

# SPNLT20278

# System Monitoring Modernisation

Issue 1.0

11/12/24

| <b>RIIO-T3 System Monitoring Modernisation</b> |   |            |            |
|--|---|------------|------------|
| <b>Name of Scheme</b>                          | RIIO-T3 System Monitoring Modernisation   |            |            |
| <b>Investment Driver</b>                       | Asset Health  |            |            |
| <b>BPDT / Scheme Reference Number</b>          | SPNLT20278  |            |            |
| <b>Outputs</b>                                 | <ul style="list-style-type: none"> <li>Protection &amp; Control - Fault Recorder</li> </ul>                   |            |            |
| <b>Cost</b>                                    | £2.81M  |            |            |
| <b>Delivery Year</b>                           | 2027 - 2031   |            |            |
| <b>Applicable Reporting Tables</b>             | 5.1_Project_Meta_Data, 7.1_Scheme_C&V_NonLoad_Actuals, 10.2_Asset_ID, 10.3_Site_ID, 11.10_Contractor_Indirect |            |            |
| <b>Historic Funding interactions</b>           | N/A   |            |            |
| <b>Interactive Projects</b>                    | N/A   |            |            |
| <b>Spend Apportionment</b>                     | <b>ET2</b>  | <b>ET3</b> | <b>ET4</b> |
|  | £0.23M  | £2.58M     | £0.00M     |

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## Table of Contents

|  |    |
|--|----|
| Table of Contents .....                                      | 3  |
| 1. Introduction .....  | 4  |
| 2. Background Information .....                              | 4  |
| 3. Optioneering .....  | 5  |
| 3.1. Baseline: Do Nothing / Deferral to T4 .....             | 5  |
| 3.2. Option 1: Replacement with new equipment.....           | 5  |
| 3.3. Option 2: Upgrade existing equipment.....               | 5  |
| 3.4. Selected Option.....                                    | 7  |
| 4. Cost.....   | 7  |
| 4.1. Estimated Total Project Cost.....                       | 7  |
| 4.2. Regulatory Outputs .....                                | 8  |
| 5. Deliverability .....                                      | 8  |
| 5.1. Delivery Schedule (Level 1 Programme) .....             | 8  |
| 5.2. Risk and Mitigation.....                                | 8  |
| 5.3. Quality Management .....                                | 9  |
| 5.3.1. Quality Requirements During Project Development ..... | 9  |
| 5.3.2. Quality Requirements in Tenders .....                 | 9  |
| 5.3.3. Monitoring and Measuring During Project Delivery..... | 9  |
| 5.3.4. Post Energisation .....                               | 9  |
| 5.4. Environmental and Wayleave Considerations .....         | 10 |
| 5.4.1. Environmental Planning.....                           | 10 |
| 5.4.2. Wayleave Issues.....                                  | 10 |
| 5.4.3. Environmental Sustainability .....                    | 10 |
| 6. Conclusion.....   | 11 |
| 7. Outputs included in RIIO T2 Plans.....                    | 11 |
| 8. Drawings.....   | 11 |
| 9. Appendix A: .....   | 12 |

## 1. Introduction

ScottishPower Energy Networks (SPEN) utilise fault recorders for multiple applications including post-fault analysis, oscillation (stability) monitoring and power quality monitoring.

The data from these devices is crucial for connecting low carbon technologies such as BESS as they are used in commissioning and post-connection performance monitoring.

By the end of RIIO-T2, SPEN will have 237 legacy fault recorders and 10 legacy fault locators remaining on the transmission network. These devices are categorised as Health Index 5 and require to be upgraded or replaced.

In line with the above, the proposed non-lead asset outputs for the selected option are:

| Asset                                 | Voltage | Intervention           | Volume | Delivery Year |
|---------------------------------------|---------|------------------------|--------|---------------|
| Protection & Control - Fault Recorder | -       | Replacement - Addition | 4      | 2027-2031     |
|                                       |         | Replacement - Disposal | -4     |               |
| Protection & Control - Fault Recorder | -       | Refurbishment Major    | 219    | 2027-2031     |

The works are expected to be completed by regulatory year 2031.

