nationalgrid DSO

Distribution Network Options Assessment

September 2024

Foreword

The role of electricity in helping to facilitate the UK's net zero transition is becoming increasingly important. One of the key roles of the Distribution System Operator is to create a smarter, more flexible network to meet our customer's needs and facilitate the decarbonisation of heat and transport.

At National Grid Electricity Distribution (NGED) we have a strong track record of delivering best in class service and, as we continue to take a more and more active role in managing the electricity distribution system, we will continue to develop our business and remain at the forefront of Distribution Systems Operations.

Over the last few years we have opened up a plethora of opportunities for distributed energy resources to help support our network across multiple voltage levels. By continuing to innovate and develop the Distribution Network Options Assessment (DNOA) process we will be able to expand opportunities to even more use cases in the future.

Developing successful markets also requires confidence in those opportunities continuing in the future and transparency in the process and outcomes of our decision making. This DNOA publication outlines our methodology for assessing the use of flexibility to manage constraints on the network and how we ensure every investment decision provides optimal value for stakeholders and customers.

The DNOA process will provide transparency in our approach to ensuring the optimal investment pathway is taken for all load related expenditure, minimising costs and maximising efficiency.

By providing more information to the growing distribution flexibility market about current and future network requirements across our region, we can help flexibility providers identify relevant opportunities to support the distribution network and bring forward investment in green technologies.

This DNOA builds on the 2024 publication of our Network Development Plan, which offers great insight into how changes in load will affect our network and could provide opportunities for flexibility providers to support the network.

To ensure our flexibility strategy continues to meet the needs of our customers as we push towards net zero, we are investigating new methods of valuing the use of flexibility. This could allow us to better target flexibility and further increase market opportunities.

The decisions made within this DNOA will show how we are optimising our investment to deliver secure, sustainable and affordable electricity to meet the evolving needs of the areas we serve.

We welcome any feedback that will help us to push the DNOA even further to drive value and benefit for our customers.

Cathy McClay
Managing Director of DSO

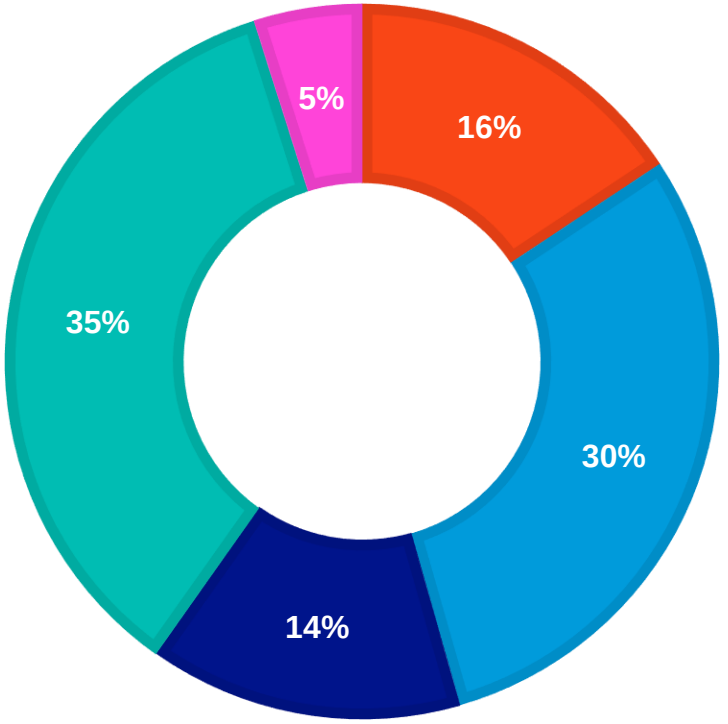
Executive summary

This DNOA report outlines the decisions made on the viability of utilising flexibility services to manage constraints across the Midlands, South West and South Wales. This includes the ceiling prices calculated using the Common Evaluation Methodology (CEM) for areas where the deferral of reinforcement using flexibility is feasible. In depth analysis of each constraint was carried out based on technical network data, load forecasts and financial inputs.

Below is a summary of the investment decisions reached across the four licence areas. Over 1,000 constraints at the primary voltage level and above were considered, with 204 taken forward to individual assessment (as the remaining schemes were deemed not technically viable for flexibility).

Of the 204 individual schemes there are: 79 in the East Midlands, 24 in the West Midlands, 28 in South Wales and 73 in the South West.

This DNOA assesses individual potential reinforcement schemes at the primary voltage level and above with a combined cost of over £580 million. Potential reinforcement schemes at the secondary voltage level with a combined reinforcement cost of over £29 million have also been assessed.



Total schemes assessed	204
Flexibility	32
Reinforce	61
Reinforce with flexibility	29
Signposting	72
Remove	10

Flexibility indicates a decision to procure flexibility or to maintain the flexibility contracts currently in place to defer reinforcement.

Reinforce indicates a decision to pursue traditional network reinforcement ahead of need without utilising flexibility.

Reinforce with flexibility is when reinforcement is set to begin immediately (or is already underway), but flexibility is required to deal with the constraint in the interim.

Signposting constraints are expected to require flexibility services in the future, but not in this current procurement cycle.

Remove signals a decision to remove a previously considered constraint from this DNOA as no flexibility requirements are seen in the next 10 years. These may be reassessed in the future.

Document overview

The strategic network planning process

NGED produces a number of publications on the future of electricity across the Midlands, South West and South Wales. The Distribution Future Energy Scenarios (DFES) provides data on the predicted growth in demand and generation across the four licence areas on an annual basis.

Forecasting

The Distribution Future Energy Scenarios (DFES) identify how customers will use our network in the future.

Network Impact Assessment

The Network Development Plan (NDP) uses forecasts to analyse and identify future network constraints.

Optioneering

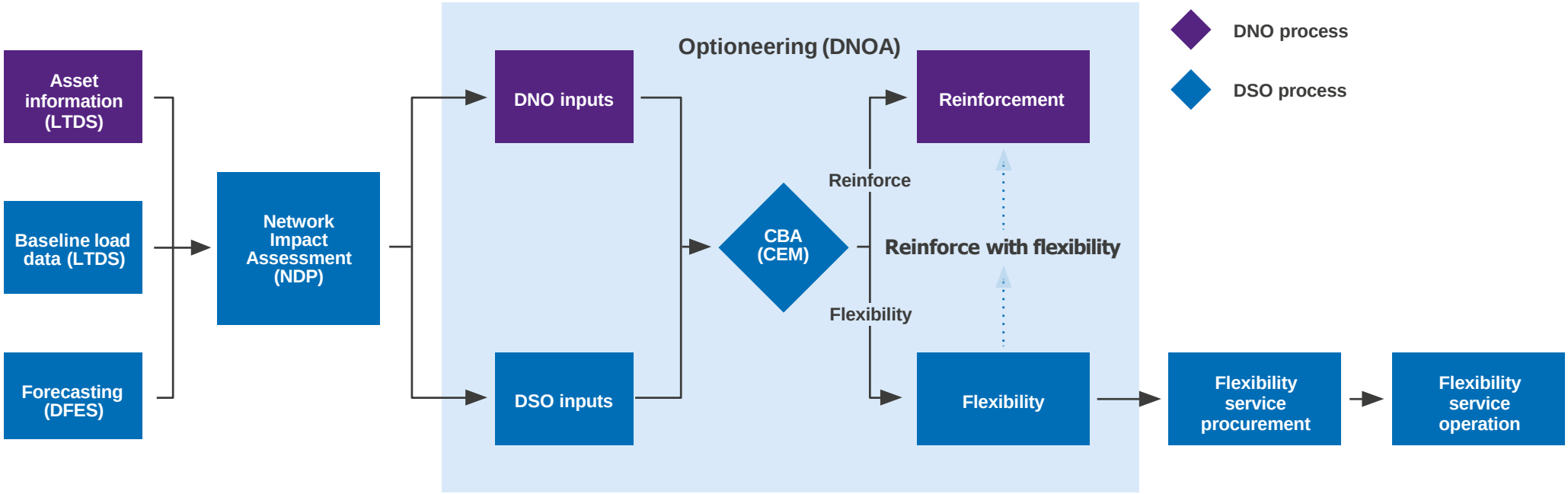
The Distribution Network Options Assessment (DNOA) outlines how we plan to invest in our network to manage or resolve constraints.

This scenario growth data facilitates the identification of areas on the network where constraints are expected through network impact assessment. This is carried out as part of NGED's Network Development Plan (NDP) published every two years, and as part of routine studies of the distribution network conducted by engineers.

Conventional reinforcement solutions are then developed, taking into consideration NGED's network asset data and the load forecasts from the DFES process to ensure the solution is enduring, efficient and strategic. These conventional reinforcement solutions are then assessed against the use of flexibility as part of the DNOA process.

The strategic network planning process

NGED's overall DNOA process from forecasting through to procurement is shown in the figure below. DNOA reports are published every year to look forward and identify which constraints should have services procured to help mitigate them, as well as looking backwards to ensure they continue to provide value. The DNOA process is managed by the DSO, with data inputs from the DNO.



