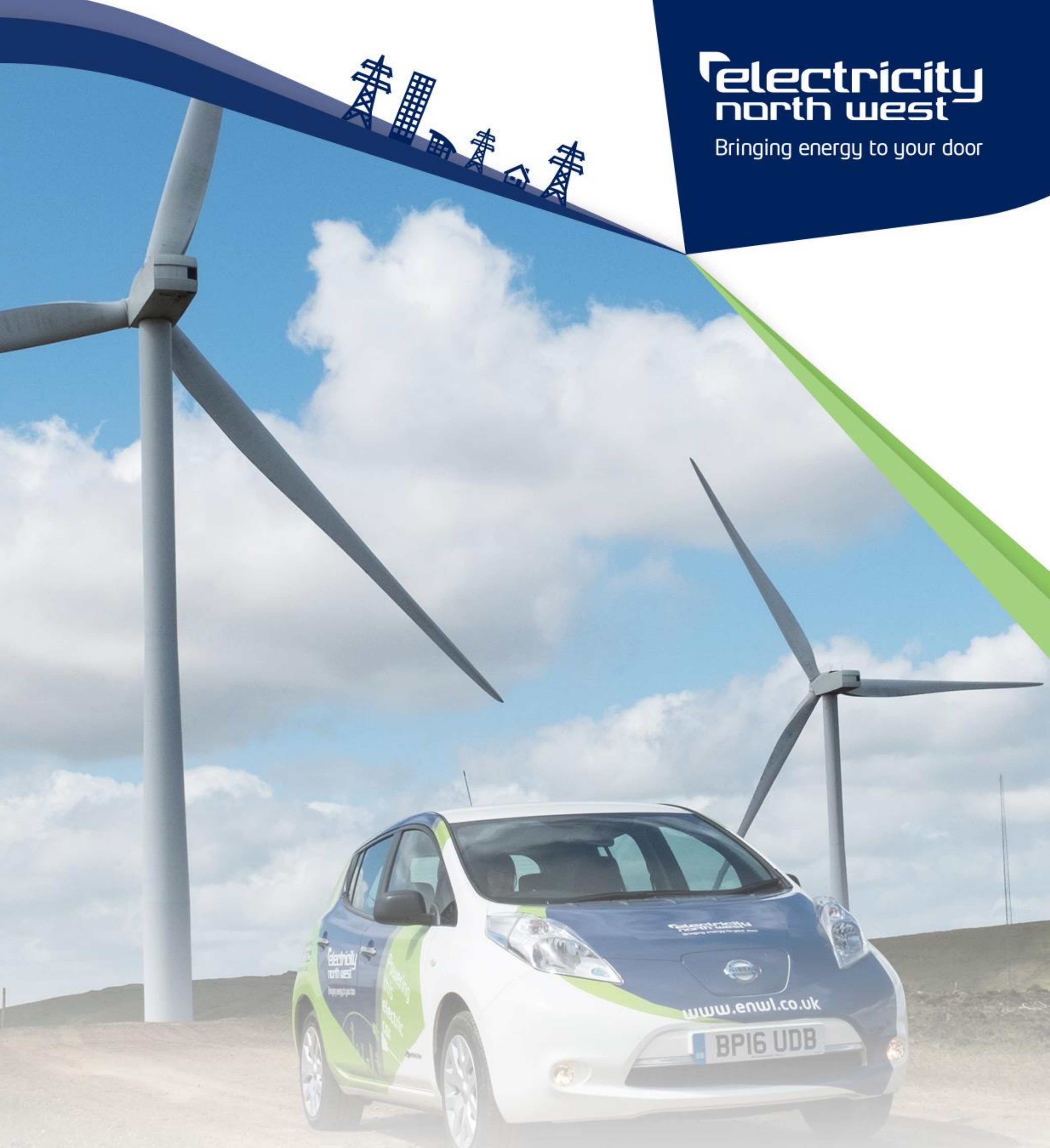
electricity north west
Bringing energy to your door



Long Term Development Statement

November 2023 update

Contents

1 Glossary

Abbreviation	Description
ALRS	Automatic Load Reduction System
BS EN	British Standard European Norm
CCCM	Common Connections Charging Methodology
CP	Code of Practice
DFES	Distribution Future Electricity Scenarios
DINIS	Distribution Network Information System
DNO	Distribution Network Operator
ECR	Embedded Capacity Register
EHV	Extra High Voltage (33 and 132kV network)
ENA	Energy Networks Association
EPD	Electricity Policy Document
ER	Engineering Recommendation
ESQCR	Electricity Safety, Quality and Continuity Regulations
FLISR	Fault Location, Isolation and Supply Restoration
GIS	Geographical Information System
GSoP	Guaranteed Standards of Performance
HV	High Voltage (11 and 6.6kV network)
IPSA	Interactive Power System Analysis
kV	Kilo Volts
kVA	Kilo Volt Amperes
LTDS	Long Term Development Statement
LV	Low Voltage
MDI	Maximum Demand Indicator
MVA	Mega Volt Amperes
MVAr	Mega Volt Amperes (reactive)
NAV	Network Asset Viewer
NDP	Network Development Plan
NMH	Network Management Hub
NMS	Network Management System
NVD	Neutral Voltage Displacement
RMS	Root Mean Squared

SCADA	Supervisory control and data acquisition
TRS	Transmission Restoration System

2 Introduction

2.1 Purpose of Statement

The Long Term Development Statement (LTDS) is provided for the primary purpose of allowing existing and potential customers to make an initial assessment of the capabilities of the electricity network and opportunities for changes in their use of the network or for connecting to it. Actual changes in supply capacity for existing customers or new connections are subject to detailed assessment and approval, and payment of appropriate charges.

The LTDS is only a part of the wider range of publications and datasets that are related with Electricity North West's Distribution System Operation (DSO) and aim to provide insights and data to our stakeholders to produce well informed plans and increase the transparency of our load related investment process.

This process starts with Distribution Future Electricity Scenarios (DFES) that present the long-term demand and generation forecasts that inform our network planning. The DFES forecasts are used in network impact analyses that define where and when additional capacity is required to facilitate the increasing levels of electricity demand and distributed generation. The network data used in these analyses are part of the LTDS.

The LTDS presents our 1 to 5 years horizon plans of high certainty plans, which includes approved reinforcement schemes and a Best View scenario forecast. Since May 2022 we have been publishing our Network Development Plan (NDP), which does not include network data but presents capacity headroom forecasts and load related interventions (flexibility services and conventional reinforcement) in a 1 to 10 years horizon.

We follow a "flexibility first" approach, which means that we would procure flexibility services from local stakeholders who are paid to change their demand and/or generation to release network capacity when it is more cost efficient than a corresponding network reinforcement option. More information on our flexibility services can be found in our latest Autumn 2023 tender.

