Powerful-CB

Project Progress Report – January to August 2022

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Contents

Glossary

Term	Description
ABB	Our technology partner for Method 1
BEIS	The Department for Business, Energy and Industrial Strategy
CB	Circuit Breaker – Protection device that interrupts the flow of current in an electric circuit in the event of a fault
COVID-19	Corona Virus Disease 2019
CHP	Combined Heat and Power – simultaneous generation of usable heat and power (usually electricity) in a single process; more efficient than generating heat and power separately
DG	Distributed Generation – generators that are connected to the distribution network
DNO	Distribution Network Operator
DSO	Distribution System Operator
ENA	The Energy Networks Association
EPN	Eastern Power Networks plc (one of three UK Power Networks licence areas)
ENWL	Electricity North West Limited
FAT	Factory Acceptance Test
Fault Current	A surge of energy that flows through the network in the event of a fault. The energy comes from the momentum of rotating generators and motors connected to the network
Fault Level	The maximum fault current that could theoretically flow during a fault. "Make" fault level is the maximum fault current that could flow during the first current peak of the fault, and that a circuit breaker closing onto a fault would need to safely handle. "Break" fault level is the maximum fault current that could be flowing 100ms after the start of the fault, and that a circuit breaker clearing the fault would need to be able to interrupt.
Fault Level Headroom	The difference between fault level and fault rating at a particular substation or part of the network; corresponding to the amount of generation that can be connected to the network without exceeding its fault rating
FCL	Fault Current Limiter – a FLMT that attenuates fault current by increasing its impedance (only) during a fault.
FC-Protector	Commercial product offered by ABB which limits the short-circuit current during the first rise (https://new.abb.com/medium-voltage/apparatus/fault-current-limiters/fc-protector)
FCS	Fast Commutation Switch
FLCB	Fault Limiting Circuit Breaker – a FLMT that blocks fault level contributions from a transformer/bus coupler/generator by disconnecting it before the first current peak of the fault
FLMT	Fault Level Mitigation Technology – a technical solution that reduces fault levels on the network
FNC	Frazer-Nash Consultancy
FSP	The Powerful-CB Full Submission Proforma - http://bit.ly/Powerful CB-fsp
GB	Great Britain

Term	Description
GT	Grid Transformer
HSE	The Health and Safety Executive
HV	High Voltage
HVDC	High Voltage Direct Current
IPR	Intellectual Property Rights
I_s-limiter	Commercial product offered by ABB which limits the short-circuit current during the first rise (https://new.abb.com/medium-voltage/apparatus/fault-current-limiters/current-limiter)
L1/L2/L3	Line 1, Line 2, Line 3 of a three-phase power network
LCNI	Low Carbon Networks & Innovation Conference
LPN	London Power Networks plc (one of three UK Power Networks licence areas)
M1	Method 1 – Installation of a FLCB at a substation
M2	Method 2 – Installation of a FLCB at a customer's premises (de-scoped from project following Ofgem approval of change request)
NIC	Network Innovation Competition
Ofgem	Office of Gas and Electricity Markets, the regulator for gas and electricity markets in Great Britain
PFD	Probability of Failure on Demand
PPR	Project Progress Report
RIIO-ED1	The current electricity distribution regulatory period, running from 2015 to 2023
QR6	Fault Current Detector from the I_s limiter and FC-protector that detects faults and issues a trip signal to the FLCB
RMS	Voltage (V rms) or Current (A rms) Root-Mean-Squared
Safety Case	A structured argument, supported by a body of evidence that provides a compelling, comprehensible and valid case that a system is safe for a given application in a given operating environment
SCADA	Supervisory Control and Data Acquisition
SDRC	Successful Delivery Reward Criteria
SPN	South Eastern Power Networks plc (one of three UK Power Networks licence areas)
TRL	Technology Readiness Level
UKPN	UK Power Networks
UPS	Uninterruptable Power Supply

1. Executive Summary

1.1 Project background

The Powerful-CB (Power Electronic Fault Limiting Circuit Breaker) has demonstrated that fault limiting circuit breakers (FLCBs) can enable distribution network operators (DNOs) to connect more distributed generation (DG) to fault level constrained 11kV electricity networks without the need for reinforcement.

A FLCB is a solid-state circuit breaker that operates 20 times faster than existing vacuum circuit breakers (CBs). This high-speed operation can mitigate fault level contributions from distributed generation, allowing us to connect more DG, including Combined Heat and Power (CHP), to fault level constrained networks in dense urban areas. This will help accelerate the decarbonisation of heat, which is a key element of the Government's Carbon Plan.

The project team has worked with a technology partner to develop such a FLCB. ABB has now developed a FLCB for use at a primary substation, known as Method 1 (M1). Method 1 is the world's first demonstration of a FLCB with a fast-commutating switch.

The project team has worked with Frazer-Nash Consultancy (FNC) to develop the safety cases for the M1 device.

1.2 Summary of progress

This Project Progress Report (PPR) covers the period from January to August 2022 and the previous PPR covering July to December 2021 is available here. To date, two PPRs per year (in June and December) have been submitted. Considering the short period of time to be covered in the next PPR before project closure (at the end of August), we have chosen to consolidate with the update we would normally provide in June. A letter was submitted in May 2022 to inform Ofgem about this decision.

This is the final PPR to be submitted as the project was completed on 31 August 2022. In the past eight months, the project made good progress completing the trial period, gathering trial data, analysing the performance of the FLCB as well as completing decommissioning activities.

1.2.1 Workstream 1 – Development of a FLCB device

All Workstream 1 (WS1) activities for the development of the FLCB have been completed in the previous reporting periods. An update of the Safety Case that incorporates learnings from the trial has been performed and it is covered under Workstream 2 section of the report.

1.2.2 Workstream 2 – Network Demonstration

During this reporting period, Workstream 2 (WS2) focused on continuing the trial period under the final running arrangement, Running Arrangement 3 (RA3). This arrangement as shown in Figure 1, saw the FLCB operating as a bus coupler by opening the existing bus coupler BC2 and required the FLCB to break the short circuit current fed from two transformers for certain faults.