Key:

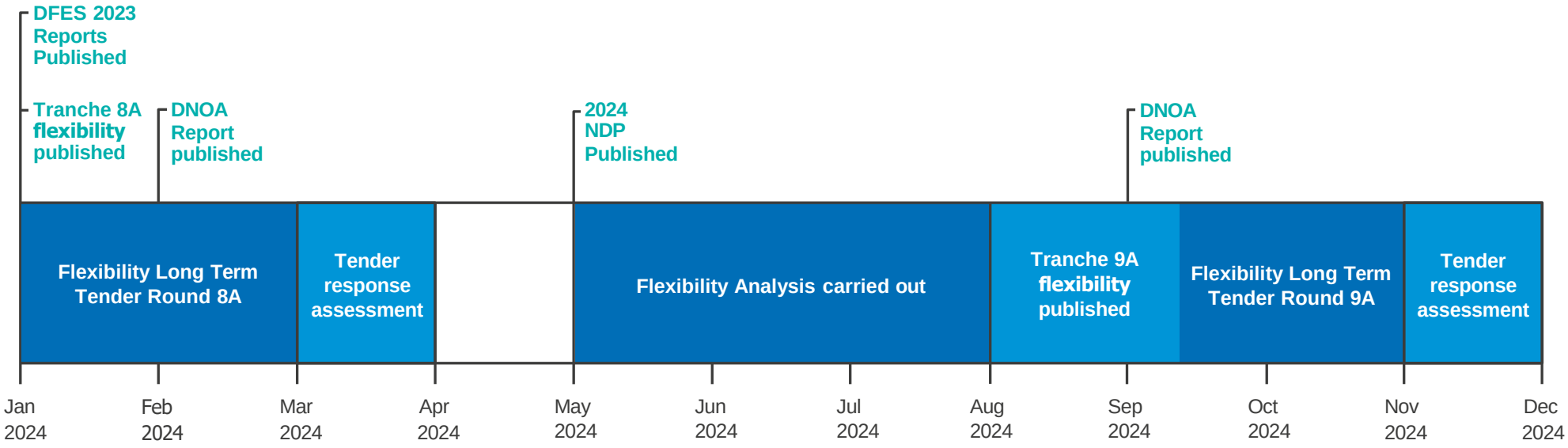
LTDS: Long Term Development Statement
DFES: Distribution Future Energy Scenarios
NDP: Network Development Plan
DNO: Distribution Network Operator
DSO: Distribution System Operator
CBA: Cost Benefit Analysis
CEM: Common Evaluation Methodology

DNOA process timeline

DNOA reports have so far been published every six months, but are now published once a year (each August/September). This is based on the latest DFES data published each year, with existing schemes being reassessed periodically to ensure the investment pathway remains optimal. Any new constraints identified on the network are also assessed in the DNOA process.

After each procurement cycle NGED checks that sufficient flexibility is available to manage each constraint. This will determine whether procurement will be needed in the next cycle (or if reinforcement should be triggered due to insufficient flexibility availability).

The DNOA process repeats annually. The processes and reports carried out as part of the strategic network planning process for 2024 are shown in the timeline below, from forecasting through to the publication of DNOA reports.



DFES overview

Using local planning data, demand pipeline data and local engagement, a range of credible future scenarios are created that predict growth across NGED's four licence areas up to 2050, down to the Electricity Supply Area (ESA) level. As part of the latest DFES round (DFES 2023 published in January 2024) more granular projections to a distribution substation level have been produced which have been utilised in the latest round of secondary network flexibility analysis.

For this DNOA the data used has been taken from the DFES for all four licence areas. The four base DFES scenarios are Consumer Transformation, Leading the Way, Falling Short and System Transformation.

These four base scenarios encompass divergent levels of societal change and speeds of decarbonisation. The forecasting methodology used here is aligned with National Grid ESO's Future Energy Scenarios (FES) and the projections made by other Distribution Network Operators (DNOs).

The suite of DFES reports are published once a year, with the scenarios changing to reflect the direction the energy landscape has taken, any legislative changes that have been revealed and expected customer behaviour driving increased growth rates.

Stakeholder engagement is held to get input on the approach and scenarios considered. Finally, the FES and DFES are reconciled to ensure a consistent picture. These steps form a feedback loop that acts as an annual process to continually improve upon the DFES as shown on the right.

A more comprehensive description of the DFES process can be found on the DFES page on the NGED website:

nationalgrid.co.uk/distribution-future-energy-scenarios-regional-information

Defining a Best View

By amalgamating the four base scenarios, a fifth scenario is created which represents NGED's expectation of the most likely future growth, called Best View, which is used to inform investment decisions.

To derive the Best View, NGED uses an iterative process. DFES data and previous Best View data is used to support stakeholder and Local Area engagement, which then allows the stakeholder plans for distributed generation, new domestic and non-domestic developments and heat networks to be assessed using criteria to gauge their ambition, engagement and deliverability.

The assessment is carried out by NGED's strategic engagement officers, who offer proactive support to stakeholders on decarbonisation pathways.

Alongside this assessment on regional ambition, an assessment of the current uptake trends of low carbon technologies is compared to previous scenario projections, and any external factors outside of the control of NGED which can impact uptake. These technologies are more impacted by national level policies. By aligning to current uptake this is used to ensure the Best View trend is accurate.

These processes enable the scenario volumes to be summated up to a licence area level, checked against NGED strategic views of development and a new Best View can then be delivered.

Before the Best View is finalised, the licence area totals are checked against national ambition to ensure NGED targets are aligned to deliver government policy.

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

Constraint identification

The load forecasts created as part of the DFES process are used to carry out network studies in order to identify any current or future constraints on the distribution network across NGED's four licence areas.

Comprehensive electrical analysis is carried out using load flow studies for each possible outage combination. This analysis is carried out for a variety of scenarios, half hours and representative seasons for both the existing and future network.

This process identifies where intervention is required to maintain compliance with NGED's obligations and keep the network safely operating within its technical limits.

The primary activity for the network impact assessment is the Network Development Plan (NDP), part of Electricity Distribution Licence SLC 25B. This outlines where and how DNOs plan to develop the distribution network over the next ten years to continue to meet customers' needs and facilitate the net zero transition.

More information on NGED's constraint identification process and the custom developed analysis tools used can be found in the latest NDP which can be accessed from the link below:

nationalgrid.co.uk/network-strategy/network-development-plan

Whilst the Network Development Plan process identifies the constraints that may occur, additional constraints can also be identified as a result of large new connection applications, which may not be captured in the current DFES projections.

Hence, there will be scenarios where New Connections that want to secure capacity and/or connect earlier bring forward a constraint, and in these instances the connection offers would be issued accordingly and in line with our policies and regulatory obligations. In some cases this may trigger a different solution altogether, which will be communicated to the affected parties as appropriate.

Reinforcement options

Reinforcement schemes aimed to alleviate constraints on the network can involve replacing a number of different assets, or installing new assets. Most conventional reinforcement will involve some combination of the four options below.

Build new circuits

Upgrade existing circuits

Build a new substation

Upgrade existing substation

Various traditional reinforcement options are evaluated to find the most optimal solution. The chosen reinforcement solution must be economic and fit for the long-term so it delivers best value to customers. The cost for the optimal reinforcement scheme is determined so that it can be assessed against flexibility.

Substations considered for reinforcement include primary substations, Bulk Supply Points (BSPs) and Grid Supply Points (GSPs). This often involves upgrading switchgear and transformers to increase their capacity.

Circuit installations and upgrades can involve replacing or installing overhead line conductors and/or underground cables.

All reinforcement schemes are designed with customers and the environment as a top priority. Through our detailed network design process reinforcement solutions which minimise cost and disruption while providing enduring capacity for the network are identified.

Various other innovative solutions are utilised to manage constraints on the network, including the use of Active Network Management (ANM).

Flexibility analysis

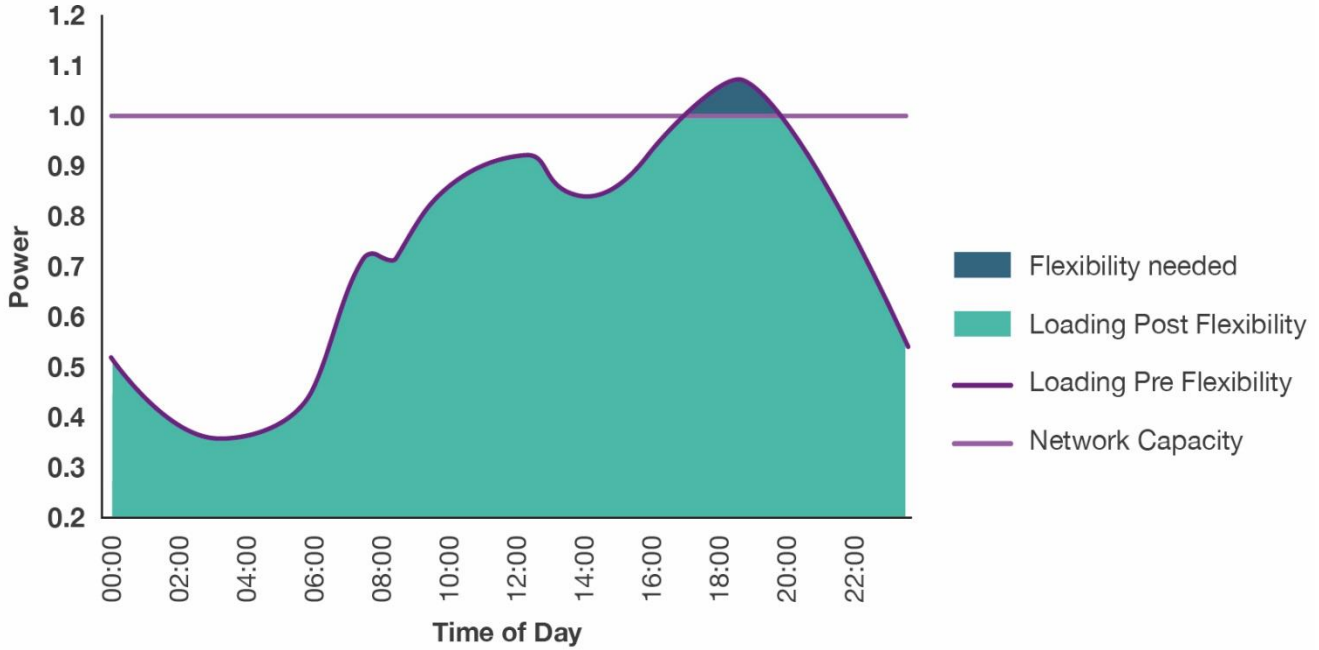
Once a constraint has been identified as part of routine strategic planning of the distribution network, options for managing the constraint are then assessed. Any constraints which can be technically managed through flexibility are taken forward for flexibility analysis to calculate how much flexibility is required.

The amount of flexibility required to manage a constraint is based on how much load is expected to exceed the capacity of the network. This is calculated using data from the network and projections from the DFES process in NGED's custom built Flexibility Analysis Tool. To reduce the exceedance for an identified constraint triggered by high levels of demand, services are needed to either turn up generation assets or turn down demand to achieve the same outcome.

In order to calculate how much flexibility is required to support the network for a given constraint two inputs are needed. First, how much load the network can safely support (also known as its capacity), which is represented by the purple line in the figure below. Second, how much demand is used at different times of day across the year (also known as a load profile).