The DFES, NDP and Flexibility Tender publications include over 40 datasets, which can be used together with LTDS data and information by our stakeholders to inform their plans and understand our load related investment process. These datasets and various additional information can be accessed through our Open Data Portal.

This statement is the November annual revision of the Long Term Development Statement (LTDS). It has been prepared in accordance with standard licence condition 25 of the electricity distribution licence of Electricity North West Limited.

2.2 About Electricity North West

Electricity North West is one of 6 distribution network operators in the UK regulated by Ofgem. We operate the local electricity network and distribute electricity, mainly from the National Grid, to around 2.4 million homes and businesses in the North West of England and cover an area of approximately 12,500 square km.

As a rough guide, about 55% of our customers live in Greater Manchester, 30% in Lancashire and 10% in Cumbria, with the remainder in parts of Cheshire, Derbyshire and North Yorkshire.

Our network in the North West is one of the most reliable in the country and we are investing over £2 billion between 2023 and 2028 to ensure we continue to deliver an excellent, safe and affordable service to all our customers.

2.3 Content of Statement

2.3.1 Summary Information

The summary of information section contains:

- High level information relating to the design and operation of all voltage levels of the distribution network, and
- Small scale geographic plan(s) providing an overview of the 132kV, EHV networks and substations described in the detailed information section.

2.3.2 Detailed Information

The Detailed Information section contains information relating to the electricity distribution network from 132kV to the lower voltage busbars of primary substations and includes:

- Schematic diagrams of the 132 and 33kV systems
- Circuit data
- Transformer data
- Load data
- Fault level data
- Generation data
- Interest in a connection
- HV feeder loading Data
- Distribution substation information, and
- Distribution Network Information System (DINIS) data.

2.3.3 Network Development Proposals

The Network Development Proposals section contains information on proposals where finance has been secured, detailing:

- Area of the network affected
- Work that is intended to be carried out
- Impact on the distribution network, and
- Expected timescale.

Also contained within this section is a high-level summary of the interest in specific parts of the distribution system provided in tabular form for each interface point between the 132kV and the Low Voltage (LV) System.

2.4 Contact Information

To request a copy of the full Long Term Development Statement please contact LTDS@enwl.co.uk.

For enquiries relating to new connections please contact connectionsapplications@enwl.co.uk.

For enquiries relating to existing connections please contact flexible.contracts@enwl.co.uk.

To request further information related to the LTDS, or to provide feedback please contact LTDS@enwl.co.uk.

2.5 Other Information Sources

2.5.1 Relevant Codes

The Distribution Code details the technical parameters and considerations relating to the use of and connection to public distribution system: www.dcode.org.uk.

The Grid Code specifies technical requirements for connection to, and use of, the National Electricity Transmission System.

2.5.2 Standards

The Distributed Generation Connection Guide is provided by The Energy Networks Association (ENA) and aims to assist with the connection of distributed generation to the UK's electricity distribution networks.

Learn more about our Guaranteed Standards of Performance (GSOP) regarding the provision of budget estimates and formal quotations for metered and unmetered connections.

Engineering Recommendations (ER) as referenced throughout the statement.

Information on requesting additional network information can be found in the full statement in section 4.3 – Additional information.

3 Summary Information

3.1 Design Philosophy and Practices

All new work is designed in accordance with current policy and will comply with all relevant statutes and licence conditions, and with the distribution code. The minimum standard of security is as set out in Engineering Recommendation (EREC) P2/8. New connections shall be made at the lowest practicable voltage and shall use only approved equipment.

Network designs shall be considered on an individual basis, taking into account the nature of customers' load and the existing network loading arrangement. Further information regarding network protection, fault level and methods of system earthing are provided within the general network characteristics section of this document.

3.1.1 General principles of design policies by voltage

132kV network – key design principles

- Close liaison with National Grid must be maintained on all developments affecting the 132kV network or the final metering scheme.
- Any new network extension will generally be by 132/33kV feeder-transformers in a substation designed to be equipped with two such transformers of up to 90MVA rating.
- Alternatively, a 132/11kV substation with up to two transformers of up to 30 MVA rating may be considered.
- The numbers of circuit addresses and isolation points are limited in accordance with ER P18. Interconnection at 33kV may be used to provide security to single transformer substations or to provide load transfer facilities.

33kV network – key design principles

- Approved circuit and substation configurations are defined in Electricity North West's appropriate Electricity Policy Document (EPD).
- Any new network extension will generally be by 33/11kV or 33/6.6kV feeder transformers in substations designed to be equipped with two such transformers of 23MVA rating.
- Transformer-feeder circuit ratings will normally match those of the transformers.
- For interconnectors between Bulk Supply Points or where further extension is anticipated, circuits of up to 38MVA rating may be considered.
- The numbers of circuit addresses and isolation points are limited in accordance with ER P18.
- Where more than two underground cable circuits feed a common load group, they should not all be laid in the same trench. Interconnectors at 11 or 6.6kV may be used to provide security to single transformer substations.

11/6.6kV network – key design principles

- The network is to be developed on the basis of radial circuits forming open rings on 33/11kV or 33/6.6kV substations or interconnectors between them.
- Switched alternative circuits must be sufficient to restore any part of the network after fault with a maximum of two load transfer stages.
- Opportunities to convert 6.6kV parts of the network to 11kV must be used whenever practicable.

- New designs should be such that no more than 200 customers or 500kVA of transformer capacity would remain disconnected for repair time after any one fault.
- The number of customers on a circuit between a 33/11kV or 33/6.6kV substation and a normal open point should not exceed 2500.
- The maximum rating of distribution transformer to be used on the network is 1000kVA and all newly commissioned or re-commissioned ground-mounted distribution transformers must have local means of High Voltage isolation.
- All new cables for use on either 11 or 6.6kV networks must be rated for 11kV non-effectively earthed (i.e. impedance earthed) systems.
- All new cables shall have a cross-section of 300mm^2 aluminium except for specified situations where 95mm^2 aluminium cable may be used.
- Conditions for the use of teed circuits and pad-mounted transformers are defined in Electricity North West’s appropriate EPD.
- Overhead circuits must be provided with sufficient isolation points to facilitate fault sectionalising and restoration. Existing unit-protection schemes on 11 and 6.6kV networks should be maintained as long as is reasonably practicable.