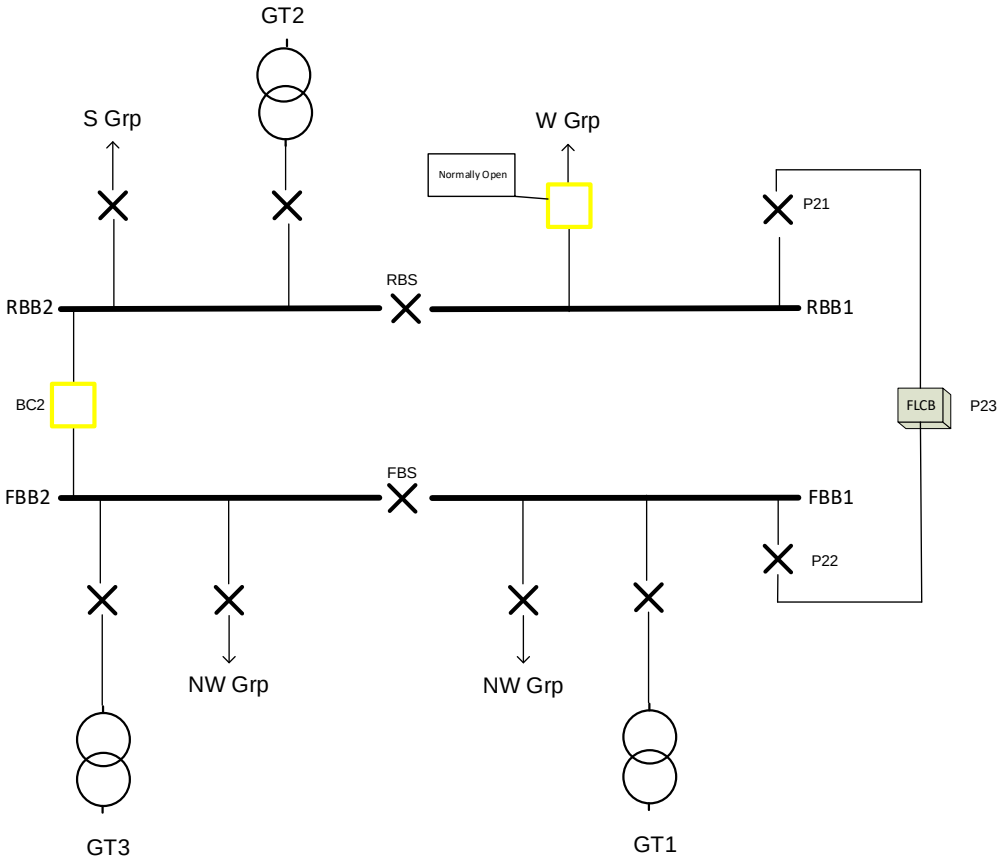

Figure 1: Running Arrangement 3. Note yellow indicates 'normally open'

In this reporting period, we experienced two network faults, with the first occurring on 3 February caused by a two-phase fault and the second on 30 March caused by a single-phase fault. In both instances the FLCB operated correctly. The tripping value in the FLCB was set to 4kA and the FLCB performance showed that when the fault current reached this level, the peak was limited after 0.7ms and it was then forced down to zero in approximately 1ms after this peak, giving a total time of 1.7ms for the interruption sequence. Figure 2 below provides the data captured from the network fault on 30 March which illustrates this fault limiting and interruption behaviour, more details are provided in Chapter 2.

SDRC 9.2.3 – Demonstration of solution at an 11kV substation (Method 1) was submitted to Ofgem and published on the UK Power Networks website which included results and learnings from operating and maintaining a substation containing a FLCB, and technical performance of the FLCB and overall solution under real network conditions.

The FLCB was taken out of service on 27 June due to a fault reported on the UPS acting as back-up power for the control system in phase L2. It was concluded that the issue was related to the UPS battery status which was used to provide the requested back-up power in the event of a problem with the primary 110V DC supply. Even though the FLCB was operating fine, it was decided to switch it out as the faulty UPS would have to be fixed in order to continue with the FLCB trial and decommissioning was due to commence.

Decommissioning activities of the FLCB took place in July and the unit will be transferred to an alternative suitable location within UK Power Networks. Details regarding this activity will be included in the project closedown report.

Finally, an update of the Safety Case and Risk Assessment Report was performed by Frazer Nash in order to incorporate any learnings from the FLCB trial.

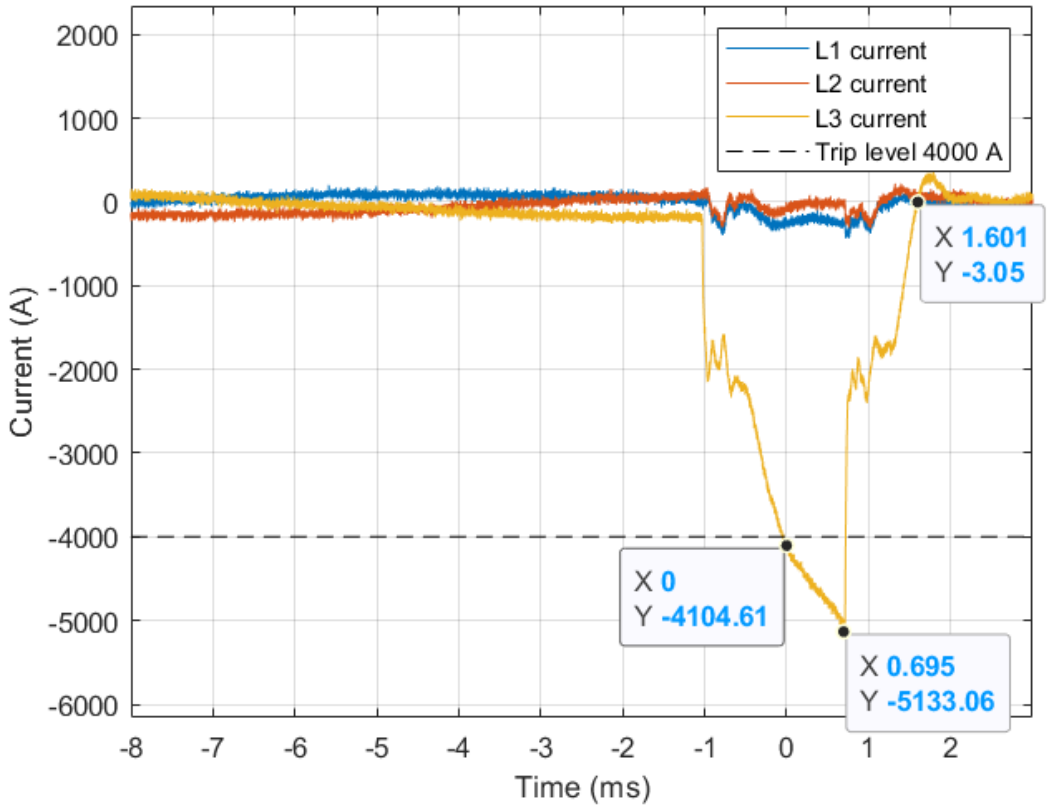

Figure 2 Fault current measured by the FLCB during network fault on 30 March 2022

1.2.3 Workstream 3 – Understanding Customers' Requirements

Following the removal of M2 from the project in 2021 there were no remaining activities for Workstream 3 (WS3).

