nationalgrid

Distribution Network Options Assessment

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Foreword

With the government's commitment to end the UK's contribution to greenhouse gas emissions by 2050, the role of electricity in helping to facilitate net zero is becoming increasingly important. As our customers shift to electrify their heating and transport needs, our network needs to be smarter and more flexible than ever.

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. As we continue to expand these opportunities we will ensure we are able to access the maximum value reinforcement deferral using flexibility is able to provide for our network by utilising ceiling prices for new flexibility contracts.

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 Distribution Network Options Assessment (DNOA) publication outlines our methodology for assessing the use of flexibility to defer conventional reinforcement and how we ensure every investment decision provides optimal value for stakeholders and customers.

As part of our RIIO-ED2 Business Plan we have committed to adopting a 'flexibility first' approach to maximise utilisation of the network. The DNOA process will provide transparency in our approach to meeting this commitment and ensure 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.

The recent expansion of flexibility services offered by NGED into the secondary network has significantly widened the opportunities for customers to participate and benefit in flexibility markets. This has helped further incentivise the uptake of LCTs and other green technologies, and will continue to be developed to ensure maximum value for customers and the distribution network.

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.

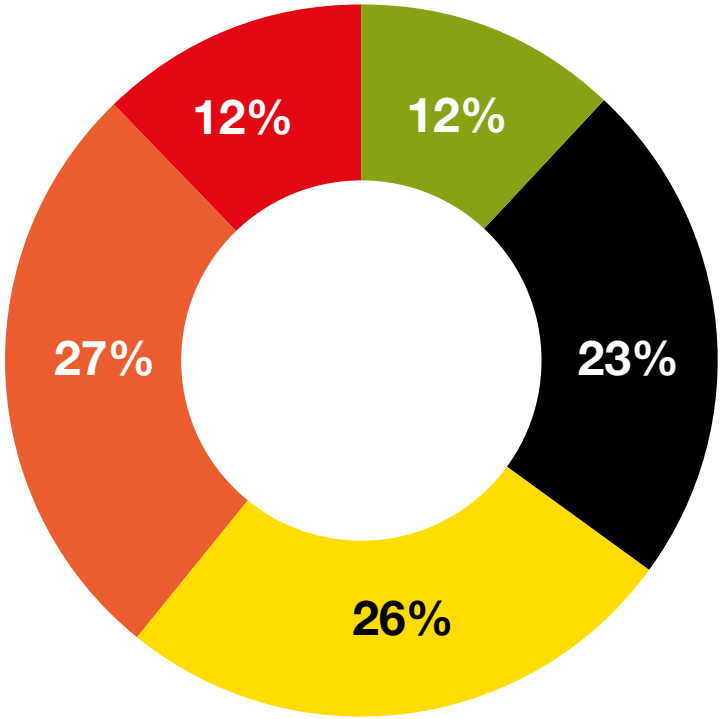
Ben Godfrey
Director of Distribution System Operator

Executive summary

This DNOA report outlines the decisions made on the viability of utilising flexibility services to manage constraints across NGED's four licence areas. 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. 173 unique schemes were assessed; 59 in the East Midlands, 25 in the West Midlands, 25 in South Wales and 64 in the South West.

This DNOA assesses individual potential reinforcement schemes at the primary voltage level and above with a combined cost of over £550 million. Potential reinforcement schemes at the secondary voltage level with a combined reinforcement cost of over £60 million have also been assessed.



Total schemes assessed	173
Flexibility	21
Reinforce	40
Reinforce with flexibility	45
Signposting	47
Remove	20

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 signals a decision to inform potential providers of future flexibility requirements whilst the need requirement is monitored.

Remove signals a decision to remove the scheme from consideration in future DNOAs. All schemes will be re-assessed in future DNOAs until there is no option value left to realise.

Executive summary

This report explains the methodology and data sources for the investment decisions on our network, including how the DNOA fits into the wider load related expenditure planning process. A summary of the investment decisions made is also provided below, with more in-depth information for individual schemes 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.

Table 1 Summary of investment decisions for NGED-wide schemes

Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	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
Green recovery	Reinforcement projects funded as part of the Green Recovery initiative.	Various	-	Reinforce

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Table 2 Summary of investment decisions in the East Midlands

Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	DNOA Decision
Ashby/Willesley	N-1 condition for the exceedance of 33 kV circuit ratings between Gresley BSP and Moira primary.	-	2030	Signposting
Blidworth	N-1 condition due to the demand growth being expected to be higher than the firm capacity of the site (limited by the primary transformers).	-	2031	Signposting
Castle Road	N-1 condition as the demand growth is expected to be greater than the firm capacity and could overload a transformer.	-	2032	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.	-	2029	Signposting
Copsewood	Firm capacity is limited by its 33/11 kV transformers, which are forecast to be constrained under N-1 outage conditions.	-	2034	Signposting
Dowsby Fen	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	-	2033	Signposting
Hawton BSP	For an N-1 condition of the loss of one of the infeeds or transformers the remaining circuit takes the full load of Hawton BSP.	-	2027	Signposting
Holbrook Lane	Site is limited by the incoming 33 kV circuits and transformer ratings. An N-1 outage condition would see the loss of either transformer causing the other to pick up the full demand.	-	2028	Signposting
Hopton – Cromford	Hopton and Cromford primaries run as a group, with one transformer at each site. Both are sites fed from Winster BSP via two 33 kV circuits. Load growth indicates that the group will exceed its firm capacity under an N-1 condition.	-	2030	Signposting
Langdale Drive	Langdale Drive is a two transformer primary. Under an N-1 condition, the full demand of the site would be supplied by one of these transformers.	-	2035	Signposting
Marlborough Road	Two transformer primary where the site's firm capacity is limited by its T1 33 kV infeed circuit's rating.	-	2028	Signposting
Moira	Moira is a two transformer primary where an N-1 condition of the loss of one transformer will cause the other to overload based on current forecasts.	-	2031	Signposting
North Wheatley	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
Northampton East BSP	N-1 constraint for the loss of one Grid Transformer (GT) and the full demand is supplied by the remaining transformer, causing an overload in the near future.	-	2030	Signposting

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Table 2 Summary of investment decisions in the East Midlands

Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	DNOA Decision
Northampton West BSP	Loss of one of the Grid Transformers (GTs) means the full demand is supplied by the other. Growth projections indicate this demand will overload the remaining transformer in the near future.	-	2029	Signposting
Quorn	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.	-	2031	Signposting
Skegby Lane	The 11 kV switchboard is the limiting factor at the site. Site is expected to exceed its firm capacity, leading to overloads for N-1 outages.	-	2029	Signposting
Sneinton	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.	-	2028	Signposting
Spondon Primary	The 11 kV switchboard is the limiting factor. In an N-1 scenario for the loss of one of the transformers, overloads could be seen in the future.	-	2031	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.	-	2028	Signposting
Walpole to Spalding Tee	South Holland, Spalding and Bourne BSPs (as well as half of Stamford BSP) are normally fed from Walpole GSP via a 132 kV double circuit tower line. Following an outage on either of the circuits to the Spalding tee, the other is anticipated to overload.	-	2029	Signposting
West Bridgford	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.	-	2029	Signposting
Wingerworth	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
Berkswell GSP	N-1 and N-2 constraints are seen on the Super Grid Transformers (SGTs) at Berkswell GSP (N-1 outages for the loss of a single SGT and N-2 outages for the loss of two SGTs during the access period).	-	-	Remove
Clowne	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	-	-	Remove
Coalville	N-1 constraint for the loss of one of the Grid Transformers (GTs) at Coalville BSP.	-	-	Remove
Hinckley BSP	The constraint is on the 132/11 kV transformers under an N-1 scenario (either transformer potentially overloads following the loss of the other).	-	-	Remove

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Table 2 Summary of investment decisions in the East Midlands

Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	DNOA Decision
Lincoln – Anderson Lane	33 kV circuit constraint on the 33 kV circuit from Lincoln to Anderson Lane primary under N-1 conditions.	-	-	Remove
Mackworth	The transformers at Mackworth were limited due to not having automatic on-load tap changers, meaning that the site firm capacity was limited in order to maintain the 11 kV voltage within statutory limits.	-	-	Remove
Manton	An N-1 condition at this site for the loss of one transformer results in the full demand being picked up by the other transformer.	-	-	Remove
New Dove Valley	Hatton primary will not be able to accommodate the additional load growth projected. Under an N-1 condition the site would overload a transformer.	-	-	Remove
Union Street – Rugby	Union Street is a two transformer primary. An N-1 condition for the loss of one transformer could overload the other.	-	-	Remove
Atherstone	Constraints on the primary transformers at and 33 kV circuits to Atherstone primary for N-1 outages (both circuit outages and busbar outages at the BSP).	2027	2024	Reinforce with Flexibility
Bretby	Bretby primary is limited by its 33/11 kV transformers. An N-1 constraint is forecast for the loss of one transformer triggering an overload of the other.	2027	2024	Reinforce with Flexibility
Ellesmere Avenue	Constraints on the primary transformers at and 33 kV circuits to Ellesmere Avenue primary for N-1 outages on either infeed.	2027	2024	Reinforce with Flexibility
Grassmoor	Grassmoor primary has a limited capacity for an N-1 circuit outage, limited by the primary transformers (with the next limitation being the incoming 33 kV circuits).	2027	2024	Reinforce with Flexibility
Grendon – Corby 132 kV	There are four 132 kV circuits between Grendon GSP and Corby. Under an N-2 condition, one of the remaining circuits potentially overloads.	2029	2024	Reinforce with Flexibility
Hallcroft Road	The demand growth for this site is predicted to exceed its firm capacity. N-1 condition for the loss of one transformer could lead to overloads on the remaining transformer.	2027	2024	Reinforce with Flexibility
Shepshed	Shepshed is a two transformers primary. The site's firm capacity is currently limited by its 11 kV circuit breakers.	2027	2024	Reinforce with Flexibility
Stamford	Wittering is back-fed at 11 kV to Stamford primary for a number of arranged outages. The N-1 condition is the arranged outage on the main 1 busbar at Stamford causing an overload on T4 at Stamford.	2027	2024	Reinforce with Flexibility

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Table 2 Summary of investment decisions in the East Midlands

Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	DNOA Decision
Staythorpe GSP	Staythorpe Grid Supply Point (GSP) has two Super Grid Transformers (SGTs), each rated at 240 MVA. The demand is near this rating so in an N-1 scenario, for the loss of one of the SGTs, the other could potentially overload.	2027	2024	Reinforce with Flexibility
Toton	Toton is a two transformer primary. In an N-1 scenario, for the loss of one of the transformers, the full demand is on the second transformer which could potentially overload.	2027	2024	Reinforce with Flexibility
Woodbeck	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	2025	2024	Reinforce with Flexibility
Hockley Farm Road	The constrained circuit is a short cable section on the Leicester North – Hockley Farm Road T1 33 kV circuit, which is anticipated to overload when picking up the site's demand following an N-1 outage on the infeed from Leicester BSP.	2024	-	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
South Holland – Long Sutton – Holbeach Circuit	Both thermal and voltage constraints are forecast on the 33 kV network feeding Long Sutton and Holbeach primaries for various outage conditions.	2028	-	Reinforce
Staythorpe C to AD1C circuit	Two spans of 132 kV overhead line between Staythorpe C and tower AD1C are constrained.	2024	-	Reinforce
Willington – Derby South – Spondon	Various outage conditions can overload the 132 kV circuits from Willington to Derby South BSP and from Derby South BSP to Spondon BSP (the most onerous of which is a busbar fault at Willington GSP).	2026	-	Reinforce
Wollaton Road	Firm capacity is limited by its 33 kV circuit feeder to T1. Following the loss of one transformer, the other would pick up the full load at the site, potentially overloading this feeder circuit.	2028	-	Reinforce
Alfreton – Wessington	Thermal and voltage constraints for N-1 outages on the 33 kV circuits from Alfreton BSP to Wessington primary.	-	2024	Flexibility
Chesterfield GSP	Demand constraints are observed during N-1 and N-2 outages on the SGTs at Chesterfield GSP (which is normally run split 2 + 2 due to fault levels at the site).	-	2024	Flexibility
Chesterfield Main	N-1 condition due to the loss of one of the 33 kV circuits supplying Grassmoor, Biwater and Danesmoor primaries potentially overloading the other circuit.	-	2024	Flexibility
Harbury – Banbury 132 kV	N-2 restoration requirements are increasing for the Warwick and Harbury group, which is expected to exceed the current transfer capacity at 33 kV.	-	2024	Flexibility

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Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	DNOA Decision
Holme Carr	N-1 condition for the loss of the transformer and subsequent load applied to the 11 kV network.	-	2024	Flexibility
Ilkeston	Ilkeston primary is fed via two transformers, which are currently limiting the firm capacity of the site (as they could overload during N-1 conditions).	-	2024	Flexibility
Loughborough	For certain arranged outages on the Enderby network, Coalville Bulk Supply Point (BSP) is transferred to the 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 (N-2 constraint).	-	2024	Flexibility
Sharnbrook	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	-	2026	Flexibility
Tuxford	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	-	2024	Flexibility
Wise Street	N-1 scenario for the loss of one of the transformers and the full demand picked up by the second transformer which could potentially overload.	-	2026	Flexibility

