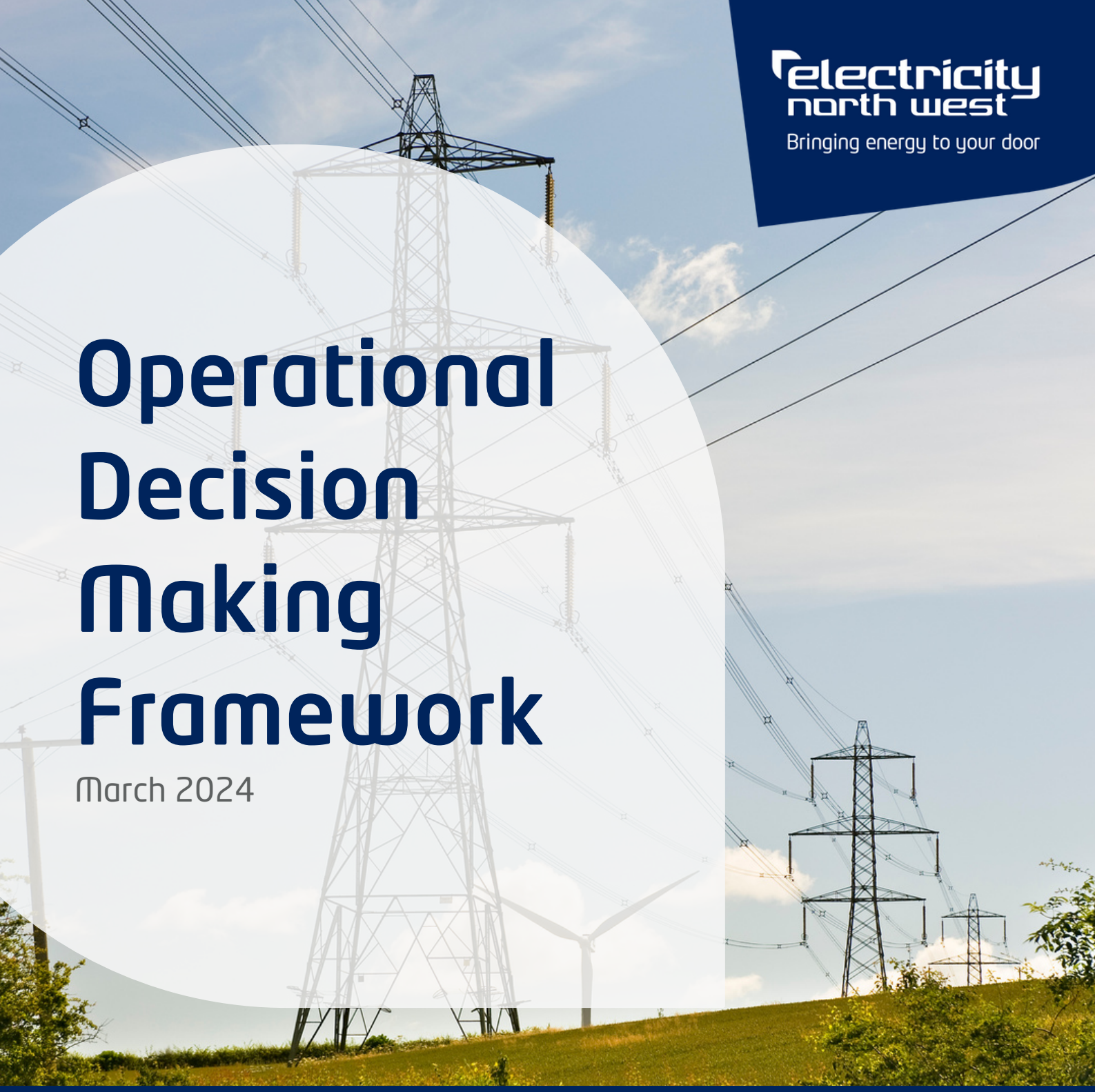

electricity north west
Bringing energy to your door

Operational Decision Making Framework

March 2024

Optimising distribution with automation, flexibility, and informed decisions

Operation Decision Making Framework

1. Introduction

This Distribution Operation Decision Making Framework sets out Electricity North West's approach to decision making surrounding the use of network automation systems, flexibility, and human decision making. This includes the use of Flexible Services, Flexible Assets, and Flexible Connections.

About us

Electricity North West is one of 14 distribution network operators in the UK regulated by Ofgem. We operate the local electricity network and distribute electricity, mainly from the National Grid, to 2.4 million homes and businesses in the North West.

We are responsible for maintaining and upgrading 13,000 km of overhead power lines and more than 44,000 km of underground electricity cables and much more.

Our network in the North West is one of the most reliable in the country and by the end of our current regulatory period, we will have invested £1.9bn in our network to ensure we continue to deliver an excellent, safe and affordable service to all our customers.

Figure 1: Electricity North West service area

Key Information

We are currently experiencing the largest step change in the electricity network that has ever been seen. To fulfil the UK's ambitions of becoming a net zero economy, as well as supporting the increasing digitalisation of almost everything we do in life, it is increasingly important that the electricity network is at the forefront of this journey. People are relying more and more on the electricity networks they are connected to live their lives, so it is becoming increasingly important to demonstrate that as a network operator, we are making good operational decisions about how the network is operated. Electricity North West's key operational decision-making focuses on our commitments to ensure:

- Safety for all parties who interface with and are affected by how the network is operated.
- Maintaining and improving the security and reliability of supply for our customers.
- Operating the network in an efficient manner delivering value for money to Electricity North West's customers and stakeholders, and
- Transparency in operational decision making.

As a business, we are digitalising the network and utilising network automation systems to make operational decisions.

This means faster, reliable, and consistent decision making required to fulfil our commitments. We retain human oversight of these automation systems, allowing users to ensure the systems are delivering upon our commitments and providing the fall-back capability to switch to manual operation if these systems become unavailable.

Flexibility plays a key role in the increasing operational decision-making process. Where historically the majority of consumer demands within the distribution network were not controllable and there was little to no generation connected at a distribution level; it is now possible to signal to demand and generation resources within the network to influence their behaviours. As a network operator, we also are increasingly able to utilise remotely operated network assets to modify the network topology in such a way as to influence the power flows in real-time. Increased use of monitoring and control technologies allows us to increase the potential number of connected distributed energy
resources to the network, increase the utilisation factors on existing network assets, and increase security of supply, whilst minimising the amount of network reinforcement that historically would have been required to facilitate these improvements.

