

The logo for Electricity North West, featuring the word "electricity" in blue and "north west" in green, with a stylized green leaf icon to the left.

Bringing energy to your door

Site selection methodology

5 February 2016



RESPOND

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VERSION HISTORY

| Version | Date | Author | Status | Comments |
|---------|-----------------|-------------|--------|-----------|
| V1.0 | 5 February 2016 | J. G. Lucas | Final | K. Bailey |
| | | | | |

1 INTRODUCTION

Electricity North West's Low Carbon Networks funded project, Respond, is investigating active fault level management techniques as a cost beneficial alternative to traditional reinforcement of network assets. It is a requirement of the project submission document that the trial site selection methodology, prepared at bid submission, is reviewed and refined during the project delivery to ensure that the techniques are applied to HV and EHV substations with different relay ages and types to ensure that the learning captured will be transferable to other DNO's.

The updated site selection will then be peer reviewed by PB Power to confirm that the sample is statistically representative using data from the long term developments standards of GB DNOs.

This document lays out in detail the site selection which was based upon the latest data and additional more detailed considerations, and will capture any future changes identified during the project.

2 ORIGINAL SITE SELECTION METHODOLOGY

The original site selection methodology is contained in Appendix B of the submission document and is reproduced below for the reader's convenience.

2.1 Introduction

Two of the three fault level mitigation technical solutions to be trialled in Respond will be deployed in Electricity North West substations and this document describes the methodology for the selection of those substations. Respond will trial the use of:

- Adaptive Protection: Five installations on 11kV and 6.6kV high voltage (HV) substations and two installations on 33kV extra high voltage (EHV) substations
- I_s-limiters at two HV substations.

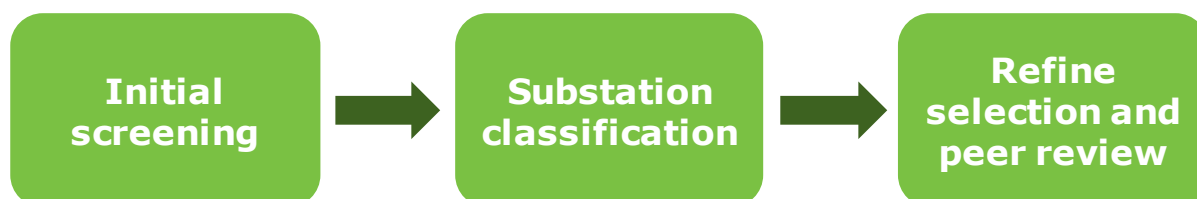
This methodology enables the selection of a representative sample of substations covering a mix of substation ages, relay types, type of distribution RMUs on the HV networks and configuration of equipment and takes into consideration the known fault history and also the likelihood of a fault level issue arising during RIIO-ED1 or RIIO-ED2.

This approach will ensure the trial results are representative of the GB population and facilitate the take-up of the learning from Respond. The proposed methodology takes into consideration the learning from Western Power Distribution's FlexDGrid project.

2.2 Description of site selection methodology

The substation selection methodology is outlined below in Figure 2.1, using the following steps:

Figure 2.1 Steps of site selection methodology



Each of these steps is described in greater detail below.

2.3 Step 1: Initial screening

Considering our full portfolio of EHV and HV substations, preference will be given to those assets within our RIIO-ED1 tables identified as having fault level issues either now or at some future date out to RIIO-ED2. This is part of the initial screening not classification.

2.4 Step 2: Substation classification

Substations will be classified according to the following criteria:

- Voltage levels ie 6.6kV, 11kV and 33kV
- Existing or potential future fault level issues
- Fault history of outgoing circuits
- Age of substation switchgear and protection relays
- Physical constraints (desktop initially).

2.4.1 Voltage levels

The following voltage levels are considered in the selection methodology as these are the substations/ circuits where fault level issues will manifest:

- 33kV; and
- 11kV and 6.6kV

2.4.2 Existing or potential future fault level issue

The list of substations and equipment with a potential fault level issue in RIIO-ED1 and RIIO-ED2 is the starting point for site selection. From this list, all substations where work is to be carried out during the project delivery period will be removed. This delivers a list of possible sites on which to deploy the techniques for Respond.

2.4.3 Fault history

In order to increase the chance of the fault level mitigation technologies operating, the fault history for the substations/ circuit will be analysed to understand whether the location would be a good test bed for the trials, fully expecting the new fault level mitigation equipment will operate in the trials. The list produced above will be ordered by fault history.

Age and type of substation and protection equipment

This criterion is only used to select sites for the Adaptive Protection trials to ensure we get a mix of the different relay types. Using the list developed above we will apply the ages of the equipment and select at least one of each of the categories below.

The following categories of equipment will be considered in the selection methodology, based on the number, age and type of substation equipment, defined as:

- Electro-mechanical protection (age range between 1960s and 1970s)
- Static electronic relays (approximate age range of 1980s and 1990s)
- Numerical/ microprocessor based relays (approximate age range 2000 to date).

2.4.4 Physical constraints

Consideration shall be given to the following when selecting the sites for the installation of I_S-limiters:

