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Electricity Policy Document 279

Issue 12 September 2023

Distribution System Design General Requirements

Amendment Summary

ISSUE NO. DATE	DESCRIPTION
Issue 10 **June 2022**	Section 4.5 modified to specify modelling requirements for new BESS connections, including voltage step change assessments. Section 4.19 modified to recognise the revision to EREC G100 which has been extended to cover import limitation schemes in addition to the existing export limitation arrangements. Prepared by: Peter Twomey Approved by: Policy Approval Panel and signed on its behalf by Steve Cox, DSO Director
Issue 11 **Feb 2023**	Policy for 'behind the meter connections of BESS by third parties to other customer networks added in 4.21 Operation of BESS by third parties at large demand sites Section 4.5.1 Power factor requirements for new BESS and embedded generation connections specified. Diversity between multiple BESS sites operating in a coincident manner specified. Concept of including attrition rates and diversity between new demand and generation sites added in subsection 4.5.2. Network Studies Section 4.20 – new section added covering the connection of Managed Connections to dedicated circuit breakers at a primary or 33kV board. Direct Connection of Managed Connections to primary and 33V switchboards Other minor editorial updates made throughout the document, not marked. Prepared by: Peter Twomey Approved by: Policy Approval Panel and signed on its behalf by Steve Cox, DSO Director
Issue 12 **Sept 2023**	Clarification on the application of diversity factors in Utilisation, diversity and attrition of new connection applications. Network studies shall model the full import/export requested for individual application against a background of diversified generation and demand. Prepared by: Peter Twomey Approved by: Policy Approval Panel and signed on its behalf by Paul Turner, PAP Chair.

Contents

1 Introduction

The general principles contained within this Electricity Policy Document (EPD) shall be applied to all new work on the network (Network) of Electricity North West Limited (Electricity North West). The decision as to whether existing networks shall be brought into line with this EPD when reinforcements or material alterations are carried out (including asset replacement work and new connections) will depend on individual circumstances and each case shall be actively considered.

This document is one of the following suite of policy documents relating to Network Design.

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 - Distribution System Design - Low Voltage Network

2 Scope

This document describes the general distribution network design principles, at all voltages from LV to 132kV, which shall be used by Electricity North West Limited (Electricity North West), operating as service provider, and any third party connector. It will assist network designers in discharging their responsibility for compliance with The Electricity Safety, Quality and Continuity Regulations 2002, Electricity Distribution Licence – Condition 5, The Distribution Code and appropriate safety legislation. Additional information and guidance are available, in Code of Practice 279, to staff and contractors employed by Electricity North West.

3 Definitions

For the purpose of this document the following definitions apply:

BESS	Battery Energy Storage Systems
CP	Code of Practice
DECC	Department for Energy and Climate Change
ENA	Energy Networks Association
Electricity North West	Electricity North West Limited
EPD	Electricity Policy Document
ER	Engineering Recommendation
ES	Electricity Specification
LV	Low Voltage – a voltage less than 1000V
NGET	National Grid Electricity Transmission

4 General Requirements

4.1 Approval

The Network Planning Policy Manager, Policy and Implementation, Electricity North West shall approve all procedures used in network design.

4.2 Safety Legislation

The Network shall be designed to be safe and comply with all current safety legislation.

The design stage shall take into account the requirements of the Construction (Design & Management) Regulations 2015 (CDM).

The design stage shall take into account the requirements of the New Roads and Street Works Act 1991 (NRSWA).

Where possible all underground equipment shall be installed in accordance with National Joint Utilities Group publication - NJUG Guidelines on the Positioning and Colour Coding of Underground Utilities' Apparatus. The recommended arrangement of Utilities' services is shown in Appendix A. Neither LV nor 11/6.6kV cables shall be laid lengthwise under carriageways, unless evidence is produced (eg congestion under the footways) that there is no reasonably practicable alternative.

4.3 Legal Rights

Rights to the placing of equipment shall be obtained before any asset is erected on site, or, if erected by a third-party, adopted as an Electricity North West asset. The principal requirements, in this respect, are expected to be:

- substation purchase or long-term lease; planning permission;
- cable statutory rights in public highway or permanent easement;
- overhead line statutory rights in public highway or wayleave; planning permission; DECC consent.

"Long-term" in this context shall normally be for at least the expected life of the equipment.

4.4 Industry Documentation

When designing distribution networks, account shall be taken of all relevant documents, especially EPDs, ESs, ENA ERs, NGET standards or appropriate Central Electricity Generating Board standards held as reference documents.