Low Voltage (LV) network- key design principles

- The LV network is operated at a design voltage of 230/400V and a maximum voltage drop between transformer terminals and customers' exit points of 7%.
- LV distributors operate radially with limited interconnection via link-boxes to provide sufficient security to substations fed from teed circuits or limited alternative feed for use during plant maintenance.
- All new extensions to the LV network shall use protective multiple earthing. Aerial bundled conductor is the preferred construction for LV overhead lines.
- Maximum values of prospective short circuit current are defined in Electricity North West’s appropriate EPD.
- LV networks shall be designed such that all mains are fully protected by the substation fuses. No more than 200 customers may be connected to any one three-phase fuseway.
- All new cables shall have a cross-section of 300mm^2 aluminium except for specified situations where 95mm^2 aluminium cable may be used.
- Any new service shall have a minimum size of 35mm^2 aluminium single-phase, a maximum length of 30m, a maximum voltage drop of 2% and shall not be looped. As an exception, a new service to a street electrical fixture may have a minimum size of 4 mm^2 copper single-phase up to a maximum length of 15m.

3.1.2 General characteristics of design policies for Generation and Storage

Customer protection will generally be allowed, including that required in compliance with EREC G99, to trip the distribution metering circuit breaker at the connection interface. Synchronizing on this circuit breaker will not be allowed. If for some reason the nature of the customer's system or protection indicates a relatively arduous duty, we may insist on the customer installing their own circuit breaker to protect their system. Metering circuit breakers will be selected from their standard specifications for ground mounted circuit breakers: pole mounted circuit breakers will not be used for this duty.

A tripping supply may be provided to the customer's protection from the network operator's battery, subject to the drain imposed. However each case will be judged on its merits. In particular, the use of the battery is not likely to be granted if the direct current wiring energised from it is routed outside the curtilage of the substation.

Our specification for the construction of single circuit 132kV lines on wood poles is the Energy Networks Association Technical Specification (ENATS) 43-50 (specification for single circuit overhead lines on wood poles for use at 132kV).

3.1.3 Electricity Policy Documents

For more detailed information on our distribution system design policy and practises, please submit a request to LTDS@enwl.co.uk quoting the relevant Electricity Policy Document (EPD) below:

- EPD279 – Distribution system design – general requirements
- EPD280 – Distribution system design – 132kV network
- EPD281 – Distribution system design – 33kV network
- EPD282 – Distribution system design – 11/6.6kV network
- EPD283 – Low Voltage Design Manual
- EPD259 – Generation connected to the Electricity North West distribution network.

3.2 Engineering Recommendations & Standards

Further to the above, the following recommendations and standards provide guidance on network design and planning:

- BS7430 – Code of practice for protective earthing of electrical installations
- ENATS 41-24 – Guidelines for the Design, Installation, Testing and Maintenance of Main Earthing Systems in Substations
- EREC G12/5 – Requirements for the Application of Protective Multiple Earthing to Low Voltage Networks
- EREC G5/5 – Planning levels for Harmonic Voltage Distortion and the connection of non-linear equipment to Transmission Systems and Distribution Networks in the United Kingdom
- EREC G99 – Requirements for the connection of generation equipment in parallel with the public distribution networks on or after 27 April 2019
- EREC G74 – Procedure to meet the Requirements on IEC 909 for the Calculation of Short-Circuit Currents in Three-Phase AC Power Systems
- EREC G78/2 – Recommendations for low voltage connections to mobile telephone base stations with antennae on high voltage structures
- EREC G81 – Framework for design and planning, materials specification and installation and record for Greenfield low voltage housing estate installations and associated, new, HV/LV distribution substations
- EEC G98 – Requirements for the connection of Fully Type Tested Micro-generators (up to and including 16A per phase) in parallel with the public Low Voltage Distribution Networks on or after 27 April 2019
- EREC P16 – EHV or HV Supplies to Induction Furnaces
- EREC P17 – Current Rating Guide for Distribution Cables
- EREC P18 – Complexity of 132 kV circuits
- EREC P2/8 – Security of Supply
- EREC P24 – AC traction supplies to British Rail
- EREC P25 – The short-circuit characteristics of single-phase and three-phase low voltage distribution networks
- EREC P27 – Current Rating Guide for High Voltage Overhead Lines Operating in the UK Distribution System

- EREC P28 – Planning Limits for Voltage Fluctuations caused by Industrial, Commercial and Domestic Equipment in the United Kingdom
- EREC P29 – Planning Limits for Voltage Unbalance in the United Kingdom
- EREC S34 – A guide to assessing the rise of earth potential at substation sites
- EREC S36 – Procedure to identify and record 'hot' substations

Engineering Recommendations can be acquired through the ENA's website.

3.3 General Network Characteristics

3.3.1 System earthing and fault levels

The following earthing systems and design fault currents (three-phase symmetrical) are in use throughout the distribution network:

Voltage	Type of earthing	Design fault current	Design fault level
132kV	Solid earthing	21.9kA	5,000MVA
33kV	Impedance earthed	17.5kA	1,000MVA
11kV	Impedance earthed	13.1kA	250MVA
6.6kV	Impedance earthed	21.9kA	250MVA
Low Voltage (LV)	Solid earthed (PME)	27kA	19.4MVA

Where the network is impedance earthed the typical neutral earth resistor will limit the earth fault current to 1kA per transformer i.e. giving a maximum earth fault level of up to 3kA. Earthing for substations and networks must comply with Electricity North West's following documents:

- EPD332 – Customer installation earthing
- CP332 – LV service connections and application of PME
- CP333 – Earthing design for high voltage substations and equipment
- ES333 – Earthing Design for 11/6.6kV Substations and Equipment – Guidance for ICPs and IDNOs
- CP335 – Earthing design for 132kV, 33kV and 33/11/6.6kV primary substations and equipment.

These documents, in turn, reference a number of industry standards including ENATS 41-24, ENA ER S34, ER S36, BS 50522 and BS7430.

Design earth fault clearance times are:

Voltage	Clearance time

132kV	200ms
33kV	500ms
11/6.6kV	1s

3.3.2 Protection systems used

This section contains high level view of the protection philosophy on the electricity distribution network.

3.3.2.1 Network protection

The policy on protection systems for 132, 33 and 11/6.6kV is detailed in the Electricity Policy Document, EPD350. The protection of secondary distribution substations through standard settings is detailed in EPD283 Low Voltage Design Manual. The following is a brief summary of the protection philosophy on the distribution network.

3.3.2.2 132kV network protection

At 132kV main protection will be fully discriminative for phase and earth faults and have an operating time not to exceed 200ms. This will generally be provided by distance or biased differential protection relays. Backup protection will be provided by inverse time overcurrent and earth fault relays, which in general will be non-discriminative. Transformer protection will also be fully discriminative for phase and earth faults, typically biased differential, although this may be reliant on a non-duplicated inter-tripping scheme (fully monitored). Busbar protection will be a fast acting fully discriminative high impedance scheme for phase and earth faults with backup from line and plant inverse time relays as well as additional relays fitted to bus couplers and bus sections.

