery customers.

Table 1 below maps the cumulative financial benefits in terms of reduced costs to our customers as included in our ED2 Business plan against each of the above processes. Furthermore, it highlights some of the outcomes for specific customers as we provide capacity at the lowest cost through our DNOA Methodology.

	Nature of issue	Network Options Assessment process	Cost reduction for providing network capacity through RIIO-ED2 (£m)	Complementary customers' benefit
1.	Whole System	As outlined in Chapter 7	£130m	Acceleration of new generation and storage connections Providing access to additional revenue streams Improved Local Authority Area Planning
2.	Grid & Primary Level demand capacity needs	As outlined in Chapters 3 to 6	£410m	New revenue streams
3.	LV network demand capacity needs	As outlined in Appendix B of this document		New revenue streams
4.	Generation capacity needs	As outlined in Appendix C of this document	£30-40m	Increased access to the system, new revenue streams

Table 1 DNOA Methodology approach against system needs

The next steps for our DNOA Methodology

In the first year of RIIO-ED2, we published and implemented our DNOA Methodology as an end-to-end process. More specifically, we market tested £472m capex to address constraints at 98 High and Extra High Voltage sites and at 354 Low Voltage areas of forecasted network needs. The Supervisory Board has approved our recommendation to award £7.6m of flexibility and progress £37.2m of capex. We are publishing the outcome of this process through our DNOA Reports alongside this document.

Also, throughout the first year of RIIO-ED2 we engaged with stakeholders, including our Supervisory Board and consulted with the industry on our proposed enhancements to the DNOA Methodology. These activities have highlighted the two areas where we believe we should focus the development of the DNOA Methodology:

a. The option value of flexibility – So far we have used the Consumer Transformation scenario as the basis for our DNOA Methodology and the respective recommendations. However, we do acknowledge the inherent uncertainty around the various paths to Net Zero. Hence, we will explore how we can structure the DNOA Methodology to develop recommendations that deliver benefits against multiple scenarios.

b. A framework for strategic interventions on our network – The optioneering phase includes market testing of investments on a site-by-site basis for a defined deferral period, e.g. 5 years. We have identified that market-based operation of DER can be considered over different horizons and across different voltage levels. This can allow us to optimise interventions by taking a strategic approach when developing future recommendations for future capacity needs.

Following the development of the above areas, we will publish further updates to our DNOA Methodology in Q3 2024. Overall, we will be adapting our DNOA Methodology as required by the evolving needs that we face in RIIO-ED2.

Lastly, we kindly ask your review of our DNOA Methodology and provide us with feedback via the link below or QR code.

https://forms.office.com/pages/responsepage.aspx?id=nCN6iJLg_kWSyNkCw2gVZy76v8CuRqlAj9TmweAf31RUNjVUTk9ZTDAwN0JKOVNQQkJFUlFIS1BVUC4u&origin=QRCode

CHAPTER 02

Introduction

The purpose of Distribution Networks Options Assessment (DNOA) is to provide transparency to the industry on the investment recommendations we are making to meet the future capacity needs across our South Eastern Power Networks (SPN), London Power Networks (LPN) and Eastern Power Networks (EPN) regions over the next few years. In our RIIO-ED2 submission we committed to publishing on an annual basis the framework for our DNOA process, and the resultant recommendations on an annual basis. This document represents our DNOA Methodologies. Alongside this document, we are also publishing the DNOA Report packs. These provide the information of the investment recommendations we are progressing for each of the issues we face in our licence areas.

The following chapters describe in detail the DNOA Methodology and supporting processes that help us address efficiently future needs of our distribution network and of the whole electricity system.

Chapter 03
The DNOA cycle and annual timelines
This chapter explains the key steps of our DNOA Methodology and the five (5) DNOA processes that we have developed to facilitate optimal investment recommendations for the key issues we face on our network. Capacity needs due to increasing demand load at our High and Extra High Voltage network require the highest amount of load related capital expenditure. Hence, this chapter provides visibility of the end-to-end process and its annual implementation timelines.

Chapter 04
Identifying the System Need
This chapter explains how we move from forecasting to the identification of distribution system needs.

Chapter 05
Optioneering
This chapter describes the fundamental options we explore through DNOA for the distribution system needs. The optioneering process involves laying out traditional intervention options for dealing with network needs, such as reinforcement, and alternatives, such as flexibility services that are procured through market testing. Also, we explain how we use the ENA's Common Evaluation Methodology (CEM) Cost Benefit Analysis (CBA) to compare on an equal basis the different options available to us before we proceed to the recommendation for investment decisions.

Chapter 06
Evaluation, recommendation and approval process
This chapter explains how we develop the DNOA recommendation using the data and information established through the previous steps. Subsequently, our dedicated governance steps include the review and approval of the recommendation from our Supervisory Board. These are then followed by the implementation of the approved investment option.

Chapter 07
Our DNOA Methodology for Whole System issues
This chapter describes how we approach Whole System issues using the DNOA Methodology and brings to life current work to deliver benefits for the wider system.

Chapter 08
Data provision and Reporting
This chapter explains our approach to data provision and describes the layout of the DNOA Reporting pack.

Chapter 09
DNOA Roadmap – Engagement – Feedback
This chapter lays out our next steps in developing the DNOA Methodology and the respective timelines. Furthermore, it indicates our engagement plans and ways for stakeholders to submit their feedback.

Appendices – In the appendices we provide:
- Detailed diagrams around the DNOA governance process to establish investment recommendations for:
  (i) low value reinforcement schemes,
  (ii) the capacity needs at the Low Voltage network and
  (iii) network areas with capacity needs for generation and storage connections.
- Additional information regarding our Forecasting process.
- Additional details for the functionality of the CEM CBA.

CHAPTER 03

The DNOA Methodology

3.1. Our comprehensive DNOA Methodology

Our DNOA Methodology is a framework of processes that develop investment recommendations aimed to deliver the optimal development of both our distribution network and of the wider electricity system.

These processes start with collating information and data from critical stakeholders and sources. Depending on the identified needs, the available options are evaluated and go through a governance process that approves the optimal recommendations.

Below we explain all the key steps.

Step 1: Engagement

For the main activities that we cover through our DNOA Methodology, we proceed to identify and then engage regularly with the key internal and external stakeholders that either hold key data and information or can help us collect data with respect to future system needs. For example, we engage continuously with our forecasting team to understand the future utilisation of our network.

Step 2: Identification of system needs

At this stage we collate additional relevant data to identify future network issues. For example, we collate and compare forecasted demand load against the distribution's network capacity and operating arrangements.

Step 3: Optioneering

At this stage, we consider a range of options, such as market based and infrastructure solutions that can address the identified system need. This step includes also establishing costs for each option. To do this, we use a mix of high level and detailed cost estimates for network reinforcement. Furthermore, we use economic tools, such as CEM CBA to estimate the cost of market solutions. Ultimately, we run flexibility tenders to establish accurately the availability and costs of flexibility services. Depending on the nature of the issue we may engage with our stakeholders further.

Step 4: Evaluation

This step involves the comparison of all options depending on the specific requirement for the identified network issues. We typically compare the technical aspects and costs of the options. It can also include considering additional more up to date information and data that are becoming available during the optioneering phase. As mentioned previously, this step may involve further engagement with our stakeholders.

Step 5: **Make recommendation**
This step entails developing a recommendation for the optimal solution. This recommendation explains the nature of the issue that we have considered, the process we have followed and the supporting evidence that underpin the recommendation. We subsequently submit the DNOA recommendation to our internal governance boards and/or our Supervisory Board for their approval.

Step 6: **Review & Approval**
This step involves our governance boards, including our Supervisory Board, reviewing the DNOA recommendation, providing feedback, challenging assumptions and auditing the supporting evidence. This ensures the robustness of the investment proposal.

Step 7: **Implementation and publication**
After receiving the approval, the responsible team or organisation will proceed with implementing the approved investment proposal. For example, the DSO can proceed with awarding flexibility contracts. In a different scenario, the DNO may need to proceed with reinforcement interventions. Additionally, we will publish the approved recommendations through our DNOA Reporting packs. These facilitate the transparency of our investment decisions.

Figure 2 below presents the steps of our DNOA Methodology.

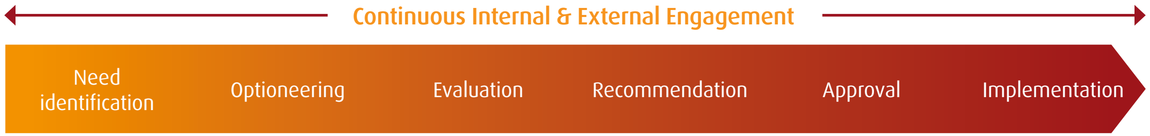


Figure 2 DNOA Methodology

3.2. The DNOA Processes

Our distribution network spans across different areas and voltages. The transition to Net Zero results in increased load on our network either through organic growth from existing customers or new connections, such as grid scale batteries, generators, and a variety of demand customers. As our role is to provide capacity for our customers, we have adapted the DNOA Methodology to ensure that our investment recommendations are optimal across multiple cases.

Hence, we have developed a portfolio of DNOA processes depending on:

i. Our role in the energy system
Most of the issues relate to our distribution network. Additionally, we collaborate with other system operators and stakeholders to resolve needs in the Whole System.

ii. The nature of system issue
Network needs manifest themselves in form of capacity needs to facilitate additional demand and generation load.

iii. The voltage of the assets that face the issue
Network assets facing constraints are classified according to their operating voltage, e.g. High or Low voltage.

iv. The value of intervention required
High value interventions require increased due diligence.

Hence, we have tailored our DNOA processes for:

- **Whole System Issues**
  This process relates to the framework of cooperation and coordination with stakeholders such as the ESO, other DNOs and Local authorities to develop solutions and services for the Whole Electricity system. This is a crucial process for UK Power Networks in our effort to facilitate the transition to Net Zero for all GB consumers. Hence, we provide detailed information in Chapter 7.

- **Capacity needs to accommodate additional demand at High and Extra High Voltage**
  This process represents the core of our DNOA Methodology. The reason is that these capacity needs represent most of the issues we face on our network that would have traditionally required capital expenditure to deliver reinforcement schemes to augment the network's capacity. Due to the significant value of the interventions, we will assess options for each individual scheme, and we will market test all these schemes as we have committed since RIIO-ED1. We will base our investment recommendations on the CEM CBA. We present the detailed process in paragraph 3.2.1 below.

- **Capacity needs to accommodate additional demand at Low Voltage**
  The DNOA Methodology for the capacity needs in our LV network aims to resolve forecasted constraints due to the significant growth of Low Carbon Technologies and Electric Vehicles at street level. We will seek the procurement of flexibility services as per our RIIO-ED2 business plan. We explain the process in more detail in Appendix B.

- **Capacity needs for additional generation and battery storage connections**
  For capacity needs to accommodate additional generation and battery connections we have developed a DNOA process that is similar to demand capacity needs at our HV network. This relates typically to reinforcement schemes that will increasingly be required to facilitate the increasing volumes of renewable energy generators. This will entail the use of all available tools foreseen in the current framework for connecting new generation and storage customers. Hence, we have developed a process that enables flexibility services to mitigate generation constraints through the optimisation of market actions and investment recommendations. We explain the process in more detail in Appendix C.

- **Low value reinforcement costs**
  We aim to facilitate new customer connections, especially at the lower voltage levels of our HV network. These would typically create constraints or operability issues that require very localised reinforcement schemes and are below £1.5m in value. Our DNOA process for these schemes' options are assessed as an annual strategic plan. We will manage these through the agreed policy with the DNO as we describe in Appendix D.

3.2.1. The DNOA Process for demand capacity at the HV and EHV network

The transition to Net Zero, e.g. through the connection of Electric Vehicles (EVs), and wider economic growth will increase the demand for electricity on our network.

This increase of the load can exceed the capacity of the network. In order to address these issues proactively, our DNOA process involves using the most up to date forecasts to identify which network areas would face capacity needs. These needs represent most of the issues we face on our network that would have traditionally required capital expenditure for the reinforcement schemes that lead to the increase of the network's capacity. Hence, the optioneering process involves mapping out and costing all options. More specifically, it warrants that we will market test all these needs. Also, we will proceed to market test needs several times and monitor the flexibility procured from previous tenders. If the market-testing has been successful, i.e. we are able to procure flexibility services at an efficient cost, the DNOA Methodology will recommend to our Supervisory Board the award of flexibility contracts. We explain in Chapters 5 and 6 the criteria around efficient procurement of flexibility. If, after repeated tenders, the flexibility tenders have not yielded sufficient flexibility to manage the constraints, the DNOA process will recommend that the DNO progresses with a non-flexibility intervention. Lastly, in the scenario where after the annual iteration of the process a forecasted capacity need fades away, the DNOA process will recommend pausing any intervention. These iterations allow us to adjust the services we are seeking according to the most up-to-date information for network needs. For example, if load reduces and there are no network needs in an area, the site does not proceed through the rest of the steps.

Figure 3 below presents in detail all the steps that lead to efficient investment recommendations in our network. We explain all these steps in more detail in Chapters 4, 5 and 6.