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Table 3 Summary of investment decisions in the West Midlands

Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	DNOA Decision
Cowhorn	Cowhorn is a two transformer primary with N-1 capacity limited by the 33 kV voltages remaining within statutory limits.	-	2029	Signposting
Eccleshall	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	-	2032	Signposting
Hill Chorlton	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	-	2032	Signposting
Hookgate – Market Drayton	Market Drayton is fed via three 33 kV circuits, two directly from Hookgate and one via Bearstone. A fault outage of one of the direct circuits would overload one of the remaining two in service.	-	2031	Signposting
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.	-	2028	Signposting
Stockton	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
Feckenham South	Feckenham South network supplies a group of meshed 66 kV circuits, and an N-1 within the group causes voltages to drop below statutory limits.	-	-	Remove
Forsbrook – Simplex	Cheadle, Tean, and Simplex (T1) are primary substations fed from Forsbrook BSP via two 33 kV circuits; an N-1 outage at one end could thermally overload the other remaining circuit.	-	-	Remove
Hereford BSP	Hereford BSP is a site consisting of two 132/66 kV grid transformers (GT4 and GT5) fed via two 132 kV circuits from Port Ham GSP. Load growth indicates that the site will exceed its firm capacity under N-1.	-	-	Remove
Brimscombe	Camp and Cherrington are fed via a 33 kV ring from Ryeford, with voltage constraints observed following an outage of either of the incomers.	-	-	Remove
Alderton Primary	Alderton primary is a 66/11 kV site fed from Cheltenham 66 kV network via two transformers, where an outage of one could thermally overload the other.	2027	2024	Reinforce with Flexibility
Hereford – Ledbury Ring	The ring is fed via two main 66 kV circuits from Hereford BSP, with voltages dropping to below statutory limits following an outage of one of the circuits.	2027	2024	Reinforce with Flexibility
Knighton	Single 66/11 kV transformer primary with firm capacity reliant on 11 kV interconnection, expected to be exceeded for an outage of the transformer.	2027	2024	Reinforce with Flexibility
Shrewsbury GSP	An arranged outage of the Shrewsbury SGT followed by a fault on either of the 132 kV circuits between Ironbridge and Shrewsbury GSPs, potentially overloads the remaining 132 kV circuit feeding the group.	2027	2024	Reinforce with Flexibility

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Table 3 Summary of investment decisions in the West Midlands

Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	DNOA Decision
Stowfield – St Weonards	St Weonards is a single 66/11 kV transformer primary with firm capacity reliant on 11 kV interconnection, mainly from Stowfield primary. This capacity is expected to be exceeded for an outage of the transformer.	2026	2024	Reinforce with Flexibility
Barlaston/Meaford BSP	An N-2 condition resulting in an outage of both grid transformers, leaves Meaford BSP with very limited interconnectivity to restore supplies. This could make the site P2 noncompliant.	2026	-	Reinforce
Bayston Hill to Malehurst	This circuit is part of the Shrewsbury ring that has thermal, voltage, step change and generation driven constraints following N-1 outages on some of the main incomers to the group.	2027	-	Reinforce
Berrington Primary	Single transformer primary which is limited by the transformer capacity itself (under intact conditions) and 11 kV interconnection under N-1 conditions; both of which are expected to be exceeded in the near future. Additionally, the transformer is protected via fuses and there are no analogues on site to determine power flows making it difficult to carry out a reliable flexibility study.	2027	-	Reinforce
Cellarhead Network	The 132 kV network consists of several interconnected circuits that also run in parallel with parts of SP Manweb's network. Under certain N-2 conditions, various thermal constraints are observed. There are also fault level and network operability restrictions.	2028	-	Reinforce
Chipping Sodbury	The BSP is fed via two 132/33 kV transformers banked with two 132/11 kV transformers. The BSP supplies several primaries some of which are connected in ring configuration with thermal and voltage constraints following an outage of one of the main infeeds to the ring. There are also N-2 security of supply constraints leading to the loss of the entire BSP group.	2028	-	Reinforce
Hinksford to Wribbenhall	Under N-1 conditions, there are thermal overloads and voltage restrictions along the Hinksford-Wribbenhall 33 kV network.	2026	-	Reinforce
Ironbridge to Star Aluminium	Under a fault or arranged outage of the direct Ironbridge-Star Aluminium 33 kV circuit, one of the remaining circuits within the group is expected to thermally overload, and the 33 kV voltages drop to below statutory limits.	2026	-	Reinforce
Lea Marston to Copt Heath	A busbar or circuit outage affecting supplies to the Lea Marston-Elmdon 132 kV circuit causes a thermal constraint on the Lea Marston-Copt Heath circuits.	2027	-	Reinforce
Brockworth Primary	Brockworth and Rotol primary substations are fed from Castle Meads BSP. An N-1 condition on either circuit between Castle Meads and Brockworth could overload the other remaining feeder.	-	2028	Flexibility
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.	-	2024	Flexibility

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Table 4 Summary of investment decisions in South Wales

Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	DNOA Decision
Abergavenny – Crickhowell	An N-1 outage of one of the 66 kV circuits from Abergavenny overloads the remaining circuit. Additionally, forecast demand growth will exacerbate existing voltage regulation issues on the 66 kV network during N-1 conditions.	-	2030	Signposting
Llanfoist	An N-1 constraint for the loss of one of the Super Grid Transformers (SGTs) at Rassau Grid Supply Point (GSP).	-	2030	Signposting
Newport West	An N-1 constraint for the loss of one of the Newport West 132/11 kV Grid Transformers (GTs).	-	2027	Signposting
Pantyffynnon	An N-1 constraint for the loss of either transformer or associated 33 kV circuit into Pantyffnnon primary. The firm capacity is limited by the 33 kV infeeds.	-	2030	Signposting
Nantwen Primary	Nantwen primary is a single transformer primary. For an N-1 outage of the transformer, the site is limited by the 11 kV backfeeds.	-	2027	Flexibility
Ravenhill	Ravenhill 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 which could lead to overloads.	-	2026	Flexibility
Swansea North/Upper Boat	Under first circuit outage conditions both the Hirwaun and Travellers Rest Bulk Supply Point (BSP) substations may need to be transferred from the Swansea North Grid Supply Point (GSP) group to the Upper Boat GSP group. This can increase the group load fed by the Y, YE & D dual circuit tower line. If a subsequent 132 kV fault is suffered, then the thermal rating of the remaining 132 kV circuit is exceeded.	-	2024	Flexibility
Aberaeron	Aberaeron is a single transformer site. For an N-1 outage of the transformer, the site is limited by the 11 kV backfeeds.	2027	2024	Reinforce with 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.	2025	2024	Reinforce with Flexibility
Llandrindod – Rhayader	Llandrindod Wells and Rhayader substation drop below statutory voltage limits when there is an N-1 outage on T1 at Llandrindod Wells.	2028	2024	Reinforce with Flexibility
Llandrindod Wells Primary	An N-1 constraint for the loss of one transformer at Llandrindod Wells primary causes an overload on the remaining transformer.	2028	2024	Reinforce with Flexibility
Llanfyrnach	Llanfyrnach is a single transformer site. For an N-1 outage of the transformer, the site is limited by the 11 kV backfeeds.	2027	2024	Reinforce with Flexibility

