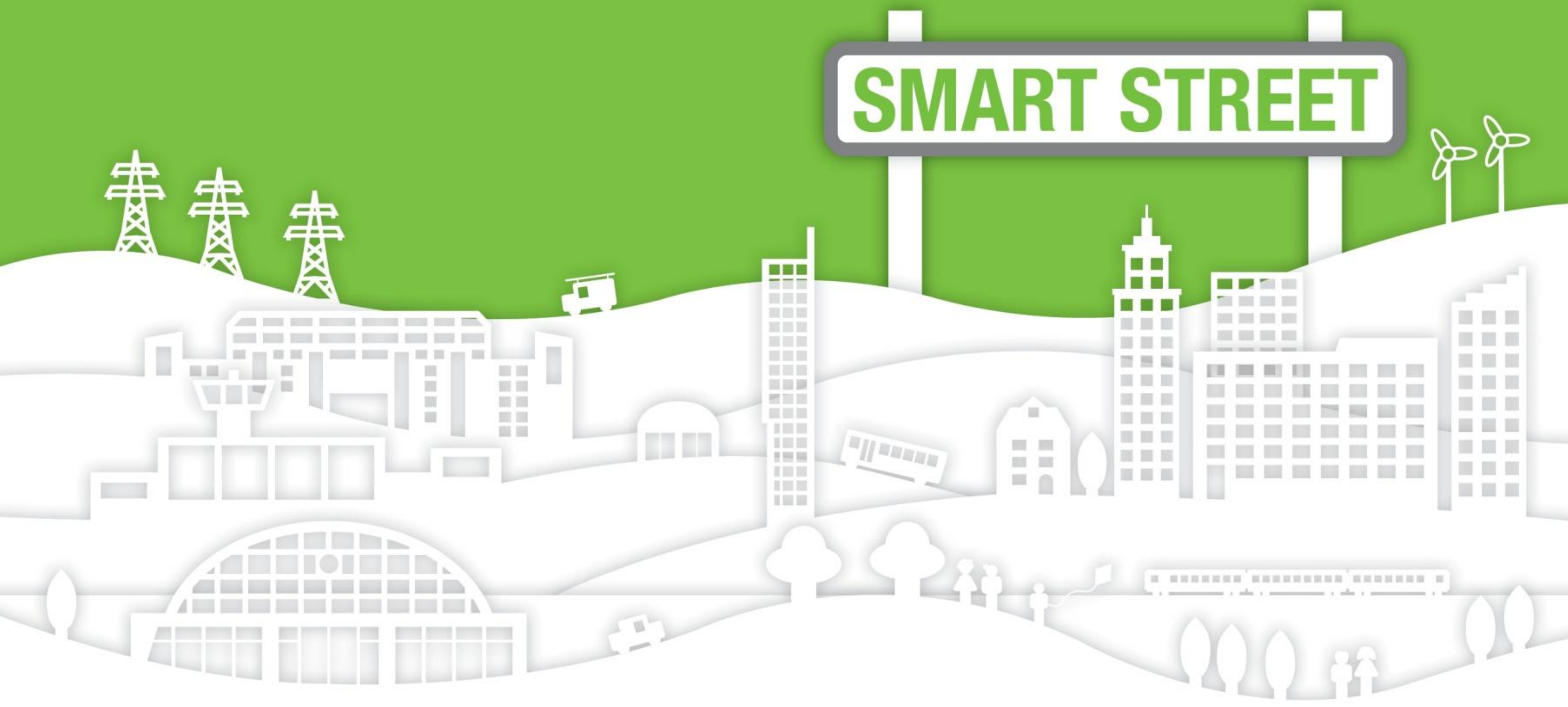
Smart Street
LV Network Management Protocols

24 June 2015



CONTENTS

1 INTRODUCTION

The general principles contained within this Electricity Policy Document (EPD) draft shall be applied to existing work on the Low Voltage (LV) Networks of Electricity North West Limited (hereinafter referred to as Electricity North West) affected by Smart Street installations.

2 SCOPE

This document states Electricity North West's draft policy for the LV Network Management only applicable to Smart Street installations. The document contains any additional Policy requirements to allow the LV network to perform as described in the Smart Street project description and incorporates comments about the relevant policy and procedure documents that will need to be reviewed to accommodate a Smart Street network.