3.3.2.3 33kV network protection

At 33kV, the protection for phase and earth faults is mainly unit protection, but some distance protection is used, particularly in rural areas. The general aim is for 200ms clearance time except for zone two clearance on distance protection in some locations. Backup protection is standard inverse time overcurrent and earth fault relays. Feeder transformers incorporate balanced earth fault at the source with restricted earth fault, and standby earth fault on the Low Voltage (LV) side at the remote end. Neutral voltage displacement would be incorporated for overhead line fed transformers. Inter-tripping will be used for fast fault clearance on plant, but where pilots are not available then a fault thrower will be used to ensure remote end tripping. Busbar protection at 33kV assumes the use of metal clad switchgear and therefore only requires earth fault protection. The standard is a main discriminatory system for each bus zone with a check system for the whole board, usually of the frame leakage type.

3.3.2.4 High Voltage (HV) network protection

At HV there will be only a main overcurrent and earth fault protection of the inverse time type. Clearance time for a fault close to the primary will generally be 1s. Where faster clearance times are required, a high set facility can be utilised. Where feeders contain large sections of overhead line there will usually be auto-reclose fitted incorporating instantaneous, inverse time overcurrent and earth fault trips as well as sensitive earth fault protection. Backup protection for feeders is the standby earth fault protection on the primary transformer which will usually trip only the affected half of the board.

Busbar protection is not applied at HV but a form of busbar blocking with circuit breaker fail protection is utilised on modern installations with microprocessor based relays.

Automatic voltage control relays are utilised on transformers at grid and primary substations. The method of control utilised in the relay and settings employed will vary depending on the location, age and configuration of the network. Differing types of voltage control have been utilised; however, the modern schemes utilise a combination of circulating current control with the ability to change to reverse reactance where necessary for operational reasons. Line drop compensation is applied to give the optimum voltage characteristic for the network.

3.3.2.5 Generator Neutral Voltage Displacement (NVD) protection

We would only consider the application of NVD for a generation connection at High Voltage or Extra High Voltage. This would only be required in the unusual circumstances of a generator and its controls being considered capable of supporting our network demand in islanded mode.

3.3.3 Telecontrol and System Operation Automation

Full time system control engineers at the Network Management Hub monitor the network.

Telecontrol of the electricity network is enabled via primary and secondary computer based real time Supervisory Control and Data Acquisition systems, referred to as SCADA. Primary and secondary SCADA systems allow the control and monitoring of the 132kV, 33kV, 11kV and 6.6kV networks.

The level on monitoring and control varies by voltage as follows:

- The 132kV and 33kV networks are fully controlled from our Network Management Hub by the primary SCADA system
- The outgoing High Voltage (HV) circuit breakers at primary substations are also controlled from the Network Management Hub by the SCADA system, and
- Selected switches on the rest of the 11kV and 6.6kV networks are monitored and controlled via the secondary SCADA system which has a separate set of central servers.

Control of both the primary and secondary SCADA is implemented through a single graphical user interface in order to ensure a standard interface for the control engineer.

Primary SCADA monitoring is carried out through outstations and at all grid and primary substations. Grid and primary substations communicate with the central servers over a mixture of copper pilots, optical fibre and telemetry scanning radio.

The secondary SCADA system is based on the Remote Terminal Units (RTU) communicating with the central servers over radio networks and controls the urban and rural HV network.

3.3.4 Automation

3.3.4.1 Automation on the 33kV network

Transmission Restoration System (TRS) is an automated solution leading to the restoration of customer supplies at 33kV voltage levels. It can identify the presence of an unplanned loss of supply and when appropriate, uses computational algorithms embedded into the Network Management System (NMS) to reconfigure the available network to restore customer supplies. TRS aims to ensure that where possible customer supplies are restored via automatic switching actions within a three minute window.

3.3.4.2 Automation on 11kV and 6.6kV networks

Fault Location, Isolation and Supply Restoration (FLISR) is a system, targeted at the 11kV and 6.6kV networks, that uses software algorithms, Remsdaq and SCADA data communication systems to automatically reconfigure the electrical distribution network to restore supplies to customers within the first five minutes of a power supply interruption.

3.3.4.3 Auto Load Reduction Schemes (ALRS)

ALRS are employed at some sites to protect the plant and long-term supplies to customers.

ALRS normally:

- Only operates when some of the plant at a site is out of service
- Sheds load to within the capability of the remaining plant in service at a site, and
- Recognise the real time loadings on the system.

3.3.5 Use of auto-reclosers

Auto-reclosing is employed on 132kV, 33kV, 11kV and 6.6kV networks. Delayed auto-reclosing at 132kV is detailed in CP338 – 132kV Protection.

The policy for application on the 33kV, 11kV and 6.6kV networks is detailed in EPD321 – policy for automatic reclosing of 33/11/6.6kV overhead lines.

Auto-reclosing is:

- Utilised at 33kV but only in the form of a single shot reclose initiated from the main protection, and inhibited by a permanent intertrip-receive or busbar protection operation, and
- Employed extensively at 11kV and 6.6kV to ensure that as far as possible supplies are maintained for non-damage faults on overhead line networks.

Modern reclosers are utilised in conjunction with existing reclosers, sectionalisers and auto-sectionalising links.

The maximum number of trips is four with the preferred mode of operation to utilise two instantaneous protection trips followed by two Inverse Definite Minimum Time (IDMT) trips.

The number of instantaneous trips can be varied but the last trip will always be IDMT. There will be a standard dead time of 5 seconds between each reclosure and a reclaim time of 15 seconds.

Sensitive earth fault protection is also used and a single auto-reclose shot is allowed following a trip.

Modern reclosers and protection also employ sequence co-ordination to minimise the number of trips seen on the network, and this is employed wherever possible.

3.4.1 Load managed areas (LMAs)

LMAs are sections of the network where special arrangements are in place to manage security and continuity of supply.

LMAs are designated in accordance with the provisions of the electricity Distribution Connection and Use of System Agreement (DCUSA).

We actively manage the electricity distribution network as real-time configuration determines whether or not it is necessary to limit a customer to their firm Maximum Import Capacity (MIC). The following are key factors in determining when and how we actively manage the network:

- The level of generation export capacity is determined by the real-time configuration of the distribution network
- Some customers have both a firm MIC and a non-firm MIC, which is usually larger, and
- If customers export excess generation to the network, we may make arrangements for output to be constrained between zero and their full MIC.

Under fault conditions some customers may be requested to restrict their usage, until the network is once again reconfigured and allow their normal load to return.

3.3.7 Operating voltages

The Electricity Safety, Quality and Continuity Regulations (ESQCR) (2002) defines a frequency of 50Hz and low voltage supply of 230V with a permitted variation of ±1% for frequency and +10% or –6% for voltage. For high voltage operating below 132kV the permitted variances are at ±6%, but for high voltage operating at 132kV or above are set at ±10%.