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Table 4 Summary of investment decisions in South Wales

Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	DNOA Decision
Milford Haven BSP	Under N-2 scenarios the entire group between Pembroke Grid Supply Point (GSP) and Milford Haven Bulk Supply Point (BSP) could be fed via just one 132 kV circuit.	2027	2024	Reinforce with Flexibility
St Davids Primary	St Davids is a single transformer site. For an N-1 outage of the transformer, the site is limited by the 11 kV backfeeds.	2027	2024	Reinforce with Flexibility
Trevaughan	An N-1 scenario for the loss of one of the transformers can cause an overload on the remaining transformer.	2028	2024	Reinforce with Flexibility
Cardiff North circuits	An N-2 outage for the loss of two 33 kV circuits in the Cardiff East & Cardiff North group leads to the potential overload of the remaining circuits.	2026	-	Reinforce
Golden Hill to St Florence	An N-1 outage of the Golden Hill – Jordanston Farm 33 kV circuit heavily loads the Haverfordwest – Broadfield circuit.	2026	-	Reinforce
Haverfordwest to Brawdy	An N-1 outage of the Haverfordwest to Fishguard circuit leaves several primary substations supplied by the remaining Haverfordwest to Brawdy circuit. This also leads to voltage issues.	2028	-	Reinforce
Pembroke to Broadfield	An N-1 outage for the loss of the Golden Hill – St Florence circuit results in the Pembroke South – Broadfield circuit and connected primary dropping below the statutory voltage limit.	2026	-	Reinforce
Rhos BSP	An N-2 condition losing both Grid Transformers (GTs) at Carmarthen Bulk Supply Point (BSP) overloads the GT at Rhos BSP.	2026	-	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.	2024	-	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).	2024	-	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
East Aberthaw	N-2 condition resulting in both 132/33 kV Grid Transformers (GTs) at Brynhill BSP being out of service, leaving the entire group demand supplied via the single 22.5/45 MVA GT at East Aberthaw.	-	-	Remove
Mountain Ash	The 33 kV network is split following the loss of an Upper Boat SGT. This split results in Mountain Ash GT2 being left to supply a sizable share of the group, overloading it.	-	-	Remove

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Table 5 Summary of investment decisions in the South West

Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	DNOA Decision
Barnstaple to South Molton	An N-1 outage of one of the 33 kV circuits feeding Heddon Cross, Aaronsons and South Molton primaries leaves the full demand on the remaining circuit and causes a low voltage at South Molton 33 kV.	-	2029	Signposting
Blagdon	A single transformer primary with the transformer ancillary rating being the limiting factor, so the constraint occurs under intact conditions and worsened under N-1.	-	2031	Signposting
Bridgwater to Bath Road Circuit	An N-1 outage of one of the 33 kV circuits from Bridgwater Bulk Supply Point (BSP) to Bath Road primary would thermally overload the remaining circuit in service.	-	2030	Signposting
Camborne to St Agnes to Perranporth to Truro	St Agnes and Perranporth primary substations are fed via two 33 kV circuits: Truro to Perranporth (normal running) and Camborne to At Agnes (backfeed). For an outage of either, the remaining in-service circuit could overload.	-	2030	Signposting
Core Hill Primary	Core Hill is a two transformer primary where an N-1 outage of one of the transformers potentially overloads the other.	-	2030	Signposting
Hayle BSP	N-1 condition for the loss of one of the Grid Transformers (GTs) at Hayle BSP potentially overloads the other.	-	2028	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.	-	2031	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
Offwell Primary	Offwell is a two transformer primary where an N-1 outage of one of the transformers potentially overloads the other.	-	2035	Signposting
Paignton to Laywell Brixham 33 kV circuits	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.	-	2031	Signposting
St Mawgan	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	-	2030	Signposting
St Tudy to Davidstow 33 kV circuit	St Tudy to Davidstow 33 kV circuit expected to thermally overload following an outage on one of the other feeders into the group.	-	2033	Signposting

Executive summary

Table 5 Summary of investment decisions in the South West

Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	DNOA Decision
Woodland Way Primary	A fault outage of Feeder Road BSP 33 kV main 1 or reserve 1 busbars would result in the loss of two of the four transformers at Woodlands Way, potentially overloading the remaining two in-service.	-	2031	Signposting
Yeovil – Coker Tee	An N-1 outage of the 33 kV circuit from Yeovil BSP to Montacute primary leaves several primaries fed via a single 33 kV circuit which is expected to overload.	-	2030	Signposting
East Yelland	East Yelland BSP has two 132/33 kV transformers; an outage of either potentially overloads the other.	-	2024	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.	-	2027	Flexibility
Keynsham East Primary	Keynsham East is a two transformer primary where an N-1 outage of one of the transformers potentially overloads the other.	-	2026	Flexibility
Tiverton to Bridge Mills and Cullompton circuits	Bridge Mills and Cullompton primaries are fed from Tiverton BSP via a 33 kV ring. An outage of one of the infeeds subsequently leads to low volts on the network.	-	2027	Flexibility
Weston Super Mare	Weston 132/33 kV BSP has two transformers where an N-1 outage of one of the transformers potentially overloads the other.	-	2024	Flexibility
Witheridge	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	-	2024	Flexibility
Camborne Treswithian	A single transformer primary with the transformer being the limiting factor, so the constraint occurs under intact conditions and worsened under N-1.	2025	2024	Reinforce with Flexibility
Exeter City	An N-1 constraint for the loss of one of the 132/33 kV transformers at Exeter City BSP overloads the remaining transformer.	2025	2024	Reinforce with Flexibility
Exminster Primary	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
Feeder Road A Primary	A fault outage at Feeder Road BSP could result in the loss of two of the four transformers at Feeder Road A, potentially overloading the remaining two in service.	2027	2024	Reinforce with Flexibility
Feeder Road BSP	N-2 outage condition for the loss of two of the Grid Transformers at Feeder Road BSP potentially overloads the remaining two in service.	2026	2024	Reinforce with Flexibility