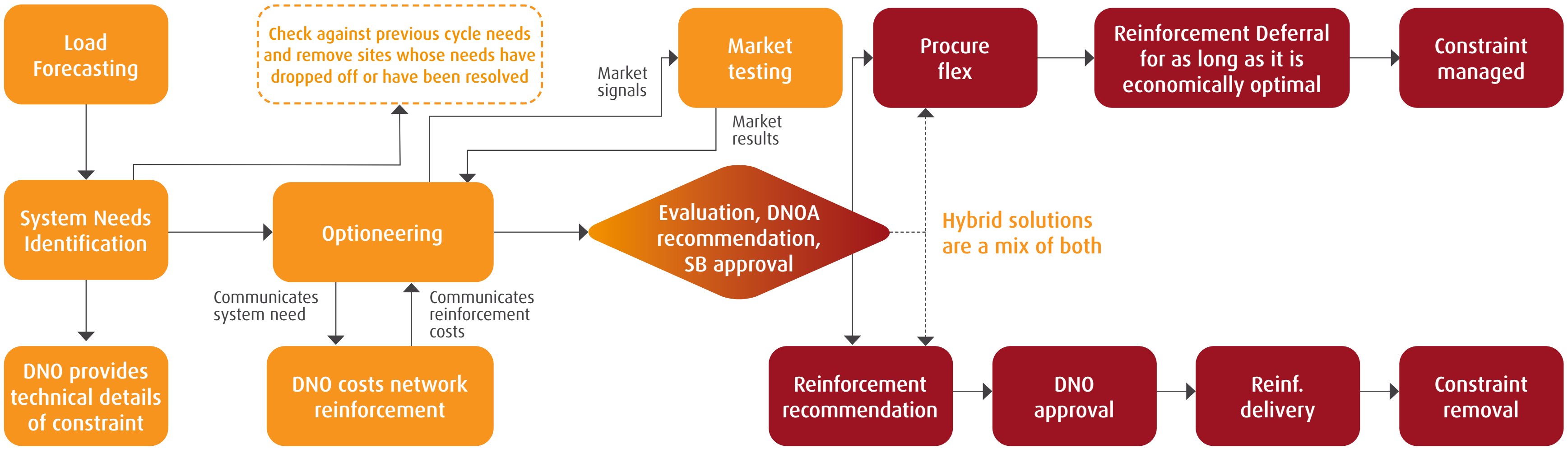


Figure 3. DNOA high value scheme process

3.3. The DNOA Timeline

Implementation of DNOA process for Distribution network needs

To ensure our investment recommendations are optimal, including the procurement of flexibility, we want to make use of the most up-to-date information available. Hence, we have based our DNOA process on the timelines of establishing the Distribution Future Energy Scenarios between January and February on an annual basis. Towards the middle of the calendar year (Year 1), the DSO will complete the analysis of load data from the previous regulatory year (1st April - 31st March). Based on that, we will engage both the DSO and the DNO to identify the system needs (Step 2 above) in Q3 every year.

Our optioneering step (Step 3 above), takes place in Q3 and Q4 annually. This involves establishing and developing cost estimates for the available options. More specifically, we utilise cost estimates for reinforcement options and establish the budgets for comparative flexibility solutions through the CEM CBA. We will then market test the flexibility solutions in Q4 every year.

We proceed with evaluating all options (Step 4) in January of the following year (Year 2). After the conclusion of the flexibility tender, the DSO will submit the DNOA recommendations (Step 5) to the Supervisory Board in February (of Year 2). After receiving the relevant approvals (Step 6), we will proceed to the publication of the DNOA results by the end of Q1 for each calendar year (Year 2).

Following that approval, the DSO will proceed with a second top-up flexibility tender in Q2 for any remaining flexibility needs. This will typically be followed by an iteration of Steps 3 to 6 between Q2 and Q3 of the following year (Year 2).

Figure 4 below shows the timeline of implementing the DNOA process

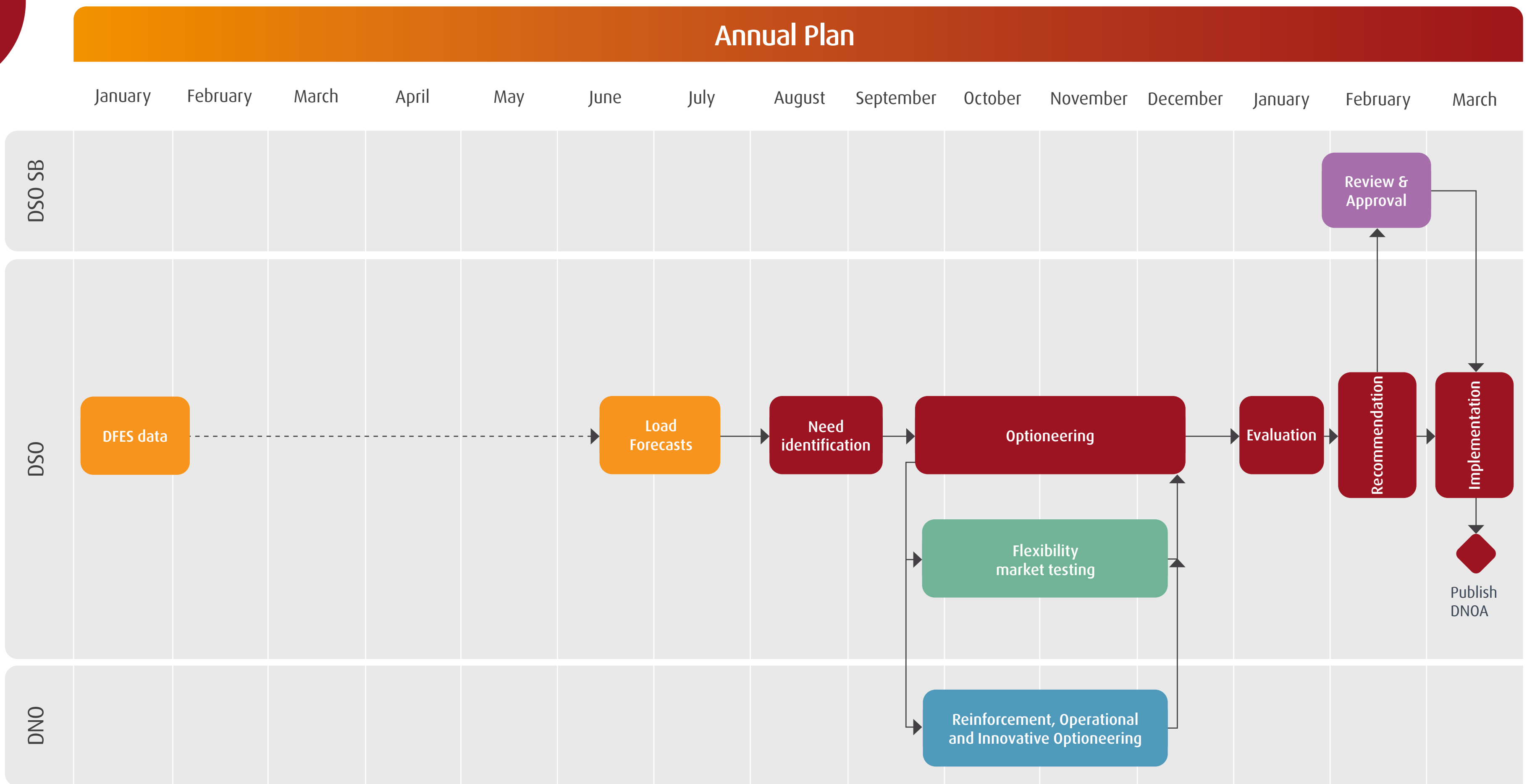


Figure 4 – Annual DNOA timeline

CHAPTER 04

Defining the system needs

4.1. The process of defining system needs

System needs are defined where the forecasted network load is larger or predicted to be larger than the capacity of the relevant network assets. In order to identify system needs, there is an intermediate step where we will establish the available network headroom. This task is carried out as part of the production of UK Power Networks' Network Development Plan (NDP).

The May 2024 updates of the NDP Methodology and Network Development Reports (listing interventions) are informed by the 2024 DNOA Methodology (this document) and the DNOA Report, both being published in March 2024. As this information is being shared with stakeholders in our DNOA publication and has been challenged by the DSO Supervisory Board, there is no separate consultation on these materials.

The NDP consists of three components:

1. **Network Development Report**
   This includes plans for infrastructure and flexibility services interventions, updated every two years.
2. **Network Scenario Headroom Report**
   This includes data tables for load and generation, updated annually. These show unused substation capacity per scenario and over time, noting this capacity may be committed or contracted to customers.
3. **Methodology**
   This methodology document for the NDP explains how the network headroom is produced and how interventions are identified, and the methodology is updated as required.

Figure 5 below is a representation of these components.

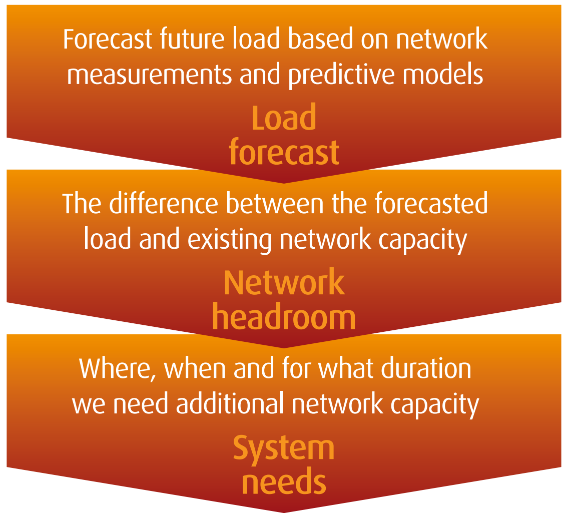


Figure 5 – The components of the Network Development Plan

All the NDP documents can be downloaded from the UK Power Networks Open Data portal Long Term Development Statement and Network Development Plan Landing Page. The next full publication will be 1st May 2024., There has been no material change in the methodology to deliver the Network Scenario Headroom reports, but data inputs have been fully updated since the last annual update. These reflect the best information available for unused network capacity in the future. The draft Network Scenario Headroom Reports are being shared in March 2024 alongside this DNOA methodology, for consultation ahead of the full publication. Feedback or queries are welcome to networkinsights@ukpowernetworks.co.uk.

4.2. Forecasting

To calculate the available headroom, the first step in the process is to forecast the future demand.

This section explains how regional forecasts for each UK Power Networks area have been developed and describes the building blocks that underpin the forecasting approach. Specifically, this includes what parameters are forecasted; the steps taken to create the forecasts; and how they are informed, alongside descriptions of the adopted scenarios. It details what differentiates a best view forecast from those which define the range of an uncertain future, in particular how policy, stakeholder engagement and local characteristics are considered.

We need to accurately forecast future demand so we can efficiently plan when and where we need to invest in the network. Knowing where demand is being driven by decarbonising buildings, heat, or transport is a key factor in our forecasts.

Hence, we have worked together with our stakeholders and third-party vendors to develop our Strategic Forecasting System (SFS) and to annually publish our DFES describing the evolution of demand and generation across our licence areas out to 2050. The scenarios modelled show that the greatest uncertainties relate to the extent and pace of decarbonisation of heating and transport. This matters because electrification of transport and heat results in significant load growth and it is key to ensuring there is sufficient network capacity, so the electricity network is not a barrier for the uptake of Low Carbon Technology (LCT) under any scenario.

Additionally, Local Authorities have a key role to play in delivering Net Zero, influencing over 80% of the UK's carbon emissions[6]. The majority of the decarbonising actions depend on the take up of LCT solutions. We serve 133 Local Authorities in our area with 88% of them aiming to reach Net Zero before the national 2050 target. To support Local Authorities with their Net Zero plans, UK Power Networks has established the Local Net Zero team responsible for engaging with Local Authorities on their regional or local climate change action plans. Through our collaborative relationships, we encourage local authorities to share their latest decarbonisation plans (e.g., deployment of EV charging points) with us as early as possible. This provides a clear line of sight to when capacity is needed, and this is being used as an input directly into our SFS.