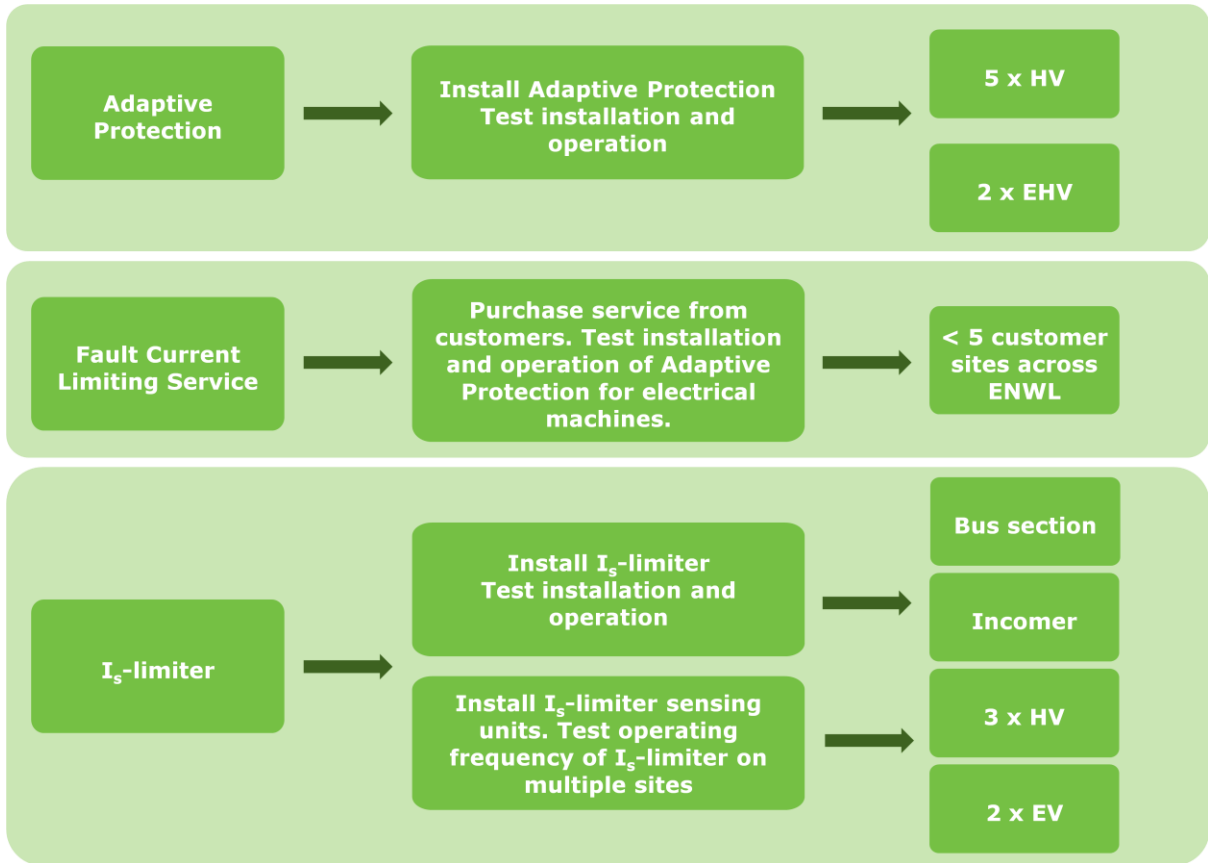
- Is the site currently operating as a standard configuration?
- Is there space available to install the new equipment?
- What is the access to and egress from the site?
- The potential for installation without planned supply interruptions.

2.5 Step 3: Refine selection and peer review

For meaningful results, primary substations will be selected to best demonstrate the project benefits. In project delivery the preliminary selection will be investigated in more detail to ensure they are suitable to install the techniques and to check that no issues have arisen to prevent deployment. PB Power, our technical consultants on this project, will peer review our site selection methodology and outputs.

The diagram below shows the range of Respond installations to be catered for in the site selection methodology.

Figure 2.2: Range of Respond installations



It is assumed that the substations selected for inclusion within the trials are currently being operated in a standard configuration.

The Adaptive Protection trial may, in the event of a fault on the system, alter the substation configuration to remove the fault contribution and then revert back to the traditional configuration using automated switching once the fault has cleared.

The total number of locations where the fault level mitigation technologies were explored under Respond will be deployed on 14 primary substations. These will demonstrate city and town centre locations with load patterns that include distributed generation.

3 REVIEW OF SITE SELECTION

The trial sites selected during the bid phase has been reviewed and updated by reapplying the methodology with consideration of the latest parameters and further additional detailed information.

3.1 Step 1: Updated Initial screening

An updated spreadsheet (**Appendix A**) of the 43 substations where the maximum permissible symmetrical RMS fault level was anticipated to be reached or exceeded was produced based upon the latest LTDS information. Due to legacy repairs and upgrades to protection systems there was often a mixture of protection relay categories at an individual primary substation site. Consequently, the protection equipment at each primary substation site was categorised by the predominant protection relay type fitted to the outgoing 11/6.6kV feeder circuit breakers. Eligibility for inclusion in the trial was decided by excluding 30 of the sites, as highlighted in Appendix A, for the following reasons:

- Load related work programmed during the trial period
- Switchgear replacement due in RIIO ED1
- Protection replacement due in RIIO ED1 period
- Other protection work scheduled
- Other reasons such as work on adjacent 132kV systems.

A further spreadsheet (**Appendix B**) was produced listing 156 primary substations where there was an HV feeder with installed switchgear that had a reduced fault level rating of 150MVA at 6.6kV. All of the switchgear identified was Long and Crawford T3GF3 HV ring main units. A number of these units were scheduled for replacement in RIIO ED1 and therefore the associated primary was excluded from the trial.

3.2 Step 2: Updated substation classification

Combining the two lists of eligible sites (**Appendix C**) resulted in 126 substations as some of the sites were duplicated. The combined list was then checked by the system planning team and a number of substations were deemed ineligible for a variety of reasons

The following criteria were then used to classify the substations:

- System voltage
- Protection type and age
- Fault history (feeder performance ranking and number of faults)
- Prospective short circuit current in excess of fault level rating
- Circuit breaker type.

As faults are required to operate the fault level mitigation techniques the final list of suitable sites was sorted by highest no of faults on a feeder using the 2012/13 primary substation fault data.

The technical solutions were then applied to the substations in order to ensure that there was the following mix:

- Adaptive Protection: Five installations at high voltage substations
- Adaptive Protection: Two installations at extra high voltage substations
- Sensing equipment: Three installations at high voltage substations
- Sensing equipment: Two installations at extra high voltage substations
- I_S-limiters: Two HV substations.

This analysis produced the list shown in **Appendix D**

At this stage it was deemed necessary to undertake a site visit with ABB to ascertain the feasibility of installing I_S-limiters or I_S-sensing equipment. **Appendix E** gives details of the substations selected.

The sites suitable for adaptive protection were then added to this list to produce the **Bid list** which is shown in **Appendix F** and reproduced in the Bid document as the Map of indicative substation locations

4 SELECTION REFINEMENT

From the initial list four changes were made due to unforeseeable reasons.

Three of the substations were replaced due to discharge issues with existing equipment.