Executive summary

Table 5 Summary of investment decisions in the South West

Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	DNOA Decision
Feeder Road to Bedminster and Bower Ashton circuit	The N-2 condition leading to the loss of the direct 33 kV circuits from Feeder Road to Bedminster results in an overload on the circuit to Bedminster/Bower Ashton.	2027	2024	Reinforce with Flexibility
Filton Airport and Cribbs Causeway	A fault on the 6L5 circuit out of Bradley Stoke BSP causes an overload on the other leg of the ring.	2027	2024	Reinforce with Flexibility
Gunnislake	Gunnislake is a two transformer primary where an N-1 outage of one of the transformers potentially overloads the other.	2025	2024	Reinforce with Flexibility
Hayle – Camborne	An outage of the Indian Queens-Fraddon Tee-Camborne 132 kV circuit causes an overload on the Hayle-Rame 132 kV circuit, and vice versa.	2026	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
Isles of Scilly	For an outage of the 33 kV submarine cable to the Isles of Scilly the demand is likely to exceed capacity; this is worsened by the aging life of the backfeed power station.	2026	2024	Reinforce with Flexibility
Moretonhampstead	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	2024	2024	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.	2025	2024	Reinforce with Flexibility
Newton Abbot to Newton Abbot Main Circuits	Newton Abbot Main is a three transformer primary each supplied via a 33 kV circuit. The limiting factors are the transformers in the summer, and circuits in the winter. An outage of one of the infeeds potentially overloads the remaining ones.	2026	2024	Reinforce with Flexibility
Plymouth/South Hams	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 BSPs), or similar combinations, the 132 kV circuit between Ernesettle and Milehouse BSPs and the associated 132 kV reactor are at risk of overloading.	2027	2024	Reinforce with Flexibility
Plympton BSP	Plympton BSP has two transformers where an N-1 outage of one of the transformers potentially overloads the other.	2024	2024	Reinforce with Flexibility

Executive summary

Table 5 Summary of investment decisions in the South West

Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	DNOA Decision
Shapwick Primary	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
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 grid transformer at Tiverton, the maximum demands could exceed the rating of the remaining in service transformer.	2024	2024	Reinforce with Flexibility
Truro – Truro Treyew	For an N-2 outage (or a 33 kV busbar fault) a potential overload occurs on the Truro - Truro to Treyew Road 33 kV circuit.	2024	2024	Reinforce with Flexibility
Alverdiscott GSP and K Route	Several N-1 and N-2 constraints have been identified in this area including GT overloads at East Yelland, Barnstable and St Tudy BSPs.	-	-	Reinforce
Alverdiscott to East Yelland and Barnstaple	The two circuits feeding the group are connected to the same busbar, and for an N-2 outage the group demand is lost with insufficient interconnectivity to meet P2 requirements.	-	-	Reinforce
Barnstaple BSP	The transformers are limited by ancillary ratings which are expected to overload following an N-1 outage.	-	-	Reinforce
Bristol Airport Circuits	For an N-1 fault on the main 1 busbar at Churchill BSP, Bristol Airport is left at single circuit risk, and for a main 2 busbar fault the circuit overloads.	-	-	Reinforce
Camborne Holmans	An N-1 outage of one of the legs of the Camborne Hayle ring leads to low voltages at Camborne Holmans.	-	-	Reinforce
East Yelland to Penn Hill Tee	Four circuits supply the group; for the arranged or fault outage of one of these circuits, the circuit between East Yelland and Pen Hill Tee potentially overloads.	-	-	Reinforce
Exeter City to Folly Bridge Ring	N-1 constraint for the loss of one of the infeeds or a busbar affecting one of the infeeds, would overload the other two infeeds.	-	-	Reinforce
Exeter Main to Exeter City	An N-1 constraint for the outage of a single 132 kV circuit (Exeter Main 905) triggers an overload on another, mainly due to clearance infringements with an 11 kV line.	-	-	Reinforce
Feeder Road Voltage Step Change	An N-2 outage of one leg of the XW route, and the loss of one leg of the VW route leads to a 33 kV voltage step change constraint at Feeder Road BSP.	-	-	Reinforce

Executive summary

Table 5 Summary of investment decisions in the South West

Scheme	Constraint	Proposed scheme closure	Flexibility Start Year	DNOA Decision
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 voltages.	-	-	Reinforce
Hayle to Penzance	An N-1 fault on Hayle main 1 busbar overloads several of the 33 kV circuits, and leads to low voltage constraints.	-	-	Reinforce
Iron Acton to Seabank	An N-1 outage of one of the circuits on the DA route overloads the remaining circuit.	-	-	Reinforce
Lapford and Tinkers Cross	Low voltage at Lapford and Tinkers Cross primaries for an N-1 outage condition.	2025	-	Reinforce
Newton Abbot to Higher Woodway circuits	An N-1 condition for the loss of main 1 33 kV busbar at Newton Abbot BSP overloads the circuits to Higher Woodway.	-	-	Reinforce
Penryn/Falmouth Bickland Hill/Falmouth Dock Ring	A busbar outage taking out a circuit supplying the group overloads one of the remaining circuits.	-	-	Reinforce
Portishead BSP	Various constraints arising as a result of non-optimal running arrangement and parallel configuration within the Sandford and Seabank areas.	2024	-	Reinforce
St Germans to Liskeard Ring	An N-1 outage of one of the circuits that feed the group or a fault on main 1 and 2 at St Germans means the remaining circuit could overload.	-	-	Reinforce
Tiverton to Dunkeswell	An N-1 condition for the loss of one of the 33 kV circuits to Dunkeswell primary heavily overloads the remaining circuit.	2025	-	Reinforce
Chewton Mendip	A single transformer primary with the transformer being the limiting factor, so the constraint occurs under intact conditions and worsened under N-1.	-	-	Remove
Countess Wear	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	-	-	Remove
Laneast	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	-	-	Remove
Probus	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	-	-	Remove
Stokenham	Single transformer primary with firm capacity reliant on 11 kV interconnection, which is expected to be exceeded for an outage of the transformer.	-	-	Remove