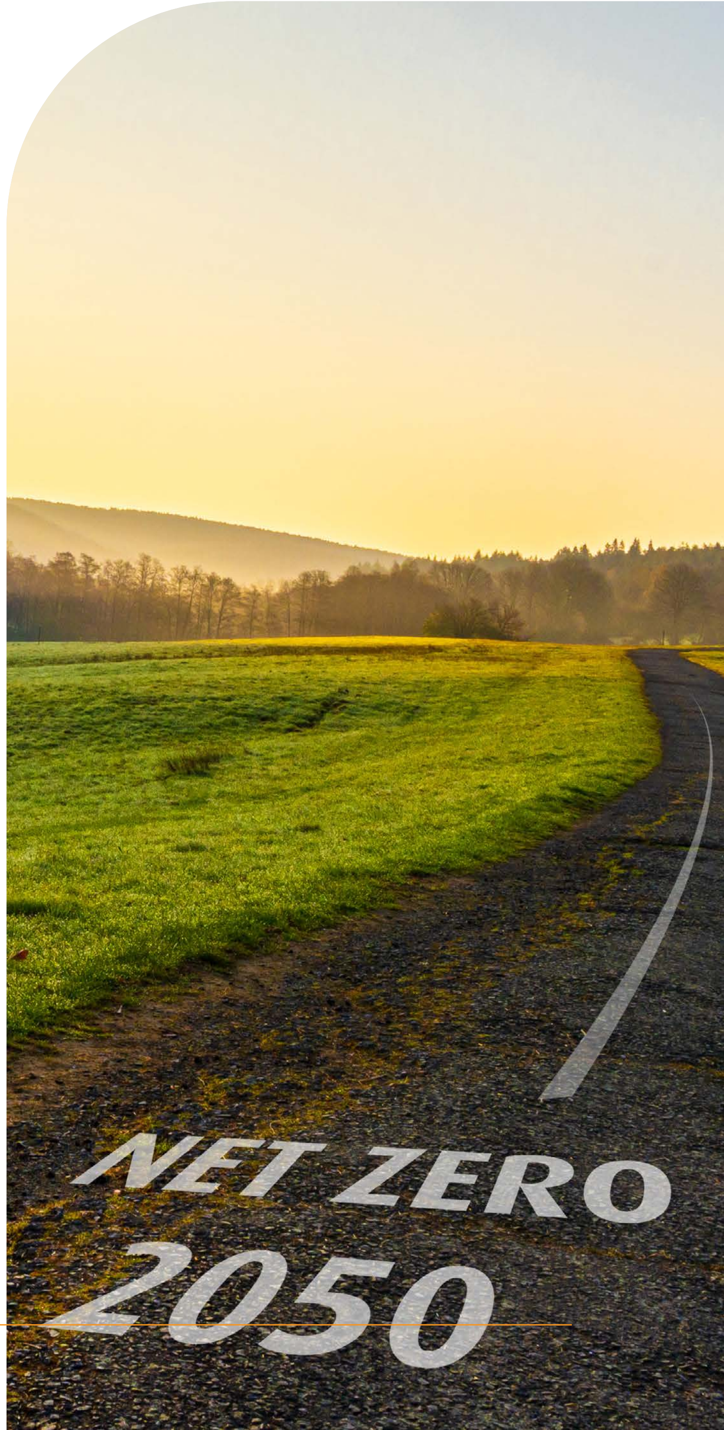
[6] For more information please see the Government's Net Zero Strategy published in 2021.

4.2.1. An overview of UK Power Networks' Distribution Future Energy Scenarios

Our **published DFES documents** provide further information on the methodologies used to produce it. The SFS contains daily and seasonal profiles for assumed electricity consumption and generation.

These are not simple profiles per kW installed. In the case of demand technologies, they also relate to the underlying demands for heat and transport energy (kWh) which are then converted to kW and assigned to the appropriate substation. These profiles are combined with the predicted volumes of new LCTs with appropriate diversity into additional electrical power flows. All existing accepted connections are also included in the forecast calculations.

The DFES framework includes four potential energy pathways to 2050, three of which reach Net Zero emissions by 2050. These pathways represent different positions on two main axes, speed of decarbonisation and level of societal change. We developed bespoke scenarios for each driver of demand and generation and constructed four overarching scenario worlds that align with the narratives of the pathways from National Grid ESO. By developing our own uptake scenarios with local knowledge, we can reflect more accurately UK Power Networks' regional characteristics, the customers within this region and the current deployment of low-carbon technologies.



The four scenario worlds are structured as follows:

- **Falling Short:** General progress is made towards decarbonisation; however, this is the only scenario world that does not meet Net Zero by 2050;
- **System Transformation:** The 2050 Net Zero target is met by relying on hydrogen to decarbonise the more difficult sectors of heat and heavy transport;
- **Consumer Transformation:** The 2050 Net Zero target is met by a high degree of societal change as well as deep electrification of transport and heat; and
- **Leading the Way:** This is the fastest of the scenario worlds to achieve Net Zero, with the highest level of societal change, utilising both hydrogen and electric low-carbon technologies.

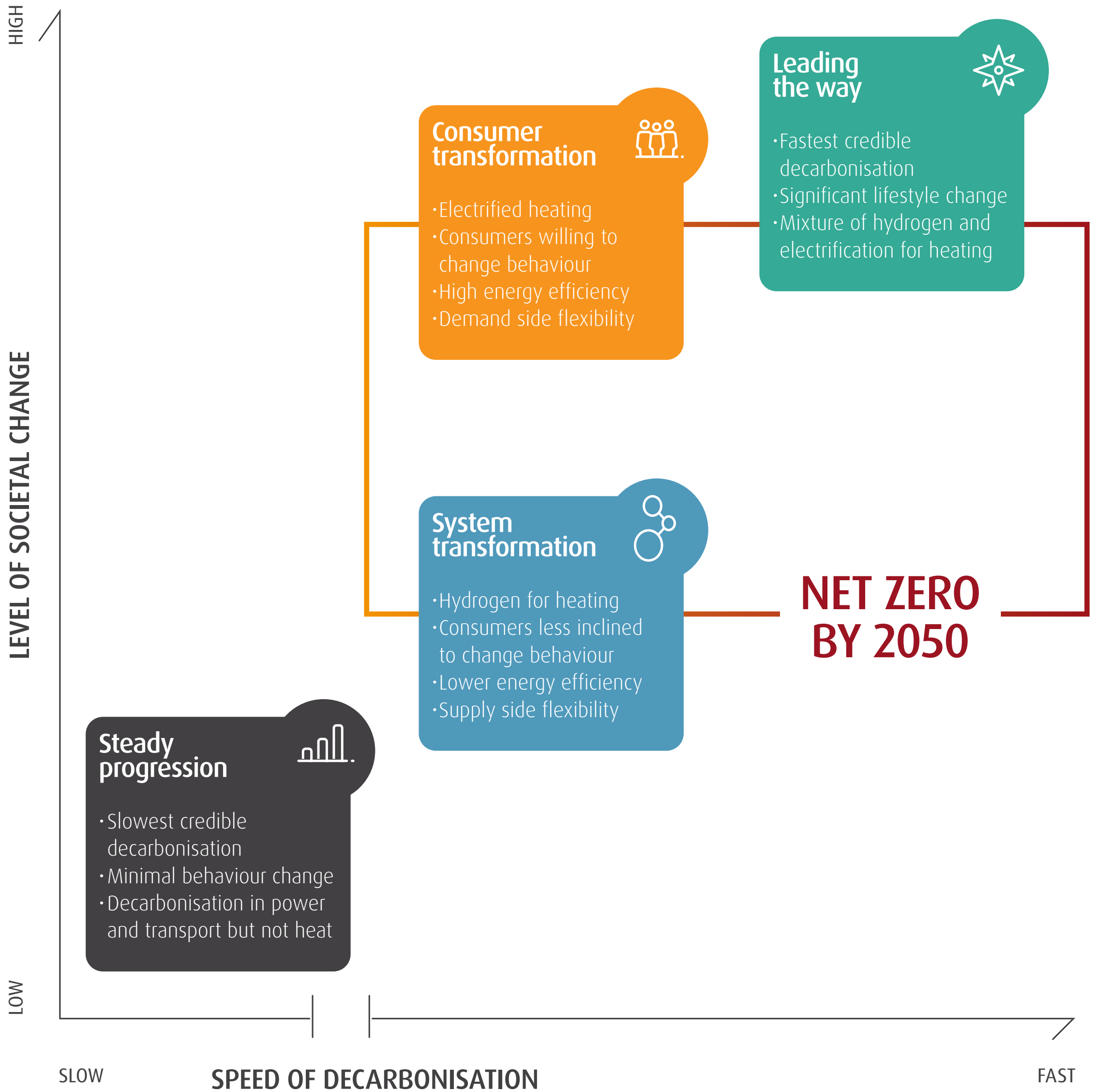


Figure 6 – 2023 FES scenario world framework

4.2.2. Our Best View Scenario

Our high confidence forecast best aligns to the DFES Consumer Transformation. This would equate to delivering a Net Zero pathway with lower costs than alternative pathways we have modelled.

The choice of best view scenario is based on justification criteria related to:

- alignment with existing/announced policies.
- alignment with stakeholder engagement inputs, and
- alignment with regional and local characteristic inputs.

Therefore, for planning purposes we use the Consumer Transformation scenario as its best view scenario. For each licence area, the best view scenario is shown in the UK Power Networks Long Term Development Statement (LTDS) for five years ahead. For example, Table 3 in the LTDS shows grid and primary substation peak demand forecasts. LTDS for all licence areas are published on our **Open Data Portal** and can be easily accessed by clicking the **Long Term Development Statement (LTDS) and Network Development Plan (NDP)** tile in the Feature links section. The LTDS also provides information on ongoing reinforcement schemes.

Furthermore, in 2024 we will integrate our DFES with the most up-to-date local inputs to create a 'Locally Enhanced' scenario.

A simple overview of the annual timeline to produce the DFES is shown in **Figure 7** below.

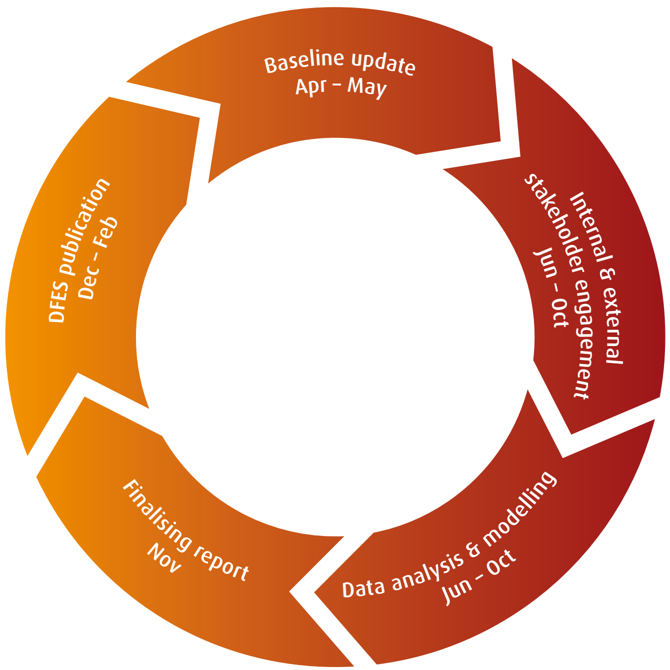


Figure 7 – DFES annual timeline

4.2.3. Converting the DFES assumptions to a substation loading.

The information in the DFES scenarios is sorted on a regional level. In order to make substation specific predictions, we need to process the information further. The translation of the information from our DFES into peak and minimum load on a specific substation is carried out by the steps in **Figure 8.**

The load growth model within the SFS follows the general logic of first establishing the number of units (this would refer to customer connection counts, but also to LCTs). These are often resolved across different unit types, and we have a bespoke forecast for each unit for future years (considering growth/uptake scenarios from the DFES).

To assign the high-level scenario data into smaller geographical regions we used Office for National Statistics (ONS) areas called:

- Middle Layer Super Output Areas (MSOAs); and
- Lower Layer Super Output Areas (LSOAs)

Our region is made up of about 2,200 MSOAs which in turn are made up of around 11,000 LSOAs. The average dimensions of MSOAs and LSOAs across England are given in Table 2 below.

The best available data is used to allocate units geospatially. The model is informed with LCT uptake at LSOA resolution, and the underlying distribution network topology resolves customer counts at LV Feeder level.

The annual consumption (or generation) is modelled for each unit, which is typically archetype specific and subject to additional scenario assumptions, such as changes in energy efficiency. Practically, this means that our forecasts take into consideration proactively the roll-out of energy efficiency across the network users.

Once the annual consumption of a specific electricity consumer/generator is established, a profile shape is applied, which is characteristic for the diurnal load (customer behaviour throughout the day). Once the daily load is defined (for specific loading conditions and seasons), the peak load can be obtained. This peak load is corrected to reflect demand diversity, taking into account the phenomenon that a smaller number of customers will cause a higher per customer unit peak on the network than a larger number of customers. **For further information on this please see Appendix A.**

In summary, DFES indicates the forecasted distribution of technology for each geographical region. For example, a scenario could say that 50 electric vehicles and 20 heat pumps are projected to be installed at an LSOA on year 2026. After this information is validated, these units are then allocated to each LV feeder based on the customer distribution. We use the consumption profiles of all the LCTs and customers to build up the energy profile of an LV feeder. Then we keep building up and moving upstream all the way to our highest voltage substations.

Figure 8 - Conversion of DFES to substation loading

Geography	Minimum population	Maximum population	Minimum number of households	Maximum number of households
LSOA	1,000	3,000	400	1,200
MSOA	5,000	15,000	2,000	6,000

Table 2 Average dimensions of MSOA and LSOA across England

4.3. Calculating the network headroom

The methodology used for calculating the network headroom is using time series[7] as shown in Figure 9 below.

Seasonal firm capacity time series minus **Seasonal peak demand to 2050 in four scenarios** equals **Demand headroom time series in four scenarios (most onerous season)**

Figure 9 – High-level approach to estimating unused capacity for demand per substation

[7] In mathematics, a time series is a series of data points indexed (or listed or graphed) in time order. Most commonly, a time series is a sequence taken at successive equally spaced points in time. Thus, it is a sequence of discrete-time data.