3.3.8 Power quality

Our policy on power quality includes:

- Transient variations in voltage and frequency, and
- Limits of voltage fluctuations, harmonics and fault level.

The policy is detailed in EPD290 – Power quality strategy and further guidance on application is provided in **CP290 – Power quality**. Where power quality issues do arise these will be dealt with as detailed in the policy.

Power quality will generally be as specified in BS EN 50160 Voltage characteristics of electricity supplied by public distribution systems.

In addition, the requirements of Energy Networks Association (ENA) Engineering Recommendation P28 Planning limits for voltage fluctuations caused by industrial, commercial and domestic equipment in the United Kingdom, and ENA ER G5/5 Limits for harmonics in the UK electricity supply system shall be met.

3.4 Geographical area covered

Our distribution network serves an area broadly covering the North West of England including:

- Cumbria
- Lancashire
- Greater Manchester, and
- Parts of Cheshire, Derbyshire and North Yorkshire.

This section provides small scale geographic plans of the 132kV, 33kV and 6.6-11kV systems indicating the approximate location of substations and circuits.

The 132kV system is shown geographically on a single page. Due to the scale used it is not possible to separate some of the circuits where they run closely together.

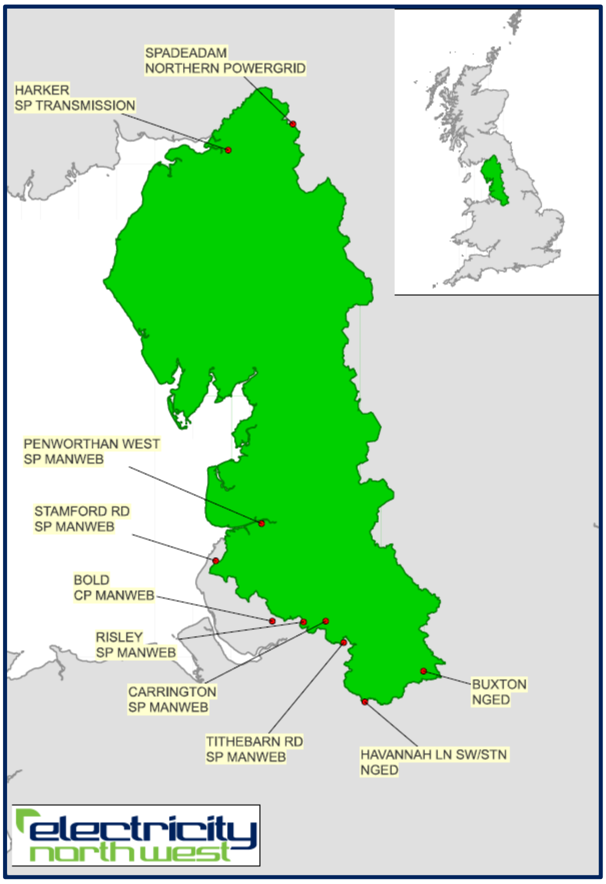
The 33kV system is shown on four pages which cover roughly the same area. Due to the scale used it is not possible to separate some of the circuits where they run closely together. This is noticeable mainly, but not exclusively, in urban rather than rural areas.

The HV network is divided up into 9 control regions. These regions can be viewed by clicking within the documents.

Please refer to Appendix 1 to view these diagrams, or for access to the HV diagrams please register for NAV (network asset viewer) access.

3.5 Adjacent networks

There are a number of interface points with other networks. The majority of these are with National Grid but there are a small number with other Distribution Network Operators (DNOs).



In order to manage development of the network at these interface points effectively, regular joint co-ordination meetings with National Grid are held where each company's work programme is discussed and co-ordinated. Network development at interface points with other DNOs is discussed as required by specific network developments that would affect both parties.

Contact details for adjacent networks including National Grid can be found on the following page.

Company name	Address
National Grid	National Grid House, Warwick Technology Park, Gallows Hill, Warwick, CV34 6DA
Northern Powergrid	Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
SP Energy Networks (SP Distribution)	320 St. Vincent Street, Glasgow, Scotland, G2 5AD
SP Energy Networks (SP Manweb)	3 Prenton Way, Prenton, Merseyside, CH43 3ET
National Grid Electricity Distribution	Avonbank, Feeder Road, Bristol, BS2 0TB

3.6 Load growth

Due to the energy and cost of living crisis experienced last year, we observed a slight decrease in the overall electricity demand in our region compared to the previous financial year. This decrease is likely attributed to reduced consumption from the domestic and commercial sectors in response to higher gas and electricity prices. However, in some substations we have still observed a rise in peak demand driven by local developments and Low Carbon Technology (LCT) uptakes.

Despite the energy crisis, we observed a record increase in Electric Vehicle (EV) registrations, mainly driven by the reduced battery prices and the reduced whole life cost compared to conventional internal combustion engine vehicles. This year, extensive engagement with most local authorities in our area has enabled us to capture a wide range of projects expected to go live or within Local Authority (LA) ambitions. This has allowed for a more realistic representation of demand growth from mature planned developments without an application for network connection yet.

Our Long-Term Development Statement (LTDS) demand forecast is based on the ‘Best View’ scenario from our 2023 Distribution Future Electricity Scenarios (DFES), due for publication by the end of 2023. The ‘Best View’ scenario aligns with the ENA Open Networks DFES-FES product definition, signifying it as the highest certainty scenario for our region within a 1 to 10 years horizon followed by central assumptions in the longer term.

Following its standardised definition across all DNOs, the ‘Best View’ scenario considers:

- the political landscape: currently marked by uncertainty due to recent announcements that may postpone the adoption of low carbon technology by a few years. However, considering the exponential trends in the historical Electric Vehicle (EV) uptake and the fact that the ban remains in effect (though potentially delayed), we foresee the same trend in the short-term EV uptake. The uptake is primarily driven by a demographic segment, including early adopters and green-adopters.These adopters are inclined towards achieving net-zero, irrespective of potential policy relaxation and supported by large manufacturers that in the last year exponentially increased their EV production.

- local policies: no local policy has been identified (eg, air quality zones) that could prevail over national policies and accelerate decarbonisation.

- justified stakeholder engagement inputs: this includes the connections pipeline, supporting evidence from local customer engagement to inform demand and generation growth trends. Also our engagement with local authorities has enabled us to incorporate into forecasts mature action plans from their Local Area Energy Plans (LAEP).

- local characteristics: the consumer choice models used by our expert forecasting partners have been influenced by local factors such as access to the gas grid for heat pump adoption, planning permission for renewable installations, housing stock for efficiency measures, etc.