- Shaw substation was replaced by Irlam substation which was the next substation on the list where static electronic protection relays were installed.
- Hall Cross substation was replaced by Offerton substation which was some 60 places below it on the list. While other substations higher on the list also had electromechanical protection relays installed they all had a common ranking of zero faults in 2012/13 so it was considered that Offerton was better suited to the trial as it is supplied from 3 BSP's which should provide opportunities to increase fault levels on the EHV network when making system parallels between adjacent BSP's.
- Cheadle Hulme substation was replaced by Broadheath. Broadheath had ten faults in 2012/13 of which three exceeded fault level limits, by comparison Cheadle Hulme had eight faults in 2012/13 of which two exceeded fault level limits.

Hindley Green primary substation was identified for asset replacement and as such was replaced by Denton West primary substation. Due to the late change this selection was based on technical suitability.

The final list selected for **installation** is shown in **Appendix G**.

APPENDIX A: SITE SELECTION FAULT LEVEL TABLES

Sites included in selection

| Substation | Voltage | Load related work carried out during trial period | On RIIO ED1 switchgear asset replacement list | On RIIO ED1 protection asset replacement list - phase 1 | Protection work being carried out | Other reason to discount |
|----------------------|---------|---|---|---|--|--------------------------|
| Atherton Town Centre | 11kV | YES but only CT Change could be combined with installation of trial equipment | | YES | 2 x Translay Relay - could still use | |
| Chassen Rd | 6.6kV | | | | | |
| Shaw | 6.6kV | | | | | |
| Campbell St | 6.6kV | | | | | |
| Farnworth | 11kV | | | | | |
| Buxton | 33kV | | | YES | 2 x AEI DT2 2 x Telecode 80 2 x Translay 2 x DBS Relay Could still use | |
| New Mills | 33kV | | | | | |
| Bolton | 33kV | | | YES | 12 x DBS Relays | |
| Hindley Green | 11kV | | | | | |
| Green Street | 6.6kV | | | | | |
| Barbara Street | 6.6kV | | | | | |
| Bamber Bridge | 11kV | | | | | |

Sites excluded from selection

| Substation | Voltage | Load Related work carried out during trial period | On RIIO ED1 Switchgear Asset Replacement List | On RIIO ED1 Protection Asset Replacement List - Phase 1 | Protection Work Being Carried out | Other Reason to Discount |
|---------------------------|---------------------------------|---|---|---|--|---|
| Barton Dock Rd | | | YES | | | |
| Bispham | | YES | | | | |
| Morton Park | 11kV | | | YES | 1 x Panel Condition 2 x Translay Relay | |
| Newton Heath | | | YES | | | |
| Kendal Primary | 33kV & 11kV (if Parkside Rd) | | | YES | 2 x AVE Relays 2 x AEI DT2 Relays 3 x Distance Relays 2 x Translay Relays | |
| Southern Gateway | | YES | | | | |
| Lower Darwen Bsp | | YES | | | | |
| Bollington | | YES | | | | |
| Ribblesdale T13 / Peel St | | | | | | YES - Work on 132kV system. Project only 11kV and 33kV. |
| Peel Bsp | | YES | | | | |
| Catteral Waterworks | | YES | | | | |
| Sale Moor | | | YES | | | |
| Annie Pit | | YES | | | | |
| Thornton Bsp | | | | | | YES - Work on 132kV system. Project only 11kV and 33kV. |

| Substation | Voltage | Load Related work carried out during trial period | On RIIO ED1 Switchgear Asset Replacement List | On RIIO ED1 Protection Asset Replacement List - Phase 1 | Protection Work Being Carried out | Other Reason to Discount |
|--|---------|---|---|---|--|---|
| Chorlton | | YES | | | | |
| Athletic St- Burnley Centre-Heasandford (Substations 295, 192, 406) | | YES | | | | |
| Arnside-Kirkby Lonsdale-Whasset-Bentham-Melling-Ingleton-Yealand-Sedbergh (Substations 405, 256, 164, 40, 87, 209, 88, 35) | | YES | | | | |
| Romiley-Woodley (Substations 180, 129) | | YES | | | | |
| Bury-Radcliffe (Substations 183, 188) | | YES | | | | |
| Kendal BSP | | | | | | YES - Work on 132kV system. Project only 11kV and 33kV. |
| Winifred Rd | | | | | | Issues with 11kV SPE Breakers |
| Manchester Airport | | YES | | | | |
| Kendal | 33kV | | | YES | 2 x AVE Relays 2 x AEI DT2 Relays 3 x Distance Relays 2 x Translay Relays | |
| Moss Nook | | | | | | Feeds Manchester Airport |

| Substation | Voltage | Load Related work carried out during trial period | On RIIO ED1 Switchgear Asset Replacement List | On RIIO ED1 Protection Asset Replacement List - Phase 1 | Protection Work Being Carried out | Other Reason to Discount |
|------------------|--------------------------|---|---|---|---|--------------------------|
| Mount Street | | YES | | | | |
| Rochdale | If Cental 33kV and 6.6kV | | | YES | 3 x AVE Relays 2 x VTJC Relays 3 x Panel Condition 17 x Wiring Condition | |
| Bloom Street | 33kV | | | YES | 7 x DBS Relays | |
| Bradshawgate | | | YES | | | |
| Dickinson Street | | | YES | | | |
| Frederick Road | 33kV and 6.6kV | | YES | | | |