3 DEFINITIONS

For the purpose of this document the following definitions apply:

AVC	Automatic Voltage Control
CIM	Common Information Model
CP	Code of Practice
DNO	Distributor Network Operator
DSMC	Distribution System Management Centre
EPD	Electricity Policy Document
ES	Electricity Specification
ICCP	Inter Control Communications Protocol
IIS	Information Incentives Scheme
LCT	Low carbon technology
Low Voltage (LV)	A voltage not exceeding 1,000V
High Voltage (HV)	A nominal voltage of either 11,000V or 6,600V
NMS	Network Management System
NRC	Network Report Centre
RTU	Remote Terminal Unit
SLD	Single Line Diagram
UDB	Underground Distribution Box
LYNX	LV switch designed to fit into existing Underground Distribution Boxes (UDBs) replacing existing solid link or fuse and allowing network meshing and un-meshing alongside advanced monitoring capabilities. Capable of closing and opening the circuit at the link box either locally or remotely via remote monitoring and NMS control.
WEEZAP	LV vacuum circuit breaker combined with advanced measurement and protection capability. Designed to close and open the circuit at the LV substation either locally or remotely and to be fitted directly to existing LV panels in replacement of the fuse without replacement of the LV board itself. Protection to the network is provided via opening of the circuit breaker in overload and fault conditions and load automated re-closing is possible via its configuration settings. Alternatively reclose control can be implemented via the Network Management System (NMS).

4 LOW VOLTAGE NETWORK MANAGEMENT FOR SMART STREET INSTALLATIONS

4.1 Assessment of relevant drivers

The anticipated changes in consumer behaviour and electricity demand on the low voltage (LV) network coupled with the reduction in the carbon footprint associated with the electrification of heat, transport and electricity generation through to 2050 will pose a significant challenge to electricity Distribution Network Operators (DNOs) who historically employed traditional reinforcement to address the problems created by new low carbon technologies (LCTs) but can no longer adopt this option due to the high cost and associated disruption.

The substantial increase in new electricity loads from LCTs such as heat pumps for heating and electrical vehicles for transport coupled with the take up of micro-generation will create thermal and voltage challenges for the management of the network. DNOs must connect the new LCTs to facilitate customer's transition to a low carbon future, whilst maintaining statutory voltages, reducing network losses, managing power quality and, against a backdrop of increasing energy bills, help reduce cost to customers.

DNOs must therefore adapt the design and operation of their networks via efficient intervention techniques, alternative to traditional reinforcement, to enable the networks to facilitate efficient connection of LCTs, whilst maintaining the power quality and network voltage within mandated limits.

As such, the key business drivers relating to the Smart Street project that may determine the design of the future LV distribution networks due to the changes imposed, but not limited to, the increasing distributed generation and LCT penetration, and UK's decarbonisation are:

- Reinforcement cost reduction,
- Carbon efficiency improvement,
- Ability for faster connection of LCTs, and
- Energy cost reduction to customers.

4.2 Key policy requirements

Distribution networks should be designed to deliver electricity to the customer in an efficient and cost effective manner.

The general objective in managing the voltage on distribution networks is to improve the quality and reliability of the supply provided, to increase effectiveness of circuit ratings, reduce network losses and therefore reduce the carbon footprint of the distribution network as a result of, but not limited to, the changes imposed by the increasing distributed generation and LCT penetration.

Smart Street will optimise network voltages and configurations in real time to simultaneously manage all EHV, HV and LV network assets to respond to customers changing demands in the most efficient end to end manner.

The three key methods that the Smart Street project considers appropriate for the quality improvement of the supply provided, to reduce losses associated with transporting energy across the distribution networks, release significant network capacity and control network voltages and harmonics within designated limits[1] are:

- Co-ordinated voltage control, using on-load tap changing transformers and capacitors, across EHV, HV and LV networks all of them controlled by the Optimisation software;
- Interconnecting traditionally radial HV and LV circuits through the Optimisation software and assuming control of these networks within the control room; and
- Real-time co-ordinated configuration and voltage optimisation of HV and LV networks.

4.2.1 LV network management and interconnection

Existing networks are not designed to cope with the highly variable power flows that will be caused by the introduction of LCTs, such as vehicle recharging, and on-site generation. Interconnection of LV networks is one means by which voltage, thermal and harmonic problems created by LCT loads and generation connected to LV networks can be significantly reduced.

Smart Street proposes using intelligent switching devices (WEEZAP –vacuum circuit breaker– and LYNX –remote control link box switch-) that can be remotely controlled, sense feeder flows and offer dynamic reconfiguration of the LV network to safely transform radial LV networks into interconnected LV networks providing centralised LV network management and automation system.

4.2.2 HV and LV voltage control

Energy flows on LV networks are predicted to become more complex and less predictable due to the penetration of new LCTs over the coming years. Traditional LV electricity networks, designed and operated without voltage control capability, will therefore face significant voltage challenges unless addressed accordingly.

Smart Street suggests the use of capacitors on HV and LV networks and on-load tap changing distribution transformers to allow supply voltages to customers to be sustained at the optimum level for energy-efficient operation of appliances, reducing the energy consumed by customers and, on the HV network, simultaneously reduce network losses.