## 2. Background Information

This paper supports a proposal to carry out a programme of work to upgrade 237 fault recorders and replace 10 fault locators on SPT's network.

The existing equipment is obsolete with spares no longer available for purchase and business requirements for data is increasing so these devices require to be upgraded or replaced.

Four different models of fault recorder and one model of fault locator are in use:

- [REDACTED] (92 off)
- [REDACTED] (69 off)
- [REDACTED] (56 off)
- [REDACTED] (2 off)
- [REDACTED] (4 off)

All the above are of similar vintage and are no longer supported by the manufacturer.

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### 3. Optioneering

This section provides a description of each intervention option and details the key considerations. A summary of each option is described at the end of this section.

#### 3.1. Baseline: Do Nothing / Deferral to T4

A 'Do Nothing' option has been considered to represent ongoing maintenance and repair as part of the business as usual.

The intervention timeline considered within this option is summarised below:

- RIIO T3 Period [2027-2031]: Maintenance activities and replacement of failed units.
- RIIO T4 Period [2032-2036]: Upgrade / Replacement of the intended monitoring equipment

This option has been rejected based on the following:

- The monitoring equipment has reached the end of its useful life, and spare parts are no longer available for purchase.
- As inverter-based technologies become more common on the network, the need for data from monitoring equipment has increased and the 'do nothing' option is incompatible with this requirement.

#### 3.2. Option 1: Replacement with new equipment.

The option to replace the monitoring equipment with entirely new equipment was considered but rejected based on the following:

- Replacement of this equipment requires outages on every circuit concerned meaning it would be impractical to replace it in a reasonable timescale.
- Replacement of this equipment is substantially more expensive as:
  - Entirely new equipment has higher costs.
  - Installation contractor would be required to wire new equipment.
  - New drawings would be required for every site/circuit.

#### 3.3. Option 2: Upgrade existing equipment.

This option achieves the principal objectives of supportable hardware and improved performance by replacing specific circuit boards within the fault recorders. This option is also substantially less expensive and is therefore the preferred option.

The specific circuits are detailed in Appendix A.

| Options  | Map | Layout of Substation/ Connection | Layout of all Route Works | Relevant Survey Works | Narrative Consenting Risks | Narrative Preferred Option  | Narrative Rejection  |
|--|-----|----------------------------------|---------------------------|-----------------------|----------------------------|---|--|
| <b>Preferred – Option 2:</b><br>Equipment upgrade        | N/A | N/A                              | N/A                       | N/A                   | N/A                        | Preferred option will achieve the objectives of replacing obsolete hardware with modern supportable hardware and providing enhanced data quality. | N/A  |
| <b>Rejected – Option Baseline:</b> Do Minimum / Deferral | N/A | N/A                              | N/A                       | N/A                   | N/A                        | N/A   | The need for data from monitoring equipment is increasing due to the prevalence of inverter-based technologies and this need is incompatible with not upgrading this equipment. Spare parts are no longer available from the manufacturer. |
| <b>Rejected – Option 1:</b><br>Equipment replacement     | N/A |                                  |                           |                       |                            |   | Rejected on the basis that it would: <ul style="list-style-type: none"> <li>• Be more expensive.</li> <li>• Take substantially more time to complete.</li> <li>• Require outages for every circuit concerned</li> </ul>                    |

### 3.4. Selected Option

Option 2 achieves the main objectives of:

- Replacing hardware with modern, supportable equivalents
- Improving data quality which will have multiple uses for SPEN and its customers.

This is also the most cost-effective option as:

- No installation contractor is required which is cost-effective.
- No circuit outages are required which is beneficial to network security.
- The target can be achieved much more quickly as entire sites can be completed in one exercise instead of circuit by circuit working.

## 4. Cost

The aim of this project is to upgrade 237 fault recorders and 10 fault locators on SPT’s network.