The recovery and identification of idle assets shall be in accordance with EPD201 - Recovery and Identification of Idle Assets

All designs shall ensure conformity with Electricity North West's Environmental Policy.

Where a proposed substation site is in a flood plain, the policy requirements of EPD355 - Substation Flood Protection - shall be applied.

All designs shall use only Electricity North West approved cables, lines, plant & protection systems and associated components.

All protection systems shall comply with EPD350 – Protection for 132kV, 33kV and 11kV Systems.

All designs for new connections from the Network shall comply with ES210 - New Connections, Extensions and Alterations.

Measurement transformers and associated equipment used for settlement metering purposes shall facilitate conformity with CP510 - Commissioning of Measurement Transformers connected to Settlement Metering Equipment.

4.5 Network Studies

4.5.1 Network Modelling

When load-flow and voltage studies are undertaken for design purposes, the standard approach, based on its being the worst-case condition, shall be to model loads as fixed P and Q, i.e. the loads, both real and reactive, are independent of voltage. However, at the discretion of the Head of Strategic Planning (or nominee) and where there is sufficient knowledge of the local network to justify it, the load may be modelled, either as constant current, i.e. the loads, both real and reactive, vary linearly with voltage, or as a combination of fixed P and Q and constant current.

Battery Energy Storage Systems (BESS) have unique operating régimes and require specific study conditions, particularly for voltage step change, where coincident operation of multiple sites may occur due to operation in the same commercial markets. More generally, the adverse effect of all new embedded generation whose routine operation may cause voltage step change on network voltage shall be mitigated by specifying operation in leading power factor. The network conditions tabulated below shall be applied for BESS and relevant embedded generation connection studies, unless stated otherwise in the Standard Application Form (SAF). Site specific parameters such as power factor range and ramps rates shall be used if provided in the SAF.

Individual BESS and embedded generation assessment			**Coincident swing multiple BESS only**		
Limit	**Network condition**	**Power Factor**	**Limit**	**Network condition**	**Power Factor**
3%	n-1 or n-0* if this is the site's connection arrangement	0.99 lead when importing and exporting P (132kV point of connection) 0.98 lead when importing and exporting P (33kV and HV point of connection)	6%	n-1	0.99 lead when importing and exporting P (132kV point of connection) 0.98 lead when importing and exporting P (33kV and HV point of connection) Apply 0.5 diversity over all BESS

For clarity, operation in leading power factor when exporting real power P means importing reactive power Q. Similarly, operation in leading power factor when importing P means exporting Q.

*Some sites may be designed to n-0 security due to other network constraints such as thermal limitation. The voltage step assessment for these sites shall be done with network intact conditions to match the actual connection arrangement.

The power factors specified in the table above shall be applied to all new connection studies, as well as those sites with accepted offers but as yet not connected. The power factor shall be specified in the connection

contract. Real time operation shall be monitored periodically once the site is commissioned. Specific protection or monitoring devices are not required.

It is appropriate to apply a diversity factor when studying coincident swings of multiple BESS sites. This recognises the fact that not all BESS sites will operate simultaneously because sites will have different market participation. The output from all accepted and connected BESS shall be reduced by a factor of 0.5 when modelling voltage step. This reduction does not apply to thermal or fault level in coincident power swing studies. This reduction factor is specifically intended for coincident power swing assessments. The diversity and attrition factor described in 4.5.2 below shall not be applied to these studies.

4.5.2 Utilisation, diversity and attrition of new connection applications

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Not all connection applications progress to a constructed scheme, and for schemes that do progress it is possible the import or export capacity originally requested will never be realised. Furthermore, once constructed, there will be diversity between newly connected schemes. In all but highly unusual circumstances, e.g. where there is just a single large connection scheme, these factors mean that when performing a network study it is inappropriate to simply summate the total import or export capacity requested for all new connection applications and assume this will be realised on the network, i.e. the background assumptions. There needs to be recognition of the utilisation of capacity, attrition rate and diversity between applications in this background assumption. Therefore, scaling factors shall be applied when modelling new connections. Note: the scaling factors shall be applied as appropriate to both the new connection application, i.e. the connection being assessed, and the accepted, proposed and connected connections.

An analysis of the project progression of EHV and HV schemes has demonstrated around 66% of applications progress to construction, and then there is diversity between connections when operating. Therefore, a scaling factor of 60% shall be applied initially. For clarity, all new HV and EHV connections, including those which have accepted offers but are as yet to connected, shall be modelled, with their maximum import or export capacities reduced by a factor of 0.6, i.e. background assumption. With approval of the Head of Strategic Planning (or nominee) and where justified, alternative scaling factors may be used.