4.2.3 Network configuration and voltage optimisation

Smart Street will be able to optimise the network configuration and voltage profiles in real time in response to customer's needs. For this Smart Street will dynamically analyse network loads and generation levels and will alter both interconnected configurations and voltage profiles across HV and LV networks. The software that will be used for voltage optimisation and network configuration will also allow carbon reductions to be optimised. In this regard the software will directly compare and balance network losses and customer's energy consumptions.

[1] The control system and operation of Smart Street needs to comply with the requirements set in EPD279.

4.3 Smart street design overview

The Smart Street project will integrate several technologies into a common operating regime, co-ordinated and managed through Optimisation software. In this way traditional networks combined with technological enhancements to existing assets are proposed to address the challenges imposed by the increased penetration of LCTs and low carbon generation.

4.3.1 Smart Street assets

The products and equipment investigated under the Smart Street project include:

WEEZAP

LV vacuum circuit breaker combined with an advanced measurement and protection processing unit. Functionalities:

- Retrofit design onto existing LV fuse panels in replacement of the fuses;
    - Provides circuit breaker protection instead of traditional fuse protection;
- Local or remote LV substation circuit breaker switching;
- Overload and fault condition protection with local automated, or via the NMS, re-closing;
    - Protection can be reconfigured for cold load pickup or protection of distant networks previously unprotected by fusing;
    - Provides reduced response times to fault incidents, staff visits to site and CI & CML figures through combination of reconfiguration and reclosing.
- Remote monitoring and control;
    - Communicates with the Gateway device providing a remote connection to the installed devices;
    - Measures voltage, current, power factor, real power, apparent power, reactive power, frequency, THD, and individual harmonics including magnitude and phase up to the 25^{th} order;
    - Detects over/under voltage conditions;
    - Monitors overload currents and assess their duration and magnitude;
    - Checks harmonic levels on the network;
    - Uses power flow information at NMS level to make network configuration decisions;
    - Captures high speed data to diagnose network problems, including incipient fault detection and location;
- Fault location capability;
    - Interprets data to give distance to fault before the fault becomes permanent reducing time to locate and repair the network fault.

LYNX

LV vacuum switch with the below functionalities:

- Retrofit design onto existing LV link boxes where traditionally solid links or fuses can be installed;
- Consideration needs to be given to the required retrofit bell house when installing a LYNX device.
- Local or remote link box circuit breaker switching;
- Remote monitoring and control;
    - Communicates with the Gateway device providing a remote connection to the installed devices;
    - Measures voltage, current, power factor, real power, apparent power, reactive power, frequency, THD, and individual harmonics including magnitude and phase up to the 25^{th} order.

Capacitors

Standard capacitor products installed at strategic points along the HV and LV feeders used to provide further points of voltage control and voltage profile stabilisation on the HV and LV networks.

The capacitors are switched directly and/or the set point is communicated to their controllers via the Optimisation software. In the event of a loss of communication, the local controller decides whether to add or remove capacitance from the network based on the set point.

Distribution transformers with on load tap changers

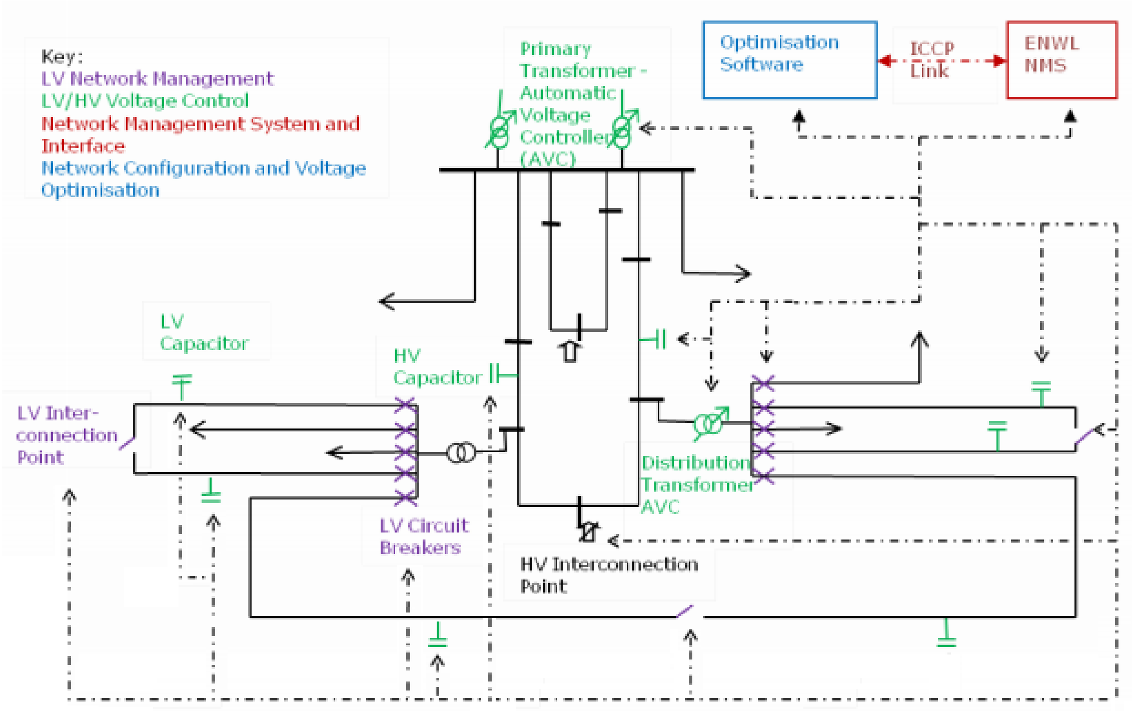
Products to be installed in the local distribution substation to assist with voltage regulation via the operation of an automatic voltage control relay.