Figure 2: Benefits of the use of Flexibility

Our commitment to flexibility first

Our ongoing commitment is to use flexibility as our first response to resolving network constraints, unlocking capacity, improving network security, and supporting the transition to a net zero future. This commitment covers the three types of flexibility, flexible Connections, Flexible Services and Flexible Assets.

How we will deliver on our commitments

The flexibility market is still developing, and we will be unable to procure the volume of flexible services we need without encouraging customers and key third parties to adopt new technologies and adapt their behaviours. These actions are common for the Net Zero and DSO transitions; with the common messages of being more energy efficient, changing over to low carbon options for both transport and heat, and be more flexible in your use of energy as it helps reduce your own carbon footprint as well as supporting the transition to distribution system operation.

We have supported the development of the changes to the connection charging methodology that have been made through the Significant Code Review (SCR) modifications that became live in April 2023. These reforms aim to reduce the barriers to connections caused by network reinforcement costs and provide assurances to connectees who sign up to temporary flexible connection agreements. We are also supporting the implementation of Transmission Technical Limits that have been developed to accelerate the delivery of projects which would have otherwise been held in reinforcement queues waiting for reinforcement to the GB transmission network.

To develop the flexibility market we will need to encourage three key types of participants: firstly, customers to adopt Low Carbon Technologies (LCTs) and be more flexible; secondly, third parties, like aggregators to encourage new entrants into the market to provide their flexibility; and thirdly platform providers to seamlessly link buyers and sellers either directly or indirectly. Our collaborative work within the ENA Open Networks project on the standardisation of flexible services products and processes, flexible connections options, and enhanced data sharing will ensure that there is commonality and alignment of approach across the whole of GB, opening up the provision of flexibility to all.

1 https://www.ofgem.gov.uk/publications/access-and-forward-looking-charges-significant-code-review- decision-and-direction

2. Systems and Operations

Active Network Management (ANM)

Introduction to ANM

In RIIO-ED1 (2015-2023) we implemented a new network management system (NMS) produced by Schneider Electric and with their assistance have developed and will deliver a new Active Network Management (ANM) system. Our ANM system is made up of two core components. The first component is the system which carries out network modelling activities in real-time to manage network constraints utilising flexible network assets, flexible connections, and flexible services. The second component is the Merit Order Management (MOM) system. This system holds contractual data for all flexible connections and flexible services which the ANM system can send dispatch signals to request a change in the site's import or export. Our ANM system has been built to directly integrate with our Network Management System so will hold real-time data for the network topology, running arrangements, metering data and other system monitoring devices. The NMS system also is the platform that the majority of our other network automation systems are built upon or interface with; so this also allows for the coordination of operational decisions that these systems undertake.

The MOM system will send a merit order list to the ANM system on a regular basis which determines the order in which flexible resources are to be dispatched when the ANM system has detected a network constraint. The methodology for how this stack is generated is described within the section below. The ANM system shares data to the MOM system which comprises of an engagement list, this holds the data of which Flexible resources (connections, and Services) it has dispatched/curtailed. The ANM system also creates a 48-hour forecast of likely future constraints via a Look Ahead report which is sent to the MOM system, this report is then used to make commercial decisions on whether more flexible services should be procured, or if other operational practises should be considered.

The ANM system will send dispatch requests for Flexible Services contracts via the Flexible Services Dispatch platform, which will then Dispatch these resources and monitor the response to carry out settlement activities. These data flows are shown in Figure 6.

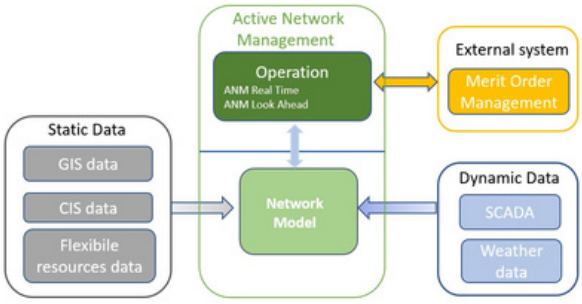

Figure 4: ANM system architecture

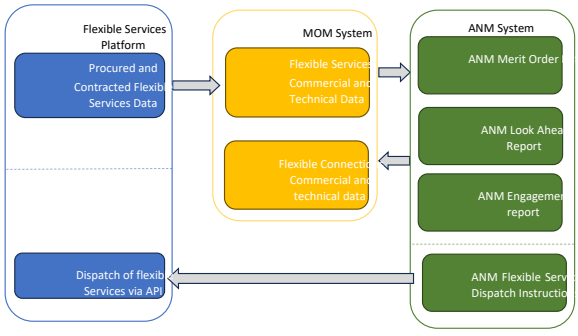

Figure 5: Commercial and Technical Data flows for Flexible Resources

Introduction to the Merit Order Management System

We have implemented the standalone Merit order Management system (MOM) system to generate the curtailment list or merit order for all potential constraints within a defined ANM zone. The merit order is determined using our unique curtailment index approach. The curtailment index ensures fairness through equal use of assets connected via flexible connection arrangements. This is fairer than the current alternatives of LIFO (Last In First Off) and shared utilisation, as the order of curtailment is defined by the current level of curtailment for each network user. Utilising this approach ensures that customers are not negatively affected by the use of the ANM system, as curtailment should not exceed the pre-agreed thresholds. To allow for the unbiased deployment of flexibility solutions, all procured flexible services are also contained within the same merit order list. As flexible services and flexible connections need to exist in the stack together, we need to assign values to rank them in the optimal commercial order.

We assign a pseudo price for the curtailment index in £/MWh which then can be compared to a flexibility service measured in £/MWh. The value of curtailment can be configured in the MOM system providing a transparent way to value flexibility services against constraints.

$$\text{Psudo Curtailment price} = \frac{1}{\text{Curtailment index}} \text{ x Value of curtailment (£/MWh)}$$

E.g. where Curtailment index = 5; and Value of curtailment = £1.40 £/MWh

$$\text{Psudo Curtailment price} = \frac{1}{5} \text{x £1.40} = \text{£0.28 /MWh}$$

The value of curtailment will be defined with input from our stakeholder population, to rank curtailment fairly against procured flexible services.

The MOM system has been developed as a standalone system so that it is ring-fenced from other DNO activities. This allows interface with other systems or platforms futureproofing it against any commercial developments as the scope of Distribution System Operation evolves.

Transparent decision-making:

Figure 6 shows a curtailment stack/merit order list, where network users are stacked in order of likely curtailment i.e. those at the top of the stack face greater probability of curtailment. For each potential constraint identified within an ANM zone by the ANM system, the MOM system will provide a stack. This means that if there are multiple constraints within an ANM zone, network users may appear in multiple stacks or lists. For the utilisation of resources within the Merit order stack the MOM system will re-evaluate all flexible resources across the lists to ensure that the site with the lowest price is at the top of the merit order list. For flexible connections as the price is based upon the curtailment index value those sites with the highest curtailment index will have the lowest pseudo curtailment price so will rise towards the top of the stack.