With the removal of M2 from the project, SDRC 9.3.2 – Assess the (commercial) business case based on the technical and customer findings, focusing on investment decision criteria and trade-offs, such as cost, time to connect, space and impact on security of supply, will no longer be produced and published.

UK Power Networks still intends to build upon the learnings generated from our engagements with customers willing to participate in such a trial, and continue to see real value in the customer placed FLCB. As such we have partnered with Western Power Distribution on an NIA project called EDGE-FCLi (Embedded Distributed Generation Electronic – Fault Current Limiter interrupter). The scope is similar to that of M2 and, although a different supplier is being used, we aim to deliver similar benefits to customers once the project is complete. The project is unique as the technology readiness level (TRL) of the device being developed is lower than what was originally proposed with AMAT in M2 and hence provides a great opportunity for the project to increase choice in the market for customers.

1.2.4 Workstream 4 – Knowledge Dissemination

During this reporting period, Workstream 4 (WS4) prepared and delivered an external webinar with ABB on 18 August 2022 to share knowledge gained from the design, installation, commissioning and operation of the FLCB to date. Following the webinar, SDRC 9.4.1 – *Share overall learning from the project with customers, regulators, other DNOs, other manufacturers, and academia via a stakeholder event* was prepared and submitted to Ofgem on 26 August as part of the project deliverables.

The project was shortlisted for one award during the reporting period:

- the 'Energy Tech – Innovation' award at the Better Society Energy Awards

The project team continued to engage with colleagues from Asset Management, Capital Programme and Procurement and Network Operations to share data captured, the ongoing performance of the FLCB and interaction with existing protection. This knowledge sharing is extremely valuable in understanding how the FLCB can be integrated into DNO networks and will help support the transition into BAU following completion of the project.

Project learnings and information are publicly available through UK Power Networks' website and social media as well as the Electricity Networks Association (ENA) website.

1.3 Risks and Issues

The project team have taken mitigating actions to reduce the impact of issues and closely managing high risk items. Most of the risks have now been closed due to the project closedown. More details about the risks can be found in Section 11 of the document.

1.4 Outstanding activities

The only outstanding activity is the UK Power Networks Closedown report for Powerful-CB project which will be completed and submitted to Ofgem after the project completion by 31 November 2022. The Closedown report will summarise the full FLCB project collating the data from progress reports, SDRCs, inspections, faults, lessons learnt etc. as applicable.

2. Project Manager's Report

The project made good progress during this reporting period (January to August 2022) focusing on the following areas:

- Ongoing project planning for trial conclusion;
- Continuing the trial period under Running Arrangement 3;
- Data gathering and analysis;
- Performance analysis of the FLCB under network faults;
- Engaging with internal UK Power Networks stakeholders to share data captured and the ongoing performance of the FLCB;
- Hosting external closedown webinar with ABB to share overall project experience with external stakeholders and interesting parties;
- Decommissioning of FLCB unit; and
- Preparing and submitting final SDRC documents.

The following sections present individual workstream reports covering progress made, challenges encountered, lessons learned and the outlook for the next reporting period.

2.1 Project Team

In this reporting period the project team has changed and the core project team comprises of three[1] dedicated roles:

Role	Status	Start Date
Project Manager	Appointed	15 March 2022 (note this date is when current project manager commenced. There were previous project managers prior to this date)
Workstream 1&2 Lead	Fulfilled by Project Manager	23 March 2018
Workstream 4 Lead	Appointed	3 July 2017

Table 1 Project team roles

2.2 Project partners

As highlighted in the December 2018 Project Progress Report (PPR), our project partner ABB signed onto a collaboration agreement with UK Power Networks, developed the FLCB and trialled the unit in the LPN network.

The project held fortnightly Project Partner meetings to ensure successful delivery of the project. The Project Partner meeting covered a number of key points, including:

- Workstream updates – Report on progress to date, risks and issues;
- Technical discussions requiring input from all involved in the project, including internal stakeholders;
- Collaborative planning of tasks for upcoming project milestones;
- Planning for workshops and engagement with UK Power Networks' stakeholders;
- Planning external webinars; and
- Commercial replicability of the unit.

[1] The Workstream 3 (WS3) Lead role no longer exists due to the change request submitted to Ofgem 5 July 2019 for the removal of M2 from the scope of the project.

2.3 Workstream 1 – Development of a FLCB Device

WS1 is responsible for designing, building and testing prototype devices suitable for installation and trial in a primary substation and customer site within London Power Networks (LPN). Following the removal of M2 from the project, a device has no longer be developed for trial at a customer site. For the current reporting period, WS1 focussed on developing and delivering M1 only.

ABB have progressed their technology from TRL 4 (single-phase proof-of-concept prototype) to TRL 7 (three-phase field prototype), in accordance with defined specifications provided by UK Power Networks. For WS1, ABB designed a three-phase prototype, built and integrated into modular switchgear cubicles and performed testing to ensure the prototype complies with UK Power Networks' requirements.

The learnings from WS1 including specifying the device, prototype development and testing were disseminated via SDRC 9.1.1. The test reports generated from WS1 are available to other Network Licensees and stakeholders upon request.

2.3.1 Progress during this reporting period

All WS1 activities for the development of the FLCB were completed in earlier reporting periods. An update of the Safety Case that incorporates learnings from the trial was performed and it is covered under chapter 2.4.

2.3.2 Challenges and lessons learned

No WS1 specific activities were completed during this period. The data collection and learnings generated as part of the network demonstration will be used for future development of the FLCB.