Flexibility requirements are calculated both for the current year and each of the next 10 years (aligned to the timescales captured by the NDP). This allows NGED to procure the appropriate volumes of flexibility early enough to ensure the needs of the network are met and the correct investment decisions made.

The volumes of flexibility required to manage each constraint are then taken forward into the CBA, which is discussed in more detail in the next section.



Common Evaluation Methodology

To improve transparency in how DNOs reach decisions regarding flexibility procurement and the potential to delay conventional reinforcement, a Common Evaluation Methodology (CEM) CBA tool was created by Baringa Partners. This tool is used to assess the net benefit of flexibility against a baseline of conventional reinforcement for each of the four base scenarios plus Best View over a number of years.

The economic analysis is based on the Time Value of Money whereby delaying reinforcement costs creates a significant economic benefit.

The amount of flexibility availability and utilisation projected to be required to manage a given constraint is taken from NGED's Flexibility Analysis Tool and input into the CEM CBA tool.

The costs associated with the optimal reinforcement solution identified by NGED are also fed into the CEM CBA tool to provide a baseline against which flexibility is assessed.

The CEM CBA tool is then used to calculate the ceiling price for flexibility (i.e. the break-even point at which the cost of flexibility is equal to the economic benefit of deferring reinforcement) for each year. Ceiling prices are calculated based on the NGED Best View scenario which is used to inform investment decisions.

Utilising ceiling prices means that flexibility services should always provide an economic solution to a constraint. The amount of available flexibility services is then compared to the requirement, which forms the decision point for whether flexibility is a viable solution.

These ceiling prices are then used to inform the MWh prices for areas where we are procuring additional flexibility (for both availability and utilisation).

Additional functionality within the tool also allows for consideration of losses and other carbon and societal impacts. This functionality will be utilised further in future DNOA tranches. By cultivating greater transparency in the decision making process and providing robust justifications for the investments made on the network, customers can be assured that their money is being utilised effectively.

Current and future ceiling prices published in the DNOA give flexibility service providers visibility of the opportunities available in each area, helping inform their investment in flexibility. To provide additional clarity the ceiling prices are now only published in the DNOA for the NGED Best View scenario, as these are the ceiling prices which are used in procurement. Data for other scenarios is still published on NGED's Connected Data Portal.

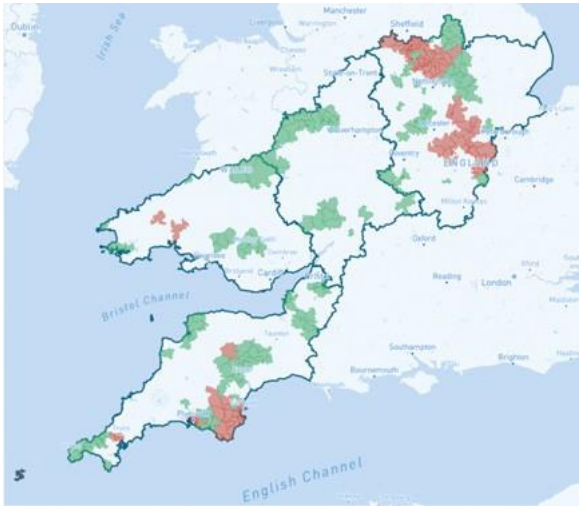
More information regarding the CEM CBA tool can be found on the Energy Networks Association's website:

energynetworks.org/industry-hub/resource-library/

Flexibility services

NGED has always used the flexibility inherent in the distribution network to provide economic and secure supply ahead of undertaking conventional reinforcement. For over five years NGED has also lead the way in utilising market-provided flexibility.

This flexibility is sought as part of ongoing year-round procurement. The areas where flexibility is required are known as Constraint Management Zones (CMZs), the figure below shows these areas as of January 2024. To give providers and operators of flexibility services advanced notification of future needs, signposting information is now provided for a ten year window for each area on the network with forecasted constraints. This additional visibility of future network needs will help inform the investment decisions of flexibility service providers, and aligns to the timeframe of constraints identified in the Network Development Plan.



More information on our use of flexibility and any future developments can be found in our Distribution Flexibility Services Procurement Statement:

nationalgrid.co.uk/distribution-flexibility-services-reporting

The four main flexibility products offered to providers are standardised across the industry:

Scheduled Utilisation – Settlement Periods
Used to manage peak demand loading on the network to pre-emptively reduce network loading.

Utilisation Only, API instruction optional.

Scheduled Availability, Operational Utilisation – Day Ahead
Developed to support the network in the event of specific outage conditions, namely maintenance work.

Operational Utilisation – 15 minutes
Supports power restoration following rare fault conditions.

Utilisation Only. Utilisation instructed in real time.

Scheduled Utilisation – Specific Periods
Scheduled constraint management service with fixed delivery periods.

Scheduled Utiliisation Only, API instruction optional.

The customer-facing brand for flexibility services established by by Western Power Distribution (now NGED) in 2017 is known as Flexible Power. The Flexible Power website allows businesses to confirm their eligibility for flexibility products and to begin the procurement process.

Flexible Power

NGED continues to procure flexibility services through the Flexible Power brand. The Flexible Power website highlights how providers can participate in flexibility markets. In 2023 the Market Gateway was also launched to digitise and streamline the process of procuring flexibility services.

Find out more at: **flexiblepower.co.uk**

Secondary Network Flexibility

We have recently expanded our flexibility opportunities onto the secondary distribution network (specifically the distribution transformers which connect the HV and LV networks).

In order to accurately target flexibility at highly loaded areas and manage network risk we are installing monitoring equipment across a representative population of distribution transformers. The data from the monitors and smart meters will train our HV and LV network models to improve our understanding of network utilisation at a level where there has historically been very little visibility. To date we have installed over 4,800 monitors, and plan to install a a greater number across the RIIO-ED2 period. As utilisation at each distribution transformer increases monitoring equipment will be installed, flexibility will be procured and utilised as required until reinforcement works need to commence.

Since our last secondary flexibility procurement round in January 2024 (where we tendered for 1,426 zones) we have been seeking feedback from stakeholders and looking into ways to improve market participation in LV Sustain. One of the key challenges of secondary flexibility is its value in comparison to other market services. This is partly due to the low cost of reinforcement and long delivery periods for Sustain. In the January 2024 round we continued the reduced delivery period approach applied in October 2023 round, which meant providers would get the same benefit with fewer delivery requirements. This round of procurement has seen an improvement, with some response received, which has enabled us to defer 592 secondary transformer reinforcement works.

The first Sustain tenders, alongside secondary network DNOA process reviews, highlighted an additional benefit of partial flexibility response when considering potential delivery challenges. Where flexibility has partially met the forecasted need, it allows us to reassess the priority of reinforcement areas and direct delivery resources at the highest priority sites. Depending on the speed and location of demand growth, this could help free up resources for reinforcement delivery.

This approach results in better network management as we can still defer reinforcement by targeting delivery resources to areas that are at higher risk than ones with partial flexibility support, reducing overall network risk.

In the latest analysis tranche, the secondary transformer constraints across the four NGED licence areas have been reassessed. 744 LV zones have been opened in September 2024, for service delivery in the next winter (2025/26). The 4 months delivery period (November to February) will be continued in this tender round, to make it easier and more cost effective for flexibility providers. Opposite is a summary of LV Sustain tenders to date.

		East Midlands	West Midlands	South West	South Wales
October 2023 tender	Number of zones	265	257	146	82
	Tendered (kW)	30,207	14,832	4,633	5,664
	Contracted (kW)	679	441	55	126
	Number of zones deferred	63	43	4	11
January 2024 tender	Number of zones	740	288	297	101
	Tendered (kW)	70,732	10,893	6,279	4,413
	Contracted (kW)	2,033	284	46	44
	Number of zones deferred	454	74	31	33
September 2024 tender	Number of zones	203	258	193	90
	Tendered (kW)	9,105	7,416	2,494	2,923
	Contracted (kW)	-	-	-	-
	Number of zones deferred	-	-	-	-

We continue to engage with providers and look at how we can improve our internal processes to help balance our network risk with the service value to the market. We are working on improving our data, assumptions, and understanding of the secondary network risks, with the aim of releasing more value where possible.

Future developments

Common Evaluation Methodology

In order to accurately assess the financial impacts of utilising flexibility services to defer reinforcement a robust and periodically reviewed methodology is required.

By having an NGED representative as the workstream lead for the Open Networks working group which oversees the development of the Common Evaluation Methodology (CEM) we are leading the industry in the development of this process.

Refreshing the CEM will ensure that the process continues to meet the ever evolving needs and diverse use cases of the UK's Distribution System Operators (DSOs) while providing full transparency for stakeholders and flexibility service providers.

Having an adaptable and scalable process will also help facilitate the expansion of flexibility opportunities.

Revenue Stacking

Many constraints identified on the distribution network are downstream of other constrained assets. NGED's existing flexibility processes only allow provider's assets to be registered in a single constraint management zone. Work is ongoing to allow providers to participate in multiple overlapping zones.

By developing the process such that providers can participate in multiple zones, market opportunities could be expanded significantly. The ability to stack revenue by managing multiple constraints simultaneously would also be created, driving benefits for both the network and flexibility providers.

Flexibility analysis

Our flexibility analysis tool takes in a set demand profile and calculates flexibility requirements against the given capacity as determined by our detailed network analysis, with provisions for abnormal configurations, varying and seasonal capacities, future demand changes, losses, and procurement factors. It incorporates data cleansing and replacement algorithms to ensure results are as accurate and realistic as possible.

Over the past few years, we have developed it by further optimising the demand data inputs, made provisions for weather correction factors, and incorporated DFES forecasts and projections down to a granular level representative of the constraint studied.

There are a number of planned future developments for the flexibility analysis tool used for this process:

- Increasing efficiency to manage the increased data requirements associated with the growing number of flexibility areas.
- Further developing synergies with the analysis tools used as part of the Network Development Plan.
- Expanding its functionality to keep up with new developments in the flexibility market and expand use cases for flexibility.

Stakeholder engagement

We want to hear your views on the DNOA process and our report format as feedback from stakeholders will be valuable in shaping future publications.