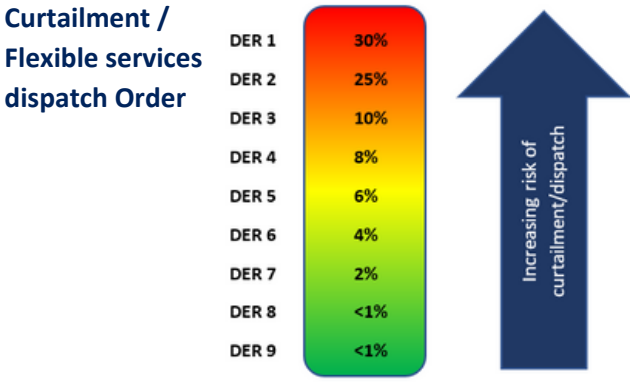

Figure 6: Curtailment stack/merit order list

Defining curtailment order:

A network user's order within the curtailment list is based on their current curtailment value when compared with each connected network user behind the constraint. The curtailment value is adjusted dynamically to reflect any network event or activity that causes the Distributed Energy Resource (DER) to adjust its import or export. Each Distributed Energy Resource controlled by the Active Network Management system will be assigned a curtailment index rating. These ratings will be assigned based upon the voltage of connection, and security of supply that has been agreed within the connection agreement.

Our curtailment methodology was consulted upon in our DSO 2021 strategy, where our stakeholders were unanimous in their support of the use of the curtailment index approach over other curtailment methodologies.

Managing curtailment and distribution flexibility services together:

Flexible connections are combined with the relevant distribution flexibility services procured for the anticipated service requirements within the merit order list. Figure 7 shows where we would seek to purchase flexible services and Figure 8 shows the combination of flexible connections and flexible services. Flexible services are often procured in advance to secure against a specific level of perceived network constraints. However, this does not exclude them from being purchased a day or even hours in advance should the need arise. For example, our short-term constraints-forecasting application may identify that there are not enough flexible resources available to manage the constraint and so we would go to the market to buy flexibility from network users behind the constraint. This facilitates competition for flexibility as anyone behind the constraint could opt to provide flexibility, including network users whose curtailment index has already been used up for the year.

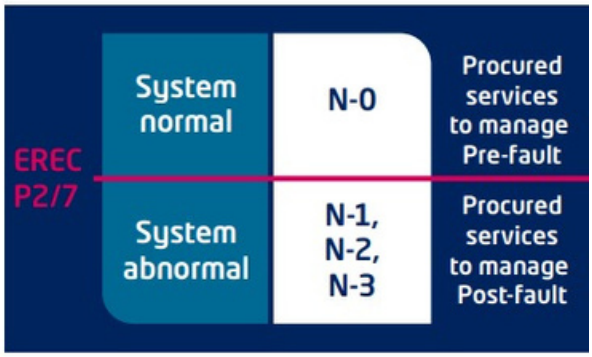

Figure 7: Procurement of Flexible Services in line with P2/8 security of supply requirements

The forecasting application built into ANM runs simulations for up to 48 hours in advance and will highlight potential scenarios which may result in the ANM system needing to dispatch flexible resources. The forecasting functionality incorporates historical demand trends, weather forecasts, planned outages and maintenance periods and pre-scheduled flexible services. The ANM system will utilise all resources which are available to it to resolve network constraints in the sequential order of the merit order list.

As such if an N-2 fault occurred the ANM system will first dispatch all of the category 1 assets, and then the category 2 assets prior to dispatching the category 3 assets.

Category	Network Status	Flexible resources within the merit order list
1	System normal	Unfirm and constrained connections for normal running arrangement (N-0) Pre-fault flexible services
2	System abnormal, N-1	N-1 Unfirm connections for any abnormal running conditions Post Fault flexible services for N-1
3	System abnormal, N-2	Firm connections for first abnormal running condition (N-2) Post Fault flexible services for N-2
4	System abnormal, N-3	Firm connections for second abnormal running condition (N-3) Post Fault flexible services for N-3

Figure 8: Flexible Services Combined with Flexible Connections

Sharing curtailment information

Once the ANM system is live in 2025 we will publish the merit orders, created by the MOM system, by which we propose to dispatch flexible resources for each constraint. Initially, the merit order information will be available to all network users in the stack that are at risk of being curtailed.

3. Solutions

Types of Flexibility Explained

Our operational decision-making framework centres around the ability to utilise a range of flexibility options. There are three types of Flexibility which Electricity North West utilise:

Flexible Connections	Contractual arrangements are established as part of the customers connection agreement that allow Electricity North West to signal a curtailment of demand or generation to resolve network constraints. Customers will generally be given a flexible connection where: offering a non-curtailable connection would require network reinforcement, which has cost and time implications on them being connected.
Flexible Services	Electricity North West purchased demand side response services from distributed energy resources to provide services for demand turn-down, and demand turn-up to alleviate network constraints. These services are used to defer and avoid reinforcement, as well as to allow other customers to connect faster and cheaper to the network. These services can be provided from Demand, Generation, and Energy Efficiency measures.
Flexible Assets	These are Electricity North West owned and operated assets which can be controlled e.g. tap changers, capacitors, circuit breakers, switches. By changing the network topology we can alter power flows alleviating constraints.

Flexible Connections

Electricity North West offers customers the ability to connect to the distribution network utilising a flexible connection arrangement. These types of connections are predominantly utilised where it has been identified that network reinforcement would be required to provide a customer with an unconstrained flow of import and/or export power. Contractual arrangements are established as part of the customer's connection agreement that allow Electricity North West to signal a curtailment of demand or generation to resolve network constraints. The benefits of accepting a flexible connection include reduced time to connect to the network, and/or reduced financial costs of connecting to the network.

In some scenarios, the limitations of these flexible connections are pre-defined within the customer's connection agreement, and they are responsible for self-managing within a defined operating regime that would prevent them from causing constraints within the network.

Within the RIIO-ED1 (2015-2023) period predominantly flexible connections were utilised to manage the export of power from sites with generation equipment. It is now also becoming common practice to utilise flexible connections which have demand import restrictions to avoid network constraints at certain periods of the year and during certain abnormal network running arrangements.

Customers have the option to utilise a flexible connection:

- Until the required network reinforcement has occurred or the constraint can be managed via alternative methods e.g. utilising Flexibility Services; or
- For the lifetime of the connection.