APPENDIX B: PRIMARY SUBSTATIONS WITH A FEEDER THAT HAS A T3GF3 RING MAIN UNIT FAULT LEVEL ISSUE

Sites included

| Substation | Substation Number | Voltage | Substation | Substation Number | Voltage | Substation | Substation Number | Voltage |
|----------------------|-------------------|---------|---------------|-------------------|---------|---------------|-------------------|---------|
| Ansdell | 400101 | 6.6kv | Chamberhall | 200205 | 6.6kv | Griffin | | 6.6kv |
| Ardwick | 100101 | 6.6kv | Chassen Rd | 100608 | 6.6kv | Hall Cross | 400407 | 6.6kv |
| Ashton On Mersey | 100102 | 6.6kv | Cheadle Heath | 301208 | 6.6kv | Hareholme | | 6.6kv |
| Ashton In Makerfield | 200414 | 6.6kv | Cheadle Hulme | 100108 | 6.6kv | Heady Hill | 200211 | 6.6kv |
| Ashton | 400401 | 6.6kv | Chester Rd | 100610 | 6.6kv | Heap Bridge | 200212 | 6.6kv |
| Ashwood Dale | 301467 | 6.6kv | Clarendon Rd | 400010 | 6.6kv | Heaton Moor | 302610 | 6.6kv |
| Athletic St | 400052 | 6.6kv | Cleveleys | | 6.6kv | Heaton Norris | 301340 | 6.6kv |
| Barbara St | 200104 | 6.6kv | Clover Hill | 400051 | 6.6kv | Heyrod | 304200 | 6.6kv |
| Belgrave | | 6.6kv | Cog Lane | 400054 | 6.6kv | Heyside | 302808 | 6.6kv |
| Blackbull | 400403 | 6.6kv | Copse Rd | | 6.6kv | Heywood | | 6.6kv |
| Blackburn | 400001 | 6.6kv | Craggs Row | 400419 | 6.6kv | Hollinwood | 307008 | 6.6kv |
| Blackburn Rd Clayton | | 6.6kv | Denton West | 100111 | 6.6kv | Hurst | 302893 | 6.6kv |
| Blackfriars | 100639 | 6.6kv | Didsbury | | 6.6kv | Hyndburn Rd | | 6.6kv |
| Blackpool | 400113 | 6.6kv | Dukinfield | 302692 | 6.6kv | India St | 400023 | 6.6kv |
| Brinksway | 303222 | 6.6kv | Eastlands | | 6.6kv | Irlam | | 6.6kv |
| Broadheath | | 6.6kv | Failsworth | 100613 | 6.6kv | Kay St | 400021 | 6.6kv |

| Substation | Substation Number | Voltage | Substation | Substation Number | Voltage | Substation | Substation Number | Voltage |
|-----------------------|-------------------|---------|--------------------|-------------------|---------|-----------------|-------------------|---------|
| Burnley | 400052 | 6.6kv | Feniscowles | 400015 | 6.6kv | Kitt Green | 200406 | 6.6kv |
| Bury Town Centre | 200209 | 6.6kv | Gale | | 6.6kv | Lamberhead | | 6.6kv |
| Cannon St | | 6.6kv | Gidlow | 200408 | 6.6kv | Langroyd Rd | 400056 | 6.6kv |
| Cecil St | 400103 | 6.6kv | Great Harwood | 400008 | 6.6kv | Littleborough | 304884 | 6.6kv |
| Central Manchester | | 6.6kv | Green St (T12+T13) | | 6.6kv | Longford Bridge | | 6.6kv |
| Chadderton | 300029 | 6.6kv | Greenhill | 300024 | 6.6kv | Longridge | 400416 | 6.6kv |
| Lyons Rd | 100618 | 6.6kv | Snipe | | 6.6kv | | | |
| Marton | 400108 | 6.6kv | Spa Rd | 200102 | 6.6kv | | | |
| Mereside | 400123 | 6.6kv | St Annes | 400111 | 6.6kv | | | |
| Milnrow | 304883 | 6.6kv | St Marys St | 400412 | 6.6kv | | | |
| Monton | 100620 | 6.6kv | Strangeways | 100631 | 6.6kv | | | |
| Mosley Rd | 100621 | 6.6kv | Tame Valley | 300209 | 6.6kv | | | |
| Moss Side (Longsight) | 100122 | 6.6kv | Trinity | | 6.6kv | | | |
| Mount St | 100622 | 6.6kv | Union Rd | 200114 | 6.6kv | | | |
| Musgrave Rd | | 6.6kv | Urmston | 100635 | 6.6kv | | | |
| Nelson | 400044 | 6.6kv | Victoria Park | 100140 | 6.6kv | | | |
| Norbreck | 400109 | 6.6kv | Wardleworth | | 6.6kv | | | |
| Northenden | 100123 | 6.6kv | Warton | 400414 | 6.6kv | | | |
| Offerton | 302872 | 6.6kv | Waterhead | 302852 | 6.6kv | | | |

| Substation | Substation Number | Voltage | Substation | Substation Number | Voltage | Substation | Substation Number | Voltage |
|----------------|-------------------|---------|----------------|-------------------|---------|------------|-------------------|---------|
| Openshaw | 100125 | 6.6kv | Weaste | 100640 | 6.6kv | | | |
| Pendleton | 100625 | 6.6kv | Werneth | 303300 | 6.6kv | | | |
| Phillips Lane | | 6.6kv | West Didsbury | 100113 | 6.6kv | | | |
| Portwood | 305211 | 6.6kv | Willowbank | 302292 | 6.6kv | | | |
| Poulton | 400110 | 6.6kv | Withington | 100131 | 6.6kv | | | |
| Preston East | | 6.6kv | Wordsworth St | 200105 | 6.6kv | | | |
| Pringle St | 400018 | 6.6kv | Worsley Mesnes | 200409 | 6.6kv | | | |
| Prinny Hill | 400088 | 6.6kv | | | | | | |
| Queens Park | 100628 | 6.6kv | | | | | | |
| Rawtenstall Rd | 400090 | 6.6kv | | | | | | |
| Reddish Vale | 300238 | 6.6kv | | | | | | |
| Robert Hall St | 100629 | 6.6kv | | | | | | |
| Roman Rd | | 6.6kv | | | | | | |
| Rossall | 400122 | 6.6kv | | | | | | |
| Royton | 300009 | 6.6kv | | | | | | |
| Salford Quays | | 6.6kv | | | | | | |
| Shaw | | 6.6kv | | | | | | |

Sites excluded

| Substation | Substation Number | Voltage | Load Related work carried out during trial period | On RIIO ED1 Switchgear Asset Replacement List | On RIIO ED1 Protection Asset Replacement List - Phase 1 | Other Reason to Discount |
|----------------------|-------------------|---------|---|---|---|--------------------------|
| Ashton under Lyne | | 6.6kV | | | YES | |
| Barton Dock Rd | | 6.6kV | | YES | | |
| Bispham | | 6.6kV | YES | | | |
| Blackley | | 6.6kV | | YES | | |
| Burnley Centre | | 6.6kV | | YES | | |
| Burnley North | | 6.6kV | | YES | | |
| Castleton | | 6.6kV | | | YES | |
| Catterall Waterworks | | 6.6kV | YES | | | |
| Cheetham Hill | | 6.6kV | | | YES | |
| Chorlton | | 6.6kV | YES | | | |
| Dickinson St | | 6.6kV | | YES | | |
| Frederick Rd | | 6.6kV | | | YES | |
| Harpurhey | | 6.6kV | | YES | | |
| Hyde | | 6.6kV | | | YES | |
| Levenshulme | | 6.6kV | | YES | | |
| Longsight | | 6.6kV | | | YES | |