In order to do this we aim to collect feedback after every publication and use this to improve the DNOA process and ensure the data we publish is relevant and valuable. A number of questions on the DNOA process can be found on NGED's website:

nationalgrid.co.uk/dso/distribution-future-energy-scenarios/distribution-network-options-assessment

We are keen to get your feedback

It is important that we get a broad range of stakeholders' opinions and we are keen to get your feedback.

Responses should be returned to:

System Planning Team
National Grid Electricity Distribution
Feeder Road
Bristol
BS2 0TB

Or emailed to:
nged.primarysystemplan@nationalgrid.co.uk

Interpretation of DNOA outcomes

The ceiling prices for each scheme across NGED's four licence areas are given in the scheme pages on the DNOA page on NGED's website, along with information on the proposed reinforcement schemes. These ceiling prices are given for the NGED Best View scenario for every year up to 2029. Other information pertaining to each zone is also given on these scheme pages. This section outlines how this information should be interpreted.

The decision tree to the right demonstrates the different choices our analysis can lead to. Firstly, the schemes that do not require any intervention are removed from future DNOAs (usually because reinforcement works have been completed).

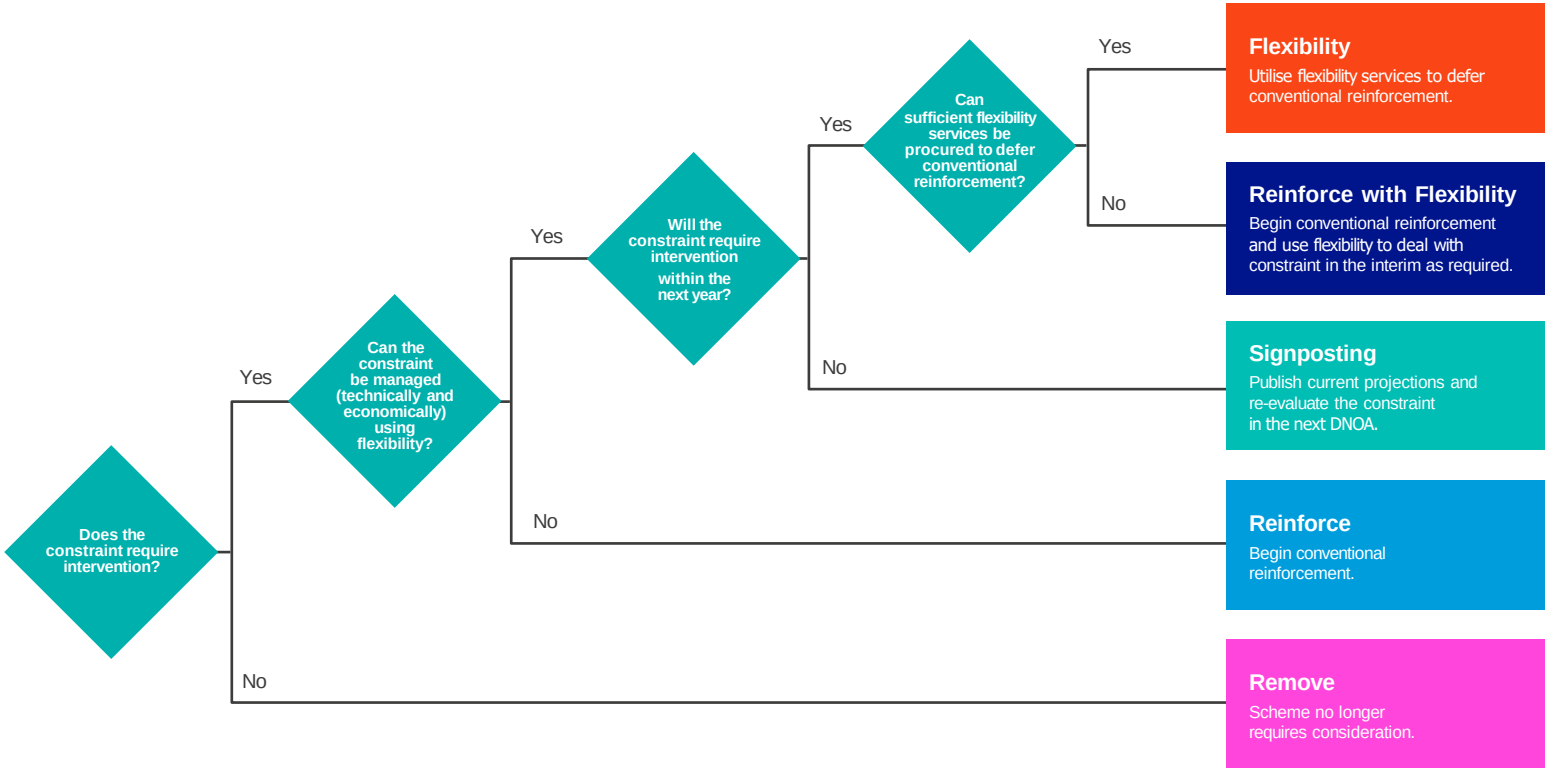
Among the schemes which do require intervention, if the constraint cannot be managed using flexibility then reinforcement is pursued.

If the constraint can be managed using flexibility but no intervention is required within the next year signposting is published.

The schemes which require flexibility services within the next year undergo CBA in order to calculate the ceiling prices for availability and utilisation of flexibility.

If sufficient flexibility cannot be procured to defer conventional reinforcement, reinforcement works will begin in order to be completed before the network need arises.

Flexibility may be used in the interim as required to manage the constraint and provide additional network security before the reinforcement is completed.



Interpretation of DNOA outcomes

Constraint Description

For each scheme presented in this DNOA this description will outline the constraint on the network that is being addressed.

Reinforcement Description

For each scheme an overview of the proposed or ongoing reinforcement works to deal with the constraint is provided.

Time to Reinforce

The estimated time (in years) that conventional reinforcement would take is provided for each scheme. This includes reinforcement projects which are underway and those which are planned to commence in the future.

The time taken to complete reinforcement projects is indicative and will be subject to a range of factors, including but not limited to asset lead times, third party consents, outage restrictions, and resourcing.

NGED will always endeavour to provide reinforcement timescales as accurately as possible, and where unforeseen factors impact delivery, flexibility will be considered as an option to maintain network safety and security.

Ceiling price

The ceiling prices are provided for each year under the NGED Best View scenario. The ceiling price per MWh will usually drop year-on-year as the benefit of deferral remains constant but the volumes of flexibility required increases. Reinforcement will be deferred until sufficient flexibility is no longer available to manage the constraint.

Estimated flex utilisation required per year table

The estimated flexibility availability and utilisation volumes required per year are provided for each scheme in MWh. For Signposting schemes only the utilisation volumes are provided.

For more detailed data on the volumes of flexibility required (including the exact times of the year flexibility will be needed) a link to the Flexible Power website is provided on each scheme page.

Constraint management timeline

The constraint management timeline shows what decision has been made for each scheme in each procurement cycle from when the scheme was created up to the upcoming procurement cycle.

Justification for decision

For each scheme the reasoning behind the DNOA decision is explained. For new schemes where flexibility is an option the decision to defer will be driven by sufficient flexibility being procured to manage the constraint.

For reinforce schemes, the reason why flexibility is not viable will be given. Likewise, for remove schemes, the reason why the constraint no longer needs intervention will be provided (e.g. reinforcement works have been completed).

Other information

Also provided is the season (or seasons) the constraint being addressed is expected to arise (and therefore the season in which flexibility services are required) and the flexibility product expected to be utilised.

For signposting schemes the flexibility product may change closer to procurement to ensure the network's requirements are met.

Each scheme is also categorised based on the network condition the constraint is present under (intact, N-1 or N-2) and based on the constraint type (thermal, voltage, fault level, etc.).

DNOA Outcomes – East Midlands

Table 1 Summary of investment decisions in the East Midlands

A summary of the investment decisions made is provided below, with more in-depth information for each constraint available on NGED's website and on the Connected Data Portal.

Reinforcement and flexibility both have important parts to play in the efficient and economic development of the distribution system. This DNOA has both forwards and backwards looking elements when considering flexibility. Flexibility start years are based on the first year of network requirement under the NGED Best View DFES scenario. Proposed scheme closures indicate when reinforcement is expected to be completed (and therefore the need for flexibility removed).

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Bradwell Abbey BSP	Bradwell Abbey BSP has two 132/33 kV GTs which are projected to be constrained due to demand growth for an N-1 (fault or arranged outage on either GT).	2026	-	Flexibility
Braunstone Primary	T2 at Braunstone Road primary is rated lower than T1, limiting the firm capacity of the site. The 33 kV circuits to the site are also projected to be constrained in the future.	2025	-	Flexibility
Burton to Bretby	Arranged outages or faults on either Burton to Bretby 33 kV circuit leave the full demand of Bretby and Woodville primaries on the remaining circuit.	2027	-	Flexibility
Hawton BSP	For the loss of one of the GTs at Hawton the full demand is supplied by the remaining GT and 132 kV circuit.	2028	-	Flexibility
Hawton Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2024	-	Flexibility
Ilkeston	Under an N-1 condition (loss of one transformer) the load would be fully applied to the remaining transformer, potentially causing it to overload.	2027	-	Flexibility
Irthlingborough BSP	Irthlingborough BSP has two 132/33 kV GTs which are projected to be constrained due to demand growth for an N-1 (fault or arranged outage on either GT).	2024	-	Flexibility
Irthlingborough to Higham Ferrers	For an arranged or fault outage on the Irthlingborough BSP to Rushden T2 33 kV circuit the circuit from Irthlingborough to Higham Ferrers Switching Station could overload based on demand projections.	2024	-	Flexibility
Kettering BSP	Kettering BSP has two 132/33 kV GTs which are projected to be constrained due to demand growth for an N-1 (fault or arranged outage on either GT).	2024	-	Flexibility
Langdale Drive	Both transformers at Langdale Drive primary are expected to exceed their thermal capacity following an outage on the other. The 33 kV circuits would become the next limiting factor.	2026	-	Flexibility
Newdigate Primary	Both transformers at Newdigate primary are expected to exceed their thermal capacity following an outage on the other.	2026	-	Flexibility
Newport Pagnell Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2024	-	Flexibility