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

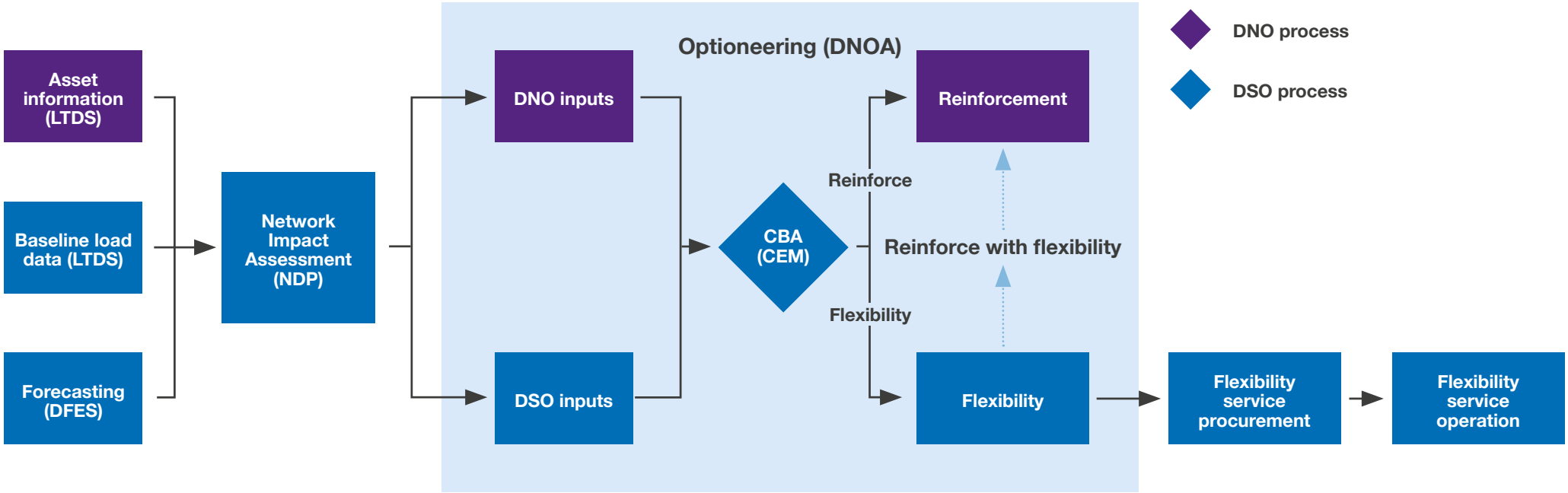
The Distribution Network Options Assessment (DNOA) outlines how we plan to invest in our network to manage or resolve constraints.

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 six months 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.

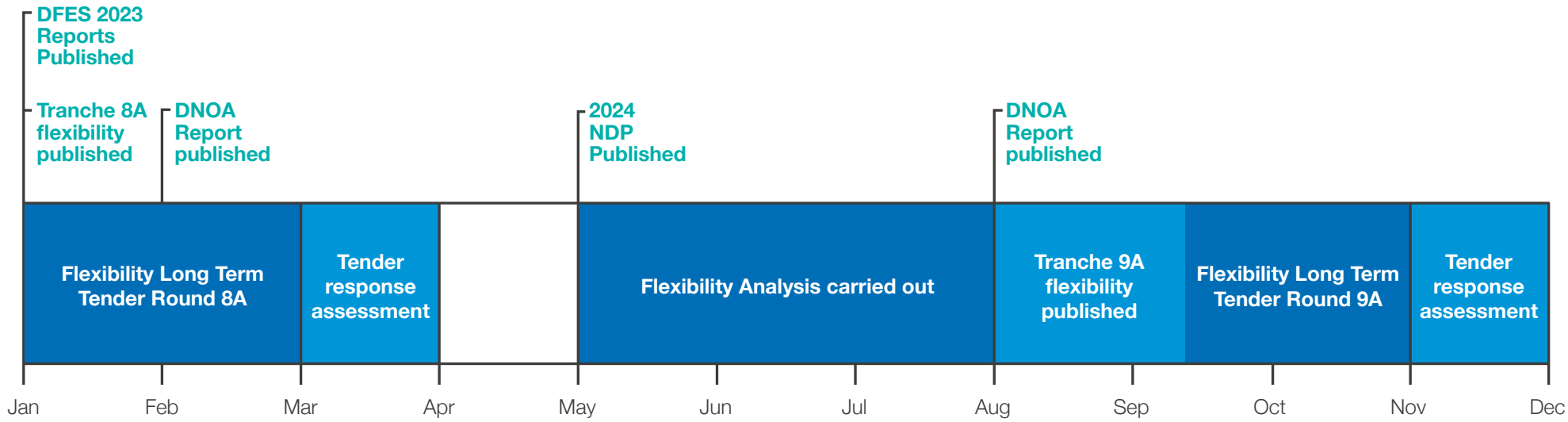


DNOA process timeline

DNOA reports are published twice a year in February and August. 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 every six months. The processes and reports carried out as part of the strategic network planning process 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 our recently published DFES 2023 more granular projections to a distribution substation level have been produced which will be utilised in future iterations of the DNOA.

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.

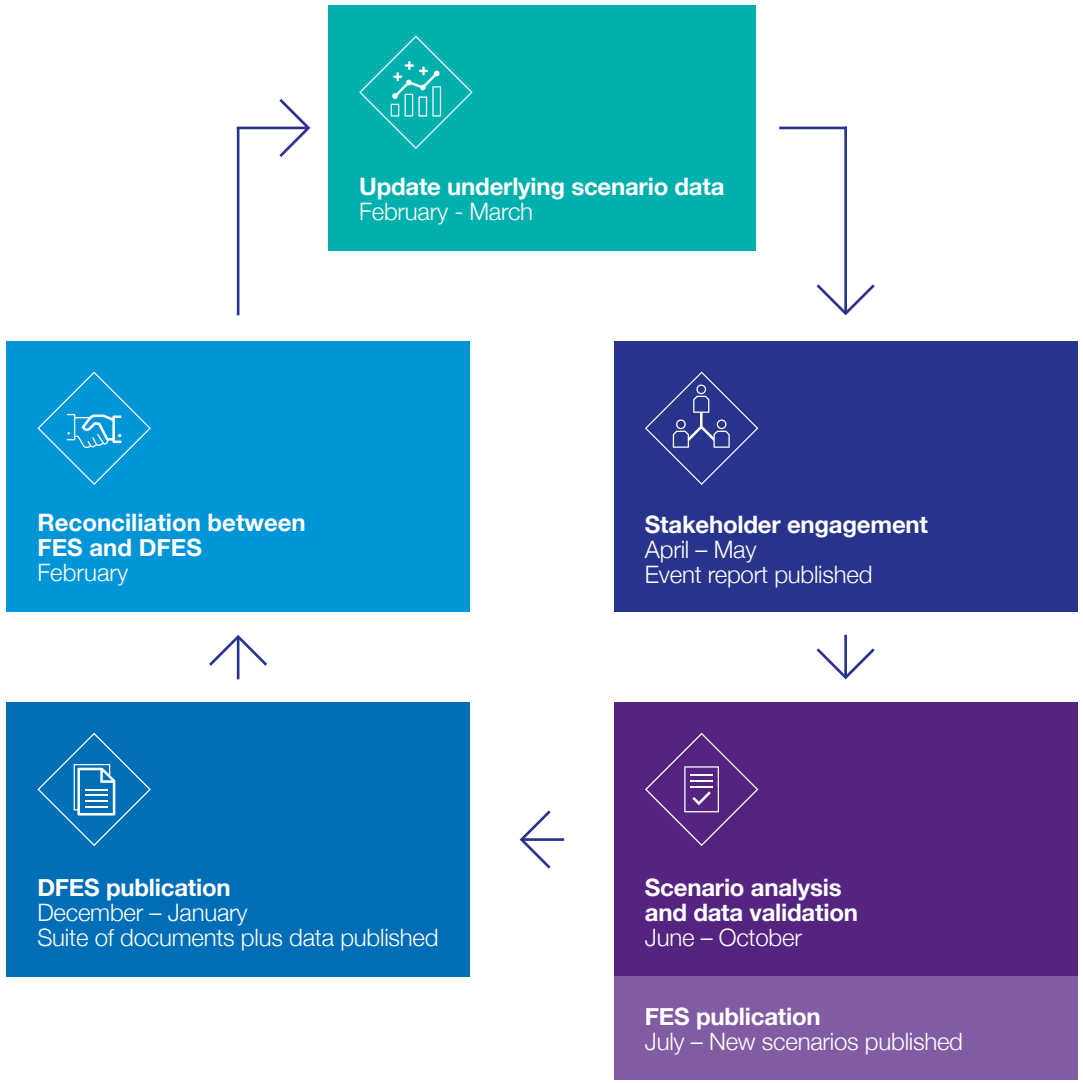
These four base scenarios encompass divergent levels of societal change and speeds of decarbonisation. The forecasting methodology used here is aligned with National Grid ESO's Future Energy Scenarios (FES) and the projections made by other Distribution Network Operators (DNOs).