| Substation | Substation Number | Voltage | Load Related work carried out during trial period | On RIIO ED1 Switchgear Asset Replacement List | On RIIO ED1 Protection Asset Replacement List - Phase 1 | Other Reason to Discount |
|------------------|-------------------|---------|---|---|---|--------------------------|
| Lower Darwen | | 6.6kV | | | YES | |
| New Moston | | 6.6kV | | YES | | |
| Newton | | 6.6kV | | YES | | |
| Newton Heath | | 6.6kV | | YES | | |
| Prestwich | | 6.6kV | | | YES | |
| Randal St | | 6.6kV | | YES | | |
| Rochdale Central | | 6.6kV | | | YES | |
| Sale | | 6.6kV | | | YES | |
| Sale Moor | | 6.6kV | | YES | | |
| Shannon St | | 6.6kV | | YES | | |
| Spotland | | 6.6kV | | YES | | |
| Squires Gate | | 6.6kV | | YES | | |
| St Marys | | 6.6kV | | YES | | |
| Strawberry Bank | | 6.6kV | | YES | | |
| Stuart St | | 6.6kV | | | YES | |
| Trafford | | 6.6kV | | YES | | |

| Substation | Substation Number | Voltage | Load Related work carried out during trial period | On RIIO ED1 Switchgear Asset Replacement List | On RIIO ED1 Protection Asset Replacement List - Phase 1 | Other Reason to Discount |
|---------------------|-------------------|---------|---|---|---|-------------------------------|
| Trafford Park North | | 6.6kV | | YES | | |
| Tulketh | | 6.6kV | | YES | | |
| Warbreck | | 6.6kV | | YES | | |
| Wesley Place Bacup | | 6.6kV | | YES | | |
| Whalley Range | | 6.6kV | | YES | | |
| Whitworth | | 6.6kV | | YES | | |
| Winifred Rd | | 6.6kV | | | | Issues with 11kV SPE Breakers |
| Woodbine St | | 6.6kV | | YES | | |

APPENDIX C: COMBINED LIST

Sites suitable for Respond selection

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 |
|----------------------|-------------------|-----------------|---|--------------------------------|--------------------------------|-------------------------------|
| Longridge | 400416 | 6.6kV | Mixture | 1967 | 135 | 36 |
| Hall Cross | 400407 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1984 / 1994 | 102 | 32 |
| Atherton Town Centre | 205318 | 11kV | Static Electronic | 1994 | 7 | 29 |
| Athletic St | 400052 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1964 | 294 | 28 |
| Hindley Green | 200416 | 33kV, 11kV | Electromechanical | 1963 / 2005 | 2 | 26 |
| Gidlow | 200408 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1962 / 1968 | 145 | 20 |
| Hareholme | 400092 | 6.6kV | Static Electronic | 1994 | 257 | 20 |
| Nelson | 400044 | 6.6kV | Electromechanical | 1965 | 131 | 17 |
| Blackbull | 400403 | 6.6kV | Numerical / Microprocessor | 2007 | 303 | 17 |
| Littleborough | 304884 | 6.6kV | Electromechanical | 1966 | 336 | 13 |
| Mount St | 100622 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1966 | 223 | 10 |
| Shaw | 300006 | 6.6kV | Static Electronic | 1995 | 220 | 8 |
| Cheadle Hulme | 100108 | 11kV | Electromechanical | 1966 | 228 | 8 |
| Belgrave | 300832 | 6.6kV | Numerical / Microprocessor | 2010 | 348 | 8 |

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 |
|---------------|-------------------|-----------------|---|--------------------------------|--------------------------------|-------------------------------|
| Marton | 400108 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Mixture | 1964 / 1970 | 240 | 7 |
| Irlam | 100615 | 6.6kV | Static Electronic | 1989 | 275 | 7 |
| Bamber Bridge | 400201 | 11kV | Numerical / Microprocessor | 2006 | 315 | 7 |
| Hollinwood | 307008 | 6.6kV, 33kV | 6.6kV - Mixture 33kV - Mixture | 1994 / 1989 | 121 | 6 |
| Hurst | 302893 | 6.6kV | Numerical / Microprocessor | 2007 | 304 | 6 |
| Copse Rd | 400105 | 6.6kV | Electromechanical | 1990 | 237 | 5 |
| Craggs Row | 400419 | 6.6kV | Electromechanical | 1981 | 295 | 5 |
| Heywood | 200115 | 6.6kV | Electromechanical | 1990 / 2006 | 125 | 4 |
| Mereside | 400123 | 6.6kV | Electromechanical | 1976 | 325 | 4 |
| Gale | 304894 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1966 | 153 | 3 |
| Cog Lane | 400054 | 6.6kV | Static Electronic | 1996 | 345 | 3 |
| St Annes | 400111 | 6.6kV | Electromechanical | 1985 | 343 | 0 |
| Kay St | 400021 | 6.6kV | Electromechanical | | 352 | |
| Heady Hill | 200211 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 363 | |
| Chamberhall | 200205 | 6.6kV | Electromechanical | | 385 | |
| Preston East | 400399 | 6.6kV | Numerical / Microprocessor | | 393 | |
| Broadheath | 100134 | 11kV | Electromechanical | | 401 | |
| Clarendon Rd | 400014 | 6.6kV | Electromechanical | | 406 | |
| Barbara St | 200104 | 6.6kV | Electromechanical | | 410 | |