DNOA Outcomes – East Midlands

Table 1 Summary of investment decisions in the East Midlands

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Rugby	The 132/33 kV transformers at Rugby BSP are expected to overload following an outage on the other. The 132 kV circuits are also a limiting factor on this network.	2027	-	Flexibility
Stony Stratford BSP	Stony Stratford BSP has two 132/33 kV GTs which are projected to be constrained due to demand growth for an N-1 (fault or arranged outage on either GT).	2026	-	Flexibility
Tamworth to Polesworth and Atherstone	For an arranged or fault outage on the main 1 33 kV busbar at Tamworth Grid BSP the Tamworth to Polesworth main 2 33 kV circuit could overload.	2024	-	Flexibility
Towcester Primary	Following an arranged or fault outage on one of the three transformers at Towcester primary the site demand is picked up by the other transformers.	2024	-	Flexibility
Victoria Road Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2026	-	Flexibility
Alfreton-Wessington	Due to high demand and generation growth, the 33 kV circuits from Alfreton BSP to Wessington, Ambergate and Ravensdale Park primaries are expected to have thermal and voltage constraints.	2024	2026	Reinforce with Flexibility
Bruntingthorpe Primary	Bruntingthorpe primary has a single transformer which limits its firm capacity under intact running conditions. Under N-1 outage conditions the site also relies on 11 kV backfeeds to maintain supply.	2024	-	Reinforce with Flexibility
Grassmoor	Both transformers at Grassmoor primary are expected to exceed their thermal capacity following an outage on the other. The 33 kV circuits are the next limiting factor.	2024	2027	Reinforce with Flexibility
Hallcroft Road	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2024	2027	Reinforce with Flexibility
Harbury to Banbury 132kV	The 33 kV circuits used to support the demand group of Harbury and Warwick BSPs are projected to become insufficient due to demand growth.	2024	2028	Reinforce with Flexibility
Langrick Primary	Langrick primary has a single transformer which limits its firm capacity under intact running conditions. Under N-1 outage conditions the site also relies on 11 kV backfeeds to maintain supply.	2024	-	Reinforce with Flexibility
Loughborough	For certain arranged outages on the Enderby network, Coalville Bulk Supply Point (BSP) is transferred to Ratcliffe Grid Supply Point (GSP). A subsequent fault on one of the Ratcliffe-Loughborough tee 132 kV circuits can cause an overload on the other circuit.	2024	2027	Reinforce with Flexibility
Shepshed	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2028	2027	Reinforce with Flexibility

DNOA Outcomes – East Midlands

Table 1 Summary of investment decisions in the East Midlands

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Stamford	For an arranged outage on the main 1 33 kV busbar at Stamford BSP the full demand of Stamford and Wittering primaries is supplied by a single transformer at Stamford primary.	2024	2028	Reinforce with Flexibility
Alford Primary	Both transformers at Alford are projected to exceed their thermal capacity following an outage on the other.	2031	-	Signposting
Anderson Lane Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2034	-	Signposting
Ashbourne Primary	The transformers at Ashbourne primary and the two 33 kV circuits from Winster BSP and Longcliffe primary are projected to overload for an N-1 condition (the loss of either circuit or transformer).	2029	-	Signposting
Atherstone	Atherstone primary is projected to be constrained, with an N-1 outage for the loss of either infeed overloading the transformers at Atherstone and the two incoming 33 kV circuits.	2029	-	Signposting
Braunston Road Primary	Both transformers are expected to exceed their thermal capacity following an outage on the other.	2032	-	Signposting
Bretby	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2031	-	Signposting
Checkerhouse Primary	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	2034	-	Signposting
Church Street Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2029	-	Signposting
Corby Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2032	-	Signposting
Daventry to Welton	An N-2 constraint is projected for the 33 kV circuit which supplies Welton, West Haddon and Crick primaries.	2028	-	Signposting
Ellesmere Avenue	Both the 33 kV circuits to and the 33/11 kV transformers at Ellesmere Avenue are forecast to be constrained for N-1 outages on the other infeed.	2031	-	Signposting
Irthlingborough Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2033	-	Signposting
Kilton Road Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2033	-	Signposting

DNOA Outcomes – East Midlands

Table 1 Summary of investment decisions in the East Midlands

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Lawford Primary	Both transformers are expected to exceed their thermal capacity following an outage on the other. The 33 kV circuits would become the next limiting factor.	2031	-	Signposting
Leicester North BSP	Leicester North BSP has two 132/33 kV GTs which are projected to be constrained due to demand growth for an N-1 (fault or arranged outage on either GT).	2034	-	Signposting
Lincoln Local BSP	Lincoln Local BSP has two 132/11 kV GTs which are projected to be constrained due to demand growth for an N-1 (fault or arranged outage on either GT).	2031	-	Signposting
Lutterworth Primary	Both transformers are expected to exceed their thermal capacity following an outage on the other. The 33 kV circuits would become the next limiting factor.	2030	-	Signposting
Mansfield BSP	Both 132/33 kV transformers at Mansfield BSP are expected to overload following an outage on the other.	2033	-	Signposting
Mansfield Primary	Overloads are expected on the primary transformers following an outage on the other.	2032	-	Signposting
Mansfield to Skegby Lane Tee	The 33 kV circuit from Mansfield BSP to Teversal and Skegby Lane T1 is expected to overload following a fault at Mansfield BSP.	2031	-	Signposting
Market Harborough Primary	Both the 33/11 kV transformers at and the 33 kV circuits to Market Harborough primary are projected to become constrained due to demand growth.	2034	-	Signposting
Mountsorrel Primary	Both the 33/11 kV transformers at and the 33 kV circuits to Mountsorrel primary are projected to become constrained due to demand growth (which could be exacerbated by low voltage).	2032	-	Signposting
Newark Junction Primary	Both the 33/11 kV transformers at and the 33 kV circuits to Newark Junction primary are projected to become constrained due to demand growth.	2032	-	Signposting
Nottingham to Wollaton Road Tee	For an arranged or fault outage on the main 1A 33 kV busbar at Nottingham BSP the 33 kV circuit between Nottingham BSP and the Wollaton Road tee is projected to overload.	2032	-	Signposting
Oakham Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2033	-	Signposting
Olney Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2033	-	Signposting

DNOA Outcomes – East Midlands

Table 1 Summary of investment decisions in the East Midlands

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Polesworth Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	-	2030	Signposting
Quorn	Quorn is a two transformer primary with a firm capacity that is limited by its 33/11 kV transformers. Predicted demand growth is greater than the firm capacity of the site.	-	2033	Signposting
Salutation Primary	The 33 kV circuits to the Salutation tee, as well as the 33/6.6 kV transformers at Salutation primary are projected to be constrained during N-1 arranged outage or fault conditions (the loss of either side).	-	2031	Signposting
Sharnbrook	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	-	2029	Signposting
Torrington Avenue	The site's firm capacity is limited by the transformer ratings. In an N-1 scenario for the loss of one of the transformers, overloads could be seen in the future.	-	2030	Signposting
Wigston BSP	Wigston BSP has two 132/33 kV GTs which are projected to be constrained due to demand growth for an N-1 (fault or arranged outage on either GT).	-	2030	Signposting
Wigston Magna Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	-	2034	Signposting
Chesterfield GSP	Demand, generation and fault level constraints at Chesterfield GSP.	2030	-	Reinforce
Chesterfield Main	The Chesterfield – Grassmoor 33 kV circuits have limited capacity for an N-1 circuit outage.	2027	-	Reinforce
Coalville to Mantle Lane T1	For the loss of the 33 kV circuit to Mantle Lane T2, the circuit to T1 could overload.	2028	-	Reinforce
Coalville to Mantle Lane T2	For the loss of the 33 kV circuit to Mantle Lane T1, the circuit to T2 could overload.	2028	-	Reinforce
Grendon - Corby 132kV	Under N-2 conditions for the loss of two of the Grendon – Corby 132 kV circuits, one of the remaining circuits potentially overloads.	2028	-	Reinforce
Holme Carr	For an arranged or fault outage on either side of Holme Carr the remaining transformer could overload.	2027	-	Reinforce

DNOA Outcomes – East Midlands

Table 1 Summary of investment decisions in the East Midlands

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Hopton – Cromford	Load growth indicates that the Hopton – Cromford primary group will exceed its firm capacity under N-1 (loss of either transformer).	-	2027	Reinforce
North Wheatley	The capacity of the 11 kV backfeeds at North Wheatley primary is forecast to be exceeded in the future.	-	2028	Reinforce
Northampton East BSP	N-1 GT constraint at Northampton East BSP.	-	2028	Reinforce
Northampton group	The Northampton group is approaching 300 MW of group load, at which point the existing circuits will not be able to meet the security of supply obligations.	-	2028	Reinforce
Northampton West BSP	N-1 GT constraint at Northampton West BSP.	-	2028	Reinforce
Spondon Primary	Following an arranged or fault outage on one of the transformers at Spondon primary the full site demand is picked up by the other transformer.	-	2028+	Reinforce
Staythorpe C to AD1C circuit	Two spans of 132 kV overhead line between Staythorpe C and tower AD1C are constrained.	-	2024	Reinforce
Walpole to Spalding Tee 132kV	Demand and generation thermal constraints on the 132 kV circuits between Walpole GSP and Spalding BSP.	-	2028	Reinforce
Willington-Derby South-Spondon	Various outage conditions can overload the circuits from Derby South BSP to Spondon BSP.	-	2029	Reinforce
Wingerworth	The capacity of the 11 kV backfeeds at Wingerworth primary is forecast to be exceeded in the future.	-	2028	Reinforce
Wise Street	Following an arranged or fault outage on one of the transformers at Wise Street primary the full site demand is picked up by the other transformer.	-	2028	Reinforce
Toton	Toton primary has two transformers, so for an N-1 scenario, which loses one of the transformers, the full demand is supplied by the remaining transformer.	-	-	Remove
Tuxford	Single transformer primary with firm capacity reliant on 11 kV interconnection.	-	-	Remove
Woodbeck	Single transformer primary with firm capacity reliant on 11 kV interconnection.	-	-	Remove