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 network 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. Scenario boundaries across the rankings may be moved to more closely align, assuming incentives and policy is directed at achieving national net zero ambitions.

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 (or a hybrid one), which will be communicated to the affected parties as appropriate.

Flexibility analysis

Once a constraint has been identified (either through the NDP process or during a routine study of an area of the distribution network carried out by one of NGED's engineers) options for managing the constraint are then assessed.

Various traditional reinforcement options are evaluated to find the most cost effective solution. This may not be the cheapest option, as the solution will need to be enduring and strategic (often multiple constraints can be alleviated using a single intervention). The cost for the optimal reinforcement scheme is then taken forward to the CBA.

In accordance with NGED's 'flexibility first' commitment in the RIIO-ED2 Business Plan all load related expenditure is assessed against flexibility. The first step in this process involves identifying constraints which are unsuitable for mitigation using flexibility (such as fault-level constraints). All load related constraints where deferral of expenditure using flexibility is deemed possible are then taken forward to the next stage of flexibility analysis.

In order to carry out a CBA on the use of flexibility against conventional reinforcement, the volume of flexibility required to manage the constraint each year needs to be calculated. This is done using NGED's custom built Flexibility Analysis Tool.

This tool takes a load profile recorded from the network over multiple years and plots it against the network capacity for each season. The network capacity is usually the thermal ratings for each season of the limiting asset under the most onerous outage condition, but for more complex constraints load flow analysis is required to understand how load may be split between multiple assets/sites.

The tool takes load growth coefficients from the DFES process to assess when and by how much the loading on the network is expected to exceed the capability of the assets over the next ten years for each scenario.

This is then used by the tool to calculate the volumes of flexibility required to manage the constraint each year and scenario (including any over-procurement deemed necessary to mitigate the risk of the network's needs not being met).

These volumes for each flexibility scheme are then taken forward into the CBA.

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. For legacy flexibility zones, if this benefit is greater than the cost of flexibility required during the deferral period, then flexibility procurement is deemed the optimal solution and could create savings that can be passed on to customers and stakeholders.

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 cost of flexibility availability and utilisation is then used to calculate the total cost of the flexibility required each year and scenario. The costs associated with the optimal reinforcement solution identified by NGED are 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.

These ceiling prices are then used to inform the MWh prices for areas where we are procuring additional flexibility. The ratio between the availability and utilisation costs per MWh is set to ensure it remains consistent for each product, without affecting the overall value of flexibility calculated by the CEM CBA tool.

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 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/

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

Circuit installations and upgrades can involve replacing or installing overhead line conductors and/or underground cables for 6.6 kV, 11 kV, 33 kV, 66 kV or 132 kV circuits.

Substations considered for reinforcement include primary substations, Bulk Supply Points (BSPs) and Grid Supply Points (GSPs).

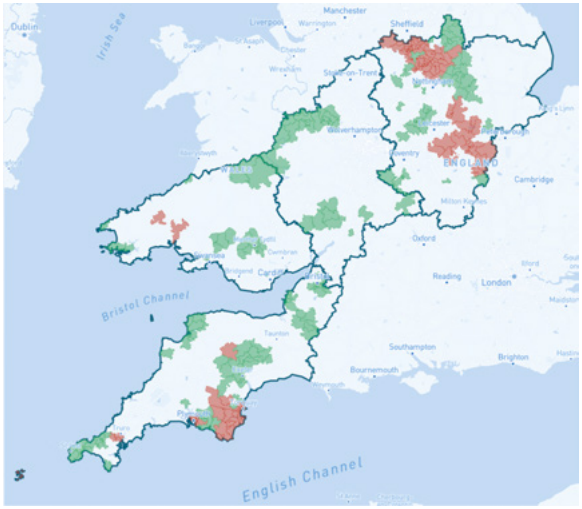
Other options for managing constraints include System Voltage Optimisation (SVO), STATCOMs for reactive power management and other innovative solutions.

In areas where multiple complex constraints are affecting a number of customers over a long period of time, Active Network Management (ANM) can also be implemented.

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. These areas 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 three main flexibility products offered to providers are standardised across the industry:

Secure
Used to manage peak demand loading on the network to pre-emptively reduce network loading.

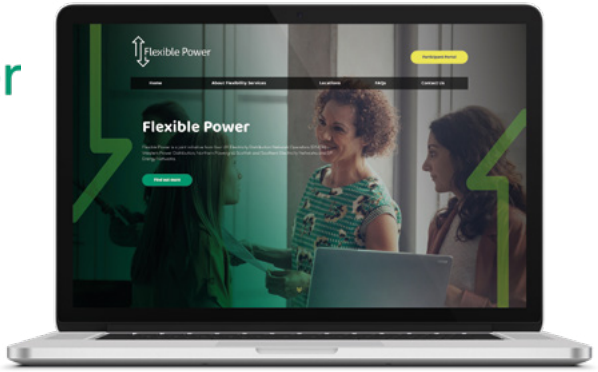
Dynamic
Developed to support the network in the event of specific outage conditions, namely maintenance work.