The scaling factor shall be applied to both thermal and short circuit assessment. Fault current attenuation shall be achieved in the IPSA models by increasing both the transient and sub-transient impedances of all generators by a factor of 1.25.

The attrition and diversity factors to be applied to all demand and generation connections is summarised below.

	Attrition factor	**Diversity and unrealised MIC/MEC factor**	**Overall factor to be applied**
Applied for	N/A	1.0	**1.0**
Accepted and proposed	0.66	0.9	**0.6**
Connected	N/A	0.9*	**0.9**

*Do not apply to fault level calculations for generation, apply only to thermal

Existing sites may not be utilising their total MIC or MEC. Unused contacted capacity may be fully or partially discounted in network studies, particularly where historic demand profiles are available and these show a consistent underutilisation.

This scaling factor shall be updated by regularly reviewing the progression of all new connection schemes through the key milestones of acceptance, constructed, and realised demand. This review shall be undertaken quarterly.

4.6 Security and Quality

As a minimum, standards of security shall be in accordance with ENA ER P2/8 - Security of Supply and Great Britain Security and Quality of Supply Standard. It is implicit that networks designed to comply with these standards shall (except in the case of the connection to a single customer) be capable of sustaining any single fault without disconnecting more than 1MW of customer demand, for longer than switching time.

It should be noted that the security of supply to be provided for an individual customer is not stipulated by ENA ER P2/8. (See Guidance Note 1 of the Distribution Code.) The security of connection provided for an individual customer is largely a matter of negotiation between the customer and Electricity North West. Accordingly, subject to Electricity North West's requirements to develop its network in an efficient manner (See, in particular, EPD282, subsection 4.5.3.) it may be acceptable for an individual customer to be connected via a single radial branch, regardless of its demand. However, when considering network assets, which are intended to provide connection for more than one customer, the level of security shall be at least that required by P2/8, as applied to each appropriate demand group.

Where specific designs or equipment are already deployed in the Network, with a view to improving security of connection beyond the minimum requirement, e.g. remote control or special protection schemes, no alteration to the Network, which would compromise these arrangements, shall be undertaken without the written agreement of the Network Planning Policy Manager.

Consideration shall be given to the quality and availability of electricity from the Network in terms of frequency and duration of interruptions, voltage fluctuations, waveform distortion or other disturbances.

Assessments or tests shall be made to ensure that new equipment being installed by customers (especially industrial or commercial process plant) shall not adversely affect the quality of existing supplies beyond acceptable levels. It is essential to comply with the guidelines set out in appropriate EPDs, ENA ERs and European Standards, e.g.:

- ENA ER G5/5 Limits for Harmonics
- ENA ER P16 EHV and HV Supplies to Induction Furnaces
- ENA ER P28 Planning Limits for Voltage Fluctuations Caused by Industrial, Commercial and Domestic Equipment in the UK.
- ENA ER P29 Planning Limits for Voltage Unbalance in the UK for 132kV and below.
- BS EN 50160 Voltage Characteristics of Electricity Supplied by Public Distribution Systems.
- Distribution Code

- Grid Code

The actual voltage of the network shall not vary from the declared voltage outside the limits permitted by Regulation 27 of the Electricity Safety, Quality and Continuity Regulations 2002, which are:

(a) For a low voltage connection (400/230V), a variation not exceeding 10% above or 6% below the declared voltage at 50Hz.

(b) For a high voltage connection operating below 132kV, a variation not exceeding 6% above or below the declared voltage at 50Hz.

(c) For a high voltage connection operating at 132kV or above, a variation not exceeding 10% above or below the declared voltage at 50Hz.

It is necessary to consider the causes and effects of voltage step change on the Network.

During normal operation of the Network and of customers' equipment (including generation), voltage step changes shall generally be in accordance with ENA ER P28, i.e. no more than ±3% on the Network. When assessing voltage step changes relative to these limits, account shall be taken of the operation of genset voltage regulators, static VAR compensators and transient decay (typically within 5s), but not of tap-changer operation or switching.

Voltage step changes caused by transformer magnetising inrush currents are relatively short (<1s). Nevertheless, customers' installations shall generally be designed to limit voltage step changes caused by magnetising inrush to the ENA ER P28 ±3% limits.