2.4 Workstream 2 – Network Demonstration

WS2 is responsible for the following activities:

- Designing the interface between the FLCB and the existing network;
- The installation and commissioning of switchgear including the FLCB and ancillary equipment;
- Conducting the network demonstration;
- Collecting adequate data to prove the FLCB is safe and effective; and
- Updating the preliminary safety case.

Within WS2, UK Power Networks have continued to collaborate with ABB, and our safety case expert, to develop the engineering knowledge necessary to safely and effectively demonstrate FLCBs on GB networks. We have investigated issues such as:

- Use cases for FLCBs – for example in parallel with a bus section/coupler or in series with a transformer;
- Protection and control philosophy – FLCB trip settings, reclosing scheme, coordination and discrimination with existing protection and how to handle FLCB failure; and
- The safety case which has been developed in parallel with the engineering investigations to ensure that safety is considered in every aspect of the business as usual (BAU) solution.

Where appropriate we have sought to engage with the Health and Safety Executive (HSE), the Energy Networks Association (ENA), and other licensees, in particular Electricity North West (ENWL) and Western Power Distribution (WPD) who have investigated similar issues with the Respond and FlexDGrid projects respectively. The learning from this phase has been captured in engineering policies, standards, and procedures and shared via learning dissemination activities.

2.4.1 Progress during this reporting period

During this reporting period, WS2 focused on the following activities:

- Completed the trial under the final running arrangement, Running Arrangement 3 (RA3);
- Gathered data and monitored the health of the FLCB. Twice a day, the supervision unit within the FLCB received a data cluster, from the control system of each phase of the FLCB, containing the present status of a large number of signals. The data in the cluster was used to monitor all the components in the FLCB including the control system itself, the mechanical switches and semiconductors. In the event of an operation, each control system sent an updated cluster and a transient recording of the currents through the FLCB;
- As highlighted in previous reporting periods the project team scheduled a monthly confidence switch where Network Control sent an open command to the FLCB and then closed it a short time later;
- Published SDRC 9.2.3 – *Demonstration of solution at an 11kV substation (Method 1)* which included results and learnings from operating and maintaining a substation containing a FLCB, and technical performance of the FLCB and overall solution under real network conditions
- Completed an update of the Safety Case report by Frazer Nash to incorporate learnings from the FLCB trial. It was demonstrated that:
  - all risks associated with the FLCB device are tolerable and reduced to a level that can be considered As Low as Reasonably Practicable (ALARP); and
  - all prescriptive safety requirements (legislative, regulatory, standards and derived) are met.
- Performed an update of the Risk Assessment Workshop Report (RAWR) report by Frazer Nash to incorporate learnings from the FLCB trial. This report:
  - addressed gaps in the analyses in the RAWR;
  - updated data in the RAWR;
  - addressed stakeholder comments on the risk and ALARP analyses in the RAWR
  - incorporated new information from the FLCB trial and the 13 April 2022 Powerful-Circuit Breakers Safety Review Meeting;
  - removed details specific to the AMAT FLCB device, which is no longer within the scope of the project;
  - included a qualitative risk assessment of the most severe and complex FLCB risks; and
  - undertook a Quantitative Risk Analysis for the “network exposed to excessive fault current” risk which demonstrated that it is no worse with FLCBs installed than without. A safety requirement of a PFD of less than 10-3 for the FLCB device has been assumed.
- Decommissioned the FLCB device and actioned the System Alteration Notice (SAN). The activity took place in July 2022. The majority of decommissioning activities were performed by trained UK Power Networks personnel apart from the retrofit of the SwGr interconnector runners which were fixed by ABB. The FLCB and fault logging were fully disconnected and all power supply to the FLCB was removed. The unit will be transferred to an alternative suitable location within UK Power Networks.

2.4.2 Challenges and lessons learned

This section describes the main challenges and lessons learned in this workstream during this reporting period:

- Two network faults were recorded since the last reporting period, on 3 February 2022 and 30 March 2022. These faults were of magnitudes 4.36 kA and 5.13kA respectively and are depicted in Figure 3 and Figure 5. As the FLCB set point is 4 kA, both faults were large enough to trigger the device. Both faults are described below:
  - The fault on 3 February 2022 was associated with a feeder supplied by Panel 1 (P1) with cause identified as a two-phase ground fault. This fault current graph is shown in Figure 3.

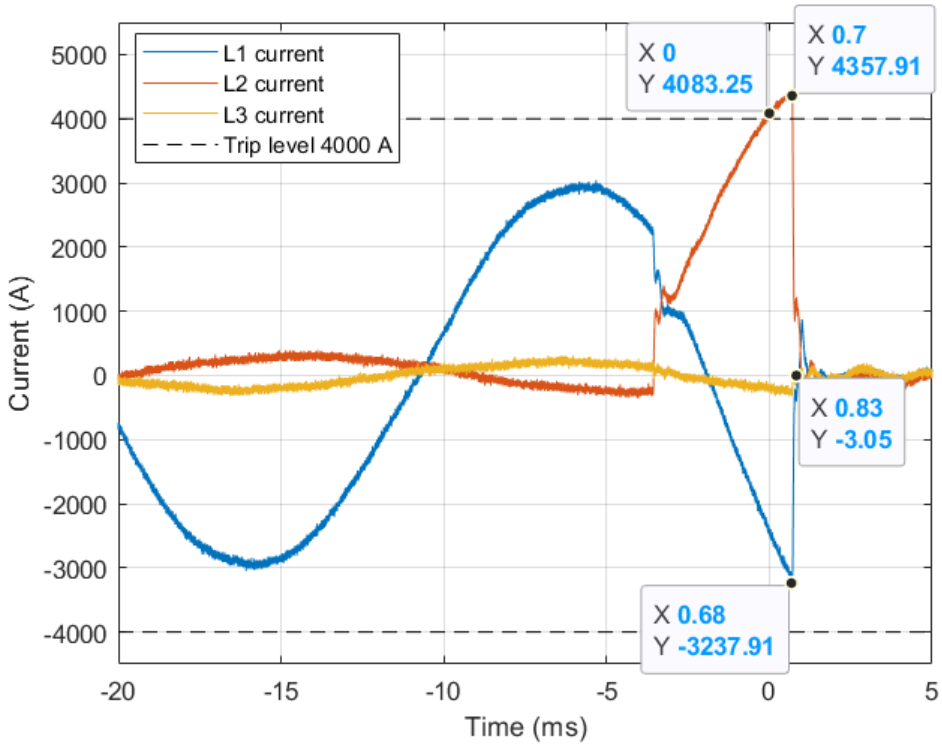

Figure 3 Fault current measured by the FLCB during network fault on 3 February 2022

A ground fault on Phase 1 occurred just prior to the measured recording in the figure above. This fault occurred in phase L1 in the network at approximately t = -23ms. The Phase 1 current level rose to approximately 3 kA peak for one negative and one positive peak before then spreading to Phase 2 and increasing in magnitude. Due to the offset, L2 was the first to reach the set trip level of 4 kA which eventually tripped the FLCB (confirmed by the QR6 display indicating L2 first to trip). The currents in all three phases were interrupted 700μs after the trip as expected. From the trip at 4 kA, the current in L2 rose to 400 A during the 700μs operation time, resulting in a peak current of 4.4 kA.