### 4.1. Estimated Total Project Cost

A Business Plan provision and estimated cost of the project is indicated in the following table. These costs include associated Contractor Indirect. To be referred to tables “7.1\_Scheme\_C&V\_NonLoad\_Actuals” and “11.10\_Contractor\_Indirect”.

Project costs for Option 2 (preferred) are summarised in the Cost Breakdown below:

| Item | Description                           | Intervention        | Volume | Estimated CAPEX (£m 23/24) |
|------|---------------------------------------|---------------------|--------|----------------------------|
| 1    | Protection & Control - Fault Recorder | Disposal            | -4     | [REDACTED]                 |
|      |                                       | Addition            | 4      |                            |
| 2    | Protection & Control - Fault Recorder | Refurbishment Major | 219    | [REDACTED]                 |
| 3    | Preliminaries and Site Establishment  | -                   | -      | [REDACTED]                 |
| 4    | Risk                                  | -                   | -      | [REDACTED]                 |

Expenditure incidence is summarised below:

| Estimated CAPEX value per year, £m, 23/24 price base |                 |                 |                 |                 |                 |                 |                      |                      |              |
|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|----------------------|----------------------|--------------|
| Energisation Year                                    | Yr. 2026: CAPEX | Yr. 2027: CAPEX | Yr. 2028: CAPEX | Yr. 2029: CAPEX | Yr. 2030: CAPEX | Yr. 2031: CAPEX | RIIO-T2 Total: CAPEX | RIIO-T3 Total: CAPEX | Total: CAPEX |
| 2027 - 2031  | 0.23            | 0.48            | 0.62            | 0.63            | 0.53            | 0.32            | 0.23                 | 2.58                 | 2.81         |

## 4.2. Regulatory Outputs

The indicative primary asset outputs are identified in table below:

| Asset                                 | Voltage | Intervention           | Volume | Delivery Year |
|---------------------------------------|---------|------------------------|--------|---------------|
| Protection & Control - Fault Recorder | -       | Replacement - Addition | 4      | 2027-2031     |
|                                       |         | Replacement - Disposal | -4     |               |
| Protection & Control - Fault Recorder | -       | Refurbishment Major    | 219    | 2027-2031     |

## 5. Deliverability

We have applied SPT project management approach to ensure that this project work is delivered safely, and in line with the agreed time, cost and quality commitments. We have a proven track record of delivering essential transmission network upgrade projects and will draw upon this knowledge and experience to effectively manage these works. We have assigned a dedicated Project Manager to the works at every stage who is responsible for overall delivery of the scope and is the primary point of contact for all stakeholders.

### 5.1. Delivery Schedule (Level 1 Programme)

A standard approach has been applied to the planning phase of these works and that will continue for the reporting and the application of processes and controls throughout the lifecycle. Table below summarises the key milestones within the delivery schedule.

| Item | Project Milestone           | Estimated Completion Date |
|------|-----------------------------|---------------------------|
| 1    | IP-2                        | October 2024              |
| 2    | SCA/ITT Documents           | July 2025                 |
| 3    | Tender Process              | February 2026             |
| 4    | IP3 Stage 2                 | March 2026                |
| 5    | Commence Site Works         | June 2026                 |
| 6    | Complete Site Works         | December 2030             |
| 7    | Estimated Project Close Out | February 2031             |

Regular meetings with the Project and Construction Management Teams shall be undertaken to assess the ongoing effectiveness of the Project Management interfaces.

The Project Manager will facilitate internal Project Team Meetings, in which project progress and deliverables will be reviewed and any arising risks or issues will be discussed and addressed.

### 5.2. Risk and Mitigation

A Risk Register would be generated collaboratively during the initial design stages to identify any risks, which if realised, could result in deviation from the delivery plan. Mitigation strategies would also be developed to manage the risks identified and these will be implemented by the Project Manager. The risk register shall remain a live document and will be updated regularly.