By reporting the ‘Best View’ scenario forecast for peak demand in LTDS, we can provide clarity with a single scenario. The Best View scenario forecast in LTDS can assist stakeholders in understanding local demand and generation trends over the short term. At the same time we recommend to LTDS users to check our DFES reports and data to understand our full range of scenarios. Consistent with previous years, the methodology and computational processes considered for this year’s ‘Best View’ and other DFES scenarios are based on the bottom-up methodology developed under our NIA funded ATLAS project (2015-2017).

3.7 Other sources of network information and charging information

At Electricity North West we are committed to enhancing the experience of our customers and improving data transparency and as such we publish a number of helpful tools and datasets containing information relating to our network, some of which are listed below. Our Data Portal allows customers to extract and overlay their chosen datasets in multiple different machine readable and geographical formats. New technologies and changing customer requirements are transforming the way that electricity is generated, distributed and consumed; and our networks are becoming smarter and more flexible. As the North West’s electrical network operator, it is our responsibility to plan for the future, support the region’s economic development and facilitate the transition to a net zero carbon future.

In this part of our website, you will find the current and previous publications of our Distribution Future Electricity Scenarios (DFES) report, which details our view of the North West’s future electricity requirements.

It contains a range of possible views of the future, which indicate how different influences can change electrical demand and generation on our network. Our DFES report is accompanied by a series of complementary documents which show the impact of our customers’ predicted requirements on our network.

- DFES workbook – allows customers to view the raw data associated with the DFES report to gain an understanding of what our forecasts mean for them on a local level
- Network Headroom Report – applies DFES forecasts to indicate the future ability of our existing network to accommodate predicted demands and generator connections under all DFES scenarios up to 2050

3.7.1 Heatmap tool

To allow developers to assess the level of capacity that might be available for new connections to our network, we provide several 'heatmap tools'. The EHV heatmap tool takes the form of an excel workbook and is available to download on our website here. Whereas the HV information is available within our data portal here. The tools allows users to input the details of their project, including the location and capacity requirement, and returns a red/amber/green status depending on whether the network can currently facilitate it. Users can also access the detailed datasets for their own analysis.

3.7.2 Flexible Services

Requirements for Flexible Services in order to address capacity related issues at specific sites are published regularly on our dedicated webpage. We provide our customers with a 'Flexibility Map' which allows them to identify if we are currently seeking flexible services in their area.

Our intentions for procuring flexibility services for the current regulatory year are published within our Distribution Flexibility Procurement Statement, detailing timelines, locations, prices and processes.

In the interest of transparency, the results from all of our previous flexibility tender can also be found on our website here. If you would like to find out more about flexible services, there are several helpful guides available within this document library, and some case studies available for potential participants.

3.7.3 Network Development Plan

Our Network Development Plan (NDP) is an important source of information on the future network as it shows where on our network new connections are suitable and where flexibility services may be advantageous. It also provides information on how we intend to create capacity over the next ten years. The latest version of our Network Development Plan can also be found on our website here.

3.7.4 Embedded Capacity Register

The register implements an industry agreed format which has been developed through an ENA Open Networks project and subsequently incorporated into DCUSA, mandating production by all Distribution Network Operators. The ECR provides information to stakeholders on generation, storage and flexible demand resources that are connected, or accepted to connect, to Electricity North West's distribution network and is updated on a monthly basis. Previously this register included assets with connecting capacities greater than 1MW, however since June the register now incudes all assets with connecting capacities greater than 50kW. The register also includes information about Flexibility Services that are being provided by connected resources, and details about network reinforcements. The register is accessible through our Open Data Portal here.

3.7.5 Connection charging information

The Common Connection Charging Methodology (CCCM) describes the methodology under which customers will be charged for a connection to the distribution system belonging to Electricity North West Limited, while the Connection Charging Statement provides the basis of charges for the provision of a connection.

We use standard industry methodologies to calculate our charges known as the CDCM and EDCM. The CDCM is the Common Distribution Charging Methodology that applies to most customers. The EDCM is the Extra-high voltage Distribution Charging Methodology which is applied to customers connecting to our network at extra-high voltage levels as designated in our licence. These charging statements are published annually on our use of system charges webpage.

Additionally, in order to promote competition in connections, we provide information for both our customers and for Independent Connection Providers (ICP's) or Independent Distribution Network Operators, to keep you informed and to explore other options regarding the contestable elements of your connection.

If you have any further questions after referring to this information, you can contact:

Connections Charging Manager
Electricity North West Limited
Frederick Road, Salford
M6 6QH.

4 Detailed Information

This section contains details of the 132kV network down to the lower voltage busbars of primary substations. A brief description of the information provided in the corresponding data tables is provided, while the tables themselves can be found in the separate Appendix documents.

4.1 Schematic diagrams

There are three 132kV schematic diagrams, ten 33kV schematic diagrams and nineteen 6.6-11kV schematic diagrams. These schematic diagrams are based on the Electrical North West operational diagrams, but some of the operational information has been removed. Similarly, some additional information has been added in order to make it easier to relate the circuit tables to the schematic diagrams. An additional document within Appendix 2 entitled 'Substation Key' is provided to aid this identification.

It is important to understand that these diagrams have been prepared specifically for the Long Term Development Statement to show the network configuration and so are not sufficient for operational purposes.

The diagrams in this section show the "system normal" running arrangements for the respective systems. An arrow symbol is used to represent a normally open point (NOP). The diagram titles are a guide to the approximate area covered but please be aware that they do not represent exact regional divisions.

The following diagrams are provided in Appendix 2.

4.1.1 132kV and 33kV schematic diagrams

- 132kV diagram
- 33kV diagram.

4.1.2 HV (11kV and 6.6kV) schematic diagrams

- Barrow
- Blackburn

- Blackpool
- Burnley & Nelson
- Carlisle
- Chorley
- Kendal
- Lancaster
- Manchester North
- Manchester South
- Mid Lancashire
- Peak Area North
- Peak Area South
- Penrith
- Preston
- Rawtenstall & Accrington
- Settle
- South Lancashire
- Workington

4.2 Data Tables

4.2.1 Table 1: Circuit data

This section provides tables of data for 33kV and 132kV circuits, along with tables of data for 6.6kV and 11kV interconnectors through which some 33/6.6kV or 33/11kV substations normally operate in parallel.

The HV circuit data in this section are equivalent circuits representing HV interconnection between primary substation and are provided to allow accurate modelling of the 33kV network. It does not represent the actual data of the installed HV circuits.

The Circuit data table can be found in Appendix 3: Circuit Data (Table 1).

4.2.2 Table 2: Transformer data

This section provides details of the 132kV and 33kV transformers on the Electricity North West distribution system.

The Transformer data table can be found in Appendix 3: Transformer Data (Table 2).