In addition, the data collected from the fault recorders during this trip were sporadic in nature. The data collected from fault recorder 1 and 2 (FR1 and FR2) are shown in Figure 4 and it was concluded that they are due to a data corruption event within the unit.

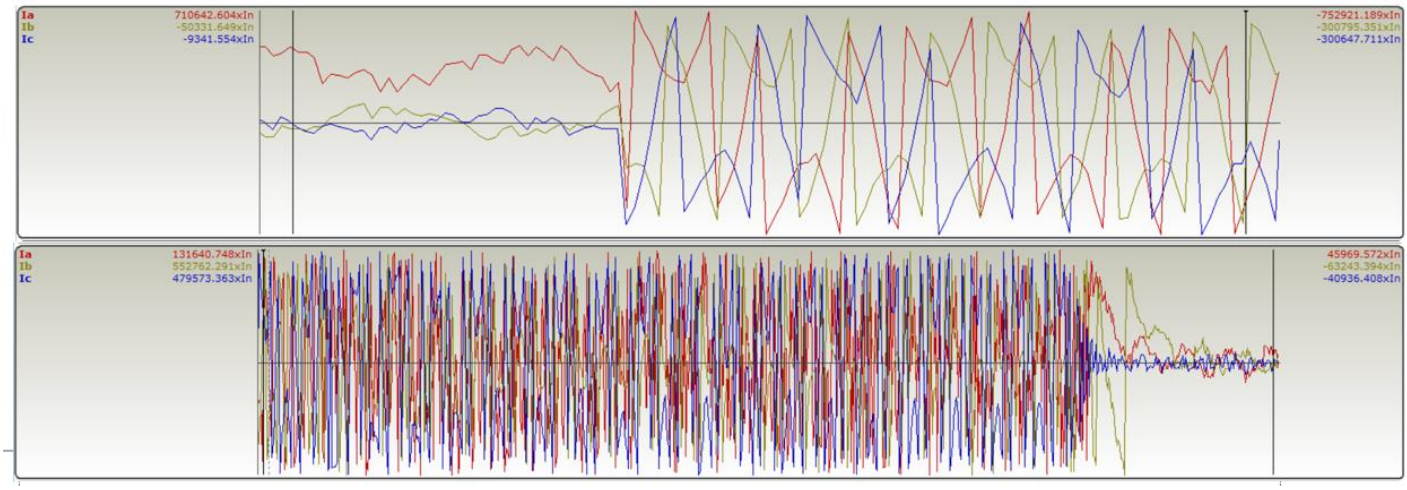

Figure 4 Data collected from Fault recorder 1 (FR1) (above) and Fault recorder 2 (FR2) (below) during non-triggering fault event on 3 February 2022

- The fault on 30 March 2022 was associated with a feeder supplied by Panel 8 (P8), and the cause identified as a single-phase ground fault. The fault current graph is shown in Figure 5.

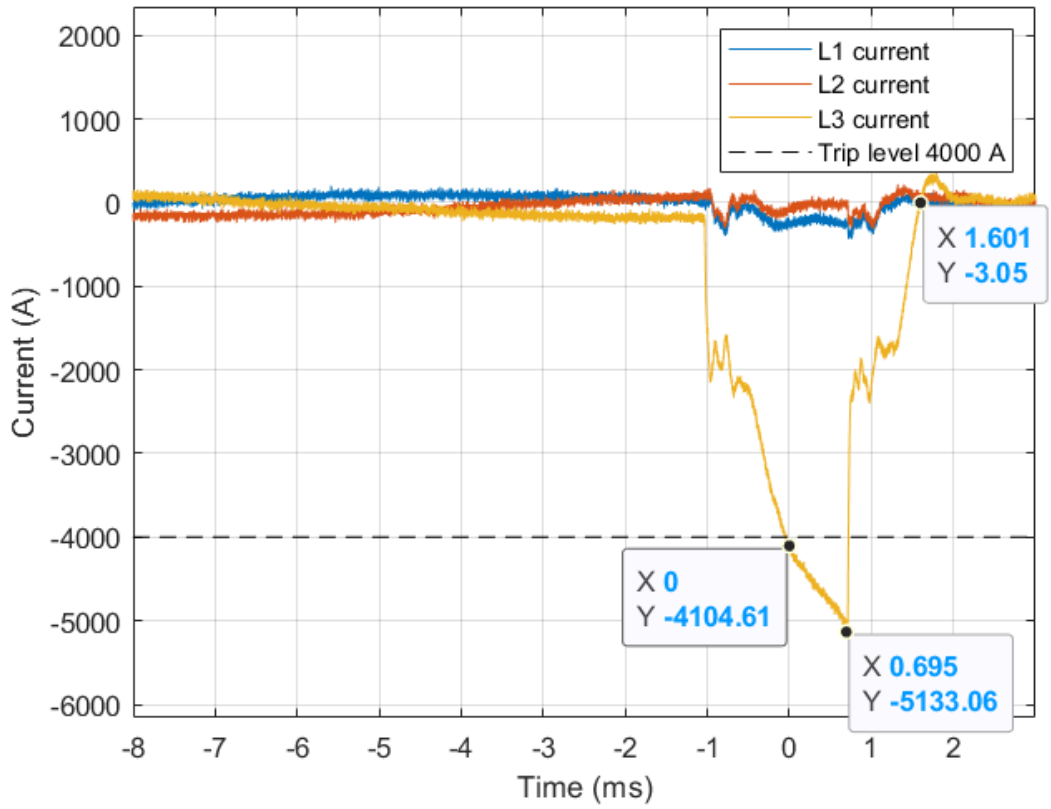

Figure 5 Fault current measured by the FLCB during network fault on 30 March 2022

Figure 6 shows a relatively typical fault current waveform. Prior to the fault, the system measured symmetrical currents in the order of hundreds of amperes in the three phases. One millisecond before the trip, a ground fault occurred on Phase 3 and rapidly rose with a negative value. Once the fault current reached 4 kA, the FLCB tripped and the interruption sequence was initiated. The fault current continued to rise for 700µs (as expected) until it was successfully limited at a peak current of 5.1 kA.