4.4. Understanding the duration of the constraint

Once it has been established that a site has a load constraint, the time of day and duration needs to be defined per season and per type of day. Seasonal (summer/winter) 24 hours profile for working days and non-working days (total of four profiles for each site) are created. For each time-step (30min) in 24 hours, the seasonal loading profile is calculated as mean[8] + two standard deviations[9].

A constraint window is defined when the seasonal profile exceeds the seasonal asset rating (summer/winter rating), as shown in Figure 10 below. We use our load growth forecasts and the seasonal profile to identify the future constraint windows.

4.5. Other needs drivers

There are occasions where system needs are identified outside of the annual forecasting cycle. For example, these can involve needs identified by the DNO Planning engineers following new customer connections that come outside of the DFES refresh cycle, and can relate to operational issues, such as voltage and fault-level constraints. The DSO DNOA team will be collaborating with the DNO to make sure that on such occasions the most optimal solution is selected. We will include such cases as part of our DNOA Reports going forward.

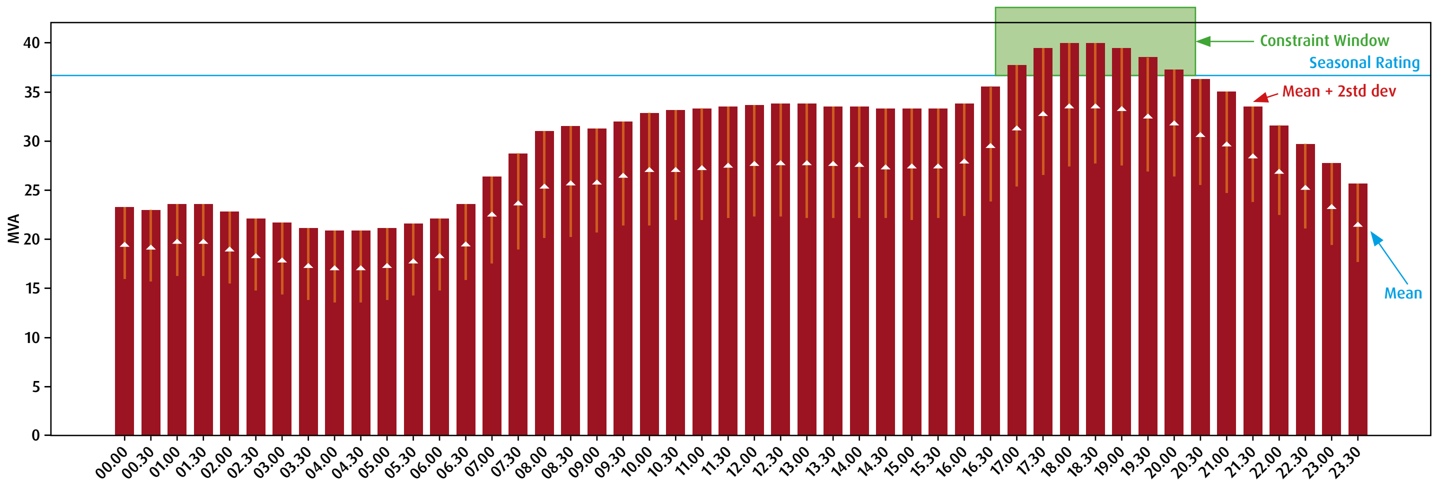


Figure 10 – Constraint window example

[8] The arithmetic mean of a list of numbers, is the sum of all of the numbers divided by the number of numbers.
[9] In statistics, the standard deviation is a measure of the amount of variation of a random variable expected about its mean.

CHAPTER 05

Optioneering

Optioneering involves mapping out and exploring the available options that can resolve the network's identified needs described earlier. Typically, this entails understanding the nature and costs of the reinforcement options that would be required in the absence of other available alternatives. Furthermore, we will explore the availability of flexibility services and other alternatives, such as operational solutions that we can depend on to resolve the forecasted constraints.

Below we explain these in more detail.

5.1. Reinforcement options

Traditional reinforcement options to address system needs are a well-established approach in the industry. UK Power Networks has an internal process for the delivery of reinforcement solutions. In the DNOA process we focus on load related needs and solutions. Therefore, the need is usually triggered by network capacity exhaustion and the solution is to increase capacity. That can be achieved by building new substations and circuits or upgrade existing assets. When a load related need coincides with an asset health need, then an upgrade is the preferred economical solution. Another potential solution is network reconfiguration.

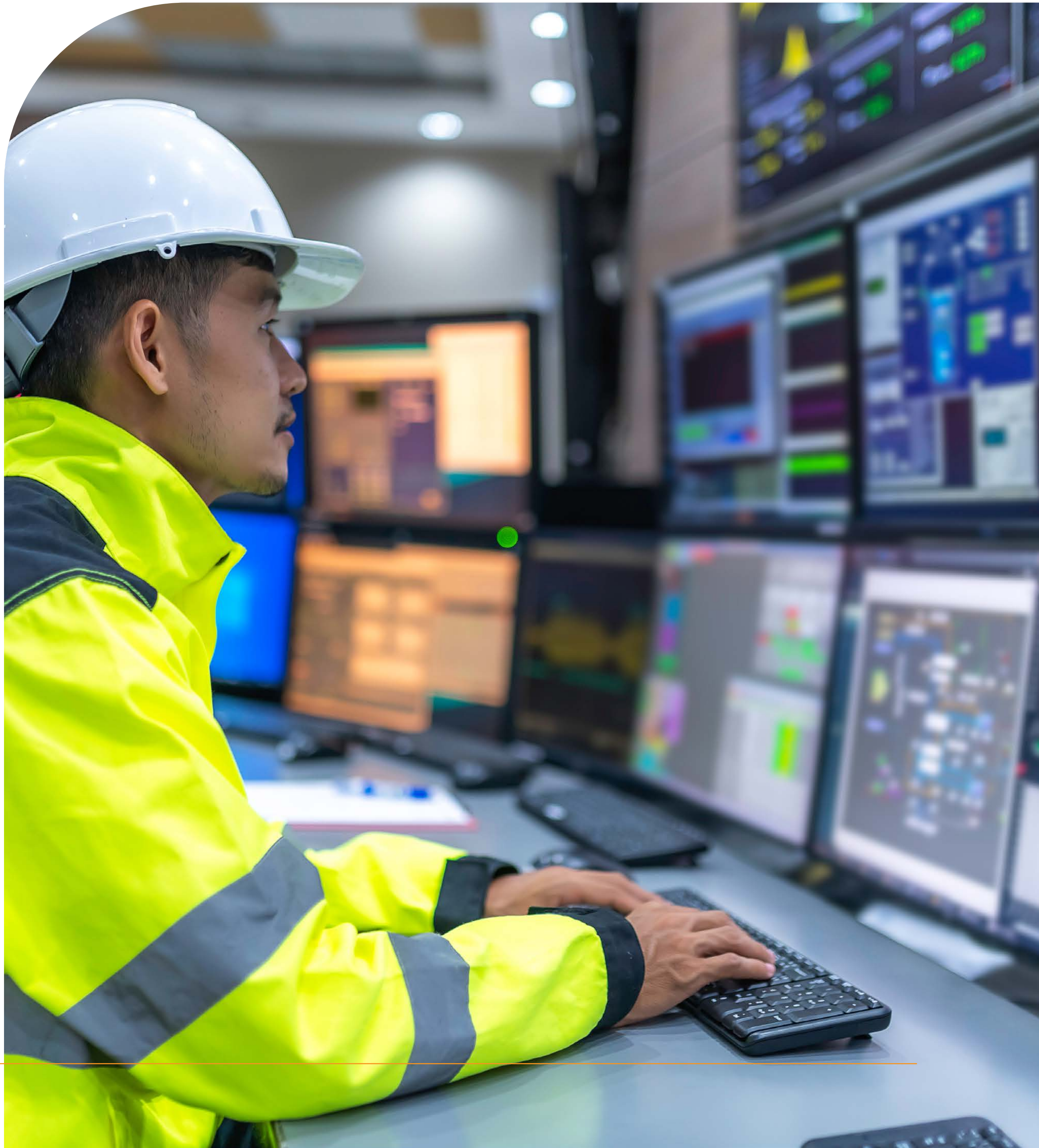
The reinforcement process uses a traditional project management phase gate process. At the early stages, a system need is identified, and possible solutions are scoped. The asset engineers will study the network, produce high level costs and compare the solutions, choosing the optimum one (Stage A). In the following stage, the experts from the delivery teams will collaborate with the asset engineers to provide more accurate concept design costs (Stage B). At the next stage the delivery team is primarily involved in creating the delivery plan and producing detailed costs (Stage C). The final stage is delivery and project closedown (Stage D). For the large reinforcement projects, the stage A costing is done prior to the start of the regulatory period.

For the purposes of the DNOA, the expense for the reinforcement and the phasing of the costing is the main input to the process. Depending on the stage of the reinforcement process, the amount of detail available can be varied. The DNOA team will always use the latest data available. On some occasions when the system need is identified far enough in advance of intervention, the reinforcement cost might not be available. On such occasions, we will use cost estimates based on average historic data as an indicator. These estimates use high level figures from a high volume of actual projects that were undertaken in the past.

5.2. Flexibility services & Energy efficiency

UK Power Networks has committed to a flexibility first approach since 2018 when we published our **Flexibility Roadmap.** Thus, we have advertised our flexibility needs through a third-party platform. This has helped us understand the availability and cost of flexibility services prior to consideration of reinforcing the network assets that are expected to be constrained. Additionally, in our RIIO-ED2 business plan and our **consultation** in 2022 we communicated to our stakeholders our plans to scale up the procurement of flexibility. This involves procuring flexibility services via biannual tenders. The reason for the frequency of tender events is to have an opportunity to seek more flexibility capacity as network needs change over time.

Flexibility is becoming a growing marketplace for Distributed Energy Resources (DER) including generators, batteries, and demand side response to offer services to electricity networks. Hence, we will continue to market test and contract flexibility services ahead of the need to start reinforcement works in RIIO-ED2. Furthermore, as our tenders are technology agnostic, we welcome any solutions that rely on energy efficiency. As part of our optioneering we will consider such proposals for the benefits they deliver in terms of load reduction.



5.2.1. Technical considerations for flexibility services

A key requirement of the optioneering process is to ensure that the available options, including flexibility services, can reliably resolve the forecasted network needs. To that end, we have worked with other DNOs to align the flexibility products at the Open Networks programme at the ENA.

Throughout 2023, the ENA Open Networks Flexibility Products Technical Working Group has collaborated with the industry to establish a more detailed definition of the parameters that make up a Flexibility Service. This comprehensive standardisation exercise was undertaken to develop proposals for alignment with the aim of eliminating the differences on the use of Flexibility Services between distribution network companies. This comprehensive piece of work has resulted in developing a set of Aligned Flexibility Products[10] in February 2024. We will be using these going forward for the procurement of flexibility services as part of the optioneering step within our DNOA Methodology.

Product name	Payment structure
Peak Reduction	Utilisation payment only
Scheduled Utilisation	Utilisation payment only
Operational Utilisation	Utilisation payment only
Operational Utilisation + Scheduled Availability	Availability and utilisation payment
Operational Utilisation + Variable Availability	Availability and utilisation payment

Table 3 ENA's standardised flexibility products

We provide further information on our flexibility products in Appendix B.

[10] on-flexibility-products-alignment-(feb-2024).pdf (energynetworks.org)

5.2.2. Budgeting for flexibility services

Ahead of the market testing for the network needs we need to establish an efficient budget for flexibility services. Hence, we use the CEM CBA to estimate the budget that is available for the provision of flexibility services against every area with a forecasted need.

The CEM CBA has been developed through the ENA Open Networks project and in collaboration with Baringa Partners. From April 2021 all DNOs committed to using the CEM to evaluate flexibility. The CEM was well received by stakeholders and suggestions were made on how the tool could be further enhanced. This feedback was incorporated into the scope for 2021 and the outcome/ deliverable being the publication of the second version of the CEM and Tool in January 2022.

Fundamentally, the tool has the ability to identify the overall available budget[11] and the ceiling prices for flexibility services to be more economic when compared against the reinforcement costs. This information is important for the DSO during the flexibility tendering process. The reason is that it allows potential providers to assess the commercial opportunities. Also, it is fundamental in the resulting price discovery process due to the competitive nature of our flexibility tenders.

Furthermore, it facilitates the evaluation of all available options on a level playing field, as we explain below in Chapter 6.

For more information, please refer to the ENA website library:

- **Statement for Common Evaluation Methodology for Network Investment Decisions v2.0**
- **Common Evaluation Methodology (CEM) and Tool v2.1- User Guide**
- **Common Evaluation Methodology Tool Version 2.2**
- **CEM Good Practice Guide**

5.2.3. Using a market platform to tender for flexibility services

UK Power Networks has consistently aimed to lower barriers to entry to the flexibility marketplace. Thus, UK Power Networks pioneered the use of online third-party platforms to advertise information on upcoming system needs and allow DER to register their interest. In early 2024, UK Power Networks partnered with the power market operator EPEX SPOT to host the procurement of flexibility[12] services. Hence, as part of the optioneering process the market operator's platform will allow us to receive the bids. These bids are necessary to establish the costs for the available flexibility options in the areas with capacity needs.