However, special consideration may be necessary, where major fault outages, post-fault switching or commissioning tests are concerned. It is anticipated that the worst credible condition giving rise to a voltage step change will be a secured outage of part of the system, which results in the simultaneous loss of circuits and transformers. Where network studies show that a secured outage would result in a voltage step change at any point on the Network greater than ±10% before the operation of tap-changers, consideration shall be given to the need for reinforcement or other expedient. This is on the assumption that such outages are expected to be rare events, i.e. less frequent than once per year.

Use of automatic load disconnection schemes may be appropriate for new connections that cause voltage step changes greater than 10% and where the Connection Contract allows disconnection of that customer for any network outage. The scheme shall only be allowed when the new connection can be tripped by either a:

(a) local cross-trip within the substation where the worst-case fault/switching operation takes place, or

(b) Inter-tripping at sites remote to the substation where the worst-case fault/switching operation takes place if the inter-tripping circuits have duplicate or redundant operation. A typical functional specification for the cross-tripping scheme is:

- At the interface panel boundary, a Normally Open (NO) Volt Free Contact (VFC) trip contact will trip the Electricity North West CB. This trip contact will provide the signal to trip the customer off in the event of the worst-case fault/switching operation.

- A communications interface will be established between the substation and the Customer site. This communications interface will also be a duplicate or redundant connection.

- Dedicated inter-tripping relays, dedicated tripping relays and multiplexers at each end and fibre between.

- Each duplicate inter-tripping circuit will consist of a tripping relay and multiplexer at each end and a separate fibre cable between inter-tripping panels. A total of four relays, two MUX units (with redundant IO and fibre cards).

- For the purpose of this solution the duplicate / redundant fibre connections to follow the same route, but in separate ducts, with a minimum spacing of 1.0m between them, which is deemed to be sufficient to prevent a single excavation incident damaging both cables.

- Space adjacent to the worst-case fault/switching operation interface panel will be required for the new Customer Tripping panel and Multiplexer panel.

  Alternatively, existing copper pilot wires may be used if records demonstrate they are historically reliable and suitable for modern protection. Designs shall use dual redundant supervised systems, with each circuit in different cables. Cables may take common routes.

(c) Connections which could cause voltage step changes greater than 17% without the mitigation of cross-tripping shall not be permitted.

The design stage shall take into account the requirements of the agreed Ofgem Guaranteed Standards, with a view to achieving optimum reduction of Customer Minutes Lost and Customer Interruptions.

4.7 Network Development

4.7.1 Non-compliant Situations

This policy and many related policies, which apply to the design of new parts of the Network are not intended to be applied retrospectively to existing parts of the Network. However, when any modification is made to the Network, care shall be taken over the extent to which current policy applies to the design of the modification. The following general principles shall be followed:

- no new non-compliant feature shall be created, without the written technical approval of the Network Planning Policy Manager;

- where a non-compliant situation exists, the effect of the modification on any existing part of the Network shall not be to worsen the non-compliance, either in severity or extent;

- the modification itself and all new work associated with the carrying out of the modification shall comply with current policy.

Planning of distribution networks shall take account of known future development and of the relationship between networks at different voltage levels.

When planning a reinforcement of any network the following factors shall be taken into account:-

(a) Loads based on adopted forecasts.

(b) The capacity of the existing Network to carry those forecast loads, taking full account of their daily and seasonal cyclic variations.

(c) Load diversity.

(d) Circuit and plant ratings, as appropriate to the daily and seasonal cyclic variations of the forecast loads.

(e) The capacity of alternative switched circuits to provide transfer facilities between load groups.

(f) Existing transformer and feeder loading.

(g) County and Local Council development plans.

(h) Optimisation of existing Network fault rate and repairs.

(i) Quality of supply considerations as detailed in subsection 4.6 above.

The earthing arrangements for the Network are as shown below and are more fully described in EPD333 - Supply System Earthing.

(a) 132kV Solid Earth

(b) 33kV Resistance Earth — maximum current 3300A

(c) 11/6.6kV Resistance Earth — maximum current 2200A

(d) LV Solid Earth (PME)

Where 11/6.6kV networks are to be supplied from a group of three transformers, reference shall be made to the Policy and Implementation Manager for further guidance, particularly in respect of the capability of stranded copper earth screens of cables to carry the possible earth-fault currents.

The nominal design fault currents (3 phase symmetrical) shall be:-

(a) 132kV 21.9kA (5000MVA)

(b) 33kV 17.5kA (1000MVA)

(c) 11kV 13.1kA (250MVA)

(d) 6.6kV 21.9kA (250MVA)

(e) 415V** 27kA (19.4MVA)

** based on a single 1000kVA transformer

On rural networks an assessment of the minimum fault current shall be made to ensure satisfactory operation of network protection.