The voltage set point is communicated to the voltage control relay via the Optimisation software.

4.3.2 Smart Street deployment

The technologies described in section 4.3.1 are deployed on the network in line with the diagram presented in 0.

Figure 1: Smart Street method intervention on stylised HV and LV networks



The LV network control will be established using new retrofit LV vacuum circuit breaker, WEEZAP and retrofit remote control link box switch, LYNX. Deploying the WEEZAP in conjunction with the LYNX will allow LV network interconnection and facilitate dynamic reconfiguration either locally or remotely from Electricity North West's Control Room. Where a link box does not exist at a proposed interconnection point then a new link box will be installed to allow the reconfiguration capability.

In addition to remote operation the WEEZAP will provide both network monitoring (voltages, currents, power flow and harmonics) and advanced adaptive protection coupled with network fault detection capability and automatic fault reclose functions.

Smart Street will simultaneously manage the Primary transformer Automatic Voltage Control (AVC) system, the HV and LV network capacitors, the distribution transformer AVC and HV and LV interconnection points in order to deliver the optimal network configuration and voltage profiles for carbon, losses and energy savings in real time.

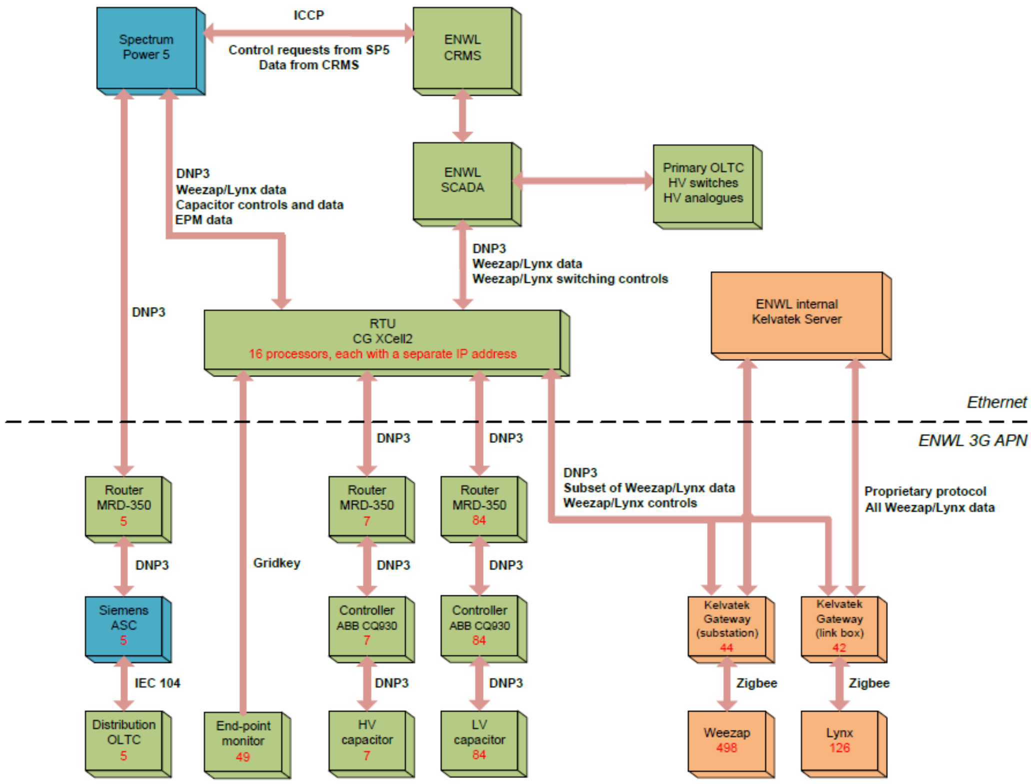
The operation of the HV and LV capacitors will be based on voltage set-points rather than power factor control. The controllers for the capacitors could operate in two modes: when communications are available they will carry out close/ open commands issued by the NMS; when communications are lost they will switch the capacitance based on the voltage detected on the network at the connection point.