5.3. Other alternative solutions

Another option available to manage system needs are operational solutions, like network reconfiguration. This approach moves load to other areas of the network to decongest the constrained areas of network. This kind of solution can be an initial response to network capacity needs and is usually economic. However, there are limitations in terms of its availability and is usually limited in terms of duration if load continues to increase.

There are also occasions where a network constraint can be managed with an innovative solution such as our **Distributed Energy Resource Management System (DERMS)** or via an asset monitoring solution **(Real Time Thermal Monitoring).**

In certain scenarios, it may also be possible to use hybrid solutions that combine a number of potential options. For example, it may be the case that an identified need is addressed partially by a flexibility service and the residual requirement through a small reinforcement scheme, or an operational solution. However, these options can be established following the conclusion of flexibility tenders as part of the evaluation process.

[11] The tool has additional capabilities. For example, it can help compare the costs of flexibility under the different future energy scenarios. Also, at the later stages of the scheme life when the market has indicated pricing, this information can be incorporated in the tool to measure the approximate benefits
[12] New partnership between UK Power Networks and EPEX SPOT set to "supercharge flexibility market"

CHAPTER 06

Evaluation, recommendation and approval process

6.1. Evaluation

The evaluation process will start with the conclusion of the market testing as indicated in **Figure 4.** Subsequently, the DSO will collate all the data that have been collected through the optioneering and proceed with a detailed evaluation.

This involves assessment of:

- The flexibility that has come through the tenders in terms of (i) their capacity against the profile of the forecasted constraints and (ii) their cost against the efficient ceiling price as established by the CEM CBA.
- The architecture of the network area with the identified needs.
- Any additional up-to-date information regarding the identified needs. This relates to shifts in energy policy that can have a material impact on our forecasts. The reason is that as indicated in **Figure 4** – the time of evaluation in Year 2 overlaps with the production of the new DFES[13].
- Capturing the most up to date load index for the sites with identified needs.

These will highlight any remaining shortfalls in capacity over the future years and the opportunities available to the DSO to retender for flexibility services. Additionally, it helps highlight the ability of the network to withstand high load conditions[14], and identify the availability of operational solutions, e.g. load transfers through interconnection.

[13] As an example, the UK government updated its policy regarding the ban of internal combustion engine (ICE) cars an updated policy in Autumn 2023. This is expected to reduce the short-term load growth due to the roll-out of Electric Vehicles on our network. Hence, we used this additional information to develop our DNOA recommendation in January/February 2024.
[14] For example, if the remaining needs are very low and unlikely, it would be inefficient to consider an intervention to increase the network's capacity.

6.2. Recommendation, approval of investment proposals and implementation

Depending on the outcome of the evaluation mentioned above, the DSO will establish a recommendation that addresses the identified needs in an efficient and agile manner.

The DNOA recommendation can typically involve any one of the following:

- Keep monitoring.
- Contract for the available flexibility.
- Retender for remaining future capacity shortfalls.
- Proceed with load transfers.
- Progress reinforcement interventions.

Furthermore, the DNOA recommendation can consist of a combination of these ones[15] and establish a hybrid solution as mentioned in paragraph 5.3 above.

The objective is to make the optimal investment proposal in terms of the three high-level objectives of the energy policy, i.e. security of supply, sustainability and affordability.

Subsequently, the DSO will submit the recommendation to the Supervisory Board for approval. The recommendation will typically describe the investment proposal on a site-by-site basis and the process that was followed to develop it. Additionally, it will include all the critical quantitative and qualitative data that underpin the recommendation.

Prior to any approval, the Supervisory Board will have sufficient time to review the recommendation and the supporting evidence. This can entail seeking clarifications, challenging constructively the assumptions and requesting additional information if necessary.

The last step in the DNOA Methodology as mentioned in Chapter 3 above, is the implementation of the proposed investment.

Practically, this means that the DSO will proceed to contract with the flexibility providers and utilise their flexibility services. Similarly, the DNO will progress the interventions that have been approved.

The end-to-end DNOA process is repeated every year in order to verify the capacity needs' existence and that the solutions proposed deliver the optimal output for our customers. The benefit of running the annual cycle of DNOA and confirming system needs, is that we can identify when a system need disappears which negates any further intervention. Overall, any reinforcement delivery would be required, only if the need persists past the period of the deferral through flexibility and in the absence of a more efficient option identified through DNOA.

[15] For example, if some flexibility has come through the tender and there are remaining needs in the future, then we can contract for flexibility and seek to procure additional flexibility through future tenders. In a similar fashion, if the remaining needs are high and flexibility is only partially available, we may recommend contracting with flexibility and proceed with reinforcement. These two will address the short-term and long-term needs respectively.

CHAPTER 07

Network Options for the Whole System

As a DSO, our role is to coordinate effectively with other sectors within the whole electricity system, e.g. the Electricity System Operator (ESO), the Electricity Transmission Owners (ETOs) and other DNOs. Also, this includes other energy vectors where relevant in terms of geographical coverage, e.g. the Gas Distribution Networks (GDNs) and key stakeholders, such as Local Authorities. This coordinated approach aims to support both the efficient use of existing network capacity across distribution and transmission networks and identify opportunities for whole system solutions to be developed and delivered for the benefit of all GB consumers.

Our DNOA Methodology for the Whole System follows the same process we described in Chapter 3 above. **Figure 11** below shows schematically the process.

The diversity of our stakeholders and their respective roles means that they face diverse needs. For example, neighbouring system operators may face constraints and operability issues within their system. Local Authorities are in the process of establishing their decarbonisation plans. Developers of large residential complexes are seeking fast and economical connections. The diversity of those needs requires adaptability and agility. Whilst our Network Options process for Whole System issues is structured along the same steps as for our distribution network, it is purposefully agile.

More specifically, we engage with our stakeholders regularly. We adapt the scope, structure and frequency of the engagement according to our stakeholders' needs. For example, we may hold monthly updates, or quarterly workshops over the period of a year. These allow us to understand our stakeholders needs and contribute to the exploration of the available opportunities.

For example, in the case of issues in the electricity system with the ESO and other DNOs, the joint optioneering can include network build solutions, establishing markets and various operational solutions. Subsequently, we support their evaluation and participate to the recommendation and approval steps depending on our role in the Whole System. Depending on the exact case, we are working jointly to support the delivery of the recommendation. Furthermore, the process allows for feedback loops, which enable us to adapt the scope of the options progressed to deliver additional benefits.

Hence, our DNOA process for the Whole System promotes the necessary collaboration and coordination with our stakeholder that will drive overall societal benefits and help to accelerate the Net Zero transition. Below, we provide insight to our current areas of work to inform, explore and deliver optimal outcomes for the Whole System and explain where we are in the Network Options process for each of these areas.

Figure 11 Network Options process for Whole System issues

7.1. Cooperating with Local Authorities and other utilities

As mentioned earlier, we have 133 Local Authorities across our three licence areas that we are engaging with alongside other utilities to better understand their Net Zero plans. Within our DSO, our Local Net Zero team develops collaborative relationships with regional governmental bodies, such as Local Authorities, County Councils, and London Boroughs. We support them in creating well justified energy plans and have developed a new methodology to allow local insights to shape our network investment recommendations.

Our collaboration with local authorities includes close conversations through our annual Regional Engagement sessions. To further strengthen our collaboration, we are creating new tools and exploring new processes designed in partnership with local authorities to make sharing local plans easier and more efficient at all stages of local energy planning.

These include:

The LAEP open data page provides easy access to over 160 datasets prioritised by local authorities to support decarbonisation plans.

The DFES Widget allows local authorities to share their high-level decarbonisation targets.

Your Local Net Zero Hub is the first digital tool to be designed in partnership with local authorities and is open to all local authorities across UK Power Networks' entire licence area. The digital tool enables local authorities to combine their decarbonisation strategies, local market trends, transport plans and social inclusion policies with network infrastructure data to develop options for their communities.

A Data Dictionary allows sharing spatially mapped, detailed LCT uptake forecasts, as might be found in a Local Area Energy Plan (Plan).

Overall, our engagement and cooperation is mapped out across various steps of the Network Options process. Hence, these tools assist Local Authorities that are at different stages of their journey to identify options and make informed recommendations on the preferred decarbonisation pathway for their local area. Ultimately, this enables us to facilitate local decarbonisation, while saving money for our customers. Energy Systems Catapult estimates that a Net Zero approach that is locally planned and coordinated with electricity networks could save £252 billion between 2025 and 2050.

7.2. West London

In the past two years Scottish & Southern Electricity Networks (SSEN) have reported a significant increase in large demand connections within their West London distribution network which has driven the need to reinforce the local transmission system. This has meant that much smaller connections are seeing significant lead times to connect within SSEN's network.

Since 2022, we have been working closely with SSEN, the Greater London Authority (GLA), West London Local Authorities, National Grid Electricity System Operator (NGESO), National Grid Electricity Transmission (NGET) and impacted customers to explore the available options that can yield potential solutions to alleviate the current constraints on network capacity in the Willesden area.

Following the evaluation process, the approved recommendation involved the approval of a portfolio of interventions across the distribution and transmission networks. As part of the investment recommendation, we are creating additional capacity within West London within RIIO-ED2 ahead of long-term reinforcement works being delivered at Willesden by National Grid Electricity Transmission.

We are implementing this in three phases:

1. Procurement of flexibility – We are including the network needs in the area in our flexibility tenders since 2023 and will continue to do so in future rounds in 2024 and beyond.
2. Transfer of load away from constrained areas of West London.
3. Installation of additional capacity through unconstrained Grid Supply Points.

Figure 12 below illustrates the area of our network where we are delivering the interventions mentioned above.

In 2024, we will be engaging further with our colleagues at the NGET, ESO and SSEN to understand the progress of their respective work. Also, we will be providing further updates with respect to the contracted flexibility on our network area within our DNOA Reports.

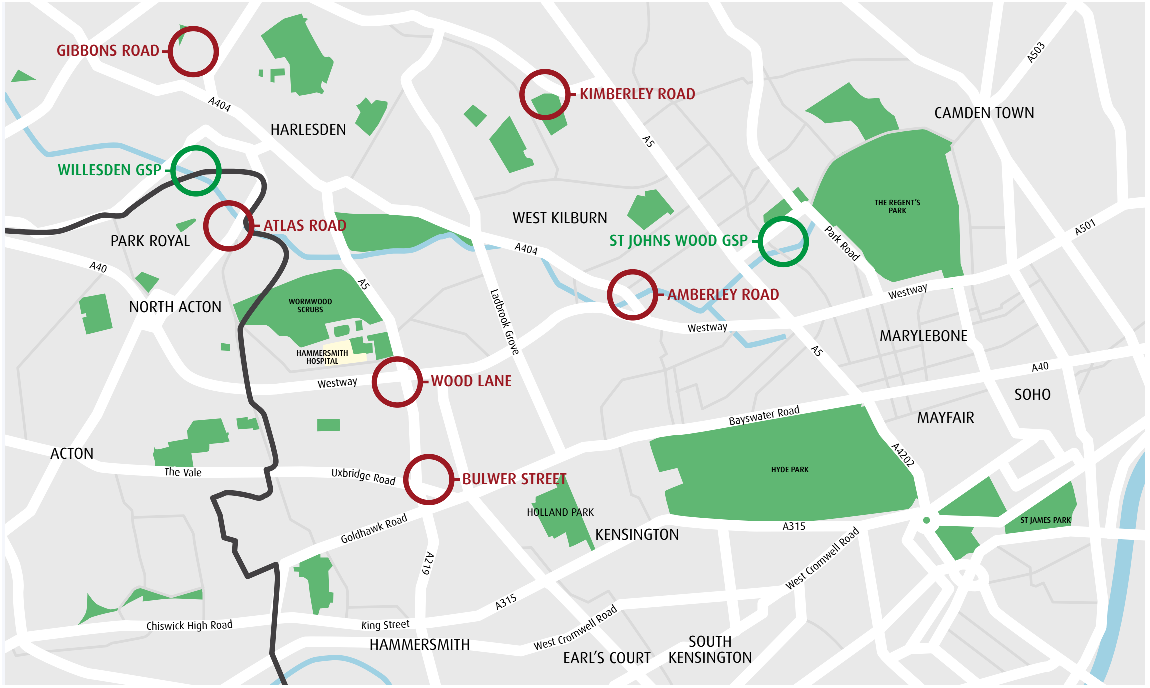


Figure 12 – Representation of the West London area and the distribution network substations[16] where we are taking actions to facilitate new customers' connection.

[16] The circles indicate the substations where we are progressing the implementation of the portfolio of interventions.

7.3. Regional Development Programmes (SPN and EPN)

We have been collaborating with the ESO since RIIO-ED1 across several areas. Our ongoing partnership with the ESO on the Regional Development Programme (RDP) for the South East and covers the areas of Kent and Sussex. It demonstrates how we applied the Network Options process to resolve Whole System issues. The initial phase involved identifying the network issues that were preventing the connection of Distributed Energy Resources (DERs). Subsequently, we collaborated to explore all available options to both the ESO and UK Power Networks, which recommended the development of new markets for transmission thermal constraint management services.