Before the network fault level (kA/MVA) is increased above the currently declared value then all customers with switchgear, connected to the affected network, shall agree to the proposed change. (See EPD220, subsection 4.3.2.)

The calculation of fault levels shall be in accordance with ENA ER G74. Guidance on the calculation and management of fault levels may be found in EPD220.

The actual fault current may exceed the nominal values quoted above as a result of the allowable manufacturing tolerance on transformer impedance e.g. with distribution transformers the tolerance is ± 10%.

Switchgear for use on the Network shall have the following minimum voltage impulse withstand levels:

(a) 132kV network 650kV

(b) 33kV network 170kV

(c) 11/6.6kV network 75kV

In the interests of economy and customer safety, the distribution network shall be designed to provide connection at the lowest practical voltage level and as close as possible to the centre of the load group. However, where a customer has overriding requirements, with significant additional costs, these additional costs shall be borne in full by the customer. Where a connection is provided at a voltage higher than the lowest practical, the customer shall be made aware that the additional responsibilities for providing safety from the customer's equipment rest with the customer.

4.7.2 Network Refurbishment and Replacement

The replacement of distribution assets shall be in accordance with principles of Asset Management set out in EPD215.

All refurbishment and plant replacement schemes shall consider the requirements of existing and future remote control and network automation. In particular, attention is drawn to EPD282, subsections 4.2.2 to 4.2.5.

4.7.3 Three Circuit Groups

Three circuit groups shall generally have arrangements designed to prevent damage to plant should a second circuit outage occur.

The arrangements described in subsection 4.7.9 may take the form of agreed load reduction contingencies following first circuit outage. An automatic scheme shall be provided as backup for double circuit faults.

Any Automatic Load Reduction Scheme (ALRS) shall be individually designed, recognising the loading or voltage conditions that may apply following a second circuit outage. They shall be designed to recognise the short time overload capability of the plant or equipment involved, and to disconnect the minimum amount of load dependent on network conditions.

Where a three circuit group supplies a single customer, the Connection Agreement between Electricity North West and the customer shall specify, as part of a special technical schedule appended to the Agreement, the first circuit outage load reduction contingency or the planned load reduction scheme operation for second circuit outage and the mode of operation of any installed ALRS.

4.7.4 Out of phase HV Networks

Different vector groups and phase relationships exist between primary substations. These are described in drawing HQ.A3.6002.01 HV Network Phase Relationships. These networks are usually physically separated, having originally been developed by regional predecessor companies pre-nationalisation, but it is important they are kept physically separate to avoid inadvertent interconnection. Therefore, no new development or

alteration shall create the co-location of out of phase networks, both at HV and LV. Where networks have become physically adjacent, alterations shall not worsen the situation as far as reasonably practicable.

4.8 Lightning Protection

Lightning protection of overhead networks and associated cables and equipment shall be in accordance with CP314 – Lightning Protection of High Voltage Overhead Line Systems.

4.9 Embedded Generation

All applications for embedded generation shall be dealt with in accordance with EPD259 and ES259 - Generation Connected to the Electricity North West Network.

4.10 Railway 25kV Traction Supplies

Traction supplies shall be designed in accordance with ENA ER P24 - A.C. Traction Supplies to British Rail. The local earth at the Traction Supply Site shall be isolated from the Electricity North West network earth by either an isolating transformer or an unearthed HV overhead line.

4.11 New Connections to Sites with a Rise of Earth Potential Exceeding 650V

There shall be no new connections to any site where the existing Rise of Earth Potential is known to exceed 650V unless authorised by the Planning Policy Manager.

4.12 Overhead Lines Crossing Motorways & Special Roads

No overhead lines, other than 132kV lines, may cross motorways or special roads. (Special road status is granted by the Secretary of State and Electricity North West requires the consent of the local Highway Authority before placing equipment above or below such a road.) Circuits at other voltages, crossing such roads, shall be placed underground.

4.13 Overhead Line Design Clearances

Overhead line clearances shall be in accordance with the following:

Wood Pole Lines	-	CP420 Part 1 – Chapter 15
Tower Lines	-	CP420 Part 2 – Chapter 15

4.14 Nomenclature

All substation and circuit names and plant identification shall be determined by Electricity North West staff in accordance with current practice.

4.15 Main Records

'As laid' underground mains and services and overhead mains and services and associated apparatus shall be recorded in accordance with "Guide for Recording Underground Assets - Electricity".