### 5.3. Quality Management

SPT adopts a “life cycle” approach to Quality Management in major project delivery. Our Management Systems are certified to ISO 9001, ISO 14001 and ISO 45001. Various areas applicable to these standards ensure a quality product is delivered. The significant areas detailed below:

#### 5.3.1. Quality Requirements During Project Development

Any risk or opportunity that may affect the quality of the product are detailed in the Project Risk Register.

The suppliers of main equipment may also receive a Factory Acceptance Test Inspection when the asset is being built.

#### 5.3.2. Quality Requirements in Tenders

Each contract that SPT issues has a standard format. Specifically in relation to quality, this will include a Contractors’ Quality Performance Requirement (CQPR). This CQPR represents a specification that details roles and responsibilities for all parties during the works, frequency and format of reporting. It will also specify the document management process to be adhered to during the delivery of the project. In addition to the CQPR, each project has a contract specific Quality Management Plan, detailing the inspection and testing regime for works as well as the records to be maintained.

#### 5.3.3. Monitoring and Measuring During Project Delivery

SPT Projects undertake regular inspections on projects and contractors to monitor and measure compliance with SPT Environmental, Quality and Health and Safety requirements, as detailed in the contract specifications for the work. All inspections are visual, with the person undertaking the inspection ensuring that evidence of the inspection and any actions raised are documented.

The following inspections are completed:

- Quality Inspections (monthly)
- Environmental Inspections (monthly, with weekly review by third party Environmental Clerk of Works)
- Safety Assessments & Contractor Safety Inspection (daily, with full time Site Manager)
- Project Management Tours (monthly)

The scope of audits and Inspections is to determine compliance with:

- Procedures & Guides
- Planned arrangements for ISO 9001, 14001 & 18001
- Legal and other requirements.

#### 5.3.4. Post Energisation

SPT Projects and SPT Operations carry out a Defect Liability Period Inspection within the Contract Defect Liability Period with the aim of identifying any defects and rectifying them with the contractors.

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## 5.4. Environmental and Wayleave Considerations

### 5.4.1. Environmental Planning

Not applicable. All works within confines of substation.

### 5.4.2. Wayleave Issues

Not applicable. All works within confines of substation.

### 5.4.3. Environmental Sustainability

ENV-01-007 encompasses all activities undertaken within and in support of SP Energy Networks three Licences. This includes operational and business support functions concerned with management of SP Transmission, SP Distribution and associated regulatory and commercial interfaces, products, services and their associated environmental, social and economic impacts. The policy makes the following commitments which shall be respected in any works associated with this scheme.

*“SP Energy Networks will incorporate environmental, social and economic issues into our business decision-making processes, ensuring compliance with or improvement upon legislative, industry, regulatory and other compliance obligations. We will deliver this by being innovative and demonstrating leadership on the issues which are important to us and our stakeholders, and will:*

- Ensure the reliability and availability of our Transmission and Distribution network whilst creating value and delivering competitiveness by increasing efficiency and minimising losses
- Reduce greenhouse gas emissions, working towards a zero carbon emissions target by end of 2050, with interim targets of 15% by 2023 and 80% by 2030 from a baseline of 2013/2014
- Integrate climate change adaptation requirements into our asset management and operations processes to support business resilience and reduce the length and time of service interruptions;
- Consider whole life cycle impacts to reduce our use of resources to sustainable levels, improve the efficiency of our use of energy and water and aim for zero waste;
- Improve land, air and watercourse quality by preventing pollution and contamination and protecting and enhancing biodiversity in our network areas;
- Improve our service to local communities, supporting their economic and social development, protecting vulnerable customers and respecting human rights;

ENV-04-014 gives specific guidance on the management of incidents with environmental consequence, or potential for environmental consequences, over and above the general requirements for the management of incidents.

## 6. Conclusion

The proposed options have been evaluated based on scope feasibility, cost, timelines, and construction risks. Option 2 has proven to be the most economical solution for upgrading 219 fault recorders and 4 fault locators within the RIIO-T3 period.