Currently, Electricity North West offers the following five types of flexible connections to its customers:

Curtailable (Under system normal conditions)	**System Normal**	**Export Limiting**	**Import Limiting**	**Timed**
A connection which can be disconnected or constrained when there are network overloads or restrictions affecting the network supplying the customer whilst the network is operating in an intact, system normal state.	A system normal connection can be disconnected or constrained when there is an abnormal network operating condition affecting the network supplying the customer e.g. circuits, switchgear etc..	A connection where the installed generation equipment has a greater export capability than that which has been agreed to be exported onto the Electricity North West distribution system. It is the responsibility of the customer to limit their export (EREC G100)	A connection where the installed equipment has a greater import capability than that which has been agreed to be imported from the Electricity North West distribution system. It is the responsibility of the customer to limit their import (EREC G100)	A connection arrangement where connection capacity is subject to restrictions within specific time periods. It is the responsibility of the customer to limit their import/export during these period.

Sites with "Technical Limits" (Part 4 Connections)

As part of the accelerated connections program in collaboration with National Grid ESO; a number of sites have been identified which would have conventionally been restricted from connection to the distribution network due to constraints on the Transmission Network.
One of the main barriers to connections to the distribution network is the dependency on transmission system reinforcement. The industry is addressing this by establishing 'technical limits' at Grid Supply Points (GSPs) – the boundaries between transmission and distribution networks. When implemented, limits enable customers to choose to connect under new interim non-firm connection arrangements agreed with the ESO in advance of transmission system reinforcement.
These customers may however be subject to curtailment in certain circumstances – for example, if there is too much generation on the distribution network on the sunniest and windiest days. The customers would not be compensated for curtailment but would benefit from being connected earlier.

What are technical limits?

These are limits calculated by National Grid to allow the use of unutilised unrestricted DNO customer transmission capacity to be temporarily utilised by DNO restricted customers (these are customers that can't connect until identified transmission reinforcement works are completed).
Implementation of these limits shall ensure connection of Restricted customers on a non-firm basis shall not cause overloads on the transmission system.
A technical limit represents a threshold beyond which the demand and generation could reasonably be expected to have a detrimental impact on the Transmission System and is expressed as a Ral Power (MW) value. These limits shall apply at relevant DNO Grid Supply Points (GSPs).
Technical limits will apply even under System-intact conditions. If the limit is breached during N-0, the DNO will be required to take appropriate action to curtail generation as necessary.

These are limits set through an industry-agreed methodology that can be applied across GSPs which would then be managed by the respective DNO using an Active Network Management (ANM) solution. Technical limits at the transmission/distribution boundary will allow customers wishing to connect to the distribution network to have non-firm connection access arrangements to the transmission system, similar to those available for managing distribution constraints.
The industry-agreed methodology for setting technical limits considers the level of power flow that has been modelled and accepted to connect to the transmission system. Transmission Network Operations across GB assess the impact of customers at cardinal points in the year, for example, summer minimum and winter peak, when an application is made for a new customer to connect. The associated demand is then accounted for, and the resultant power flow is modelled.

How these are applied

Sites which have been identified as needing to be connected under a "Part 4" connection will be entered into the Active Network Management system, for Transmission constraints only, in a curtailment index stack order. The curtailment index stack will be calculated separately to the stack used to manage Electricity North West constraints i.e. those which are within the distribution network. These contracts will be constrained ahead of all other DNO negotiated Flexible connections and Services where the "technical Limit" is going to be breached.
If the limit breach is not associated with a "technical limit" point on the network, then the standard Electricity North West Merit order list will be utilised instead (Further details of the Electricity North West stack are covered in Introduction to the Merit Order Management System).
As part of the agreement with the ESO surrounding the implementation of technical limits, it is required that DNOs should aim to never breach a technical limit or if a breach occurs it should be managed in such a way that the breach is resolved immediately. As such DNOs will need to set curtailment limits in a manner that will allow for the pre-curtailment of distributed energy resources ahead of a breach of the technical limit.

Flexible Services

Introduction to Flexible Services

When the demand for electricity in an area is greater than the amount that we are capable of providing, we can procure Flexible Services to manage constraints whilst ensuring our network remains resilient, reliable and meets customer's needs.

Many different factors can lead to network constraints including large televised events; electric heating in winter; and the uptake in Low Carbon Technologies (LCTs) such as electric vehicles, heat pumps and solar panels. Flexible Services can also be used to manage planned outages or disruptive failures, as an alternative to reinforcing the network; which can be extremely costly, disruptive and time-consuming as we upgrade assets across our region causing road closures and supply interruptions.

These services can be provided by companies or individual customers who own assets in our region such as generators, consumers, or electricity storage connected to our network that can generate more or consume less when we ask them to, and receive payment from Electricity North West in return. We're now also proud to include Energy Efficiency Measures as part of our tenders; Participants can bid for multiple years of service by installing energy-saving measures such as LED lighting, double-glazed windows, and switching to more energy-efficient appliances and heating systems to reduce their long term energy use.

Flexible services are often a cheaper and faster way of balancing supply and demand on the network as they allow us to utilise our existing assets to make the most out of the capacity we already have, and the money we save on reinforcement is passed back to the customer through cheaper energy bills or invested in the network to further improve performance. By not having to install these large assets we can also help to reduce our carbon impact and support community groups and local businesses that are utilising Low Carbon Technologies to get involved within their local energy markets.

Flexibility First

Throughout RIIO-ED1 the DNOs and ESO have been collaborating on the ongoing development, through the Open Networks Project, of the common flexible services products and processes for
signposting, tendering (including pre-qualification and contracts), evaluating and purchasing flexible services including its dispatch, baselining and settlement, as well as coordination rules. Across GB there has been a significant increase in the scale of flexible services tendered for and purchased, compared with only three years ago, and it is only set to increase. In this section we describe the initiatives that will deliver our flexibility first commitment, ensuring again a step change in the amount of flexible services tendered, purchased and dispatched. To ensure that we are using flexibility where it is the most efficient whole-life cost we will have transparent, robust methodologies and processes that show how we utilise flexibility.

In RIIO-ED1 we have primarily utilised flexible services to mitigate or defer the need to reinforce our distribution network with the dominant flexible service that we have sought to purchase being post- fault services. In preparation for RIIO-ED2, we have also been tendering for the use of pre-fault flexibility products as we seek to use flexibility for other network needs, for example, construction outages and to avoid the use of carbon-intensive mobile generation following network interruptions. Where there is uncertainty in the future demand on the network we will use flexibility, as it enables us to manage the network in the interim period whilst waiting for greater certainty on the likely network demand in the future.