In order to regulate the HV and LV network voltage using the above described configuration the Optimisation software will assimilate voltage measurements from key points on the HV network, distribution substation LV busbars and along LV circuits and will make the decision to ensure that optimum voltage is delivered to the customer and end to end carbon is minimised.

4.3.3 Control principles

The Smart Street project will use multiple communications routes as shown in 0.

Figure 2: Smart Street connectivity



Equipment counts in red. Please treat these as an indication, as they are subject to change throughout the lifetime of the project.

- All switching commands will be instructed from the Electricity North West NMS whilst the control commands, i.e. change of voltage set points, will be issued directly from the Siemens Spectrum Power software[2].
- Monitoring information will be picked up by the Spectrum Power software from the iHost system.

Optimisation software

The optimisation software is part of the already available Spectrum Power system from Siemens that facilitates, manages and controls the numerous schemes and devices and is responsible for optimising the operation of both the LV and HV networks. Spectrum Power has inbuilt optimisation targets to:

- minimise power loss; or to
- minimise power demand; or to
- maximise generated reactive power; or to
- maximise revenue whilst satisfying voltage and loading constraints and operating in real time.

[2] Optimisation software able to control the WEEZAP and LYNX devices to reconfigure the LV network, open and close the HV ring and adjust transformer taps at the primary and distribution substation through the existing Electricity North West control room automation platform (CRMS)

Interfacing

Spectrum Power will be interfaced with the Electricity North West NMS via an Inter Control Communications Protocol (ICCP) link. The protocol will require some development from Electricity North West to ensure effective real time two-way communication. Devices in the field on both the LV and HV network will communicate all their real time data to Spectrum Power via RTUs. Spectrum Power will directly control some devices in the field on the LV network via its inbuilt SCADA functionality. However, the commands for the switching devices on the network, as well as the primary tap changers, will be communicated to the field devices via the Electricity North West NMS.

Development of network model

The network information will be provided to Spectrum Power from Electricity North West in the form of Common Information Model (CIM) files. The files will include all the network data such as all analogue information and circuit status. Switch state changes will be exchanged on an event by event basis. Spectrum Power will require detailed circuit data (line lengths, reactance, etc.) as well as network topology to construct the network structures and power flows.

The load profile models for the LV network will be developed from the standard load profiles imported from Electricity North West. The load profile models on the HV network will use 30 minutes historical load profiles in either CSV or CIM format.

Operator interface

Spectrum Power will provide clear LV network representation within the Electricity North West Control Room that will present Electricity North West with real time visibility of the status of the LV network. There will be remote desktop access for LV management. The level of access will be limited via passwords and user defined levels of security.

Measurement and monitoring

Measurement and monitoring on the Smart Street project will be required for two purposes. The first will be the measurement of the voltage at the various points on the network to provide inputs to the algorithm. For the inputs to the algorithm the voltages will be required at:

- HV busbars and strategic points on the HV network; and
- LV busbars and strategic points on the LV network.

The second requirement will be to quantify the energy savings seen by customers and to quantify the losses reduction. Measurements will be recorded at various points on the LV network using monitoring built into the WEEZAP, LYNX and end-point monitors. This monitoring will provide all currents, voltages, real power, reactive power and harmonics (where required).

4.4 Documentation review

This section provides a list all of the relevant policy and procedure documents that are impacted by the Smart Street project and post project requirements (subject to trial findings) in terms of LV Network Management protocols.

Each subsection focuses on one document and includes a list of sections within that document that are affected by the project.

This enables the reader to obtain a quick summary of the impacts of this project on current practices.

4.4.1 EPD215 Asset Management (Issue 2, July 2007)

Observations on this Electricity Policy Document include:

- Section 4.1 Risk to Operators and the General Public
- Need reference to any new Smart Street related Risk Assessment procedures.
- Section 5 Investment Patterns
- May need to contemplate the fact that today's networks require more complex assets than traditional networks and further quantifiable benefits, other than equipment costs, need to be taken into consideration.

4.4.2 EPD279 Distribution System Design General Requirements (Issue 4, January 2010)

Observations on this Electricity Policy Document include:

- Section 1 Introduction

  No likely changes required but implication that the document might not apply to a Smart Street network if retrofitting such equipment is considered a "material alteration":

  "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".

  It might be worth considering adding a paragraph to make it clear what is to happen with a Smart Street network (or alternatively include such wording in EPD 283 as that is specific to LV).