The data logged on the fault recorders (FR1 and FR2) were also concurrent with the data recorded on the SU, as shown below.

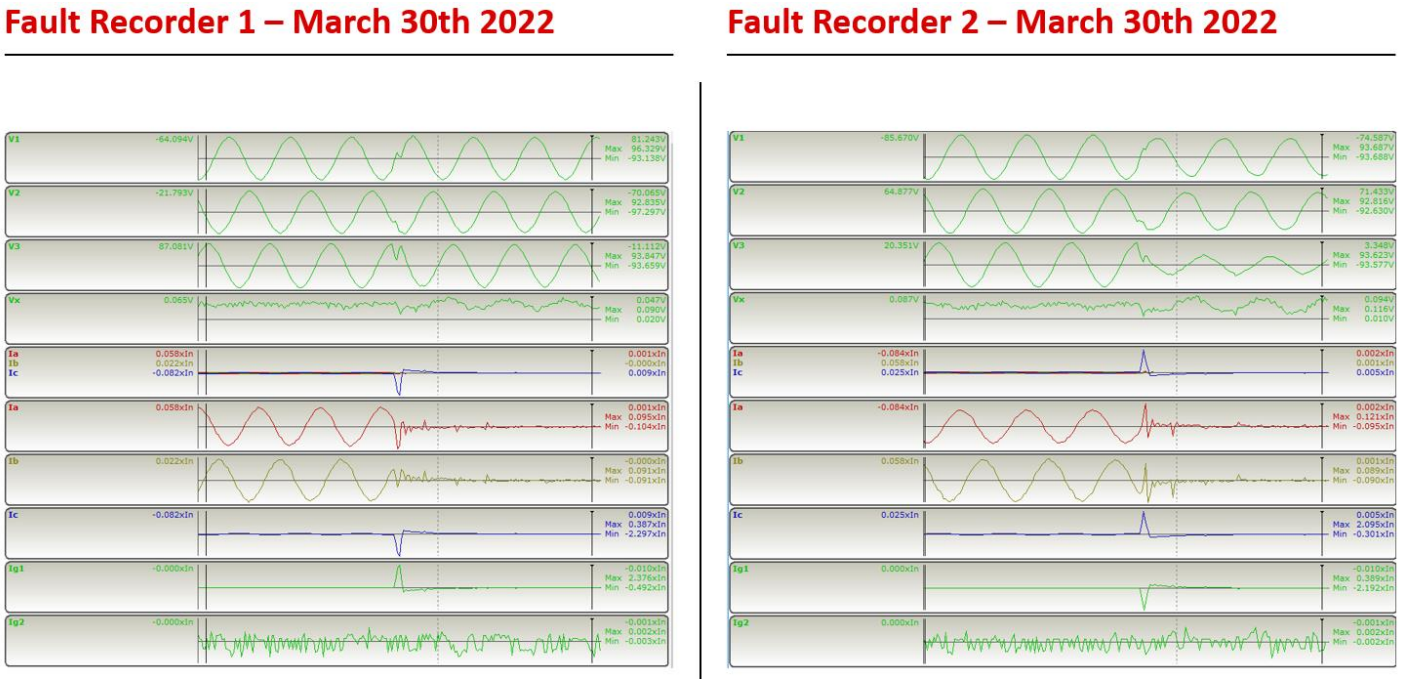

Figure 6: Fault Recorder data extracted from FLCB triggering event on 30 March 2022.

Both data sets highlight a ground fault occurring on L3. The data in the figure above also suggests that the fault initially occurred on the PN22 side of the FLCB. Once the FLCB was triggered and successfully operated, the L3 voltage on the PN21 side of the FLCB was restored. The FLCB was reclosed back into service 4 minutes after the fault, with the status on the device indicating it was healthy.

- An alarm incident on REF620 relay took place on 24 June 2022 when there was an indication of CB Supply Faulty. Even though the FLCB was still operating, an investigation was initiated on site on 27 June which identified that the UPS acting as back-up power for the control system in the phase L2 reported an error (Figure 7). This error is only reported to REF620 relay and does not affect the control system or supervision unit. It was concluded that the issue was related to the battery status of the UPS which would not provide the requested back-up power in the event of a problem with the primary 110V DC supply. Due to the imminent start of decommissioning (11 July), it was decided to take the FLCB out of service as the faulty UPS would have to be fixed in order to continue with the FLCB trial. This was not a reduction in the trial length as the trial was originally scheduled to be completed on 31 May. However, it was decided to keep the FLCB energised until the first available window for the decommissioning engineers was found (11 July). The UPS will be investigated further following the end of the unit decommissioning.
- The FLCB risk assessments support the claim that the FLCB device is safe. It was also recommended that prior to any further use of the FLCB device, e.g., further trials, Business as Usual, the safety argument and its

supporting evidence should be reviewed to determine whether any evidence items require development or update.

- All the data collection and learnings generated as part of the network demonstration will be used for future development of the FLCB.

Figure 7 UPS fault alarm indication in phase L2

2.5 Workstream 3 – Understanding Customers' Requirements

WS3 is responsible for understanding our customers' needs, ensuring that we design the solutions to meet our customers' needs and to recruit a trial participant for the M2 demonstration.

Following the removal of M2 from the project, SDRC 9.3.2 will no longer be produced and published. Further details of this SDRC can be found in section 7.

2.5.1 Progress during this reporting period

UK Power Networks still intends to build upon the learnings generated from our engagements with customers willing to participate in such a trial, and continue to see real value in the customer placed FLCB. As such we have partnered with Western Power Distribution for a NIA project called EDGE-FCLi (Embedded Distributed Generation Electronic – Fault Current Limiter interrupter). The scope is similar to that of M2 and we aim to deliver similar benefits to the customers once the project is complete and proved to be successful. The technology readiness level (TRL) of the device being developed is lower than what was originally proposed with AMAT in M2 which provides a great opportunity to increase choice for customers.