This optionality is valuable to us and the price we are willing to pay for flexibility in the interim period will be greater due to this uncertainty. The existing evaluation models (i.e. Electricity North West's Real Options Costs Benefit Analysis and Open Networks' Common Evaluation Methodology) recognise elements of this optionality, sometimes referred to as 'option value'.

Figure 3 illustrates an example where the demand on a network asset has been progressively rising over time and is expected to reach the capacity of a network asset. But our range of future energy forecasts show that in one scenario the demand keeps growing, whilst in the second scenario the demand drops over time. This uncertainty creates the opportunity to utilise flexibility services.

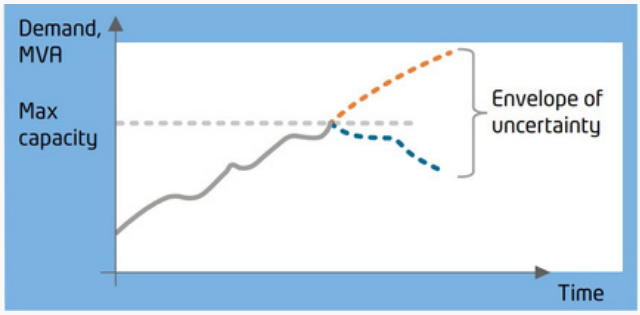

Figure 3: Optionality Diagram

Although the two scenarios are contrasting this example is typical of the potential outcomes and so using flexibility where there is uncertainty is the right thing. If the right amount of flexibility is available, and the cost of provision is below the ceiling price calculation by the common evaluation tool, then using flexibility will be the most efficient solution.

The savings forecasted from using flexibility services are already discounted from our proposed ED2 allowances. But we know the world never turns out as expected and so we have developed robust processes, coupled with appropriate oversight arrangements so that anyone can see that we are committed to using flexibility in all cases where it is the most efficient whole life cost. Our commitments to our customers in RIIO-ED2 are:

1. Seek to resolve all network needs using flexibility services for every intervention at EHV, HV and LV through open tendering
2. Transparently evaluate all solution options, and
3. Always choose the most efficient whole-life cost solution.

Participation in tenders

Flexible services providers can find out the latest information about how to participate in tenders by going to our latest requirements.

Total system considerations and benefits

Demand reduction services procured on the DNO network are generally viewed to have a positive impact regarding the Total Electricity System. By incentivising participants to reduce overall network capacity this reduces the amount of network reinforcement required on the distribution network. This provides a cascade effect to the wider whole electricity system; reducing demand at the network boundary points to the transmission network, and reducing the amount of centrally dispatched (ESO) generation required within Great Britain; all of these savings result in cheaper energy costs of GB electricity bill payers, as well as reducing the environmental impacts associated with the generation, transmission and distribution of electricity.

The DNO flexibility market offers opportunities for network customers to gain additional revenues in return for helping the network. In some cases, we have found that this additional revenue can provide sufficient incentive to customers to permanently switch their demand usage (through energy efficiency measures) or aid them in transitioning to low-carbon technologies e.g. electric vehicle smart charging.

Historical Dispatch of Services

Currently, due to a lack of contracted resources, it has not been possible to dispatch any Flexible Services in order to resolve network constraints. Once we have begun to dispatch Flexible Services we will provide, as a minimum, quarterly updates of dispatches via our Open Data Portal.

Flexible Assets

Solutions made up from distribution network assets are a tried and tested way to improve network performance, increasing network flexibility, and delivering efficient solutions to network constraints. Electricity North West have a range of asset-based solutions which are already in operation and continue to explore future opportunities to expand these existing solutions, as well as developing future asset-based solutions.

Flexible Assets

Flexible assets are items of plant or equipment, owned and operated by Electricity North West, which can be controlled in order to modify the network topology. Some examples of the types of assets which can be utilised as flexible assets include tap changers, capacitors, reactors, circuit breakers, and switches. Historically these assets have been controlled either via a human operation carrying out tele-controlled switching or on-site switching actions. Whilst these assets remain available for human-controlled switching operations, increasingly Electricity North West are utilising network automation systems in order to speed up the decision making of control actions. These systems dramatically increase the speed of operation of these assets, allowing for a greater network optimisation and the capability to unlock greater network capacity whilst also improving network stability and security.

Post Fault Network Restoration Systems

Electricity North West operate a number of systems which are responsible for automated post-fault network restoration of supplies. In the event of a network fault, the network protection systems are designed to trip circuit breakers and blow fuses to isolate the fault from the network, preventing the damage of equipment and risks to life and limb. Following the operation of these circuit breakers and fuses areas of the network fed by the faulted section of network assets will become de-energised, often leaving customers off supply. Electricity North West has incorporated a number of network automation systems to help narrow down the fault location, and then restore customer supplies to as many customers as possible without re-energising the faulted asset(s). These systems will operate utilising a range of network SCADA information to locate the most likely sections of the network where a fault may have occurred. Tele-controllable assets are utilised to rearrange the network topology to restore as many supplies as possible, also reducing the search area for operational staff to find the faulted asset(s); further improving the time taken to locate and fix the fault.

Other network automation systems have been developed to be cognisant of these restoration systems, and predominantly are operated in such a manner that the restoration of supplies will take precedence over other network automation systems e.g. Smart Street, CLASS, ANM. For example, the Active Network Management system will generally be programmed so that it will not issue any commands to Flexible Assets, Flexible Services, or Flexible Connections in an area that the automated restoration systems are working to restore supplies. This is because the restoration systems rely upon receiving stable network measurements in order to determine the likely location of the fault, and then determine the optimal restoration strategy. If another automation system were to modify the network topology or distributed energy resources demand profile this may temporarily hamper the restoration efforts of these automated restoration systems. Once these systems have completed their restoration cycle the Active Network Management system will be utilised the manage any remaining network constraints.

Smart Street

Smart Street is a series of technology solutions installed on the low voltage network which are coordinated by a centralised control system which is installed on our Network Management System. Using new controllable switching devices, as well as on-load tap changer devices installed on the HV/LV distribution transformers integrated into our network management system, Smart Street stabilises voltage and avoids it falling outside of statutory limits.

Using innovative voltage control technology, Smart Street will enable our networks and customers' appliances to perform more efficiently and make it easier for low-carbon technologies to connect to the electricity network in the future. As we become more reliant on electricity as our main source of power, our customers will use more new low-carbon technologies such as electric vehicles, heat pumps and photovoltaics/solar panels. These technologies tend to occur in clusters which has a dramatic effect on the electricity network. While electric vehicles and heat pumps could cause voltage to fall below statutory limits, new generation from photovoltaics exporting electricity to the network will have the opposite effect. If voltage levels fall outside statutory limits, the way our customers' appliances perform will be affected.