A record of phase connection for all single phase services shall be maintained.

4.16 Cost Apportionment

The rules set out in Electricity North West's Distribution Licence concerning the apportionment of the costs of connection and any associated reinforcement shall be adhered to.

4.17 Planned Work Involving Access to Land Owned by Network Rail

Network Rail requires legal agreements known as Basic Asset Protection Agreements before they allow third parties to access their land, buildings or structures. Electricity North West considers the risks imposed by these agreements are unacceptable and as a result is unwilling to enter into such agreements. Therefore, as far as reasonably practicable, there shall be no new connections, diversions, reinforcement or asset replacement that requires access to property owned by Network Rail. This includes access during construction works as well as enduring access following the installation of assets.

4.18 Battery Energy Storage Systems (BESS)

Battery Energy Storage Systems combine the characteristics of both demand and generation. Therefore, all applications to connect shall be treated as both demand and generation, and be designed in accordance with:

EPD259 Generation Connected to the Electricity North West Network

CP259 Generation Connected to the Electricity North West Network

ES259 Generation Connected to the Electricity North West Network

CP258 Connections for Industrial and Commercial Customers

ES214 New LV Connections up to 300kVA Capacity

ES215 New Connections up to 1500kVA Capacity

ES216 11-6.6kV Connections up to 15MVA Capacity

ES217 33kV Connections up to 90MVA Capacity

ES218 Connections up to 240MVA Capacity

Voltage step change studies shall be in accordance with 4.5 Network Studies

4.19 Import and Export Limitation Schemes

Demand, Embedded Generation and Storage may use import/export limitation schemes. These schemes shall comply with ENA Engineering Recommendation G100 Technical Requirements for Customer Export and Import Limiting Schemes.

4.20 Direct Connection of Managed Connections to primary and 33V switchboards

Some Managed Connections rely on a circuit breaker to switch off the supply to that connection under certain network conditions. Where Managed Connections are connected directly to a dedicated circuit breaker at a primary or 33kV switchboard, the circuit breaker at the switchboard may only be used to constrain that connection if there is no potential to use that circuit breaker to feed other network. Typically the circuit breaker will need to have unused thermal capacity and the facility to terminate two circuits at its cable box to

feed other network. If the circuit breaker has capacity to feed other network, a remote circuit breaker local to the Managed Connection shall perform this function instead. Additional ducts shall be installed at the time of laying the HV or EHV cables to accommodate inter tripping circuits. These inter tripping circuits shall comply with the functional requirements defined in Automatic Load Reduction.

This policy allows the circuit breaker to be used for future connections.

4.21 Operation of BESS by third parties at large demand sites

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BESS can be used to offset power import from the distribution network by large demand customers who have cyclic demand profiles. The BESS charges up when the demand profile is low, and discharges when the demand is high. This can be commercially beneficial for both the demand customer and the BESS owner because peak demand requirements often coincide with the highest daily electricity prices. The BESS can charge during the night when unit prices are low and use the stored energy to reduce the power import requirements at times of peak electricity prices.

The BESS may connect directly onto the demand customer's installation as shown in the typical connection arrangement below:

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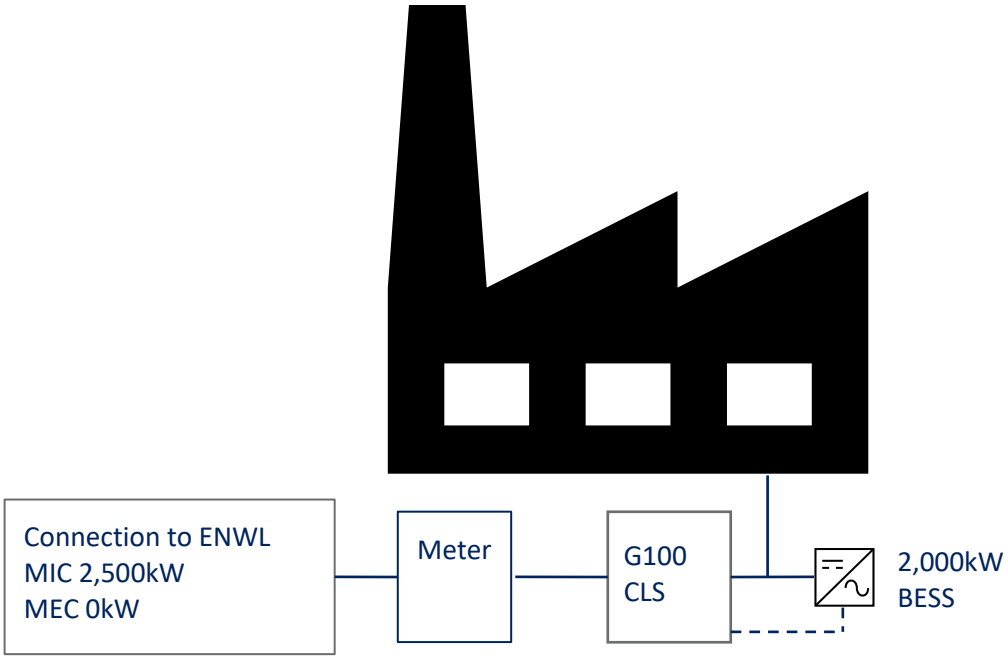