The programme involves progressing jointly with the ESO the development of a co-ordinated IT solution that will deliver:

- Visibility and data exchanges in both directions to facilitate efficient service coordination.
- Management of Distributed Energy Resources (DER) to allow constraints on transmission and distribution networks to be managed efficiently, whilst ensuring the safe operation of the distribution network.
- A coordinated service and dispatch methodology allowing DER to participate in new markets and ensure that we have identified the cheapest solution for the GB consumer.
- Coordination and service conflict resolution methodologies.

Currently, we are proceeding to starting the service utilisation in Q2 2024 to manage thermal constraints at the transmission network. Moreover, we will progressing additional optioneering work with the ESO in 2024 to develop further improvements to deliver more complex data exchange elements and enhanced solutions[17]. These options will be evaluated and go through the RDP's governance process in the next few months and years.

Overall, this is a ground-breaking programme that follows the Network Options methodology for Whole System issues. It will help optimise the flexibility markets and investment plans across transmission and distribution to secure the efficient operation of the South East Coast area whole electricity system over the next 10 years.

The RDP's framework is allowing us to address other future issues during RIIO-ED2. Hence, we have also expanded this approach to deliver similar solutions in our Eastern Power Networks area. Overall, these optioneering processes that deliver continuous engagement with the ESO and our customers are helping us unlock £130m of benefits over the current RIIO-ED2 period.

[17] Please refer to the SPN RDP Project Initiation Document (PID)

7.4. Wider electricity system engagements

We have actively collaborated with industry on a number of key areas to better inform GB wide solutions to emerging issues.

Since its inception back in 2017 we have been working alongside other network companies, utilities and impacted stakeholders on the Open Networks Project. We have been leading yearly on a number of new products and have informed across all workstreams. Notably we led the development of the Whole Electricity System Investment Planning guidance which has been used as a basis across various industry pathfinding initiatives.

Back in 2022 the Strategic Connections Group was formed to consider the emerging issues arising across GB. This work led to the identification of the following three (3) high priority areas that need urgent attention, alongside the Connections Reform:

Action 1: Managing the Distribution Queue migrating pre 2017 offers to milestones contracts, and first ready, first connected at distribution level.

Action 2: Changing how Transmission & Distribution coordinate the queue by creating clear and consistent technical boundaries and equitable re-allocation of capacity.

Action 3: Changing how battery storage connects to the network by developing tactical and longer-term solutions to better enable battery connections and the networks' ability to manage capacity efficiently.

UK Power Networks has actively participated across all three workstreams to drive a suite of solutions that are already benefiting our customers. We have taken a leading role in delivering on Action 2 and through effective collaboration with all distribution and transmission companies have identified and developed the Technical Limits framework that has unlocked c.30GW of capacity across GB, of which 4GW will directly benefit UK Power Networks customers[18].

[18] DSO collaboration releases 4GW of network capacity | UK Power Networks

CHAPTER 08

Data provision and DNOA Reporting

Our DNOA Methodology is fundamentally a governance framework to facilitate efficient investment recommendations. Hence, it relies heavily on the robustness of the processes put in place, as explained earlier, and the data that is collated, analysed and produced throughout these processes.

Also, we acknowledge that data is valuable for our stakeholders in order to understand activities and to evolve their business models, esp. when it comes to flexibility services. Hence, we strive to make data readily available to them. Therefore, in this chapter we explain where stakeholders can access the data relevant to DNOA, the tools we use, i.e. the CEM CBA, and the DNOA Reports. Also, we provide the layout of the DNOA Reporting pack and a worked-up example of the CEM CBA following our stakeholders' feedback. The latter is aimed to help them understand better how we value flexibility services.

[19, 20, 21, 24] UK Power Networks Open Data portal
[22] Microsoft Word - CEM Tool User Guide v2.0 (energynetworks.org)
[23] Flexibility - UKPN DSO (ukpowernetworks.co.uk)

8.1. DNOA data and sources

Table 4 below presents the key data that we consider and produce on an annual basis for the purposes of the various DNOA processes. We also provide the links for ease of reference.

Data used in DNOA	Data source / Database location
Load data from Long Term Development Statement	UKPN Open data portal[19]
Substation Capacity Headroom data from Network Development Plan	UKPN Open data portal[20]
Substation postcodes from "Key characteristics of active Grid and Primary sites" table	UKPN Open data portal[21]
CEM CBA template from the Energy Networks Association library	Energy Networks Association portal[22]
Flexibility Live or Previous Tender data	UKPN DSO Flexibility Hub[23]
DNOA Reports	UKPN Open data portal[24]

Table 4 DNOA datasets and sources

8.2. CEM CBA example

Our stakeholders have asked us to provide an example of how the CEM CBA is used to estimate the flexibility budget that is available for each area. Hence, we provide here a short explanation of the tool and include a hypothetical example in Appendix F.

The CEM CBA is a Microsoft Excel tool that estimates the:

(i) The net present value of the capital expenditure for the traditional reinforcement scheme; and

(ii) The net present value of the same scheme if it is deferred for a specific period (e.g. 5 years).

The difference between (i) and (ii) establishes the maximum budget for the flexibility services that can support the deferral of the scheme. After the estimation of the flexibility budget, we publish the information on our website[25] alongside with each live flexibility tender to inform flexibility providers about the revenue opportunities for each area. For future flexibility tenders, i.e. from Spring 2024 onwards, we will be publishing the aggregated deferred CAPEX we estimate consumers will see as the direct benefit from the procurement of flexibility services. In order to assist flexibility providers, the advertised revenues take into consideration key parameters around the expected utilisation of flexibility services for each area.

Also, we provide a worked example of the CBA in Appendix F. If stakeholders require further information, please refer to the ENA's publicly available links to the actual methodology[26] and the information we publish in our website for each flexibility tender.

8.3. DNOA Reporting pack lay out

After the conclusion of every flexibility tender, we will publish the DNOA Reports. These reports will include information and data for every HV and EHV area and the respective approved DNOA recommendation as described in paragraph 6.2 above.

The report page is self-explanatory. Below we provide a short explanation of the key information included in each DNOA Report:

- **Nature of constraint:** This will indicate whether the network asset is forecasted to face demand or generation constraints. It will also provide a short technical description of the forecasted constraint.
- **Constraint Season:** Season that the network experiences the constraint.
- **Revenue range:** We will give an indication of the expected revenue range of the flexibility services.
- **DNOA result history:** We will show previous DNOA recommendations in RIIO-ED2.
- **Flexibility procurement progress:** We will indicate the progress on procuring flexibility against the forecasted need.
- **Customers in area:** The number of customers served in the constraint area.
- **Local Authority:** The LA served by the substation.

[25] Tender library - UKPN DSO (ukpowernetworks.co.uk)
[26] ON22-WS1A-P1 Common Evaluation Methodology (CEM) and Tool v2.1- User Guide (14 Jan 2022) – Energy Networks Association (ENA)

Figure 13 below shows an example of a DNOA Report.

Bow

Area: LPN
Postcode: E15 2GN

Constraint description:
The site is expected to be overloaded under an N-1 outage condition due to limited transformer capacity.

Traditional solution:
In order to increase capacity at the site the traditional solution is to:
- Establish a 3rd 132/11kV transformer
- Extend 132kV switchboard at Bow GIS.

The maps are for indicative purposes. Please use the postcodes for accurate location information.

Constraint season
Winter

Constraint year
2025

Flex revenue range £/MW
£31,500 - £45,000

Customers served
27,908

Current status
Flexibility procurement

Local authority
Newham Tower Hamlets

For more information, please get in touch via email to networkoptionsassessment@ukpowernetworks.co.uk

Approved DNOA recommendation:
We procured sufficient flexibility for the first year through our Autumn 2023 Flexibility Tender. We will continue procuring flexibility in the next events to fulfil the system needs.

DNOA result history:

2023	2024	2025	2026	2027	2028
Signposting	Flexibility				

Flex requirement per year for each scenario (MW) and flex procurement progress (%)

	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029
CT		0.5	3.4	6.3	8.6
ST		1.5	4.4	7.2	9.4
LW		0.9	4.1	6.9	8.9
FS		1.3	4.0	6.5	8.5
FLEX		>100%	20%		

Key: Signposting, Reinforcement, Flexibility

Legend: **CT:** Consumer Transformation **ST:** System Transformation **LW:** Leading the Way **FS:** Falling Short **FLEX:** Flexibility Procurement Progress

Figure 13 – Representation of a DNOA Report

CHAPTER 09

DNOA Roadmap – Engagement – Feedback

We published our inaugural DNOA Methodology in June 2023. Since then, we have implemented it as an end-to-end process to market test approximately £500m of capital expenditure. Furthermore, we have engaged with stakeholders, including the ESO, other DSOs and flexibility providers to seek feedback on our DNOA Methodology. Additionally, we have received feedback from our Supervisory Board that have highlighted areas we need to consider in the evolution of the DNOA Methodology.

Below we explain our next steps for 2024 with respect to the development of the DNOA Methodology, our engagement plans and ways for our stakeholders to provide further feedback.

9.1. Next steps in the evolution of the DNOA Methodology

In the last 12 months, there have been changes in the energy policy with respect to the electrification of transport, the implementation of the Significant Code Review and the establishment of the work relating to the Technical Limits. These changes create uncertainty in relation to the load growth we were forecasting in previous years. Hence, we want to ensure that our DNOA Methodology evolves accordingly in order to facilitate efficient investment recommendations.

More specifically, we consider that in 2024 we should focus of our work in the two (2) areas below:

a. The option value of flexibility – So far, our best view scenario is Consumer Transformation. However, other pathways to Net Zero may become more relevant. For example, it may be the case that load growth follows a higher growth in RIIO-ED2 and a less pronounced path afterwards. Therefore, it seems appropriate to consider how our future investment recommendations, including the procurement of flexibility, can deliver benefits for our customers against multiple scenarios in the face of uncertainty around the pathways to Net Zero. This could include work to develop further the ENA's CEM CBA regarding the option value of flexibility.

b. A framework for strategic interventions on our network – Our optioneering considers market testing of network reinforcement schemes. Typically, this assumes a defined deferral period, e.g. 5 years, and has limited consideration for the cost of curtailment. Hence, in our consultation we identified the need to incorporate options around the cost of curtailment and/or hybrid solutions including the market-based operation of DER over different horizons. This could also include multiple network areas, if applicable. Hence, developing these areas will allow us to shape a more strategic approach to the optioneering and recommendations within our DNOA Methodology.

Furthermore, we will be considering any further adaptations in our DNOA Methodology given the evolving nature of distribution and whole system issues given the policy drive to accelerate the delivery of new connections. We plan to work on the above areas in the 2nd and 3rd quarters of 2024 and inform our stakeholders on our progress at the end of the 3rd quarter.

CHAPTER 09

DNOA Roadmap – Engagement – Feedback

9.2. Our plans for engagement

In addition to the above, we plan to increase our engagement activities in 2024. These will build on our engagement during 2023. Hence, it will include additional meetings with a wider set of stakeholders, organising online webinars and participation in other industry events. Also, we plan to provide regular updates around our ongoing engagement and outcomes of key activities regarding our work for the Whole System.

9.3. Feedback

We would kindly ask our customers or any readers of this document to provide us their views and ask questions by sending an email to networkoptionsassessment@ukpowernetworks.co.uk and use "DNOA" in the subject line.

Some of the areas that we would like feedback from our customers:

1. What is your overall feedback on our DNOA Methodology?
2. How could we improve further the provision of data and information in future DNOA documents?

Appendix A – Further information on the forecasting process

In Chapter 4 we provide a high-level view of the forecasting process. Here, we explain in more detail how these forecasts are established depending on the specific technologies we consider.

The load growth model within the Strategic Forecasting System follows the general logic of first establishing the number of units (this would refer to customer connection counts, but also to LCTs). These are often resolved across different archetypes, and we have a bespoke forecast for each unit for future years (considering growth/ uptake scenarios from the DFES).

Some of the different archetypes distributed per geographical regions and affecting the forecasts are explained below. The load growth model within the SFS considers the uptake of heat pumps, district heating, air conditioning, EVs and generation such as solar PV as the most important growing technology segments.

Generation

The model considers a table of known large generator sites (including near term forecast of the accepted connections pipeline). For these locations, the installation size (capacity), location and fuel type are defined and modelled accordingly. Small scale installations (typically solar PV) that connect behind the meter at LV level are distributed to LV customers. This is informed by uptake assumptions at LSOA level. The model also considers a range of storage installations, which mostly play a role in the constraints modelling.

There are a number of uncertainties which have been modelled based on the best available information, for instance discussions with water and wastewater companies have identified the potential for the reduction of generation output from some sites in order to divert fuels to power the company's fleet of vehicles, as green electricity can be purchased on a commercial basis, in so reducing CO2 impact further.