Smart Street demonstrates a step change in the coordination and operation of electricity networks in Great Britain and is the first demonstration of a fully centralised low voltage network management and automation system. We can reduce the supply voltage to our customers to an optimum level so that our networks and our customers' appliances work more efficiently, a technique known as conservation voltage reduction.

Smart Street currently operates independently of other automation systems such as ANM, CLASS, Post Fault Network Restoration Systems etc… However as these systems are controlling the Higher Voltage levels, and on occasion LV connected Distributed Energy resources, Smart Street will adjust the LV network assets to ensure that network voltages are maintained within statutory limits.

CLASS

CLASS (Customer Load Active System Services) is a low-cost solution which uses voltage control to manage electricity consumption at peak times. This system was developed utilising Ofgem Innovation funding and subsequently has been rolled out into business as usual across 260 primary substations across the region which serve nearly 2 million customers.

This ground-breaking approach is used to help balance electricity supply and demand for the whole of Great Britain and brings a number of other advantages:

- Makes it easier to adopt low carbon technologies onto the electricity network such as wind and solar power
- Avoids or defers the cost and disruption of expanding our network of overhead lines, underground cables and substations
- Reduces costs for all electricity customers
- Can be rolled out on a national level

We are now able to offer 'balancing services' to National Grid which can help to maintain electricity supplies for millions of customers up and down the country and avoid the need for additional expensive sources of power. The revenues from CLASS are utilised to pay back the return on the investment that shareholders made in the rollout of CLASS to business as usual, as well as providing funding to improve the network reliability and affordability for our customers. Alongside the benefits offered by CLASS nationally, the rollout of the CLASS controllers has allowed for greater network visibility of the High Voltage network, and improved controllability; both of which are helping to increase the ability to deploy additional network automation such as Active Network Management, and Post Fault Restoration Systems. Detailed research carried out during the trial showed that customers didn't notice any change in their electricity supply as a result of the utilisation of CLASS. Although CLASS was originally trialled as a solution to resolve both distribution and transmission level constraints, currently it is only utilised to resolve transmission level/national constraints. The commercial operation of CLASS has been separated within the business to prevent any actual or perceived conflicts of interest with the flexibility services market, and position as a neutral market facilitator that Electricity North West are operating as part of its new role within Distribution System Operation (DSO). A separate commercial team are responsible for the bidding of CLASS services into the Balancing Market, and then within the Electricity North West control system, the dispatching of these services is linked to the National Grid ESO balancing mechanism dispatch methodology.

4. Decision Making

Dispatch methodology

Electricity North West will utilise a combination of automated and manual dispatch methodologies for the usage of flexible resources. The Active Network Management system will become the primary method for the dispatch of flexible resources (Flexible Assets, Flexible Connections, and Flexible Services). The control room and operation staff will retain the ability to manually dispatch assets in the event that the ANM system is not operational, or during periods where there is a safety or security of supply need to discontinue automation.

ANM dispatch

Within the High Voltage network, Flexible Assets will primary be used by the ANM system in order to resolve network constraints. Typical examples of this will include if there is too much demand on a network feeder, the ANM system may opt to reconfigure where the normal network split point is located on the circuit to transfer excess demand to an alternative parallel feeder. Currently, this feature is restricted to the High Voltage network and will be limited to being utilised where this does not cause operational safety risks E.g. high fault levels.

Following the deployment of Flexible assets to resolve network constraints, where applicable, the ANM system will analyse which flexible connections and flexible services contracts can be utilised in order to resolve the network constraints.

ANM will dispatch assets in accordance with the Merit Order List ranking as detailed within Introduction to the Merit Order Management System.

Currently, ANM is restricted to deploying LV and HV connected assets to resolve constraints which occur within the High Voltage Network; similarly, only assets connected to the 33KV and 132KV network can be used to resolve constraints within the 33KV, 132KV, and Transmission network [2].

Operational Decision-Making use cases matrix

The table below defines some of the core use cases that Electricity North West follow with regards to Operation Decision Making and the hierarchy of the Decision Making Processes and systems which are utilised and implemented.

2 The resolution of transmission constraints is limited to those listed within Part 3 & 4 of the appendix G process.

Use Case	Decision Making Process/System	Process
Loss of customer supplies following a distribution network fault	Auto reclose schemes	These scheme will, where it has been deemed safe and beneficial to do so, will try to re-energise the network to see if the fault was transient in nature.
	Centralised Automated Post fault restoration systems	These systems will look to rearrange the network topology in order to restore power to as many customers as possible; whilst also reducing the search area for the faulted network asset(s).
	Tele-control and Manual switching operations	Control room staff and field-based staff will work together to locate the faulted assets, isolate, and earth the network; and then affect a repair and restoration of supplies.
Management of Transmission Technical Limits	Active Network Management (ANM)	ANM will seek to curtail Distributed energy resources that have a “Part 4” agreement in place in the event that a technical limit is likely to be breached.
Management of Thermal (A, MW, MVAr, MVA), and voltage constraints on the 33kV, 132kV, and Transmission network	Active Network Management (ANM)	ANM system will analyse the level constraint that has been experienced and then utilising distributed energy resources from the Merit Order List that are connected at 33kV, & 132kV in a sequential order to reduce the constraint to under the normal operating threshold.
	Tele-control and Manual switching operations, network reinforcement	Where ANM is not installed or has not succeeded to manage the 33kV, 132kV, and Transmission network within asset and statutory limits a combination on network topology rearrangement and network reinforcement may be required to ensure that the network revert to being inside of asset and statutory limit thresholds. These solutions are often proactively managed ahead of an excursion from asset and statutory limits.
Management of Thermal (A, MW, MVAr, MVA), and voltage constraints on the High Voltage network	Active Network Management (ANM)	ANM will seek to utilise Flexible Assets initially for constraints on the High Voltage network, reconfiguring the network topology to alter load flows across the network. If the constraint remains unresolved the ANM system will analyse the level constraint that has been experienced and then utilising distributed energy resources (flexible connections & services) from the Merit Order List that are connected at Low Voltage or High Voltage in a sequential order to reduce the constraint to under the normal operating threshold.
	Tele-control and Manual switching operations, network reinforcement	Where ANM is not installed or has not succeeded to manage the High Voltage network within asset and statutory limits a combination on network topology rearrangement and network reinforcement may be required to ensure that the network revert to being inside of asset and statutory limit thresholds. These solutions are often proactively managed ahead of an excursion from asset and statutorylimits.
Low Voltage network voltage management	Smart Street	The centralised control system will telecontrol low-voltage network assets to rearrange the network topology to maintain the voltage within statutory voltage limits.
	Tele-control and Manual switching operations, network reinforcement	Where Smart Street is not installed or has not succeeded to manage the low voltage network voltage within statutory limits a combination on network topology rearrangement and network reinforcement may be required to ensure that the voltages revert to being inside of statutory limit thresholds. These solutions are often proactively managed ahead of an excursion from statutory limits.
Balancing Mechanism	CLASS	The CLASS system will respond to a ESO defined trigger. The system will either utilise transformer tap changers or circuit breakers at primary substations to affect a change in network demand to provide a balancing service to the ESO.