- Section 4 General Requirements

  No likely changes required except us undernoted:

  - 4.5 Network Studies
    Requirements in this section may need to be reviewed if Smart Street networks are subject to a load flow / voltage study.
  - 4.6 Security and Quality
    Need to confirm that Smart Street networks are compliant with the requirements in this section.
  - 4.7 Network Development
    Need to ensure compliance of Smart Street networks - note LV fault level quoted - need to understand effect of network interconnection.
  - 4.14 Mains Records
    Need to ensure method of recording Smart Street apparatus included in Electricity North West document entitled *"Guide for Recording Underground Assets - Electricity"* (no document number quoted).

- Section 5 Documents Referenced

  May need reference to any new Smart Street policy document if mentioned in a revision of this EPD.

4.4.3 EPD282 Distribution System Design - HV Network - subsections 4.2.2 to 4.2.5 (remote control and network automation) (Issue 5, January 2010)

This document only appears to refer to HV networks (i.e. 6.6kV and 11kV). No changes required to this Electricity Policy Document.

4.4.4 EPD283 Distribution System Design Low Voltage Networks (Issue 5, December 2013)

Observations on this Electricity Policy Document include:

- Section 1 Introduction

  The paragraph reproduced below may need to be reworded if retrofitting Smart Street equipment to a network is considered a "material alteration":

  "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".

- Section 4 Low Voltage Network

  No likely changes required except as undernoted:

  - 4.1 General
    Need to confirm that Smart Street equipment specifications (e.g. on-load tap changing distribution transformers including tap specifications), dynamic distribution network and substation busbar target voltage set-points and interconnected LV networks are compliant with the requirements in this section.

  - 4.2 Substation
    Need to confirm that Smart Street equipment specifications (e.g. on-load tap changing distribution transformers) are compliant with the requirements in this section.

  - 4.3 Interconnection
    Need to confirm that Smart Street equipment specifications (e.g. WEEZAP and LYNX devices) are compliant with the requirements in this section.

- Section 5 Documents Referenced

  May need reference to any new Smart Street policy document if mentioned in a revision of this EPD.

4.4.5 CP226 Low Voltage Network Design (Issue 6, February 2014)

Observations on this Code of Practice include:

- Section 4.6 LV Distributor Design

  Need to consider if radial design is still the preferred option for distributors.

- Section 4.7 Interconnection

  Need to consider Interconnected LV networks as per Smart Street specifications, not just to cater for failure conditions but also to reduce/mitigate voltage, thermal and harmonic problems.

- Appendix C % Voltage Drop for Distributor and Service Cables and Appendix D Manual Calculation of Voltage Drop

  Voltage drops are quoted based on 415/240V busbar voltage. With the introduction of variable busbar voltage set points this may need to be re-considered.

4.4.6 CP331 – Protection of LV Underground and Overhead Distributors and HV Protection of Distribution Transformers (Issue 3, January 2009)

Observations on this Code of Practice include:

- Fuse-links are referred as means of protection for low voltage cable and overhead lines in this section and it may be appropriate to expand this terminology to a more generic term to accommodate for the Smart Street innovative assets. This is also applicable to sections 3, 4, 5 and 6.

- Need to ensure that fuse-link ratings, including cyclic ratings, and associated protection and discrimination characteristics are aligned with those provided by Smart Street equipment, if totally interchangeable. Fuse-link tables may need to be revised accordingly.

- If Smart Street apparatus is used in replacement of fuse-links and characteristics like e.g. clearance times, responses to faults, effects on loop impedances etc. are different to those for fuse-links, considerations may need to be taken throughout rating calculations and others in this document.

4.4.7 CP370 Network Voltage Control for 132kV, 33kV and 11/6.6kV Systems (Issue 1, August 2009)

This document refers to 132kV, 33kV and 11/6.6kV systems and therefore there are no changes required to this Code of Practice.

4.4.8 EPD370 Voltage Control for 132kV, 33kV and 11/6.6kV Systems (Issue 1, August 2009)

This document refers to 132kV, 33kV and 11/6.6kV networks and therefore there are no changes required to this Electricity Policy Document.

4.4.9 ES352 Design of Distribution Substations and Transforming Points (Issue 4, January 2013)

Observations on this Electricity Specification include:

- Section 7.5 Plant Movement Provision

  Size of existing substations should be considered when replacing existing with future assets. E.g. Distribution transformers with on-load tap changers may not fit where traditional distribution transformers used to sit.

- Section 8.3.7 Heating and Ventilation

  Need to ensure that Smart Street equipment installed in substations (e.g. on-load tap changing distribution transformers or capacitors) do not need any specific requirement regarding heating and ventilation.

- Section 14.3 Transformer Noise Levels

  Need to ensure that on-load tap changing distribution transformers' noise is within maximum permitted noise levels.