In line with the costs prepared, the proposed scope of works under option 2 is the selected option:

- Scheme Total Cost: £2.81M
- Timing of investment: 2026 – 2031
- Declared outputs:

| Asset                                 | Voltage | Intervention           | Volume | Delivery Year |
|---------------------------------------|---------|------------------------|--------|---------------|
| Protection & Control - Fault Recorder | -       | Replacement - Addition | 4      | 2027-2031     |
|                                       |         | Replacement - Disposal | -4     |               |
| Protection & Control - Fault Recorder | -       | Refurbishment Major    | 219    | 2027-2031     |

- Price control period of outputs: 2027 - 2031

## 7. Outputs included in RIIO T2 Plans

N/A

## 8. Drawings

N/A

9. Appendix A:

| SITE                   | Circuit                                      |  |
|------------------------|--|--|
| Earlsburn Wind Farm    | Bonnybridge                                  |  |
| Berwick                | Grid T1                                      |  |
| Berwick                | Grid T2                                      |  |
| Blackhill 33kV         | Duns 33kV                                    |  |
| Chapelcross 33kV       | Grid T1                                      |  |
| Chapelcross 33kV       | Grid T2                                      |  |
| Greengairs 33kV        | Greengairs Gas / Windfarm                    |  |
| Glenlee 132kV          | Newton Stewart / Glenluce 1&2                |  |
| Glenlee 132kV          | Kendoon / Tongland                           |  |
| Greenknowes 33kV       | Devonside                                    |  |
| Busby 275kV            | Neilston-Giffnock No1                        |  |
| Busby 275kV            | Strathaven-Giffnock No 2                     |  |
| Shrubhill 33kV         | SGT2   |  |
| Shrubhill 33kV         | SGT1   |  |
| Hagshaw Hill Wind Farm | Linmill 33kV                                 |  |
| Charlotte Street 33kV  | SGT1   |  |
| Charlotte Street 33kV  | SGT2   |  |
| Kendoon 132kV          | Glenlee / Carsfad                            |  |
| Aikengall              | Dunbar                                       |  |
| Dunlaw 132kV/33kV      | Smeaton                                      |  |
| Dunlaw 132kV/33kV      | Galashiels                                   |  |
| Dunlaw 132kV/33kV      | Grid T1                                      |  |
| Dunlaw 132kV/33kV      | Grid T2                                      |  |
| Dunlaw 132kV/33kV      | Dunlaw / Toddleburn                          |  |
| Linmill 132kV          | GT1  |  |
| Linmill 132kV          | GT2  |  |
| Toddleburn Wind Farm   | Toddleburn Wind Farm                         |  |
| Longpark               | Galashiels 33kV                              |  |
| Inverarnan 275kV       | Dalmally                                     |  |
| Inverarnan 275kV       | Windyhill                                    |  |
| Lochans Moor 33kV      | Glenluce / North Rhins / Auchneel / Barrhill |  |
| Craigengelt Wind Farm  | Stirling                                     |  |
| Dumfries 132kV         | Tongland & T4                                |  |
| Dumfries 132kV         | Chapx 1 & 2                                  |  |
| Dumfries 132kV         | T1A and T1B                                  |  |
| Dumfries 132kV         | T2A and T2B                                  |  |
| Mark Hill Wind Farm    | Auchencrosh / Coylton                        |  |
| Mark Hill Wind Farm    | SGT1   |  |
| Mark Hill Wind Farm    | SGT2   |  |
| Mark Hill Wind Farm    | Arecleoch                                    |  |
| Mark Hill Wind Farm    | Windfarm 1A                                  |  |