Heat pumps and EV charging

This sub section describes the key assumptions and process by which we have modelled EV-related demand and heat pumps

Heat pump uptake is modelled in a separate module and considers the various building archetypes separately. This module applies the uptake for each archetype for the DFES. This considers the business case and willingness-to-pay assumptions and evaluates the most suitable heating types for specific building archetypes.

EVs are modelled in line with the Recharge the Future innovation project conducted. This module has been enhanced since the project; it now considers a variety of additional transport segments, such as vans, taxis and motorcycles. A great number of vehicle types and charging behaviours are considered within each segment.

Our modelling has calculated what the EV charging annual consumption breakdown across our three licence areas will be. Then it shows our forecast of how EVs will be dispersed across our networks.

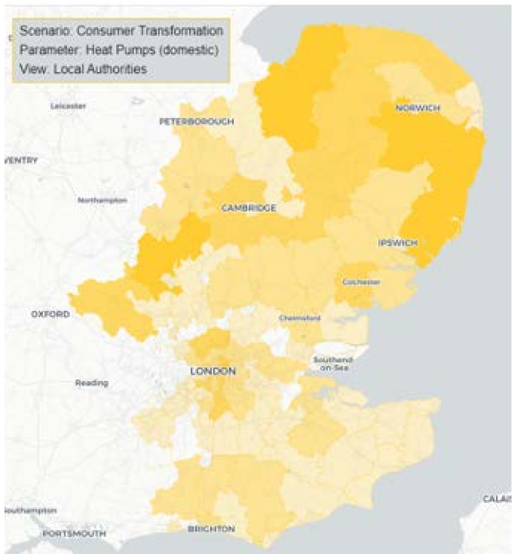
EV uptake forecasts at GB level are disaggregated geospatially using the best available deployment data. Over the shorter term we have forecast Plug-in Hybrid Electric Vehicles (PHEVs) and Battery Electric Vehicles (BEVs) registrations (modelled at GB level) and allocated to area units according to the historic uptake proportion using Department for Transport (DfT) and Driver and Vehicle Licensing Agency (DVLA) data. In the longer-term analysis, we then blend towards the distribution of car ownership. In the near term, hotspots form in areas that have a high proportion of early adopters in the baseline year (2019) and, as a result, we see high variation in the electrification between MSOAs in 2025, where anywhere from 12% to 42% of cars are electric. In 2030, EVs have reached the majority of the car stock in some MSOAs, but the hotspots are still visible. As the number of EVs grows, the difference in electrification between regions decreases and by 2050, the variation in electrification across MSOAs within our region is less than 3%.

The assumptions on LCT profiles that inform peak load estimates

As outlined in the previous section, the model determines an estimated annual consumption (or generation) for a host of customer types and technologies for each future year, scenario and at each network node. This annual consumption is then converted to a diurnal load profile. The load profiles from different technologies/customer types are stacked and the peak load is determined. This logic is repeated for each future year and network node.

The model considers profile shapes for each calendar month, and for min/average/max loading conditions. Furthermore, weekend and weekdays are distinguished where sufficient data is available.

Heat Pumps by LA - 2030



Electric Vehicles by LA - 2030

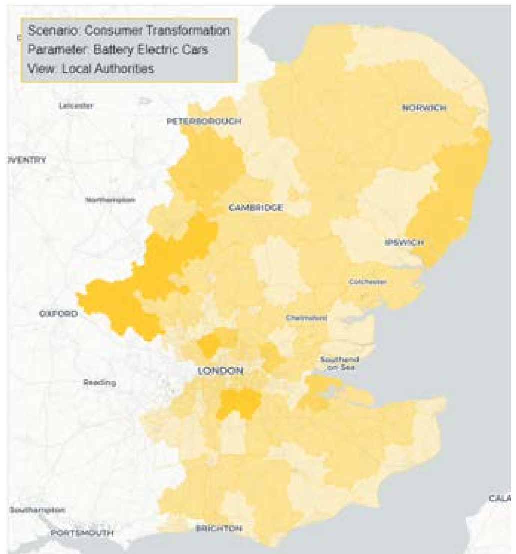


Figure 14 – Uptake of heat pumps and EVs by local authority in 2030, from the DFES interactive map

Appendix B – DNOA Process for capacity needs to accommodate additional demand at Low Voltage

LV Network

In Chapter 3 we explained that we have developed dedicated processes for the different needs we face on our distribution network. Here we provide additional details about our approach to manage network needs at our Low Voltage network.

Similar to our forecasting processes for EHV and HV networks, we are using our Strategic Forecasting System (SFS) to forecast peak loads on our Low Voltage (LV) network. These peak loads are then compared against the LV network's transformer capacities. These yield a utilisation output for the transformers on the LV network.

We have tailored our approach such that all Ground Mounted Transformer (GMT) sites with utilisation levels of more than 100% are included in our flexibility tenders, before being considered for any other type of intervention.

To ensure that we address the needs in a timely manner, we are informing interventions, including tendering for flexibility services one (1) year to two (2) years ahead of need. The budget for flexibility services follows the volume driver methodology included in the Ofgem Final Determinations for RIIO-ED2[27].

Table 4 below illustrates the intervention activities per asset type and utilisation level:

		Forecasted Utilisation Band			
		0-80%	80-100%	100-120%	>120%
PMT	Capacity	No action	No action	Reinforce	Reinforce
	Visibility	Install sample monitoring	Install sample monitoring	Install monitoring	Install monitoring
GMT	Capacity	No action	Expression of Interest for flex	Procure flex	Reinforce
	Visibility	Install sample monitoring	Install sample monitoring	Install monitoring	Install monitoring

Table 4 Intervention options per utilisation level

[27] https://www.ofgem.gov.uk/sites/default/files/2022-11/RIIO-ED2%20Final%20Determinations%20Core%20Methodology.pdf

The overall process is shown in the diagram below.

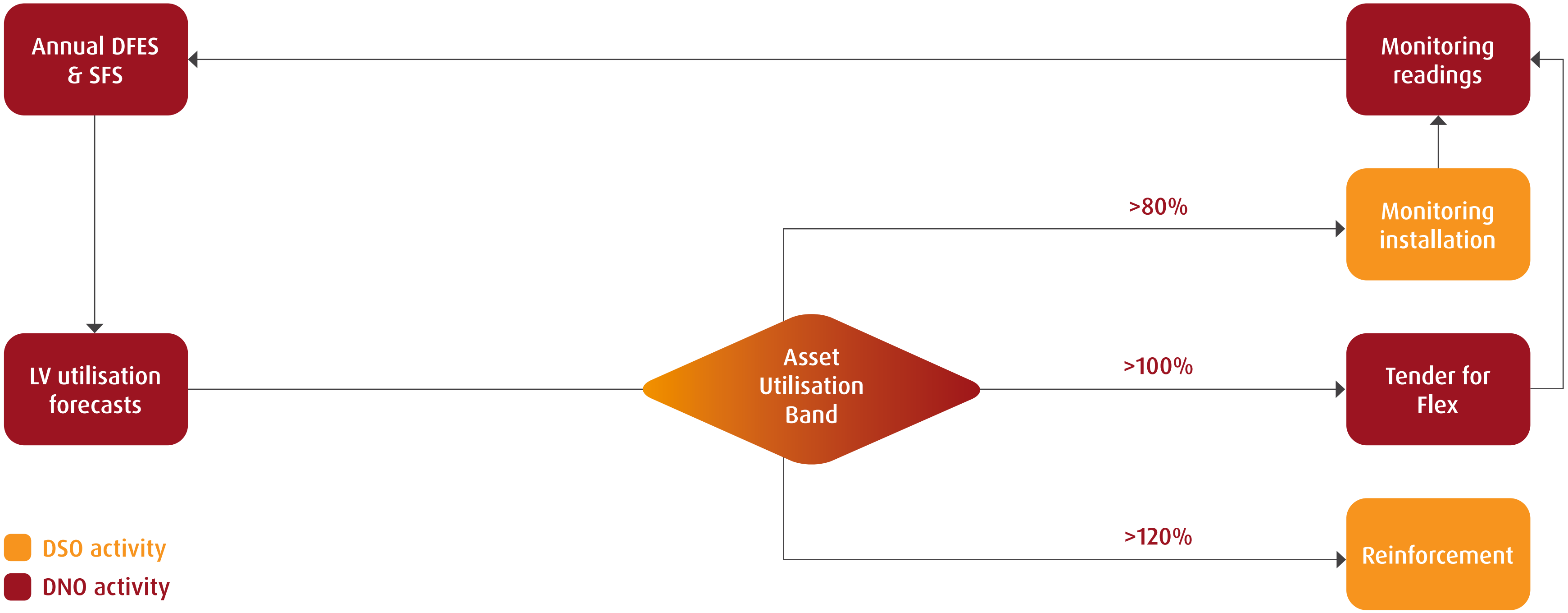


Figure 15 – DNOA Process for our Low Voltage capacity network needs

Appendix C – DNOA process for capacity needs for additional generation and battery storage connections

In Chapter 3 we explained that we have developed dedicated processes for the different needs we face on our distribution network. Here we provide additional details about our approach to manage capacity needs to allow for additional generation and storage connections. These are caused when local generation, especially generation from renewables, such as solar and wind, creates reverse power flows that exceed network capacity.

The DNOA process involves the following steps:

a. The DSO forecasts capacity needs over the next 2-3 years.
b. The DNO provides the cost of reinforcement to remove the constraint.
c. The DSO uses the CEM CBA to establish the flexibility budget.
d. The DSO market tests for flexibility.
e. The DSO provides a recommendation based on the results of market testing.

Capacity needs for additional generation and storage connections are often driven by weather patterns. This means that we will dispatch flexibility services only when we have closer to real time forecasts that will inform dispatch decisions. We will repeat the process annually so we can always have up to date information on where the constraints are, and the capacity required to manage them. The process below applies in areas where we have existing flexible generators, with non-firm connections. As we will be connecting additional generators under the Significant Code Review, we will need to consider when reinforcement options are required. Hence, future DNOA recommendations to our Supervisory Board may entail the optimisation between the use of flexibility services, curtailment actions and reinforcement.

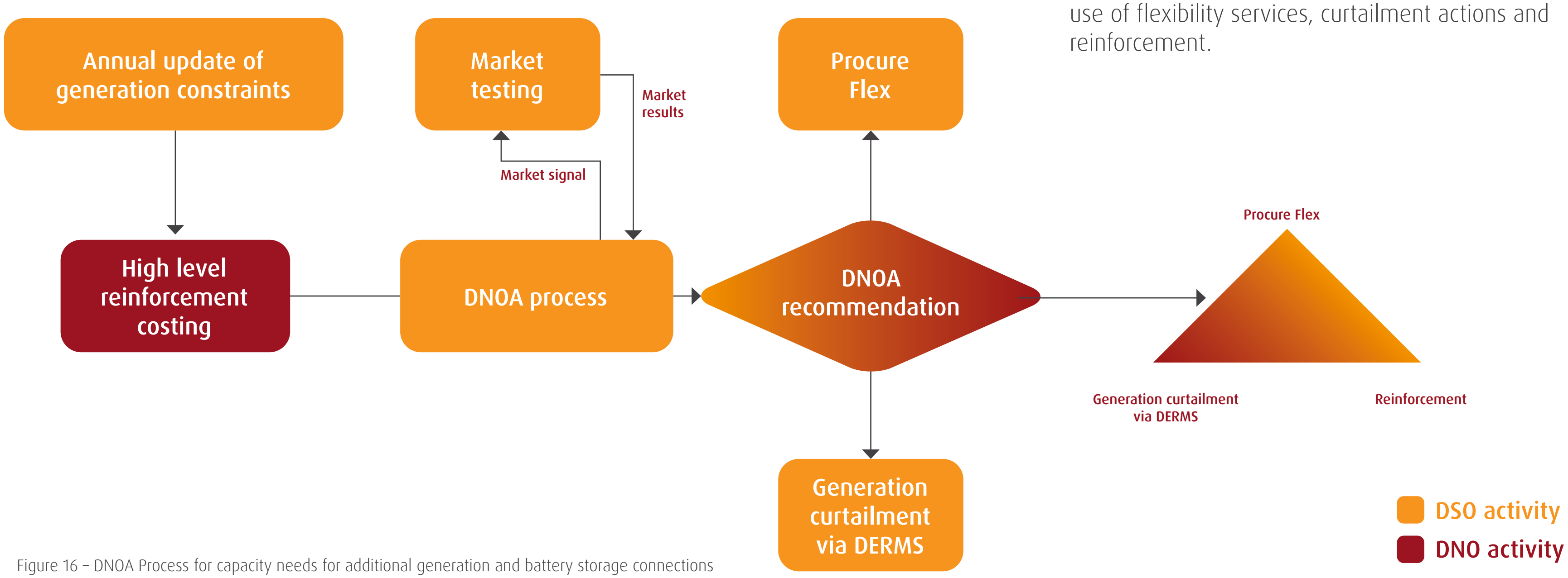


Figure 16 – DNOA Process for capacity needs for additional generation and battery storage connections

Appendix D – Low Value DNOA Process

In Chapter 3 we explained that we have developed dedicated processes for the different needs we face on our distribution network. Here we provide additional details about low value schemes that will be required either at the High Voltage parts of our network.