4.2.3 Table 3: Load data

The period used for load information is financial year ending 31 March. This is the period normally used within Electricity North West Limited for system planning purposes, and includes the winter peak for April 2022 – March 2023.

4.2.3.1 Maximum demand

Unless otherwise stated, the maximum loads given in the tables are taken via transducers fitted to metering on the lower voltage side of the transformers referred to. Adjustments have been made to account for connected generation. In a small number of cases there is no transformer metering facility, in which case the maximum load has been estimated. This applies mainly to very small transformers and some traction supplies. Estimated maximum loads have also been used in a small number of cases where the load transducers failed to provide a reading or where the reading is suspect. Wherever estimated readings have been used this is stated in the notes column of the load tables.

4.2.3.2 Firm capacity of a substation

The firm capacity at a substation is the capacity available immediately after the loss of the most critical branch without manual intervention but includes any capacity made available due to automatic switching. We have also shown the estimated contribution to capacity from connected distributed generation used in assessment of compliance with ENA ER P2/8.

In these load tables substation firm capacity is related to transformer rating, incoming circuit rating and switchgear rating). The permissible loading of a plant and cables is a function of nameplate rating, temperature rise at nameplate rating, ambient temperature and shape of load curve. The substation firm ratings quoted are normally the remaining long term emergency cyclic rating (at an ambient temperature of 0º Celsius) of the remaining asset(s) when the largest asset is out of service.

In the case of a single transformer site the firm capacity will reflect the restoration capability of the lower voltage system which may be automatic, but in some circumstances may not be e.g. substations supplying a maximum load of less than 12MVA for which Engineering Recommendation P2/8 provides for manual restoration. Cyclic rating is based on an average daily load factor below 0.833 equivalent to 8 hours at high load with 16 hours at less than 75% of high load. There are circumstances where the load cycle at a particular substation indicates that the long-term emergency rating is inappropriate. For example, where the load is high for more than eight hours per day the continuous rating will be used.

4.2.3.3 Minimum load scaling factor

As a general guide the minimum demand on a substation is usually around 25% of the peak demand.

The Load data table can be found in Appendix 3: Load Data (Table 3).

4.2.4 Table 4: Fault level data

This page provides tables of information for three phase and single phase faults at grid and primary substations, and details the operational instructions and procedures in place to address existing fault level issues.

EPD220 – 'Fault Level Management' details the policy adopted within Electricity North West to manage fault level issues. In the operational phase the operating margin shall be 0% i.e. equipment can be operated where the prospective short circuit current is less than or equal to 100% of the assigned rating of the equipment. Experience gained over many years of operating the distribution network at this operating margin shows that an acceptable level of safety is achieved. When assessing network fault levels Electricity North West complies with all relevant industry standards. In the planning phase the operating margin shall be 5% i.e. where the prospective short circuit current is in excess of 95% of the assigned rating of the equipment then the network shall be assessed to establish whether network reinforcement is required.

Please also refer to the explanatory notes provided at the bottom of the appropriate fault level[1] tables.

The fault level data table can be found in Appendix 3: Fault Level Data (Table 4).

4.2.5 Table 5: Generation data

A high level summary of connected and accepted generation connections to parts of the distribution network described is provided for each interface point between the 132kV and lower voltage network. This covers the previous twelve-month period.

The Generation data table can be found in Appendix 3: Generation Data (Table 5).

4.2.6 Table 6: Interest in a connection

A high level summary of interest in demand and generation connections to parts of the distribution network described in the detailed information section is provided for each interface point between the 132kV and lower voltage network. This covers the previous twelve month period up to 30 September 2021.

This information can be found in Appendix 3: Interest in a connection (Table 6).

4.2.7 Table 7: HV feeder load data

Table 7 contains the average half hourly loading (in Amperes) for the previous financial year of all HV feeders measured at the relevant primary substation. Primary substations have been grouped by the bulk supply point (BSP) they are fed from.

The half hourly loading data provided in the file is raw data which reflects conditions on the network at the time and will include abnormal running of the network.

The HV Feeder Load Data table can be found in Appendix 3: HV Feeder Load Data (Table 7).

4.2.8 Distribution substation information

Table 8a: Distribution substation data

Table 8a provides information for every distribution substation, including:

- Transformer size
- Customer numbers
- Maximum demand indicator (MDI) readings

Feeder fuse size.The Distribution substation data table can be found in Appendix 3: Distribution substation data (Table 8a).

Table 8b : Distribution substation peak demand for monitored sites

ENW started a programme in ED1 to install monitoring at the head of the LV feeders of ground mounted distribution substations. The programme continues in ED2 and by the end of ED2 distribution substations providing supplies to approximately 95% of our customer will be monitored. Data from

[1] Fault levels are at primary busbar only.

the monitored distribution substations has been processed to determine the annual peak demand and is provided in Table 8b.

4.2.9 Table 9: DINIS network modelling data

Distribution Network Information System (DINIS) is a commercially available power system analysis software package that allows planning engineers to carry out technical studies (load flow, fault level studies etc) of electricity distribution networks. Electricity North West uses DINIS to carry out technical studies of the high voltage (6.6kV and 11kV) electricity network.

A snapshot of DINIS network modelling data is provided in Table 9. This is not an accurate representation of the conditions on the network at the time of an assessment by a developer due to the dynamic nature of the HV network.

The DINIS Network modelling data table can be found in Appendix 3: DINIS Network modelling data (Table 9).

4.3 Additional information

Requests for other detailed information can be provided for specific parts of the network on request and may have associated charges.

Examples of the information that can be provided include:

4.3.1 Network data

- Circuit complex impedance (including zero sequence) and rating
- Circuit susceptance data for voltages other than 132kV
- Feeder load data (Amps)
- Group load data (MW and MVAr)
- Equivalent short circuit impedance at a busbar, and
- Limitation on the firm capacity of a substation.

4.3.2 Plant data

- Circuit breaker fault level ratings
- Transformer impedance, rating and tap range (including earthing details and hot site identification), and
- Transformer zero sequence reactance data.

4.3.3 Fault level studies (including limitation on fault level)

- 11kV fault level study (Root mean squared (RMS) break currents decremented to expected protection operation time)
- 33kV fault level study
- 132kV fault level study, and
- Indicative cost of work to reduce the limitation on fault level.

Voltage quality studies will not normally be undertaken for generation connection enquires, unless there is some aspect of the machine or its connection that makes such studies appropriate.