|                             |                                     |  |
|-----------------------------|-------------------------------------|--|
| Mark Hill Wind Farm         | Windfarm 1B                         |  |
| Arecleoch                   | Mark Hill Feeder                    |  |
| Arecleoch                   | Grid T1A                            |  |
| Arecleoch                   | Windfarm Feeder 1A                  |  |
| Arecleoch                   | Grid T1B                            |  |
| Arecleoch                   | Windfarm Feeder 1B                  |  |
| Wishaw 275kV                | SGT1                                |  |
| Symington 33kV              | Linnmill / Glenkerie / Symington    |  |
| Dalmarnock 275kV/132kV/33kV | SGT1                                |  |
| Dalmarnock 275kV/132kV/33kV | SGT2                                |  |
| Dalmarnock 275kV/132kV/33kV | St Andrews Cross 1                  |  |
| Dalmarnock 275kV/132kV/33kV | St Andrews Cross 2                  |  |
| Dalmarnock 275kV/132kV/33kV | Carntyne 1                          |  |
| Dalmarnock 275kV/132kV/33kV | Carntyne 2                          |  |
| Dalmarnock 275kV/132kV/33kV | GT1                                 |  |
| Dalmarnock 275kV/132kV/33kV | GT2                                 |  |
| Clyde South                 | Elvanfoot                           |  |
| Clyde South                 | SGT1A                               |  |
| Clyde South                 | SGT1B                               |  |
| Bathgate 132kV              | GT1B_GT2B                           |  |
| Blyth 400kV                 | Eccles / Stella West 1              |  |
| Blyth 400kV                 | Eccles / Stella West 2              |  |
| Spango Valley 33kV          | Grid T1                             |  |
| Spango Valley 33kV          | Grid T2                             |  |
| Bathgate 33kV               | Grid T1A                            |  |
| Bathgate 33kV               | Grid T2A                            |  |
| Mossmorran 275kV            | Longannet / Westfield               |  |
| Devonside 132kV             | Westfield / Bonnybridge_Stirling T2 |  |
| Devonside 33kV              | Grid T1                             |  |
| Devonside 33kV              | Grid T2                             |  |
| Dunfermline 33kV            | Grid T1                             |  |
| Dunfermline 33kV            | Grid T2                             |  |
| Broxburn 33kV               | Grid T1                             |  |
| Broxburn 33kV               | Grid T2                             |  |
| Helensburgh 132kV           | Windyhill / Sloy                    |  |
| Clyde North                 | Elvanfoot                           |  |
| Clyde North                 | SGT1A                               |  |
| Clyde North                 | SGT1B                               |  |
| Clyde North                 | SGT2A                               |  |
| Clyde North                 | SGT2B                               |  |
| Meadowhead 132kV            | Kilmarnock South                    |  |
| Cupar 33kV                  | Grid T1                             |  |
| Cupar 33kV                  | Grid T2                             |  |
| Leven 33kV                  | Grid T1                             |  |