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 |
|-------------------------|-------------------|-----------------|--|--------------------------------|--------------------------------|-------------------------------|
| Ashwood Dale | 301467 | 6.6kV | Static Electronic | | 426 | |
| Ashton | 400401 | 6.6kV | Electromechanical | | 432 | |
| Wardleworth | 304886 | 6.6kV | Static Electronic | | 458 | |
| Griffin | 400006 | 6.6kV, 33kV | 6.6kV - Numerical / Microprocessor 33kV - Mixture | | 461 | |
| Farnworth | 200119 | 11kV | Static Electronic | | 465 | |
| Queens Park | 100628 | 6.6kV | Electromechanical | | 471 | |
| Kitt Green | 200406 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 484 | |
| Withington | 100131 | 6.6kV, 33kV | 6.6kV - Numerical / Microprocessor 33kV - Electromechanical | | 485 | |
| Langroyd Rd | 400056 | 6.6kV | Electromechanical | | 517 | |
| Weaste | 100640 | 6.6kV | Static Electronic | | 524 | |
| Willowbank | 302292 | 6.6kV, 33kV | 6.6kV - Numerical / Microprocessor 33kV - Mixture | | 545 | |
| Reddish Vale | 300238 | 6.6kV | Static Electronic | | 547 | |
| India St | 400023 | 6.6kV | Electromechanical | | 557 | |
| Ashton In Makerfield | 200414 | 6.6kV, 33kV | 6.6kV - Static Electronic 33kV - Electromechanical | | 567 | |
| Norbreck | 400109 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Mixture | | 591 | |

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 |
|-----------------------|-------------------|-----------------|---|--------------------------------|--------------------------------|-------------------------------|
| Milnrow | 304883 | 6.6kV | Electromechanical | | 594 | |
| Pendleton | 100625 | 6.6kV | Electromechanical | | 602 | |
| Openshaw | 100125 | 6.6kV | Numerical / Microprocessor | | 631 | |
| Clover Hill | 400051 | 6.6kV | Numerical / Microprocessor | | 636 | |
| Wordsworth St | 200105 | 6.6kV | Electromechanical | | 650 | |
| Greenhill | 300024 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Mixture | | 653 | |
| Werneth | 303300 | 6.6kV | Electromechanical | | 654 | |
| Pringle St | 400018 | 6.6kV | Electromechanical | | 658 | |
| Brinksway | 303222 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 667 | |
| Rawtenstall Rd | 400090 | 6.6kV | Numerical / Microprocessor | | 669 | |
| Heyside | 302808 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 680 | |
| Warton | 400414 | 6.6kV, 33kV | 6.6kV - Mixture 33kV - Mixture | | 694 | |
| Monton | 100620 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 705 | |
| Longford Bridge | 100638 | 6.6kV | Static Electronic | | 709 | |
| Offerton | 302872 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 719 | |
| Chassen Rd | 100608 | 6.6kV | Electromechanical | | 727 | |
| Moss Side (Longsight) | 100122 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 729 | |

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 |
|---------------|-------------------|-----------------|--|--------------------------------|--------------------------------|-------------------------------|
| Urmston | 100635 | 6.6kV | Electromechanical | | 733 | |
| Blackburn | 400001 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 735 | |
| Phillips Lane | 400043 | 6.6kV | Static Electronic | | 737 | |
| Dukinfield | 302692 | 6.6kV | Electromechanical | | 741 | |
| Chadderton | 300029 | 6.6kV | Electromechanical | | 751 | |
| Union Rd | 200114 | 6.6kV | Electromechanical | | 769 | |
| Spa Rd | 200102 | 6.6kV | Electromechanical | | 796 | |
| Heaton Moor | 302610 | 6.6kV, 33kV | 6.6kV - Numerical / Microprocessor 33kV - Electromechanical | | 805 | |
| Snipe | 100129 | 6.6kV | Static Electronic | | 809 | |
| Lamberhead | 200405 | 6.6kV, 33kV | 6.6kV - Numerical / Microprocessor 33kV - Mixture | | 821 | |
| Heyrod | 300332 | 6.6kV | Electromechanical | | 849 | |
| Blackfriars | 100639 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 868 | |
| St Marys St | 400412 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 878 | |
| Heaton Norris | 301340 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 887 | |
| Failsworth | 100613 | 6.6kV | Electromechanical | | 902 | |
| Trinity | 100645 | 6.6kV | Numerical / Microprocessor | | 927 | |

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 |
|------------------|-------------------|-----------------|--|--------------------------------|--------------------------------|-------------------------------|
| Northenden | 100123 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 960 | |
| Musgrave Rd | 200101 | 6.6kV | Static Electronic | | 962 | |
| Strangeways | 100631 | 6.6kV | Electromechanical | | 973 | |
| Portwood | 305211 | 6.6kV | Electromechanical | | 986 | |
| Eastlands | 100138 | 6.6kV | Static Electronic | | 1000 | |
| West Didsbury | 100113 | 6.6kV | Static Electronic | | 1013 | |
| Denton West | 100111 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 1047 | |
| Blackpool | 400113 | 6.6kV, 33kV | 6.6kV - Numerical / Microprocessor 33kV - Electromechanical | | 1059 | |
| Salford Quays | 100641 | 6.6kV | Static Electronic | | 1064 | |
| Chester Rd | 100610 | 6.6kV, 33kV | 6.6kV - Numerical / Microprocessor 33kV - Mixture | | 1086 | |
| Didsbury | 100112 | 6.6kV, 33kV | 6.6kV - Numerical / Microprocessor 33kV - Electromechanical | | 1089 | |
| Roman Rd | 400002 | 6.6kV | Numerical / Microprocessor | | 1091 | |
| Ashton On Mersey | 100102 | 6.6kV | Numerical / Microprocessor | | 1092 | |
| Robert Hall St | 100629 | 6.6kV | Electromechanical | | 1126 | |

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 |
|---------------|-------------------|-----------------|---|--------------------------------|--------------------------------|-------------------------------|
| Cheadle Heath | 301208 | 6.6kV, 33kV | 6.6kV - Numerical / Microprocessor 33kV - Mixture | | 1129 | |
| Cecil St | 400103 | 6.6kV | Numerical / Microprocessor | | 1201 | |
| Royton | 300009 | 6.6kV, 33kV | 6.6kV - Static Electronic 33kV - Mixture | | 1219 | |
| Waterhead | 302852 | 6.6kV | Electromechanical | | 1224 | |
| Hyndburn Rd | 400013 | 6.6kV | Numerical / Microprocessor | | 1327 | |
| Ansdell | 400101 | 6.6kV, 33kV | 6.6kV - Static Electronic 33kV - Electromechanical | | 1352 | |
| Ardwick | 100101 | 6.6kV | Numerical / Microprocessor | | 1367 | |
| Rossall | 400122 | 6.6kV | Electromechanical | | 1531 | |
| Lyons Rd | 100618 | 6.6kV | Electromechanical | | 1634 | |
| Mosley Rd | 100621 | 6.6kV | Electromechanical | | 1847 | |
| New Mills | 301672 | 33kV | Electromechanical | | No data | |