- Section 17 Notices and Nameplates

  Need to consider that substations affected by Smart Street installations should be properly labelled so that authorised people entering the substation are aware of the likely equipment and operational procedures modifications.

- Section 19.1 Plant for Distribution Substations and Transforming Points

  Need to consider that Smart Street equipment likely to be installed at distribution substations should be approved and listed in EPD307 or, otherwise, their use and method of installation shall be agreed beforehand with the Electricity North West Plant Policy Manager.

  Standard LV switchgear plant installations for indoor and outdoor ground mounted network substations and transforming points should be reviewed if WEEZAP devices are to be included.

4.4.10 CP601 System Restoration and Fault Management (Issue 7, November 2013)

Observations on this Code of Practice include:

- Section 4.1 Table of ESOP Regulations relevant to Supply Restoration

  This section may need to include extra information related to Smart Street equipment able to reduce response times and costs to fault incidents, staff visits to site and CI & CML figures through combination of reconfiguration and reclosing.

- Section 4.2 Quality of Supply

  Mention may be given to the measurement capabilities of Smart Street equipment aimed at improving quality of supply.

- Section 4.4 LV Fault Process Targets and Measurements

  If restoration of supply is done remotely, without a person or team attending site, ETA and ATA to site will not be relevant and processes to inform customer of the restoration progress may need to be amended.

- Section 5 Fault Processes, Responsibilities and Management

  If restoration of supply is done remotely, without a person or team attending site, or automatically, without human intervention, the DSMC/NRC should be aware/informed somehow of supply restoration times and procedures.

  Available information on overloaded LV networks will be improved with the implementation of WEEZAP devices. Such information may be used to advise customers on consequences of overloading and also prove liabilities with tracked evidences.

- Section 6 Fault Response Processes

  If restoration of supply is done remotely, without a person or team attending site, ETA and ATA to site will not be relevant and processes to inform customer of the restoration progress may need to be amended.

  Fault location procedures would need to be amended if any fuses mentioned in the processes are replaced by the new Smart Street circuit breakers.

- It should be noted that all WEEZAP and LYNX operations and abnormal monitored conditions should be logged, the same as e.g. fuse failures are logged.

- Section 11.4 Meeting the Requirements of IIS Reporting LV Customer Interruptions

  It should be noted that all WEEZAP and LYNX operations and abnormal monitored conditions should be logged and reported.

  Need to include safety procedures under fault conditions and following restoration of supply where capacitors are present in the network.

4.4.11 CP605 System Operation (Issue 2 May 2012) (section 4 – Work on System)

Observations on this Code of Practice include:

- Section 4.2 Work on or adjacent to the low voltage system

  If there is an intention to carry out work LIVE on any of the new Smart Street-specific apparatus, then this must be done in accordance with an Approved Procedure. The implication therefore is that such new procedures will have to be drafted if LIVE work is anticipated.

4.4.12 CP606 Operations Manual

CP610 replicates relevant sections from CP606 that apply at LV. Therefore all comments made against CP610 also apply to the same sections in CP606.

Control of the LV network should be referenced in CP606 (and in CP610).

More generally, there are procedures for specific types of equipment within CP606 - these may be required for Smart Street specific apparatus (please refer to comments on CP 619).

- CP 606 Section S (switching)

  Procedure S14 (Issue 3, April 2007) - earthing - approved equipment and procedures – Reference to “COP619 – Future Networks Assets Procedures” required to highlight specific earthing requirements of Smart Street equipment.

  Procedure S44 (Issue 7 – April 2007) - automatic switching by ARS and C2C - Reference to Smart Street Codes of Practice and Approved Procedures specific to Smart Street network operations required.

4.4.13 CP608 System Control (Issue 2, July 2008)

This document only appears to refer to HV networks (i.e. 6.6kV and above). This requires changing to incorporate LV networks.

4.4.14 CP610 LV Operations Manual

Observations on this Code of Practice include:

  There may be a need to develop and include within CP610 new operational procedure documents for Smart Street networks where the requirements are not covered by the existing document suite.

- Section B (cables)

  Procedure B8 (Issue 11, March 2009) - work on or near damaged/faulty cables - Although Smart Street equipment provides advanced fault location functionality, traditional methods (e.g. use of pulse echo equipment) can still be applied following an approved procedure. Consideration may however be given to update current approved procedures with those applicable to Smart Street networks.

Procedure B11 (Issue 3, March 2009) – Consideration should be given to switching out capacitors when using the Grumbler to ensure correct application.

Procedure B14 (Issue 2, March 2009) - work on cable faults - section 7.3 - Identification of the neutral conductor – this document will need to be referenced to Smart Street procedures. Special attention should be given to the isolation of capacitors.