Conflict Management (Primacy)

The ENA Open Networks Primacy Technical Working Group have been established to bring all UK DNOs, and the ESO together to review how we can co-ordinate where risks of service conflicts between flexibility options are identified. Through this work, we aim to remove barriers to entry for flexibility providers, and encouraging service stacking. The technical working group are reviewing possible causes for service conflicts and are developing "Primacy Rules" that will define the
methodology for alleviating this risk of conflict. We have been active participants in the Open Networks primacy rules working group, working with the rest of the industry to develop rules and
procedures to allow for service stacking and conflict management.

The Technical Working Group have so far identified over 2000 possible combinations of potential service conflicts which may require conflict management utilising Primacy Rules. The group have taken the approach of evaluating the use cases which have the most likelihood of causing barriers to entry first and are working through each use case to identify potential primacy rules. It is highly likely that as each use case is assessed, that similarities between use cases will be identified allowing for re-use of Primacy rules. The technical working group are also looking to ensure that new flexibility services in development are assessed for potential conflicts prior to being introduced into business as usual to prevent the need for Primacy rules to be implemented for these products, where possible.

In support of this work, Electricity North West carried out simulated trials in partnership with the ESO of the proposed rule 1A for coordination where the ESO are contracted with balancing mechanism units within a constrained area where DNO flexible services are being deployed. Following the simulated trials this rule is now due to be put into business-as-usual processes for all DNOs.

Currently, there are no active conflicts that Electricity North West or the ESO are aware of within Electricity North West's licence area. We have committed that when conflicts are identified that we will adopt the appropriate primacy rules.

Common evaluation Methodology (CEM)

Since January 2022 we have been utilising the new Common Evaluation Methodology (CEM) and Tool to determine the most suitable solution to meet the network needs; comparing traditional asset reinforcement to procuring flexibility services, energy efficiency measures and Active Network Management (ANM) solutions.

The CEM tool evaluates solution options comparing network capacity and network losses over the range of Distribution Future Electricity Scenarios (DFES) scenarios to identify the most cost-effective solution and proposes optimum contract length. As mentioned in our Distribution Network Options Assessment Methodology, Electricity North West Limited led the development of the CEM tool within Workstream 1A of the Open Networks Project in collaboration with other DNOs and supported by Baringa. The CEM tool builds on much of the learning from the ENWL-developed Real Options Cost Benefit Analysis (ROCBA) methodology for evaluating the flexibility products against network intervention. This standardised industry approach provides greater visibility and confidence amongst flexibility providers and helps stimulate volumes and competition in the market, ultimately reducing costs for network customers.

To demonstrate our commitment to procuring flexibility openly and transparently, we publish a high-level summary table on the previous requirement page following each tender round, along with a more detailed analysis of the valuations for each requirement zone which includes publishing the CEM tool for each tender zone.

We currently operate a pay-as-bid pricing strategy for our flexibility tenders. We will utilise the Common Evaluation Methodology and Tool (CEM) to determine the guide price for the competition zone at the tender stage; meaning that we will issue in the tender materials the price above which the use of flexibility or energy efficiency is deemed uneconomic. This encourages bidders to submit competitive prices and ensures consistency with our evaluation process whilst continuing to drive competition in the market. These prices are based on the annual deferral fee and will be subject to full evaluation post-bid assessment. These prices for each requirement are published within 'Appendix 3- Site Requirements' as part of our suite of tender documentation on our website, in addition to being published on flexibility platforms, on our Open Data Portal and our interactive flexibility map. We evaluate the providers bid against the capacity and duration of service that they are offering, as well as the bid price vs the CEM tool's financial evaluation of the ceiling price. Bids which exceed the ceiling price are rejected as these are viewed as not offering value for money. During the assessment period, we may hold a Post Quotation Negotiation or Best and Final Offer meeting with successful bidders. On occasions where it was not possible to contract for the required capacity within a tender, these requirements were republished in the following tender; where it was still reasonably practical to defer network reinforcement.

DSO Panel

A DSO stakeholder panel has been established to provide external oversight into decision-making. The Electricity North West DSO Panel is a committee made up of independent individuals covering the broad spectrum of DSO stakeholders. The primary purpose of the Panel is to provide insight, independent oversight, challenge, review and guidance on Electricity North West's ongoing DSO activities. They have evaluated all our flexibility tender results and Cost Benefit Analyses. Electricity North West will use the output from the Panel to better inform both the ongoing delivery of its DSO Transition plan and the development of its forward DSO strategy and activities. The panel's objectives are:

- To provide appropriate oversight, challenge, review and guidance on Electricity North West's DSO activities
- To act as the review body of proposed decisions that have been challenged by an affected third party, and make observations on the challenge and where appropriate make observations on a process or methodology
- To act as the review body for DSO forecasting, modelling and decision-making methodologies; and where requested make observations to change relevant methodologies, and
- To support the ongoing performance of the DSO transition using the measures of the DSO Incentive mechanism supported by evidence gathered from the DSO community in accordance with Ofgem's performance framework and guidance.

Flexible Services Decision-Making Process

To ensure the continuous development of the flexible services market in the North West region we have created a clear and robust process that provides the necessary information in an easy-to-read format for these three key participant groupings to understand how to engage with and the value of engaging in the flexible services market. Figure 9 lays out the end-to-end process, including the oversight and review processes, to ensure confidence that Electricity North West is truly acting as a neutral market facilitator and that any potential conflicts of interest are openly and transparently managed. The key is having a robust and granular forecasting process that identifies the future network needs, even at the LV network level. Quality data sharing and signposting that provides clarity on the development needs of the network, means that all stakeholders will be able to participate in and/or benefit from the opportunities for the provision of flexibility or energy efficiency or any other alternative solution that delays or mitigates the need for development of network assets.

The development of network assets will be a last resort and will only be progressed where it is the most efficient whole-life cost solution.