2.5.2 Challenges and lessons learned

The project team experienced no challenges under WS3.

2.6 Workstream 4 – Knowledge Dissemination

WS4 oversees the dissemination and activities for learnings generated throughout the project. These are critical aspects of the project and will ensure that DNOs across GB can build on Powerful-CB learnings, avoiding unnecessary duplication of work. Internal stakeholder engagement activities also play an important role in guiding the development and deployment of the new FLCB within the business and support the successful transition into BAU. Key learning reports are published on UK Power Networks' innovation website.

2.6.1 Progress during this reporting period

We delivered an external webinar with ABB on 18 August 2021 with 100 attendees to share knowledge and learnings gained from the design, installation, commissioning and operation of the FLCB to date. Following the webinar, SDRC 9.4.1 – *Share overall learning from the project with customers, regulators, other DNOs, other manufacturers, and academia via a stakeholder event* was prepared and submitted to Ofgem on 31 August as part of the project deliverables.

In addition to the industry-facing knowledge dissemination webinar described above, valuable engagement with UK Power Networks' internal stakeholders has been ongoing during the project. We have continued engagement with colleagues from Asset Management, Capital Programme and Procurement and Network Operations to share data captured, the performance of the FLCB and interaction with existing protection. Engagement with planning managers has been vital to support the transition into BAU following completion of the project.

Powerful-CB continues to update the project website with any relevant information and deliverables to ensure these are easily accessible to all stakeholders.

2.6.2 Challenges and lessons learned

There were no challenges or lessons learned for this workstream during this reporting period.

3. Business Case Update

We have not identified any new information that affects the business case thus, the business case remains consistent with our FSP. The project assumes 100% deployment of M1 across GB and the delivery of committed benefits of up to £403m by 2050.

4. Progress against plan

This section summarises the project's progress in the period January to August 2022. It describes issues we faced and how we managed them, key achievements and notable events.

4.1 Summary of changes since the last Project Progress Report

Figure 8 shows the key activities and changes to the project plan during the current reporting period.

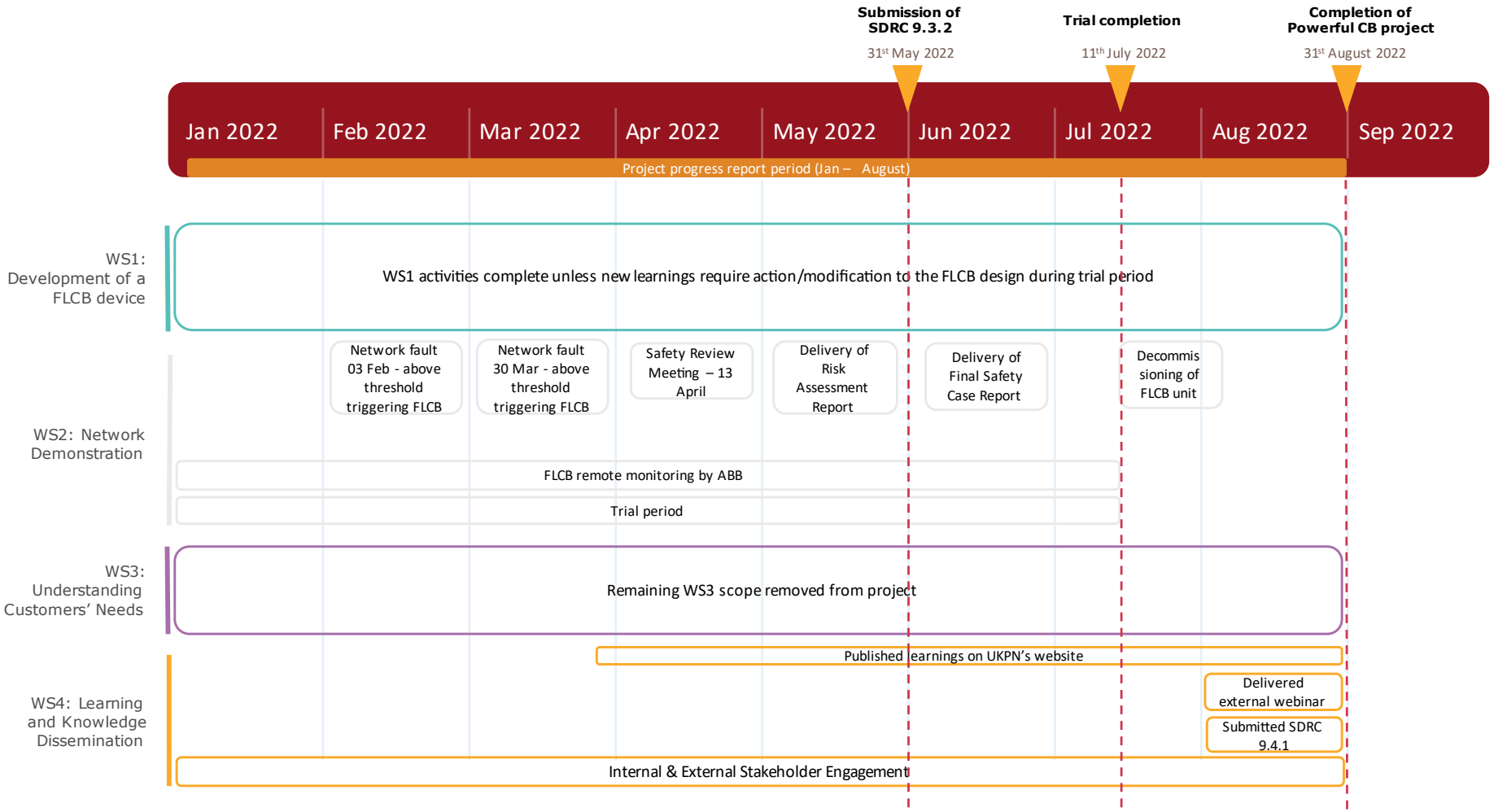

Figure 8 High level project plan highlighting changes during the current reporting period

4.2 Detailed progress in the reporting period

The project has made significant progress during this reporting period, as shown below:

Task description	Workstream	Status at start of period	Status at end of period
Trial – Running Arrangement 3 phase	2	In progress	Complete
Data monitoring and analysis of performance of FLCB	2	In progress	Complete
Safety Case Update	2	In progress	Complete
Decommissioning of FLCB	2	Not started	Complete
Delivery of external webinar with ABB	4	In progress	Complete

Table 2 Project progress during this reporting period

4.3 Identification and management of issues

The project team have taken mitigating actions to reduce the impact of issues and closely managing high risk items. Most of the risks have now been closed due to the project closedown. A full list of project risks identified for the project is provided in Section 11.