- Section G (general)

  Procedure G02 (Issue 5, April 2004) - competency of persons - requires technical knowledge and experience to prevent danger - need to ensure that those working on Smart Street networks are appropriately qualified to do so.

  Procedure G23 (Issue 3, August 2011) - IDNOs - if IDNOs are connected to a Smart Street network need to consider whether there are any associated operational or other impacts.

  Procedure G26 (Issue 1, May 2010) - planned work – an approved procedure requires developing for Smart Street networks

  Procedure G27 (Issue 1, May 2010) - open circuit neutral faults - this document will need to be referenced to Smart Street procedures. Special attention should be given to the isolation of capacitors.

- Section S (switching)

  Procedure S4 (Issue 14, October 2012) - switching programmes - section 5 (preliminary actions) - this document will need to be updated with Smart Street procedures.

  Procedure S16 (Issue 11, November 2012) - locks/operational locking - Any special locking requirements will be held within Smart Street codes of practices/approved procedures.

4.4.15 CP613 Operation of Mobile Generators (Issue 2, November 2005)

No changes required to this Code of Practice.

4.4.16 CP614 Authorisation (Issue 7, December 2011)

Observations on this Code of Practice include:

- Need to detail requirements for training, competency/authorisation levels for accessing/operating/maintaining substations or network sections that include Smart Street equipment. Special attention should be given to those network areas where capacitors are installed.

4.4.17 CP615 Substation, Circuit and Plant Identification (Issue 3, March 2007)

Observations on this Code of Practice include:

- Section 8 Circuit Labelling
  Need to consider including names and abbreviations of Smart Street equipment for circuit labels.

4.4.18 CP617 Fault Location Techniques for the Underground LV Network (Issue 1, March 2013)

Observations on this Code of Practice include:

- Section 4.3 talks about causes for fuse operations. Mention of Smart Street protective devices may need to be included in this section so that it also refers to circuit breaker operations.

  Need to review the requirements for mentioning Smart Street protective devices where fuses are noted in this document.

- Section 4.4 Immediate Effects of a Fault

  Impedances added into the network as a result of installed Smart Street equipment should be considered for fault current calculations.

- Section 5 Restoration and Pre-location Summary

  Summary of types of faults, effects on customers and the restoration/pre-location equipment to use in each case should be updated to include Smart Street apparatus.

- Section 6 Restoration Equipment

  Capabilities and operational descriptions of the Smart Street equipment mentioned in Section 5 should be included in section 6 (similar to the Rezap or Bidoyng descriptions).

4.4.19 CP619 Procedures for Future Network Assets (Issue 1, February 2014)

Description of the installation, operation and maintenance procedures associated with the technologies installed as part of the Smart Street project will need to be included in this Code of Practice.

4.4.20 CP625 Network Diagrams (Issue 2, June 2008)

Observations on this Code of Practice include:

- Section 2 General

  If Smart Street apparatus (e.g. WEEZAP or LYNX) is to be represented with specific symbols on SLDs these will need to be described in this section.

- Section 4 Network Diagram Conventions

  If Smart Street apparatus (e.g. WEEZAP or LYNX) is to be represented with specific symbols on SLD these will need to be described in the Appendices.

  Notes on Smart Street equipment/procedures may need to be included as part of the required information on LV diagrams to emphasize the uniqueness and novel operation of the network design.

5 DOCUMENTS TO BE DEVELOPED

This section is to include references to documents that, although not existing in published form at the moment, will be required in the future.

- CP618 LV Supply Restoration Strategy

6 DOCUMENTS REFERENCED

Electricity North West published documents

The following documents are available from Electricity North West:

EPD215	Asset Management
EPD279	Distribution System Design General Requirements
EPD282	Distribution System Design - HV Network
EPD283	Distribution System Design Low Voltage Networks
CP226	Low Voltage Network Design
CP331	Protection of LV Underground and Overhead Distributors and HV Protection of Distribution Transformers
CP370	Network Voltage Control for 132kV, 33kV and 11/6.6kV Systems
EPD370	Voltage Control for 132kV, 33kV and 11/6.6kV Systems
ES352	Design of Distribution Substations and Transforming Points
CP601	System Restoration and Fault Management
CP605	System Operation
CP606	Operations Manuals
CP608	System Control
CP610	LV Operations Manual
CP613	Operation of Mobile Generators
CP614	Authorisation
CP615	Substation, Circuit and Plant Identification
CP617	Fault Location Techniques for the Underground LV Network
CP619	Procedures for Future Network Assets
CP625	Network Diagrams
CP618	LV Supply Restoration Strategy

7 KEYWORDS

Design; Network; Planning; LV; 400V; 230V; Policy; Code of Practice; Low carbon technologies; Voltage optimisation