DNOA Outcomes – West Midlands

Table 2 Summary of investment decisions in the West Midlands

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Bartley Green BSP	An outage of GT1 is forecasted to cause an overload on GT2 and vice versa at Bartley Green BSP.	2024	-	Flexibility
Brockworth Primary	An N-1 condition on either circuit between Castle Meads BSP and Brockworth primary could overload the remaining circuit.	2026	-	Flexibility
Hammerley Down Primary	An outage of either of the two transformers at Hammerly Down primary substation is forecasted to cause an overload of the other transformer.	2024	-	Flexibility
Netherhills Primary	An outage of either of the two transformers at Netherhills primary substation could cause an overload of the other transformer.	2024	-	Flexibility
Simplex Primary	An outage of either of the two 33/11 kV transformers at Simplex primary substation is forecasted to cause an overload of the other transformer.	2027	-	Flexibility
Alderton Primary	T1 overloads for any outage of T2 at Alderton Primary substation (and vice versa).	2024	2027	Reinforce with Flexibility
Hereford - Ledbury Ring	An outage of one of the infeeds to the 66 kV Hereford - Ledbury ring can cause voltages to drop below statutory limits.	2024	2027	Reinforce with Flexibility
Knighton	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	2024	2027	Reinforce with Flexibility
Cheddleton to Leek	Various outages causing an overload of 33 kV circuit between Cheddleton and Leek primary substations.	2028	-	Signposting
Cowhorn	An outage of either one of the transformers at Cowhorn primary substation is projected to cause an overload on the other transformer.	2031	-	Signposting
Craven Arms Primary	T4 at Craven Arms primary is projected to overload for an outage on T1 due to demand growth.	2033	-	Signposting
Epwell	Epwell consists of two 66/11 kV transformers; an N-1 condition here due to the loss of either transformer potentially overloads the other.	2029	-	Signposting
Ludlow to Craven Arms	An outage of the 33 kV cable circuit between Ludlow BSP and 1L3 at Craven Arms primary substation is forecasted to cause an overload on the 33 kV circuit between Ludlow BSP and 4L3 at Craven Arms primary substation.	2033	-	Signposting

DNOA Outcomes – West Midlands

Table 2 Summary of investment decisions in the West Midlands

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Lye BSP	Lye Bulk Supply Point (BSP) consists of three Grid Transformers (GTs); one of which is smaller than the other two. An N-1 outage of one of the larger transformers overloads the smaller unit.	2032	-	Signposting
Princess Royal Primary	An outage of either of the two 33/11 kV transformers at Princess Royal primary substation is forecasted to cause an overload of the other transformer.	2029	-	Signposting
Barlaston / Meaford BSP	Both N-1 and N-2 constraints seen at Meaford BSP (N-1 for either GT and N-2 for both GTs).	-	2030	Reinforce
Bayston Hill to Malehurst	Part of the Shrewsbury ring has thermal, voltage, step change, and generation driven constraints.	-	2028	Reinforce
Berrington Primary	The transformer at Berrington primary is expected to overload under intact and N-1 conditions.	-	2026	Reinforce
Cellarhead Network	The constraints on the Cellarhead 132 kV network include thermal (demand and generation), fault level, and operability limitations.	-	2028	Reinforce
Chipping Sodbury	Both N-1 and N-2 constraints at Chipping Sodbury BSP (N-1 for either GT and N-2 for both GTs).	-	2029	Reinforce
Lea Marston to Copt Heath	An outage affecting supplies to the Lea Marston-Elmdon 132 kV circuit causes a thermal constraint on the Lea Marston-Copt Heath circuits.	-	2031	Reinforce
Shrewsbury GSP	Thermal constraint following an N-2 outage on two SGTs at Shrewsbury GSP.	-	2030	Reinforce
Stockton	Stockton is a single transformer site with an N-1 constraint triggered for loss of its transformer.	-	2032	Reinforce
Stowfield – St Weonards	St Weonards is a single transformer site with an N-1 constraint triggered for loss of its transformer.	-	2029	Reinforce

DNOA Outcomes – South Wales

Table 3 Summary of investment decisions in South Wales

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Lime Street and Garngoch group	A 33 kV fault to Main 2 busbar at Garngoch can result in both Garngoch and Lime Street being supplied entirely by a single 33 kV circuit from Swansea North.	2025	-	Flexibility
Ashgrove	Ashgrove primary substation is supplied by a pair of mismatched 33/11 kV transformers. The loss of the higher rated transformer means the lower rated unit must supply the full demand.	2024	2027	Reinforce with Flexibility
Bridgend Trading Estate Primary	The transformers at Bridgend Trading Estate primary are projected to overload following an outage on the other.	2033	-	Signposting
Fairwater Primary	Fairwater primary consist of two mismatched transformers. T1 is lower rated and is expected to overload following the loss of T2.	2032	-	Signposting
Golden Hill Primary	Golden Hill primary comprises two 33/11 kV transformers, which are expected to overload following an outage on the other.	2031	-	Signposting
Haverfordwest Primary	Haverfordwest primary transformers and the 33 kV circuits from Haverfordwest BSP overload for the loss of either.	2029	-	Signposting
Merlins Bridge Primary	Both transformers at Merlin's Bridge primary are rated at 7.5/15 MVA and overload for the loss of the other.	2032	-	Signposting
Neyland Primary	For an arranged fault or outage on one of the transformers, the other picks up the full demand of the site.	2031	-	Signposting
Penblewin Primary	For a first circuit outage (arranged or fault) which results in the loss of either Penblewin 33/11 kV primary transformer the remaining transformer in service begins to overload in-line with the load growth projections. The 33 kV circuit supplying the primary is also projected to overload under intact network conditions.	2033	-	Signposting
Pontllanfraith Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2032	-	Signposting
Ravenhill	Ravenhill primary substation has two 33/11 kV transformers which have different ratings. An outage on T1 is projected to overload T2 at Ravenhill primary substation.	2032	-	Signposting
St Twynells Primary	An outage of either of the 33/11 kV transformers at St Twynells primary substation is forecasted to cause an overload of the other transformer.	2030	-	Signposting
Steynton circuits	There are N-1 outages when either of the two circuits overload when required to support the demand of both primaries (Steynton and Milford Haven).	2029	-	Signposting

DNOA Outcomes – South Wales

Table 3 Summary of investment decisions in South Wales

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Steynton Primary	Both transformers at Steynton primary are 12/24 MVA units and overload for the loss of the other.	2032	-	Signposting
Sudbrook to Newhouse	An arranged or fault outage on the main 1 33 kV busbar at Sudbrook BSP puts the full demand of Newhouse and Chepstow primaries on a single circuit.	2034	-	Signposting
Aberaeron	For an N-1 outage of the transformer at Aberaeron, the site is limited by the 11 kV backfeeds.	-	2027	Reinforce
Golden Hill to St Florence	An N-1 outage for the loss of the Golden Hill – St Florence circuit results in the Pembroke South – Broadfield circuit and connected primaries dropping below the statutory voltage limit.	-	2024/25	Reinforce
Llandrindod Wells Primary	An N-1 scenario for the loss of one transformer at Llandrindod Wells primary causes and overload of the remaining transformer.	-	2027	Reinforce
Llanfoist	N-1 constraint for the loss of one of the Super Grid Transformers (SGTs) at Rassau Grid Supply Point (GSP) will result in the remaining SGT overloading in the future.	-	2030	Reinforce
Llanfyrnach	For an N-1 outage of the transformer at Llanfyrnach, the site is limited by the 11 kV backfeeds.	-	2027	Reinforce
Milford Haven BSP	Under N-2 scenarios the entire group could be fed via just one 132 kV circuit.	-	2030	Reinforce
Rhos BSP	An N-2 condition losing both GTs at Carmarthen BSP overloads the GT at Rhos BSP.	-	2027	Reinforce
Rhos to Newcastle Emlyn	An N-1 condition for the loss of one of the 33 kV circuits to Newcastle Emlyn primary heavily loads the remaining circuit.	-	2026	Reinforce
St Davids Primary	St Davids primary is a single transformer site with constraints on the 11 kV interconnection.	-	2027	Reinforce
Sully tee circuit	N-1 constraint on the section of 132 kV circuit from Aberthaw Grid Supply Point (GSP) to the tee to Sully Bulk Supply Point (BSP).	-	2026	Reinforce
Swansea North GSP to Rhos BSP	An N-2 constraint for the loss of the dual circuit 132 kV H route between Carmarthen and Rhos, leaves customers at risk of rota disconnection until a circuit is restored.	-	2028	Reinforce
Nantwen Primary	Nantwen primary is a single transformer primary whose capacity is limited by its 11 kV backfeeds.	-	-	Remove
Trevaughan	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	-	-	Remove

DNOA Outcomes – South West

Table 4 Summary of investment decisions in the South West

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Bradley Lane Primary	For an N-1 outage for the loss of one of the transformers, the remaining transformer will become overloaded.	2024	-	Flexibility
Clevedon Primary	Clevedon has two transformers; there is an overload for the loss of either one.	2024	-	Flexibility
Clyst Honiton Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2028	-	Flexibility
Stentaway Primary	In the event of a 33 kV busbar outage at Stentaway, transformer T2 becomes overloaded (due to loss of T1 at Stentaway & Plymstock South).	2024	-	Flexibility
Taunton to Culmhead Tee	33 kV circuit overload under N-1 outage conditions.	2025	-	Flexibility
Tavistock Primary	In an N-1 outage for the loss of one of the transformers at Tavistock primary, the remaining transformer will become overloaded.	2024	-	Flexibility
Tiverton to Bridge Mills and Cullompton circuits	An outage of one of the infeeds to the ring supplying Bridge Mills and Cullompton primaries subsequently leads to low voltage on the 33 kV circuits.	2024	-	Flexibility
Woodland Way Primary	A fault outage on Feeder Road BSP 33 kV main 1 or reserve 1 would result in the loss of two of the four transformers at Woodlands Way, potentially overloading the remaining two in-service.	2028	-	Flexibility
Yeovil to Martock	Martock's T2 alternative feed is currently from Yeovil BSP; however, due to load growth on both the Yeovil ring and Martock T2, in future years the group demand will begin to exceed the agreed supply capacity under this outage condition.	2025	-	Flexibility
Abham to Totnes Tee	The 132 kV cable circuits between Abham GSP & Totnes Tee become overloaded under N-2 outage conditions.	2025	2028	Reinforce with Flexibility
Camborne Treswithian	The constraint at Camborne Treswithian primary is where peak demand exceeds the primary transformer capacity.	2024	2027	Reinforce with Flexibility
Core Hill Primary	In an N-1 outage for the loss of one of the transformers at Core Hill primary, the remaining transformer will be overloaded in the future.	2024	2027	Reinforce with Flexibility
Edgarley Primary	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	2024	2027	Reinforce with Flexibility