|                        |                                  |  |  |
|------------------------|----------------------------------|--|--|
| Leven 33kV             | Grid T2                          |  |  |
| Inverkeithing 33kV     | Grid T1                          |  |  |
| Inverkeithing 33kV     | Grid T2                          |  |  |
| Drone Hill Wind Farm   | Berwick                          |  |  |
| Stirling 33kV          | Grid T1                          |  |  |
| Stirling 33kV          | Grid T2                          |  |  |
| Livingston 33kV        | Grid T1                          |  |  |
| Livingston 33kV        | Grid T2                          |  |  |
| Whitelee Extension     | East Kilbride South              |  |  |
| Whitelee Extension     | SGT1                             |  |  |
| Whitelee Extension     | SGT2                             |  |  |
| Whitelee Extension     | SGT3                             |  |  |
| Markinch 33kV          | Glenrothes No.1                  |  |  |
| Markinch 33kV          | Glenrothes No.2                  |  |  |
| Partick 132kV/33kV     | Grid T1                          |  |  |
| Partick 132kV/33kV     | Grid T2                          |  |  |
| Devol Moor 132kV       | Spango Valley 1 / Grid T1A       |  |  |
| Devol Moor 132kV       | Erskine_Braehead Park / Grid T1B |  |  |
| Devol Moor 132kV       | Spango Valley 2 / Grid T2A       |  |  |
| Devol Moor 132kV       | Grid T2B / Trip Coils (Future)   |  |  |
| Killermont 132kV/33kV  | Grid T1                          |  |  |
| Killermont 132kV/33kV  | Grid T2                          |  |  |
| Windyhill 275kV        | MSCDN                            |  |  |
| Fallago                | Smeaton                          |  |  |
| Fallago                | Crystal Rig                      |  |  |
| Fallago                | Fallago Rig Windfarm             |  |  |
| Windyhill 275kV        | MSCDN2                           |  |  |
| Drumcross              | Grid T1                          |  |  |
| Drumcross              | Grid T2                          |  |  |
| Millour Hill Wind Farm | Saltcoats A                      |  |  |
| Bonnybridge Grid       | GT3-LVA                          |  |  |
| Bonnybridge Grid       | GT3-LVB / Braco / Errochty 1     |  |  |
| Bonnybridge Grid       | Bathgate / Drumcross 1           |  |  |
| Bonnybridge Grid       | GT1 132 / 33kV                   |  |  |
| Bonnybridge Grid       | SGT1 275 / 132kV                 |  |  |
| Bonnybridge Grid       | Bainsford 1                      |  |  |
| Bonnybridge Grid       | Stirling / Devonside             |  |  |
| Bonnybridge Grid       | Cumbernauld 1                    |  |  |
| Bonnybridge Grid       | Bus Coupler                      |  |  |
| Bonnybridge Grid       | Bathgate / Drumcross 2           |  |  |
| Bonnybridge Grid       | GT2 132 / 33kV                   |  |  |
| Bonnybridge Grid       | SGT2 275 / 132kV                 |  |  |
| Bonnybridge Grid       | Bainsford 2                      |  |  |
| Bonnybridge Grid       | Stirling Westfield               |  |  |

|                       |                         |  |
|-----------------------|-------------------------|--|
| Bonnybridge Grid      | Cumbernauld 2           |  |
| Strathaven 33kV       | SGT1                    |  |
| Strathaven 33kV       | SGT2                    |  |
| Strathaven 33kV       | Blantyre Muir Wind Farm |  |
| Hunterston WTF        | Hunterston Farm         |  |
| Dewar Place 33kV      | SGT1 R1 (LVA & HV)      |  |
| Dewar Place 33kV      | SGT1 R1 (LVB)           |  |
| Dewar Place 33kV      | SGT2 R2 (LVA & HV)      |  |
| Dewar Place 33kV      | SGT2 R2 (LVB)           |  |
| Moffat                | SGT1                    |  |
| Moffat                | SGT2                    |  |
| Moffat                | Harker                  |  |
| Moffat                | Elvanfoot1              |  |
| Moffat                | Harestanes              |  |
| Harestanes Wind Farm  | Moffat                  |  |
| Harestanes Wind Farm  | Grid T1A                |  |
| Harestanes Wind Farm  | Grid T1B                |  |
| Harestanes Wind Farm  | Windfarm 1A             |  |
| Harestanes Wind Farm  | Windfarm 1B             |  |
| New Cumnock           | Coylton 1               |  |
| New Cumnock           | Coylton 2               |  |
| New Cumnock           | SGT1A                   |  |
| New Cumnock           | SGT2A                   |  |
| New Cumnock           | SGT3A                   |  |
| New Cumnock           | Dersalloch              |  |
| New Cumnock           | Black Hill / Dunhill 1  |  |
| New Cumnock           | Black Hill / Dunhill 2  |  |
| West Brown Castle     | East Kilbride South     |  |
| Moffat                | MSCDN1                  |  |
| Bonnybridge 275kV     | Denny North 1           |  |
| Bonnybridge 275kV     | Denny North 2           |  |
| Finnieston            | GT1                     |  |
| Finnieston            | GT2                     |  |
| Longannet 275kV       | MSCDN1                  |  |
| Longannet 275kV       | MSCDN2                  |  |
| Dunbar Viridor Sw/Stn | Viridor 1               |  |
| Dunbar Viridor Sw/Stn | Viridor 2               |  |
| Denny North           | Lambhill                |  |
| Denny North           | Longannet               |  |
| Denny North           | Bonnybridge 1           |  |
| Denny North           | Bonnybridge 2           |  |
| Denny North           | BONN3 SGT3              |  |
| Mark Hill Wind Farm   | Kilgallioch             |  |
| Bainsford             | GT1                     |  |