Typical connection arrangement.

The conditions for connecting the BESS onto an existing customer's installation are:

- The connection contract for the site remains with the existing demand customer
- The existing connection contract shall be modified to include the presence of the BESS. Typically, the export capacity shall be 0kVA
- The BESS shall be fully compliant with EREC G99. For the purposes of G99 compliance, the demand customer shall be classed as the customer and generator, with the BESS owner acting as their agent.
- A G100 export limitation scheme shall be used to constrain the export
- Adaptive protection may be used to manage excessive fault current

5 Documents Referenced

The following documents, legislation, national standards and ENA publications, cannot be supplied by Electricity North West to persons outside those companies

DOCUMENTS REFERENCED NON-ELECTRICITY NORTH WEST DOCUMENTS	
New Roads and Street Works Act 1991 (NRSWA)	
Electricity Safety, Quality and Continuity Regulations 2002	
Construction (Design & Management) Regulations 1994 (CDM)	

Grid Code	
NG ESO Transmission System Security & Quality of Supply Standard	
National Joint Utilities Group (NJUG) Publication No. 7 – Recommended Positioning of Utilities' Apparatus for New Works on New Developments and in Existing Streets	
BS EN 50160	Voltage Characteristics of Electricity Supplied by Public Distribution Systems
ENA ER G5/4	Planning Levels for Harmonic Voltage Distortion
ENA ER G74	Procedure to Meet the Requirements of IEC 909 for the Calculation of Short Circuit Currents in Three Phase AC Power Systems
ENA ER P2/6	Security of Supply
ENA ER P16	EHV or HV Supplies to Induction Furnaces
ENA ER P24	A.C. Traction Supplies to British Rail
ENA ER P28	Planning Limits for Voltage Fluctuations Caused by Industrial, Commercial and Domestic Equipment in the UK
ENA ER P29	Planning Limits for Voltage Unbalance in UK for 132kV & Below
ENA ER G100	Technical Requirements for Customer Export Limiting Schemes

The following documents are available from Electricity North West:

DOCUMENTS REFERENCED ELECTRICITY NORTH WEST PUBLISHED DOCUMENTS	
The Distribution Code	
Electricity Distribution Licence	
EPD201	Recovery and Identification of Idle Assets
EPD215	Asset Management
EPD220	Fault Level Management
CP258	Connections of Industrial and Commercial Customers