DNOA Outcomes – South West

Table 4 Summary of investment decisions in the South West

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Exeter City	Overloads are projected to occur on either GT at Exeter City BSP for the loss of the other GT.	2027	2024	Reinforce with Flexibility
Feeder Road A Primary	Loss of two transformers at Feeder Road A coupled with lack of 11 kV busbars.	2027	2024	Reinforce with Flexibility
Feeder Road BSP	For the loss of two GTs at Feeder Road BSP the remaining GTs are projected to overload.	2028	2028	Reinforce with Flexibility
Gunnislake	An N-1 condition for the loss of one of the 33/11 kV transformers at Gunnislake primary would overload the remaining transformer at peak loading.	2027	2024	Reinforce with Flexibility
Hemyock	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	2027	2024	Reinforce with Flexibility
Keynsham East Primary	An N-1 fault for the loss of the T2 transformer means the whole load must be supplied by T1.	2027	2025	Reinforce with Flexibility
Morwenstow	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	2027	2024	Reinforce with Flexibility
Mullion	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	2027	2024	Reinforce with Flexibility
Newton Abbot to Newton Abbot Main	Newton Abbot Main is a three transformer primary which is constrained by winter circuit ratings and summer transformer ratings.	2026	2024	Reinforce with Flexibility
Street BSP	There are multiple 33 kV circuit overloads between Bridgwater and Street during a fault on the main 1 busbar at Street BSP.	2027	2024	Reinforce with Flexibility
Tiverton	For an N-1 outage of either GT at Tiverton BSP, the winter peak demands exceed the nameplate rating of the remaining GT.	2027	2024	Reinforce with Flexibility
Weston Super Mare	The current demand at the site exceeds the continuous rating of the transformers so for an N-1 scenario the remaining transformer would be overloaded.	2027	2026	Reinforce with Flexibility
Bath BSP	GT1 and the associated 132 kV circuit infeed overloads when the GT2 and the associated 132 kV circuit infeed to Bath BSP is off supply.	-	2032	Signposting

DNOA Outcomes – South West

Table 4 Summary of investment decisions in the South West

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Bath Road Primary	Bath Road primary transformer overload for the loss of one transformer.	2034	-	Signposting
Cairns Road Primary	Cairns Road primary has four transformers, run split to have 2x2 transformer sections. For the loss of a transformer under this arrangement the remaining transformer overloads.	2031	-	Signposting
East Yelland	Overloads are projected to occur on either GT at East Yelland BSP for the loss of the other GT.	2034	-	Signposting
Falmouth Bickland Hill Primary	Falmouth Bickland Hill primary capacity for a loss of one transformer.	2030	-	Signposting
Heavitree Primary	In an N-1 outage for the loss of one of the transformers at Heavitree primary, the remaining transformer will be overloaded in the future.	2032	-	Signposting
Honiton Heathfield and Offwell Ring	N-1 condition for a fault on the Ottery St Mary main 2 busbar results in an overload of the Ottery St Mary to Honiton circuit.	2032	-	Signposting
Honiton Heathfield Primary	Honiton Heathfield is a two transformer primary where an N-1 outage of one of the transformers potentially overloads the other.	2032	-	Signposting
Newton Abbot BSP	Further demand growth at Newton Abbot BSP will result in the exceedance of the 33 kV busbar rating for an N-1 scenario of a transformer resulting in sections of busbar becoming overloaded.	2033	-	Signposting
Paignton to Laywell Brixham	The 33 kV circuit between Paignton and Laywell Brixham could overload following the arranged or fault outage of one of the other circuits feeding the group.	2029	-	Signposting
Park Lane	Park Lane primary is a 7.5/15 MVA primary that is getting close to its capacity for a loss of either transformer.	2029	-	Signposting
Park Street Primary	Following an arranged or fault outage on one of the transformers the full site demand is picked up by the other transformer.	2034	-	Signposting
Pinhoe Primary	In an N-1 outage for the loss of one of the transformers at Pinhoe primary, the remaining transformer will be overloaded in the future.	2031	-	Signposting
Portishead to Weston in Gordano	A 33 kV circuit overload is predicted under intact conditions.	2030	-	Signposting

DNOA Outcomes – South West

Table 4 Summary of investment decisions in the South West

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Roseland Primary	Two 5 MVA transformer primary getting close to its capacity for a loss of one transformer.	2028	-	Signposting
Taunton to Wellington	33 kV circuit overload under N-1 outage conditions.	2032	-	Signposting
Tiverton to Stoneshill Farm	A fault on the circuit out of Tiverton Bulk Supply Point (BSP) (2L5) causes an overload on the other leg of the ring.	2031	-	Signposting
Totnes Primary	A 33 kV busbar fault at Totnes BSP causes an overload on a 33/11 kV transformer at Totnes initially due to the reverse power flow through the 11 kV busbar and 33/11 kV transformer.	2031	-	Signposting
Weston in Gordano Primary	Weston in Gordano primary has one transformer which is projected to overload under intact conditions.	2032	-	Signposting
Alverdiscott GSP and K Route	Several constraints have been identified in this area including GT overloads at East Yelland, Barnstaple and St Tudy BSPs.	-	2028	Reinforce
Alverdiscott to East Yelland and Barnstaple	For an N-2 outage the entire group demand is lost and interconnectivity is insufficient to restore it to meet P2 requirements.	-	2027	Reinforce
Barnstaple BSP	N-1 constraint for the loss of a transformer at Barnstaple BSP.	-	2025	Reinforce
Blagdon	There is liability on Blagdon to feed some of Churchill Gate primary demand for a fault at Churchill gate. This causes an overload of the Blagdon transformer.	-	2028	Reinforce
Bridgwater to Bath Road Circuit	There is a 33 kV circuit overload under N-1.	-	2025	Reinforce
East Brent Primary	East Brent is a single transformer primary which is anticipated to overload under intact conditions.	-	2028	Reinforce
East Yelland to Penn Hill Tee	For an N-1 outage on one of the four circuits that supply the group, the circuit between East Yelland and Penn Hill Tee potentially overloads.	-	2026	Reinforce
Exeter City to Folly Bridge Ring	An N-1 outage of one of the infeeds (or a busbar) overloads one of the other two infeeds.	-	2026	Reinforce

DNOA Outcomes – South West

Table 4 Summary of investment decisions in the South West

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Exeter Main to Exeter City	Constraint present due to 132 kV tower line clearance infringement (along the Exeter Main 905 feeder) with an 11 kV overhead line.	-	2025	Reinforce
Exminster Primary	Demand growth takes the 11 kV backfeeds over their capacity.	-	2026	Reinforce
Feeder Road to Bedminster and Bower Ashton	One circuit supplies both Bedminster and Bower. For an N-2 condition for the loss of two other circuits this circuit overloads.	-	2025	Reinforce
Fraddon to Newquay Trevamper	An N-1 condition for the loss of one of the 33 kV circuits to Newquay Trevamper primary heavily loads the remaining circuit and leads to low volts.	-	2025	Reinforce
Hayle to Penzance	An N-1 fault on the Main 1 busbar at Hayle overloads several of the 33 kV circuits, and lead to low voltage constraints.	-	2028	Reinforce
Iron Acton to Seabank	Seabank and Bradley Stoke BSPs are fed via two 132 kV circuits from Iron Acton GSP. For N-2 conditions, back energisation could lead to operational, earthing and safety risks.	-	2027	Reinforce
Isles of Scilly	For a loss of the mainland supply the Isles of Scilly generator needs to support the electricity needs of the Isles.	-	2027	Reinforce
Moretonhampstead	The N-1 restoration capacity of Moretonhampstead primary is restricted by 11 kV backfeeds.	-	2028	Reinforce
Newton Abbot to Teignmouth Gasworks and Higher Woodway	Overload on the circuit from Newton Abbot 8L5 to Teignmouth Gasworks 1L3 and Newton Abbot 3L5 to Higher Woodway.	-	2028	Reinforce
Penryn / Falmouth Bickland Hill / Falmouth Dock Ring	A busbar outage taking out a circuit supplying the group overloads one of the remaining circuits on the Penryn / Falmouth Bickland / Falmouth Dock ring.	-	2026	Reinforce
Portishead BSP	Issues with parallel operation of Sandford and Seabank.	-	2024	Reinforce
Shapwick Primary	The N-1 restoration capacity of Shapwick primary is restricted by 11 kV backfeeds.	-	2025	Reinforce
St Germans to Liskeard 33kV Ring	For an N-1 outage of one of the circuits that feeds the group or a fault on main 1 or 2 at St Germans the remaining circuit could overload.	-	2025	Reinforce

DNOA Outcomes – South West

Table 4 Summary of investment decisions in the South West

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
St Mawgan	Demand growth takes the 11 kV backfeeds for St Mawgan primary over their capacity.	-	2029	Reinforce
Weston to Lypstone Farm	There is a 33 kV circuit overload under N-1 between Weston and Lypstone Farm.	-	2027	Reinforce
Witheridge	Demand growth takes the 11 kV backfeeds over their capacity.	-	2026	Reinforce
Filton Airport and Cribbs Causeway Ring	A fault on the circuit out of Bradley Stoke Bulk Supply Point (BSP) (6L5) causes an overload on the other leg of the ring.	-	-	Remove
Hayle – Camborne	An N-1 outage on the Indian Queens – Fraddon Tee – Camborne 132 kV circuit causes an overload on the Hayle – Rame 132 kV circuit, and vice versa.	-	-	Remove
Plympton BSP	Plympton Bulk Supply Point (BSP) has limited capacity for an N-1 condition on one of its Grid Transformers (GTs) at winter peak demand.	-	-	Remove
Plymouth/South Hams	The constraint occurs during the loss of a 400 kV circuit between Langage and Exeter Grid Supply Point (GSP) and the 132 kV 'B-Route' circuit (between Landulph, Ernesettle and Plymouth Bulk Supply Points (BSPs)), or similar combinations. Under high load conditions the 132 kV circuit between Ernesettle and Milehouse BSPs are at risk of overloading.	-	-	Remove
Truro - Truro Treyew	For an N-2 outage (or a 33 kV busbar fault) a potential overload occurs on the Truro - Truro Treyew Road 33 kV circuit following the connection of additional demand at Willow Green/Langarth. This condition exists irrespective of the Truro 33 kV network being run in parallel with GT1 at Fraddon.	-	-	Remove

DNOA Outcomes – NGED-wide

Table 5 Summary of investment decisions for NGED-wide schemes

The following categories of constraints were not taken forward for individual assessment as part of the DNOA process as they are not currently viable for mitigation with flexibility services. A list of each of these constraints is given in the relevant scheme pages. Managing asset condition related constraints using flexibility is not technically viable, as discussed in Appendix A – Coordination of Load Related and Asset Replacement Expenditure. Managing generation constraints with flexibility is technically feasible, but requires further development of our flexibility analysis process. This is discussed in Appendix B – Mitigating generation constraints using Flexibility Services.