The low value schemes are typically below £1.5m in value and are intended to upgrade assets installed on the high voltage parts of the distribution network. Hence, the aim is to reinforce the network in order to resolve local constraints. These are often driven by new customer connections and they rarely align with the annual forecasting process we described in our June 2023 publication. Typically, these schemes are low in value and high in volume. Indicatively, on an annual basis we could progress more than 50 schemes with an aggregated budget of less than £50m. Hence, these schemes require a complimentary decision-making process to ensure deliverability is not compromised.

In order to achieve this, our DNOA process has adopted a rules-based review and recommendation approach to facilitate timely resolution of needs at the least cost. **This methodology uses a set of established criteria checked annually to provide a clear recommendation going forward, which includes the following:**

a. What is the time required to deliver the connection?
If the capacity need requires resolution within 12 months, then the reinforcement scheme will normally proceed. Flexibility tenders have a longer delivery timeframe from tendering to contract award and delivery of the flexibility solution. This timeframe applies especially to areas where a flexibility zone has not previously been established.

b. What are the technical aspects of the need?
There are cases where flexibility is not technically feasible due to the inability to forecast the needs, e.g. when the constraint is fault related. In such cases, it is also challenging for flexibility providers to respond in very short timescales.

c. Does the need for the scheme remain? If the network can accommodate the new connection, the need for reinforcement dissipates. Hence, the scheme for asset intervention is withdrawn.

The above checklist is applied during the "annual review of schemes" activity shown in the figure below. Based on the result, a recommendation is made. Where projects are tendered for flexibility and the market-based solution is shown not to be economically optimal, these projects shall be progressed to reinforcement. Also, if any of these schemes have been identified through the annual forecasting cycle and the criteria above are met, then we will include these as part of our typical flexibility tender rounds as described in Chapters 3 to 6. Lastly, if any schemes are no longer required, e.g. when a connection does not materialise, then the scheme is removed.

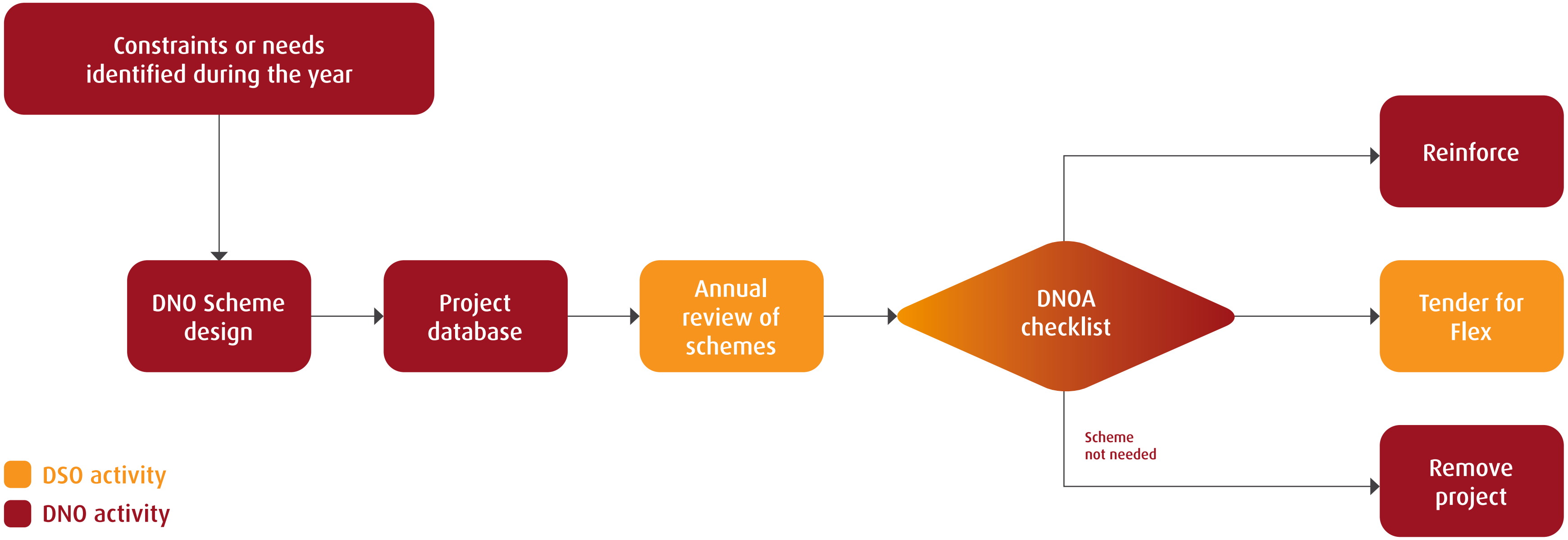


Figure 17 – DNOA rules' based process for low value schemes

Appendix E – Further information on flexibility products

The need for flexibility

UK Power Networks will typically procure services to manage constraints on the network where high demand (or high generation) leads to exceedance of network limits for short periods. UK Power Networks' **Flexibility Roadmap** explains the different applications of flexibility for the distribution network. This includes deferring generation or demand-driven network reinforcement, manage planned maintenance, and unplanned interruptions. These Flexibility Services offer an alternative approach to traditional network reinforcement solutions such as upgrading network assets.

Flexibility Services can be provided by Distributed Energy Resources (DER), which is defined as a solution that can change its level of consumption or generation relative to its normal operations. Depending on the needs and product, this change can be through responding to dispatch requests, long term response, or even through enduring changes to demand (such as energy efficiency). The DER may be a generator, storage or demand asset, or a combination of these located at the same site.

A group of DER can be aggregated together into a single controllable unit called a Flexible Unit. A Flexible Unit is a notional DER that can be made up of one or more real DER located within the same zone. Flexible Units can be made up of existing and/or planned DER.

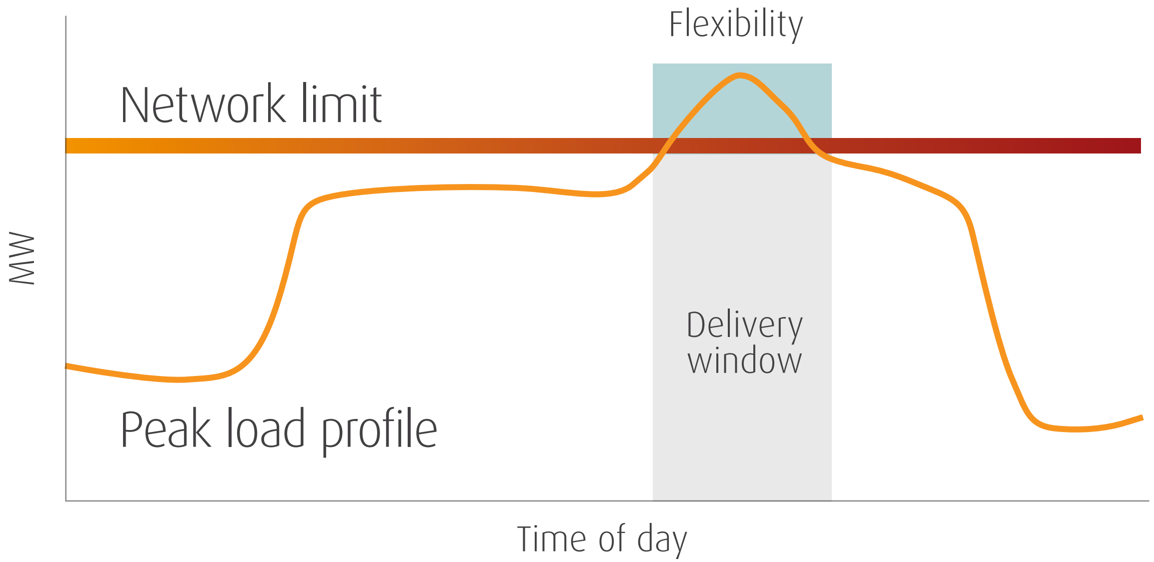


Figure 18 – Indicative schematic for flexibility needs

Appendix F – CEM CBA Worked Example

The CBA requires some basic entries in order to estimate the available flexibility budget. These relate to key financial parameters, such as the discount rate and assumed asset life. There are also other parameters that relate to the reinforcement projects. Below we provide the key ones:

i. Forecasted constraint year. This is provided by our forecasting system. For the example opposite we assume that the constraint will occur in 2026 according to the Consumer Transformation scenario.

ii. Cost of reinforcement scheme to resolve the constraint. This is provided by the DNO. For the example opposite we assume that the cost is £3m.

iii. Time to deliver the works. This is provided by the DNO. We assume that in the example opposite it is 2 years, i.e. that works will start in 2024 in order to relieve the constraint in 2026.

We use the above information to populate the "Baseline Reinforcement" tab of the CEM tool.

Baseline reinforcement

Basis for identifying intervention start year	Determined by scenario
Intervention start year (for manual input)	2024
Scenario driving intervention requirement (if selected)	Best view
Intervention start year	2026
Start Year Capacity (MVA)	100.0

Peak Network Load Projection (MVA)	2024	2025	2026	2027	2028	2029
Best view	99.4	99.5	101.0	102.0	102.3	102.6

Exceedance per year (MVA)	2024	2025	2026	2027	2028	2029
Best view			1.00	2.00	2.30	2.60

BASELINE REINFORCEMENT AND UPFRONT CAPEX (TO BE DEFERRED)	2024	2025	2026	2027	2028	2029
Cost 1	£1,000,000	£1,000,000	£1,000,000			
Cost 2						
Cost 3						
Total	**£1,000,000**	**£1,000,000**	**£1,000,000**			

Figure 19 – View of the CEM CBA tool key parameters

In order to convert the reinforcement costs to present value, we need to input some of our financial funding rates in another tab called "Fixed Inputs". There we provide capitalisation rates and Weighted Average Cost of Capital (WACC) as agreed in our RIIO ED2 settlement.

1. We can then go to the "Comparison" tab. In this tab we need to provide our deferral target. Our target is to defer reinforcement for at least 5 years. We input this number in the appropriate cell.
2. The tool provides us with the cost reduction. We use this cost reduction as target for the cost of flexibility.
3. Market testing later on will confirm if we can achieve this target and confirm that flexibility is the economically optimal solution.

Strategy length tested by VBA for comparing configs with baseline **5 years**

	Option	Discounted cost (£)	Cost reduction (£0)
1	Baseline	£ 3,136,694	
2	Flexibility under best view	£ 2,649,284	£ 487,411

Figure 20. CEM CBA outcome for flexibility budget

This cost reduction is the target budget for flexibility over the five years of deferral. Therefore, we will appropriately distribute the sum between the five years. That eventually leads to the published revenue ranges alongside the flexibility tenders shown in our flexibility hub[29].

We recommend that stakeholders go through the CEM CBA supporting material, in order to explore further details regarding the functionality of the tool.

Appendix G – Stakeholder and customer feedback

In this appendix we have collected all the questions presented throughout the document for ease of use by the reader. In addition, we repeat the link to the online form.

Online form

[28] https://dso.ukpowernetworks.co.uk/flexibility

Appendix H – Definitions and acronyms

Term	Description
BEV	Battery Electric Vehicles
CAPEX	Capital Expenditure
CBA	Cost Benefit Analysis
CEM	Common Evaluation Methodology
CT	Consumer Transformation
DER	Distributed Energy Resources
DERMS	Distributed Energy Resources Management System
DFES	Distribution Future Energy Scenarios
DfT	Department for Transport
DNO	Distribution Network Operator
DNOA	Distribution Network Options Assessment
DSO	Distribution System Operator
DVLA	Driver and Vehicle Licensing Agency
EHV	Extra High Voltage
ENA	Energy Networks Association
EPEX	European Power Exchange
EPN	Eastern Power Networks
ESO / NGESO	Electricity System Operator / National Grid Electricity System Operator
ETO	Electricity Transmission Owner

Term	Description
EV	Electric Vehicle
FES	Future Energy Scenarios
GB	Great Britain (incl. England, Wales and Scotland)
GDN	Gas Distribution Networks
GLA	Greater London Authority
GMT	Ground Mounted Transformers
HI	Health Index
HV	High Voltage
IT	Information Technology
LA	Local Authority
LAEP	Local Area Energy Planning
LCT	Low Carbon Technology
LPN	London Power Networks
LSOA	Lower Layer Super Output Areas
LTDS	Long Term Development Statement
LV	Low Voltage
MSOA	Middle Layer Super Output Areas
NDP	Network Development Plan
NGET	National Grid Electricity Transmission

Appendix H – Definitions and acronyms

Term	Description
ONS	Office for National Statistics
PHEV	Plug-in Hybrid Electric Vehicle
PMT	Pole Mounted Transformers
PV	Photovoltaic
RDP	Regional Development Plan
RIIO-ED2	RIIO stands for: Revenue = Incentives + Innovation + Outputs ED2 stands for: Electricity Distribution 2
SCR	Significant Code Review
SFS	Strategic Forecasting System
SPN	Southeastern Power Networks
SSEN	Scottish and Southern Electricity Networks
TO	Transmission Owner
UKPN	UK Power Networks
WACC	Weighted Average Cost of Capital