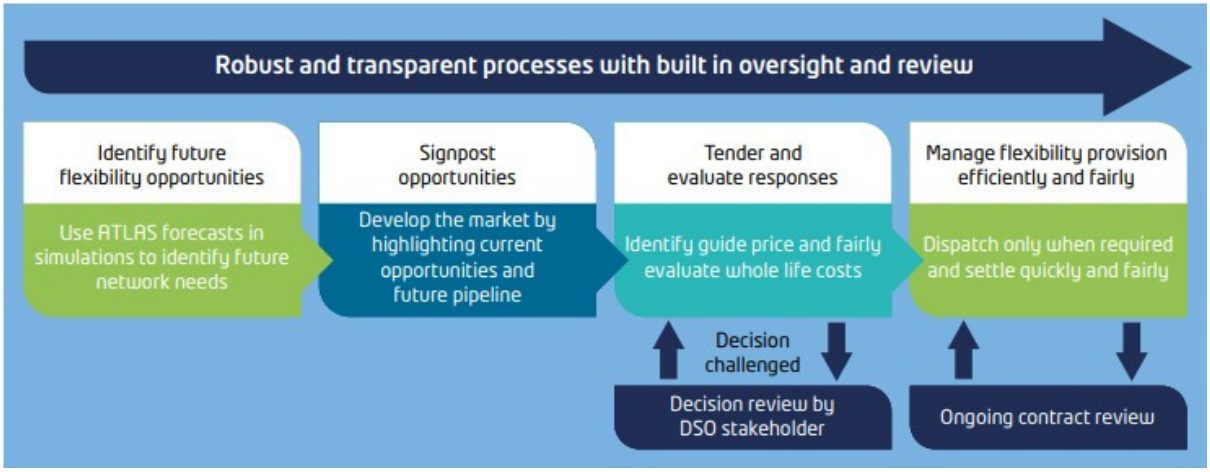

Figure 9: End-to-End Flexible Services Process

5. Data

Data Portal

In line with our commitments to make transparent decision making, as well as to allow our stakeholders to make informed decisions Electricity North West hosts an open data portal. Within the Data Portal, there is a range of operational and non-operational data sets available. We are working with the ENA Open Network Project and wider industry to triage further data sets which we will look to release in future. Going forwards new data sets will be added to our Open Data Portal, where they are triaged as being open. Additional data sets will be shared with other market entities such as the ESO via dedicated communications access routes such as ICCP links and security protected API interfaces to enable enhanced whole system operational and non-operational decision making.

Non-Operational Data

Within the Data Portal non-operational data is shared to allow stakeholders to make informed decisions on network activities such as flexible connections requests, flexible services market participation, local area energy planning, regulatory decision making, etc

Current data sets include:

- Forecasting
  - Network Development Plans (NDPs)
  - Distributed Future Electricity Scenarios (DFES)
- Flexible Services
  - Current Requirements
  - Historical Procurement
  - Historical Dispatch
  - Primacy Risk of Conflict Report
- Network Data
  - Long Term Development Statement (LTDS)
  - Network Asset Viewer (NAV)
  - Substation Locations

Operational data sharing

Within the Data Portal operational data is shared to allow stakeholders to carry out post-event analysis and tracking of historical operational flows. Currently, within the Operational Data webpages, Electricity North West publish:

- Historical records of the current (A) and power flow (active (MW) and reactive (MVAr)) into the Electricity North West Network from National Grid at Grid Supply Points (GSPs). These records provide data recorded since September 2021.
- The average voltage at each GSP. Data is provided per GSP as an average for each half-hour period, summed across all circuits at that site for flow and averaged for voltage. These records provide data recorded since September 2021.
- Outage Data is provided for the entire Electricity North West Network with data from 1984 for faults at High Voltage (6.6kV or above) and from 2000 for Low Voltage faults. The outage data provides details of all recorded power outages on the Electricity North West network including the time, duration, cause (where known) and approximate location.

Please share your thoughts on our Data Portal with StakeholderEngagement@enwl.co.uk or you can request a data set by visiting Data Request — Electricity North West (opendatasoft.com)

5. Innovation Projects

Electricity North West have a number of innovation projects currently being developed and trialled for the enhancement of Network operation and Decision making. As these are limited trials they have not been explicitly discussed within this document. For further details of these projects please refer to our Innovation Website.

6. Contact us

We are keen to hear any feedback you may have on this document and its usefulness for describing our approach to operational decision making.

Our approach to procuring and utilising flexibility will continue to evolve in line with best practice as identified by the industry and through stakeholder engagement. This year we look forward to building upon the improvements we have made to reduce barriers to participation, facilitating the developments of markets and enhancing visibility and transparency of information relating to flexibility.

If you have any comments or questions relating to this report or the process of providing flexible services to the network, please get in touch via our feedback form.

7. Useful links

Stakeholders can find the vast majority of information relating to flexible services, Open Data, Our DSO strategy, Forecasting, and whole system working via our website, this includes how to get in touch with us, previous engagement, our current requirements, future requirements, and all of our detailed guidance documents. We have also provided a number of key external links which relate to the content of this document.

Link name	URL
Electricity North West Flexibility Hub	https://www.enwl.co.uk/future-energy/flexibility-hub/
Electricity North West Distribution Future Electricity Scenarios Report	https://www.enwl.co.uk/get-connected/network-information/dfes/
Electricity North West Network Development Plan	https://www.enwl.co.uk/get-connected/network-information/network-development-plan
Distribution Network Options Assessment	https://www.enwl.co.uk/globalassets/future-energy/dnoa/distribution-network-options-assessment-dnoa-report.pdf https://www.enwl.co.uk/globalassets/future-energy/dnoa/dnoa-methodology.pdf
Electricity North West Data Portal	https://www.enwl.co.uk/future-energy/data-and-digitalisation/data-portal
DSO Stakeholder panel	https://www.enwl.co.uk/future-energy/distribution-system-operation/dso-stakeholder-panel/
Electricity North West Innovation website	https://www.enwl.co.uk/future-energy/innovation/
Sign up to receive our flexibility newsletters and event invites	https://www.enwl.co.uk/about-us/contact-us/sign-up-to-a-distribution-list/
Ofgem website	https://www.ofgem.gov.uk/
Piclo Flex platform	https://picloflex.com
Energy Networks Association website	https://www.energynetworks.org
Flexibility in Great Britain Timeline	https://www.preceden.com/timelines/523803-flexibility-in-gb-timeline
Common Evaluation Methodology and Tool (CEM)	https://www.energynetworks.org/assets/images/Resource%20library/ON20-WS1A-P1%20CEM%20Tool%20v1.0.xlsm.zip