Scheme	Constraint	Flexibility Start Year	Proposed scheme closure	DNOA Decision
Asset replacement	Condition based issues on NGED assets across all four licence areas.	-	Various	Reinforce
Fault level	Fault level constraints on substations across NGED's four licence areas.	-	Various	Reinforce
Generation	Generation driven constraints across NGED's four licence areas.	-	Various	Reinforce
Protection	Protection equipment reinforcement projects required.	-	Various	Reinforce
Voltage	Voltage driven constraints across NGED's four licence areas.	-	Various	Reinforce

Glossary

Flexibility related terminology

Acronym / Initialisation	Term	Definition
CBA	Cost Benefit Analysis	A process used by NGED to measure the benefits of a business decision compared to the costs associated with taking that action. Used to determine the optimal reinforcement solution, which is then tested against market provided flexibility by the DSO as part of the DNOA process.
CEM	Common Evaluation Methodology	A methodology developed under the Open Networks project to compare options and identify low regret pathways. The CEM tool is used in the DNOA process to assess flexibility against conventional reinforcement.
–	Ceiling Price	A price calculated based on the value of reinforcement deferred that represents the maximum NGED is willing to pay for flexibility. Given in units of £ / MWh.
CMZ	Constraint Management Zone	Constraints on the electricity network are confined to specific geographical locations, we call these locations Constraint Management Zones (CMZs).
–	Flexibility	Reducing loads on the network by using customers' ability to change their usage patterns by either switching on generators or reducing consumption.
–	Flexibility Payments to service providers	Flexible service contracts to manage network capacity constraints. Expenditure should include payments made for the availability of flexibility services and payments made for service utilisation. The volumes relate to total MVA of flexible services contracted during the reporting year.
FSP	Flexibility Service Provider	Flexibility service providers enter into contractual agreements with network operators to temporarily alter their import or export behaviour to help mitigate network constraints.

Glossary

Forecasting related terminology

Acronym / Initialisation	Term	Definition
–	Forecast	A prediction of future events that, in the balance of probabilities, NGED believes will occur.
–	Scenario	A hypothesis of future events that would or could occur given certain political, economic, social, technological and environmental conditions.
FES	Future Energy Scenarios	A set of scenarios developed by National Grid to represent credible future paths for the energy development of the United Kingdom.
DFES	Distribution Future Energy Scenarios	The Distribution Future Energy Scenarios outline the range of credible futures for the growth of the distribution network. It is the first stage of the National Grid Electricity Distribution (NGED) investment planning process.
NGED BV or BV	NGED Best View	An amalgamation of the other four DFES scenarios which then provides the most likely growth pathway that NGED expect to materialise.
CT	Consumer Transformation	Mid-level ambition DFES scenario that forecasts the volumes and regional distribution of low carbon technology uptake in NGED's licence areas. This uses stakeholder-informed bottom up analysis to align with national industry developed future energy scenarios.
LW (or LTW)	Leading the Way	The most ambitious DFES scenario that forecasts the volumes and regional distribution of low carbon technology uptake in NGED's licence areas. This uses stakeholder-informed bottom up analysis to align with national industry developed future energy scenarios.
ST	System Transformation	Mid-level ambition DFES scenario that forecasts the volumes and regional distribution of low carbon technology uptake in NGED's licence areas. This uses stakeholder-informed bottom up analysis to align with national industry developed future energy scenarios.
FS	Falling Short	The least ambitious DFES scenario that forecasts the volumes and regional distribution of low carbon technology uptake NGED's licence areas. This uses stakeholder-informed bottom up analysis to align with national industry developed future energy scenarios.
ESA	Electricity Supply Area	The area supplied by a single primary substation, or a dedicated 33 kV, 66 kV or 132 kV customer.

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Network infrastructure related terminology

Acronym / Initialisation	Term	Definition
–	Distribution Network	The electric lines, cables, plant and equipment used to distribute electricity from the transmission network to NGED's 8 million customers in the Midlands, South West and South Wales.
SGT	Super Grid Transformer	Transformers used at a Grid Supply Point. Typically used to step down from 400 kV to 132 kV.
GSP	Grid Supply Point	A substation comprising of one or more Super Grid Transformers and associated switchgear.
–	Subtransmission	The sections of an electrical distribution network which provide the interface between transmission and Primary or Secondary Distribution. In NGED's network the GSPs, 132 kV circuits and BSPs are considered Subtransmission.
GT	Grid Transformer	The transformers used at a Bulk Supply Point. Typically used to step down from 132 kV to 11 kV or 132 kV to 33 kV.
BSP	Bulk Supply Point	A substation comprising of one or more Grid Transformers and associated switchgear.
–	Primary Distribution	The sections of an electrical distribution network which provide the interface between transmission and Primary or Secondary Distribution. In NGED's network, the 33 kV circuits and Primary Substations are considered Primary Distribution.
–	Primary Transformer	A transformer that steps voltage down from 66 or 33 kV to 11 or 6.6 kV.
–	Primary Substation	A substation comprising of one or more primary transformers and associated switchgear.
–	Secondary Distribution	The 11 kV or 6.6 kV network used to distribute electricity from the primary network to customers on the low voltage distribution networks (or directly connected at 11 kV or 6.6 kV).
–	Cable	A conductor used to distribute electrical power, typically buried directly in the ground, installed in ducts or troughs or strung up in the air between poles or pylons. This excludes under eaves or mural wiring.
OH (or OHL)	Overhead Lines	An overhead line is a cable for the transmission of electricity, via wooden utility poles or metal pylons. A cable that typically transmits electricity a few metres above the ground.

Glossary

Network operations related terminology

Acronym / Initialisation	Term	Definition
–	Demand	The consumption of electrical energy.
–	Generation	The production of electrical energy.
–	Constraint	Any limit on the ability of the licensee's Distribution System, or any part of it, to transmit the power supplied onto the licensee's Distribution System to the location where the demand for that power is situated.
FCO	First Circuit Outage	P2/8 defines a First Circuit Outage as: *…a fault or an arranged Circuit outage…* Also referred to as "N-1" in some contexts (All FCOs are N-1 but not all N-1s are FCOs).
SCO	Second Circuit Outage	P2/8 defines a Second Circuit Outage as: *…a fault following an arranged Circuit outage…* Also referred to as "N-1-1" or "N-2" in some contexts (all SCOs are N-2 but not all N-2s are SCOs).
MVA	Mega volt amperes	Volt-ampere is a unit of electric power equal to the product of one volt and one ampere, equivalent to one watt at unity power factor (pf) is a unit used for measuring apparent power.
MWh	Megawatt hours	Megawatt hours (1,000,000 Watt hours). Megawatt hours is a measure of electrical energy.
GWh	Gigawatt hours	Gigawatt hours (1,000,000,000 watt hours). Gigawatt hours is a measure of electrical energy.
ANM	Active Network Management	The Energy Networks Association Active Network Management Good Practice Guide summarises ANM as: *Using flexible network customers autonomously and in real-time to increase the utilisation of network assets without breaching operational limits, thereby reducing the need for reinforcement, speeding up connections and reducing costs.*
–	Load Flow	A study conducted on a model of the distribution network to calculate the electrical flows through each asset. Carried out by engineers to identify thermal and voltage constraints on the network which may require intervention.

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Publications and documents

Acronym / Initialisation	Term	Definition
DFES	Distribution Future Energy Scenarios	The Distribution Future Energy Scenarios outline the range of credible futures for the growth of the distribution network. It is the first stage of the National Grid Electricity Distribution (NGED) investment planning process.
NDP	Network Development Plan	A plan published every two years as required by SLC 25B to provided stakeholders with transparency on network constraints and needs for flexibility.
NDR	Network Development Report	A component of the NDP that provides readers with valuable additional information on potential development projects.
DNOA	Distribution Network Options Assessment	A document published once a year by NGED that provides transparency in the investment decision making process.
LTDS	Long Term Development Statement	An annually published document that sets out the use and likely development of the distribution network and the DNO's plans for modifying the distribution system for the following two years.
ER P2	Engineering Recommendation P2	'Engineering Recommendation P2 – Security of Supply' (ER P2) is a distribution network planning standard. It sets the minimum levels of security of supply that Distribution licensees must achieve on GB distribution networks.
C31E	Electricity Distribution Standard Licence Condition 31E	In line with licence condition C31E, NGED is required to report on the Flexibility Services we intend to procure and have procured. As part of this requirement we produce two documents - a forward looking Distribution Flexibility Services Procurement Statement and a backwards looking Distribution Flexibility Services Procurement Report.

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Relevant organisations

Acronym / Initialisation	Term	Definition
NGED	National Grid Electricity Distribution	National Grid Electricity Distribution is a DNO that is licenced by Ofgem to distribute electricity in the East Midlands, West Midlands, South West, and South Wales.
DNO	Distribution Network Operator	A company, licenced by Ofgem, which distributes electricity in the United Kingdom who has a defined Distribution Services Area.
DSO	Distribution System Operator	A department within NGED that creates an efficient and more flexible electricity network to meet future energy demands as well as co-ordinating transmission and distribution services at a local level with other network and system operators. Responsible for the DFES, NDP and DNOA processes.
NGESO	National Grid Electricity System Operator	National Grid Electricity System Operator is the electricity system operator for Great Britain, soon to be named the National Energy System Operator in 2024.
NGET	National Grid Electricity Transmission	National Grid Electricity Transmission owns the electricity transmission network in England and Wales.

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September 2024. BLU28575/PR