Sites excluded from selection

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 | Other Reason to Discount |
|--------------------|-------------------|-----------------|---|--------------------------------|--------------------------------|-------------------------------|--|
| Campbell St | 200103 | 11kV | Electromechanical | 1962 | 329 | 13 | Cannot be used for Is Lmiiter as the switchgear has a fault level issue |
| Prinny Hill | 400088 | 6.6kV | Numerical / Microprocessor | | 260 | 10 | Not suitable due to HV interconnectors |
| Green St (T12+T13) | 200410 | 6.6kV | Electromechanical | | 281 | 10 | The 11 kV Swgr was due for replacement in FY15, but may be delayed into FY16 and hence run on to FY17 |
| Tame Valley | 300209 | 6.6kV | Mixture | | 235 | 5 | The Transformers at this location are in a very poor condition and are due for replacement. I'd not like to see this experimental work done here until the units are replaced. |
| Worsley Mesnes | 200409 | 6.6kV | Electromechanical | | 264 | 2 | 6.6kV Switch board replacement planned in FY17 and 18 |
| Feniscowles | 400015 | 6.6kV | Electromechanical | | 159 | | New switchgear to be installed |
| Poulton | 400110 | 6.6kV | Numerical / Microprocessor | | 404 | | Work planned |
| Heap Bridge | 200212 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 424 | | Work planned |
| Great Harwood | 400008 | 6.6kV | Electromechanical | | 427 | | New switchgear on site waiting to be commissioned |

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 | Other Reason to Discount |
|----------------------|-------------------|-----------------|---|--------------------------------|--------------------------------|-------------------------------|---------------------------------|
| Bury Town Centre | 200209 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | | 470 | | Work planned on 33kV |
| Buxton Grid | 303846 | 33kV | Electromechanical | | 583 | | Access Issues |
| Cannon St | 100607 | 6.6kV | Electromechanical | | 1122 | | Access Issues |
| Central Manchester | 100508 | 6.6kV | Numerical / Microprocessor | | 1175 | | Transformers to be relocated |
| Victoria Park | 100140 | 6.6kV | Numerical / Microprocessor | | 1638 | | Interconnectors to the hospital |
| Blackburn Rd Clayton | 400005 | 6.6kV | | | 652 | | No info on database |
| Cleveleys | 400104 | 6.6kV | | | 368 | | No info on database |

APPENDIX D: FINAL LIST PRIOR TO SITE VISIT

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 | Faults outside fault level | Technology to be Deployed | Fault Level reason |
|----------------------|-------------------|-----------------|---|--------------------------------|--------------------------------|-------------------------------|----------------------------|---------------------------------|-------------------------------|
| Longridge | 400416 | 6.6kV | Mixture | 1967 | 135 | 36 | 11 | HV Is sensing equipment - 1 | RMU on outgoing feeder |
| Hall Cross | 400407 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1984 / 1994 | 102 | 32 | 10 | EHV adaptive protection - 1 | RMU on outgoing feeder |
| Atherton Town Centre | 205318 | 11kV | Static Electronic | 1994 | 7 | 29 | 9 | HV adaptive protection - 1 | Substation equipment |
| Athletic St | 400052 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1964 | 294 | 28 | 8 | EHV Is sensing equipment - 1 | RMU on outgoing feeder |
| Hindley Green | 200416 | 33kV, 11kV | Electromechanical | 1963 / 2005 | 2 | 26 | 8 | HV adaptive protection - 2 | Fault History |
| Gidlow | 200408 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1962 / 1968 | 145 | 20 | 6 | EHV Is sensing equipment - 2 | RMU on outgoing feeder |
| Hareholme | 400092 | 6.6kV | Static Electronic | 1994 | 257 | 20 | 6 | HV Is sensing equipment - 2 | RMU on outgoing feeder |
| Nelson | 400044 | 6.6kV | Electromechanical | 1965 | 131 | 17 | 5 | HV Is sensing equipment - 3 | RMU on outgoing feeder |
| Blackbull | 400403 | 6.6kV | Numerical / Microprocessor | 2007 | 303 | 17 | 5 | HV adaptive protection - 3 | RMU on outgoing feeder |
| Littleborough | 304884 | 6.6kV | Electromechanical | 1966 | 336 | 13 | 4 | HV adaptive protection - 5 | RMU on outgoing feeder |
| Mount St | 100622 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1966 | 223 | 10 | 3 | EHV adaptive protection - 2 | RMU on outgoing feeder |
| Shaw | 300006 | 6.6kV | Static Electronic | 1995 | 220 | 8 | 2 | HV adaptive protection - 4 | Substation equipment |
| Cheadle Hulme | 100108 | 11kV | Electromechanical | 1966 | 228 | 8 | 2 | HV Is Limiter - Incomer - 2 | RMU on outgoing feeder |
| Bamber Bridge | 400201 | 11kV | Numerical / Microprocessor | 2006 | 315 | 7 | 2 | HV Is Limiter - bus section - 1 | Existing arrangements at site |

APPENDIX E: SITE VISITS WITH ABB

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 | Faults outside fault level | Is Limiter Insert change | Technology to be deployed | Fault level reason |
|---------------|-------------------|-----------------|---|--------------------------------|--------------------------------|-------------------------------|----------------------------|--------------------------|---------------------------------|-------------------------------|
| Athletic St | 400052 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1964 | 294 | 28 | 8 | | EHV Is sensing equipment - 1 | RMU on outgoing feeder |
| Gidlow | 200408 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1962 / 1968 | 145 | 20 | 6 | | EHV Is sensing equipment - 2 | RMU on outgoing feeder |
| Longridge | 400416 | 6.6kV | Mixture | 1967 | 135 | 36 | 11 | | HV Is sensing equipment - 1 | RMU on outgoing feeder |
| Hareholme | 400092 | 6.6kV | Static Electronic | 1994 | 257 | 20 | 6 | | HV Is sensing equipment - 2 | RMU on outgoing feeder |
| Nelson | 400044 | 6.6kV | Electromechanical | 1965 | 131 | 17 | 5 | | HV Is sensing equipment - 3 | RMU on outgoing feeder |
| Bamber Bridge | 400201 | 11kV | Numerical / Microprocessor | 2006 | 315 | 7 | 2 | 2 | HV Is Limiter - bus section - 1 | Existing arrangements at site |
| Broadheath | 100134 | 11kV | Electromechanical | | 401 | 10 | 3 | 2 | HV Is Limiter - Incomer - 2 | RMU on outgoing feeder |