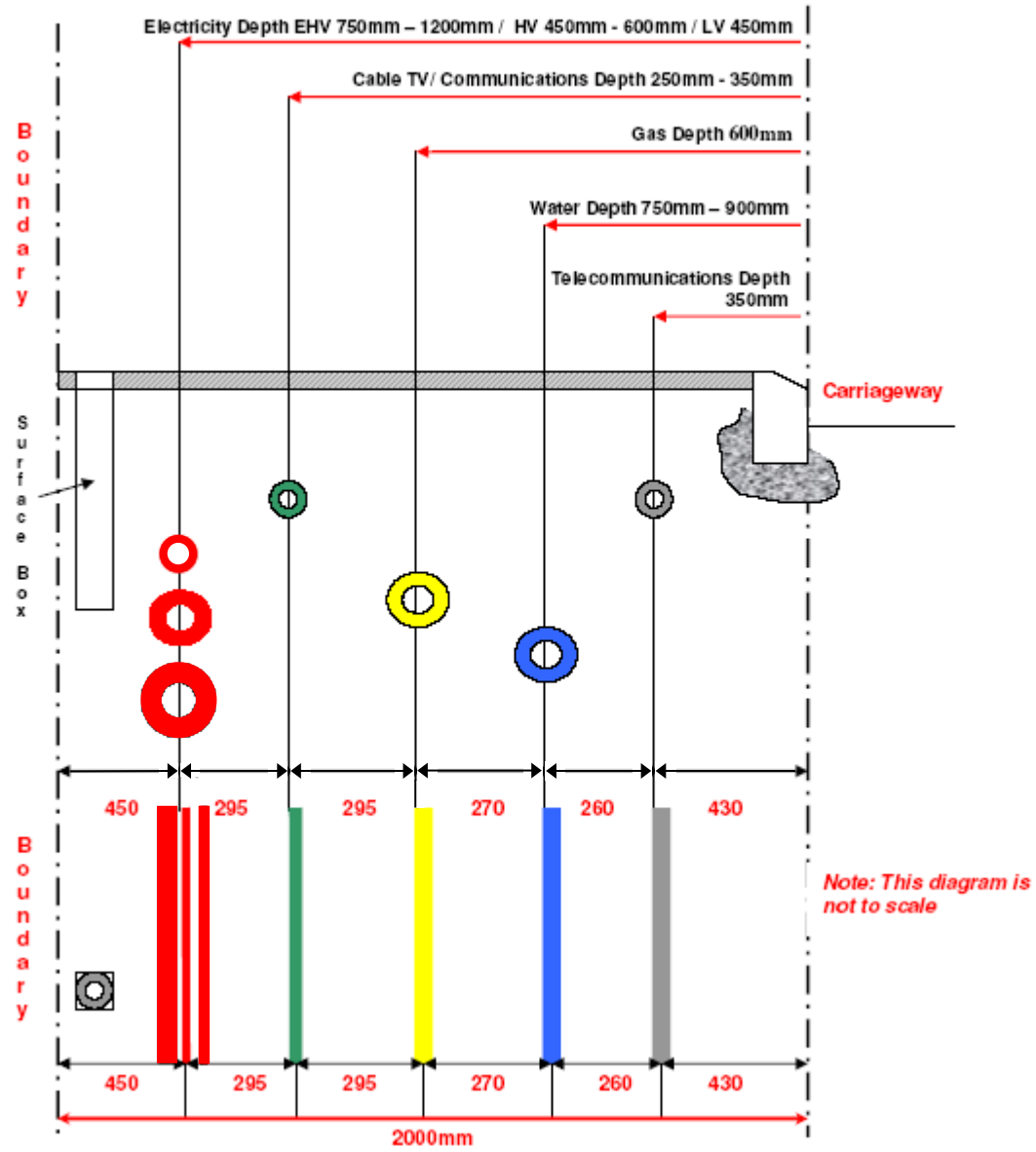
CP259	Generation Connected to the Electricity North West Distribution Network
EPD259	Private Generation Connected to the Network
EPD280	Distribution System Design – 132kV Network
EPD281	Distribution System Design – 33kV Network
EPD282	Distribution System Design – 11/6.6kV Network
EPD283	Distribution System Design – Low Voltage Network
EPD333	Supply System Earthing
EPD350	Protection for 132kV, 33kV and 11kV Systems
EPD355	Substation Flood Protection
CP314	Lightning Protection of High Voltage Overhead Line Systems
CP420	Policy and Practice for Overhead Lines
CP510	Commissioning of Measurement Transformers connected to Settlement Metering Equipment
ES210	New Connections, Extensions and Alterations
ES214	New LV Connections up to 300kVA Capacity
ES215	New Connections up to 1500kVA Capacity
ES216	11-6.6kV Connections up to 15MVA Capacity
ES217	33kV Connections up to 90MVA Capacity
ES218	Connections up to 240MVA Capacity
ES259	Generation Connected to the Electricity North West Distribution Network

6 Keywords

Design; Network; P2/6; Planning; Policy; System

Appendix A

FIGURE 1 - Recommended Positioning of Utility Apparatus in a 2metre Footway



Recommended Arrangement of Mains in a 2m Wide Footpath

(Based on NJUG Publication: Volume 1 - NJUG Guidelines on the Positioning and Colour Coding of Underground Utilities' Apparatus, Issue 4, 8/1/09 and in Volume 2 - NJUG Guidelines on the Positioning of Underground Apparatus for New Development Sites, Issue 2, 10/12/07)

NOTE:

(a) For the purpose of the above diagram LV means 400/230V, HV means 6.6kV or 11kV and EHV means 33kV or 132kV

(b) All new cable ducts installed for and to be adopted by Electricity North West shall be red, regardless of the voltage of the cable to be installed in them.