Restore
Supports power restoration following rare fault conditions.

Sustain
Scheduled constraint management service with fixed delivery periods.

Flexible Power

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.



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

Find out more at: **flexiblepower.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).

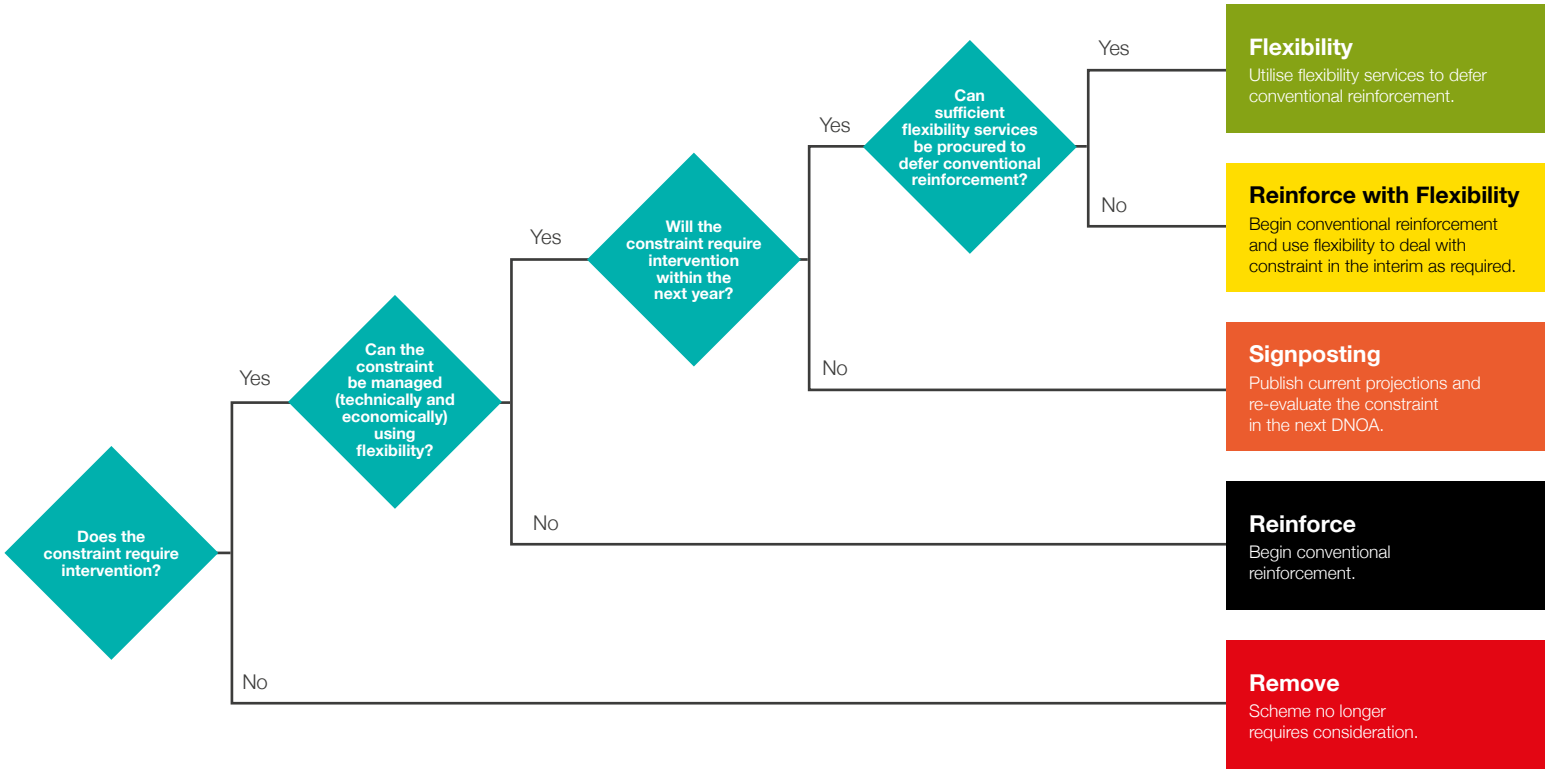
Among the schemes which do require intervention, if the constraint cannot be managed using flexibility then reinforcement is pursued.

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 (secure or dynamic).

For signposting schemes the flexibility product may change closer to procurement to ensure the network's requirements are met. Alongside the secure and dynamic products, the restore product will also be used.

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.).

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 have installed monitoring equipment across a representative population which will be used alongside smart meter data to train our HV and LV network models. To date we have installed over 1,750 and plan to install a total of 15,500 monitors. 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 first secondary flexibility procurement round in June 2023 (where we tendered for 1,359 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. As part of our ongoing commitment to utilise flexibility wherever possible and economic, in October 2023 we re-opened 750 zones where flexibility could still provide network benefit and deferral for the winter of 2023/24. In this round we were able to reduce the delivery period, which meant providers would get the same benefit with fewer delivery requirements. The second round of procurement has seen an improvement, with some response received, which has enabled us to defer 121 secondary transformer reinforcement works.

The first Sustain tenders, alongside secondary network DNOA process reviews, have 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 have significant implications for resourcing and 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 our latest analysis tranche, we have reassessed the secondary transformer constraints across the four NGED licence areas and opened 1,426 LV zones in January 2024, for service delivery in the coming winter (2024/25). Learning from our previous experience and with further data improvements, we were able to reduce the initial 6-month delivery period to 4 months in this tender round, to make it easier and more cost effective to flexibility providers. Opposite is a summary of LV Sustain tenders to date.

		East Midlands	West Midlands	South West	South Wales
June 2023 tender	Number of zones	583	375	285	116
	Tendered (kW)	52,121	21,178	10,957	8,584
	Contracted (kW)	0	0	0	0
	Number of zones deferred	0	0	0	0
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)	-	-	-	-
	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 hope to lead 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 into the secondary network and different constraint types such as voltage restrictions and thermal generation issues.

Long term procurement

The introduction of longer term procurement has driven further evolution of the DNOA process and timelines. Long term procurement will play a crucial role in the DNOA process, as we aim to make better informed decisions ahead of reinforcement works starting, ensuring we complete the works in the highest risk areas ahead of need.

Development is ongoing on how to best balance long and short term procurement, taking into account the time it takes to reinforce, alongside the uncertainties and associated risks specific to each area of network. NGED have now started to procure flexibility services years ahead, to allow sufficient time to undertake the associated reinforcement works if required.

Flexibility analysis

Our flexibility analysis tool is a python based software that 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.

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:

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