APPENDIX F: BID INSTALLATION LIST

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 | Faults outside fault level | Technology to be Deployed | Fault Level reason |
|----------------------|-------------------|-----------------|---|--------------------------------|--------------------------------|-------------------------------|----------------------------|---------------------------------|-------------------------------|
| Hall Cross | 400407 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1984 / 1994 | 102 | 32 | 10 | EHV adaptive protection - 1 | RMU on outgoing feeder |
| Mount St | 100622 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1966 | 223 | 10 | 3 | EHV adaptive protection - 2 | RMU on outgoing feeder |
| Athletic St | 400052 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1964 | 294 | 28 | 8 | EHV Is sensing equipment - 1 | RMU on outgoing feeder |
| Wigan (Gidlow Cct) | 200421 (200408) | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1962 / 1968 | 145 | 20 | 6 | EHV Is sensing equipment - 2 | RMU on outgoing feeder |
| Atherton Town Centre | 205318 | 11kV | Static Electronic | 1994 | 7 | 29 | 9 | HV adaptive protection - 1 | Substation equipment |
| Hindley Green | 200416 | 33kV, 11kV | Electromechanical | 1963 / 2005 | 2 | 26 | 8 | HV adaptive protection - 2 | Fault History |
| Blackbull | 400403 | 6.6kV | Numerical / Microprocessor | 2007 | 303 | 17 | 5 | HV adaptive protection - 3 | RMU on outgoing feeder |
| Shaw | 300006 | 6.6kV | Static Electronic | 1995 | 220 | 8 | 2 | HV adaptive protection - 4 | Substation equipment |
| Littleborough | 304884 | 6.6kV | Electromechanical | 1966 | 336 | 13 | 4 | HV adaptive protection - 5 | RMU on outgoing feeder |
| Bamber Bridge | 400201 | 11kV | Numerical / Microprocessor | 2006 | 315 | 7 | 2 | HV Is Limiter - bus section - 1 | Existing arrangements at site |
| Longridge | 400416 | 6.6kV | Mixture | 1967 | 135 | 36 | 11 | HV Is sensing equipment - 1 | RMU on outgoing feeder |
| Hareholme | 400092 | 6.6kV | Static Electronic | 1994 | 257 | 20 | 6 | HV Is sensing equipment - 2 | RMU on outgoing feeder |

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 | Faults outside fault level | Technology to be Deployed | Fault Level reason |
|------------|-------------------|-----------------|--------------------|--------------------------------|--------------------------------|-------------------------------|----------------------------|-----------------------------|------------------------|
| Nelson | 400044 | 6.6kV | Electromechanical | 1965 | 131 | 17 | 5 | HV Is sensing equipment - 3 | RMU on outgoing feeder |
| Broadheath | 100134 | 11kV | Electromechanical | | 401 | 10 | 3 | HV Is Limiter - Incomer - 2 | RMU on outgoing feeder |

APPENDIX G – FINAL INSTALLATION LIST

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 | Faults outside fault level | Technology to be Deployed | Fault Level Reason |
|-----------------------------|-------------------|-----------------|---|--------------------------------|--------------------------------|-------------------------------|----------------------------|---------------------------------|-------------------------------|
| Bamber Bridge | 400201 | 11kV | Numerical / Microprocessor | 2006 | 315 | 7 | 2 | HV Is Limiter - bus section - 1 | Existing arrangements at site |
| Broadheath | 100134 | 11kV | Electromechanical | | 401 | 10 | 3 | HV Is Limiter - Incomer - 2 | RMU on outgoing feeder |
| Athletic St | 400052 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1964 | 294 | 28 | 8 | EHV Is sensing equipment - 1 | RMU on outgoing feeder |
| Wigan BSP (Gidlow CCT No 1) | 200421 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1993 | 145 | 20 | 6 | EHV Is sensing equipment - 2 | RMU on outgoing feeder |
| Longridge | 400416 | 6.6kV | Mixture | 1967 | 135 | 36 | 11 | HV Is sensing equipment - 1 | RMU on outgoing feeder |
| Hareholme | 400092 | 6.6kV | Static Electronic | 1994 | 257 | 20 | 6 | HV Is sensing equipment - 2 | RMU on outgoing feeder |
| Nelson | 400044 | 6.6kV | Electromechanical | 1965 | 131 | 17 | 5 | HV Is sensing equipment - 3 | RMU on outgoing feeder |
| Mount St | 100622 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1966 | 223 | 10 | 3 | EHV adaptive protection - 1 | RMU on outgoing feeder |
| Offerton | 302872 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1966 | 719 | 0 | 0 | EHV adaptive protection - 2 | Can run in // with 3x BSPs |
| Atherton TC | 205318 | 11kV | Static Electronic | 1994 | 7 | 29 | 9 | HV adaptive protection - 1 | Substation equipment |
| Denton West | 100111 | 6.6kV, 33kV | 6.6kV - Electromechanical 33kV - Electromechanical | 1963 / 2005 | 1047 | 0 | 0 | HV adaptive protection - 2 | Substation equipment |
| Blackbull | 400403 | 6.6kV | Numerical / Microprocessor | 2007 | 303 | 17 | 5 | HV adaptive protection - 3 | RMU on outgoing feeder |

| Substation | Substation Number | Voltage at Site | Protection at Site | Installation year of equipment | Worst Performer Feeder Ranking | Number of faults in 2012/2013 | Faults outside fault level | Technology to be Deployed | Fault Level Reason |
|---------------|-------------------|-----------------|--------------------|--------------------------------|--------------------------------|-------------------------------|----------------------------|----------------------------|------------------------|
| Irlam | 100615 | 6.6kV | Static Electronic | 1989 | 275 | 7 | 2 | HV adaptive protection - 4 | RMU on outgoing feeder |
| Littleborough | 304884 | 6.6kV | Electromechanical | 1966 | 336 | 13 | 4 | HV adaptive protection - 5 | RMU on outgoing feeder |