|                                  |                        |  |
|----------------------------------|------------------------|--|
| Bainsford                        | GT2                    |  |
| Ardoch & Over Enoch              | East Kilbride South    |  |
| Little Raith 33kV                | Glenniston             |  |
| Carntyne                         | GT2B                   |  |
| Carntyne                         | GT1B                   |  |
| Sighthill 33kV                   | SGT1 LVA HV            |  |
| Sighthill 33kV                   | SGT1 LVB               |  |
| Sighthill 33kV                   | SGT2 LVA HV            |  |
| Sighthill 33kV                   | SGT2 LVB               |  |
| Kilmarnock Town                  | SGT1                   |  |
| Kilmarnock Town                  | SGT2                   |  |
| Denny North                      | SGT1                   |  |
| Windyhill 132kV (GIS)            | SGT2                   |  |
| Windyhill 132kV (GIS)            | SGT3                   |  |
| Windyhill 132kV (GIS)            | Partick Finnieston No2 |  |
| Windyhill 132kV (GIS)            | Killermont No2         |  |
| Windyhill 132kV (GIS)            | Kilbowie No2           |  |
| Windyhill 132kV (GIS)            | Bus Coupler            |  |
| Windyhill 132kV (GIS)            | Partick Finnieston No1 |  |
| Windyhill 132kV (GIS)            | Killermont No1         |  |
| Windyhill 132kV (GIS)            | SGT1                   |  |
| Windyhill 132kV (GIS)            | Kilbowie No1           |  |
| Burnfoot (Rhodders 33 Collector) | Devonside No2          |  |
| Linmill 132kV                    | Coalburn               |  |
| Linmill 132kV                    | Blacklaw Ext Wind Farm |  |
| Burnfoot (Rhodders 33 Collector) | Devonside No1          |  |
| Wishaw 400kV                     | SGT8                   |  |
| Wishaw 400kV                     | SGT9                   |  |
| Wishaw 400kV                     | Bus Coupler            |  |
| Blacklaw Wind Farm Ext           | Grid T1                |  |
| Bonnybridge Grid                 | GT4                    |  |
| Bonnybridge Grid                 | GT5                    |  |
| Bonnybridge Grid                 | GT6                    |  |
| Dersaloch Windfarm               | New Cumnock Grid 1A    |  |
| Bonnybridge Grid                 | Denny North 3          |  |
| Kilgallioch                      | Markhill               |  |
| Kilgallioch                      | SGT1                   |  |
| Kilgallioch                      | SGT2                   |  |
| Kilgallioch                      | SGT3                   |  |
| Kilgallioch                      | Reactor R1             |  |
| Arecleoch                        | Grid T2                |  |
| Moffat                           | Grid T1                |  |
| Westerdod 132kV                  | Crystal Rig            |  |
| Elderslie 33kV                   | GT1                    |  |



|                |          |  |  |
|----------------|----------|--|--|
| Elderslie 33kV | GT2      |  |  |
| Kendoon 132kV  | NECU GT2 |  |  |

Table 1: Fault recorders

| SITE             | Circuit   |  |  |
|------------------|---|--|--|
| Mark Hill 275kV  | 1. AUCC/COYL<br>2. KILG<br>3. AREC  |  |  |
| Meadowhead 132kV | 1. KILS<br>2. KILW1<br>3. KILW2   |  |  |
| New Cumnock 132  | 1. DESA<br>2. KEOO<br>3. BLAH1/DUNH1<br>4. BLAH2/DUNH2<br>5. BLCW<br>6. South Kyle WF |  |  |
| New Cumnock 275  | 1. COYL1<br>2. COYL2  |  |  |

Table 2: Fault locators