The following assumptions are made in undertaking studies:

- Maximum and minimum demands are used based on actual system operating conditions, or anticipated operating conditions where these are more appropriate for the study in question
- Generally only one contingent outage will be considered. However where there is more than two-circuit security or complex mesh networks, appropriate two-outage contingencies will be considered
- Circuit ratings will be used appropriate for the loading cycle anticipated. It will generally be appropriate to use continuous ratings for plant and equipment subject to generator loadings
- Appropriate pre-fault operating and running arrangements are made following first circuit outage to cater for subsequent outages, and
- Switchgear make and break duties are assessed at 100% of their nameplate ratings.

In each instance the data will be made available on payment of the standard costs. IPSA is predominantly used as a power system analysis tool for the 132kV and 33kV networks, and DINIS for 11/6.6kV networks. When considering connection enquiries or feasibility studies, the following system studies will generally be undertaken for all generator applications:

To request any of the above please contact LTDS@enwl.co.uk.

4.3.4 Timescales and cost

Please allow six to eight weeks from the date of receipt of payment before receiving requested detailed information.

Please also note the charges in the above statement for system and fault level studies only include an initial study. If you would like further studies following the initial study, this will incur the same charge again.

4.4 Asset records

If you require copies of records showing the locations of cables etc., please see the dedicated Know before you dig (enwl.co.uk) page. Alternatively, if you require more detailed records, then please sign up to access our network asset viewer.

5 Network Development Proposals

This section provides information regarding firm network development proposals over the next five years and contains network development proposals for the 33kV and 132kV networks which have received approval prior to the November update, or subsequent May update. This list includes discretionary capital investment proposals that have received internal full financial approval and proposals related to customer connections where a connection offer has been accepted.

As far as is reasonably possible, the network development proposal information is provided in the same format as the detailed information for the existing network. Any proposals for the network which do not result in material changes to the detailed information in the Long Term Development Statement have been omitted. Examples of this include where a short length of cable is to be replaced with no change to the overall circuit rating and impedance, or where an overhead line is to be refurbished with no change to the conductor size or spacing.

5.1 Areas expected to reach or exceed their capability within the next five years

Load growth on the distribution system may cause the firm load rating of parts of the system to be exceeded. This information is provided in the load data table (Table 3). Where there is insufficient infrastructure in specific locations to provide either the required or forecasted level of capacity, we detail within the Network Development Plan the potential options available to mitigate this constraint. Where applicable, we publish flexibility tenders to address these issues. To find out more, please visit our dedicated flexible services webpage.

Another effect of load growth is the increase in fault level caused by induction motor contribution, which is proportional to the load connected. This information can be found in the fault level table (Table 4).

5.2 Proposed action where calculated fault levels exceed switchgear fault ratings

In cases where the calculated fault level (make and/or break) is greater than the appropriate fault rating of the switchgear at the location referred to, a combination of operational management of the situation and asset replacement or enhancement can be employed. In deciding which action is most appropriate consideration is given to whether the break or make fault rating is exceeded, and the required duty of the equipment. Fault level reduction and automatic switching systems are considered as well as replacement or removal of the affected equipment, depending on the overall asset need for the network involved.

Network Development Proposals

GRID SUPPLY POINT	AREA OF THE NETWORK AFFECTED	COUNTY	CUSTOMERS AFFECTED[2]	OUTLINE OF WORKS	REASON FOR CARRYING OUT WORKS	EXPECTED COMPLETION DATE	EXPECTED IMPACT ON THE DISTRIBUTION NETWORK CAPABILITY	NEW FIRM CAPACITY
Harker/Hutton GSP Group	Annie Pit primary	Cumbria	10,800	Overlay of small portion of 33kV circuit feeding Annie Pit primary	Reinforcement to allow full use of installed transformer capacity	February 2024	Increase in firm capacity	23MVA
Harker/Hutton GSP Group	Kirkby Lonsdale primary	Cumbria	2,500	Replacement of existing 33kV switchgear	Asset condition	February 2024	Increase in fault level capability	No change
Harker/Hutton GSP Group	Keswick primary	Cumbria	5,500	Replacement of existing 11kV switchgear	Asset condition	February 2024	Increase in fault level capability	No change
Harker/Hutton GSP Group	Carlisle to Morton Park 33kV circuits	Cumbria	10,000	Replacement of existing 33kV overhead line circuits with underground circuit with higher capacity	Reinforcement to provide capacity in St Cuthbert's Garden Village area in Carlisle.	February 2024	Increase in firm capacity at Morton Park primary and facilitate future connections in St Cuthbert's Garden Village area in Carlisle	23MVA

[2] These values are approximates.

Network Development Proposals

GRID SUPPLY POINT	AREA OF THE NETWORK AFFECTED	COUNTY	CUSTOMERS AFFECTED[2]	OUTLINE OF WORKS	REASON FOR CARRYING OUT WORKS	EXPECTED COMPLETION DATE	EXPECTED IMPACT ON THE DISTRIBUTION NETWORK CAPABILITY	NEW FIRM CAPACITY
Macclesfield GSP	Withyfold primary	Cheshire East	12,700	Primary transformers replacement	Asset condition	March 2024	Firm capacity is initially reduced to 22.9MVA until replacement of the HV switchgear in 2025/26 coupled with minor 33kV circuit reinforcement when firm capacity would increase to 32MVA	22.9MVA
Padiham GSP	Padiham GSP	Lancashire	142,100	132kV switchgear replacement	Switchgear condition	April 2026	Improvement in fault level capability	No change
Rainhill GSP (NB. Not in ENW but in SPEN)	Golborne to Newton Le Willows 33kV circuit	Lancashire	31,000 on Ashton in Makerfield / Haydock / Golborne 33kV mesh	Underground the overhead line (OHL) portion and replace the gas assisted cable on the Newton le Willows–Golborne 33 kV circuit.	Asset condition	March 2025	Increased capacity on Ashton in Makerfield / Haydock / Golborne 33kV mesh	N/A

Network Development Proposals

GRID SUPPLY POINT	AREA OF THE NETWORK AFFECTED	COUNTY	CUSTOMERS AFFECTED[2]	OUTLINE OF WORKS	REASON FOR CARRYING OUT WORKS	EXPECTED COMPLETION DATE	EXPECTED IMPACT ON THE DISTRIBUTION NETWORK CAPABILITY	NEW FIRM CAPACITY
Rochdale GSP	Littleborough primary substation	Greater Manchester	7,700	Replace at Littleborough primary substation of transformers T11 & T12 and 6.6kV switchgear	Asset condition	October 2025	Increase in firm capacity at Littleborough primary	22.9MVA
Stanah GSP	Peel 132kV switching station	Lancashire	87,700	132kV switchgear replacement	Switchgear condition and second circuit outage capacity issue	October 2025	Improvement in fault level capability and increased second circuit outage resilience for bulk supply points supplied from the switching station	No change

While all reasonable effort has been made to ensure the accuracy of all the information in this document, no liability will be accepted for any loss or damage caused by the information not being accurate.