4.4 Key achievements and notable events

Key achievements and notable events in the reporting period are shown below:

- Continued the network demonstration period under Running Arrangement 3 (WS2);
- Collected network data to monitor performance of the FLCB (WS2);
- Experienced two network faults: both of them were above the FLCB threshold and triggered the unit. The unit operated as expected and cleared the fault within a few milliseconds (WS2);
- Updated Risk Assessment Report and Phase 2 of the safety case (WS1 and WS2);
- Published SDRC 9.2.3 – *Demonstration of solution at an 11kV substation (Method 1)*, which included results and learnings from operating and maintaining a substation containing a FLCB, and technical performance of the FLCB and overall solution under real network conditions (WS2);
- The FLCB was taken out of service on 27 June until start of decommissioning due to a fault reported on the UPS acting as back-up power for the control system in phase L2; (WS2);
- Engaged with internal UK Power Networks stakeholders to share data captured and the ongoing performance of the FLCB (WS4);
- Fully decommissioned the unit and alternative site for relocation is under discussion and consideration with the relevant UK Power Networks departments (WS2);
- Nominated for one award: The 'Energy Tech – Innovation' award at the Better Society Energy Awards (WS4); and
- Delivered one webinar attended by 100 people with ABB and published SDRC 9.4.1 - *Share overall learning from the project with customers, regulators, other DNOs, other manufacturers, and academia via a stakeholder event*; which included key materials from the stakeholder event and provided Ofgem with a list of invitees and attendees (WS4).

5. Progress against budget

This section is provided in the Confidential Appendix A.

6. Project bank account

This section is provided in the Confidential Appendix A.

7. Successful Delivery Reward Criteria (SDRCs)

This section provides a brief narrative against each of the SDRCs set out in the Project Direction. As demonstrated on the Table below, we have struck-through the SDRCs that were removed as part of the change request to remove M2.

Project Deliverable	Deadline	Evidence	Progress
9.1 Work with industry to advance new FLMTs based on FLCB technology			
9.1.1 Prototype and lab test a substation-based solution (Method 1)	31 May 2019	**Publish Learning Report – Development of a FLCB for substations**, which will include: recommendations for specifying a substation-based FLCB; results and learning from type tests (including a short circuit test) conducted at an accredited high power laboratory; and requirements for integrating FLCBs into existing networks and ensuring safety.	Completed on time
~~9.1.2 Prototype and lab test a customer-based solution (Method 2)~~	~~31 August 2019~~	~~**Publish Learning Report – Development of a FLCB for customers**, which will include: recommendations for specifying a customer-based FLCB; results and learning from type tests (including a short circuit test) conducted at an accredited high power laboratory; and requirements for integrating FLCBs into existing networks and ensuring safety.~~	Removed from project
9.1.3 Independent review of safety case	31 May 2018	**Issue preliminary safety case to relevant ENA panel(s) for independent review** which will include: Definition and justification of acceptable levels of risk; analysis of failure modes and effects; details of proposed mitigations; and claims, arguments, and evidence to demonstrate that the proposed mitigations reduce the overall level of risk to an acceptably low level.	Completed on time

Project Deliverable	Deadline	Evidence	Progress
9.1.4 Safety case for FLCB installation without back-up	31 May 2018	**Publish preliminary safety case** which will include the technological and operational safety case to the time when the trial equipment could be deployed as BAU without the FLCBs being installed in series with a back-up circuit breaker.	Completed on time
9.2 Trial the technical suitability of these two technologies including effectiveness and safety considerations for relieving fault level constraints for 11kV networks			
9.2.1 Install and commission solution at an 11kV substation (Method 1)	30 November 2020 *changed from 31 July 2020*	**Publish Interim Learning Report – Demonstration of a FLCB for substations**, which will include results and learning from installation, commissioning, and operation to date of a FLCB at a substation.	Completed on time Delayed by four months due to COVID-19 as notified in the non-material change request letter to Ofgem on 8 July 2020
~~9.2.2 Install and commission solution at a customer's premises (Method 2)~~	~~31 July 2020~~	~~**Publish Interim Learning Report – Demonstration of a FLCB for customers**, which will include results and learning from installation, commissioning, and operation to date of a FLCB at a customer's premises.~~	Removed from project
9.2.3 Demonstration of solution at an 11kV substation (Method 1)	31 May 2022 *Changed from 31 October 2021*	**Publish Final Learning Report – Demonstration of a FLCB for substations**, which will include results and learning from operating and maintaining a substation containing a FLCB, and technical performance of the FLCB and overall solution under real network conditions.	Completed on time Following decision to extend project trial, Ofgem was notified of this non-material change in July 2021
~~9.2.4 Demonstration of solution at a customer's premises (Method 2)~~	~~30 June 2021~~	~~**Publish Final Learning Report – Demonstration of a FLCB for customers**, which will include results and learning from operating and maintaining a FLCB at a customer's premises, and technical performance of the FLCB and overall solution under real network conditions.~~	Removed from project
9.3 Assess the suitability of the solutions against customers' needs			

Project Deliverable	Deadline	Evidence	Progress
9.3.1 Review the customer needs for these two FLCBs technologies on behalf of DNOs and DG stakeholders	31 October 2017	**Publish Learning report – Understanding customers' requirements**, which will describe our findings from customer dialogue sessions, i.e. understanding their requirements and concerns about FLCBs, and customer feedback.	Completed on time
~~9.3.2 Assess the (commercial) business case based on the technical and customer findings, focusing on investment decision criteria and trade-offs, such as cost, time to connect, space and impact on security of supply~~	~~31 March 2020~~	~~**Publish Learning report – Suitability of FLCBs**, which will inform generation customers of the solutions, answer frequently-asked questions, and provide enough information for customers to assess whether the solution meets their requirements (e.g. cost, time to connect, space required, operational impacts, etc.).~~	Removed from project
9.4 Share the learning throughout the project with the wider utility industry			
9.4.1 Share overall learning from the project with customers, regulators, other DNOs, other manufacturers, and academia via a stakeholder event	31 August 2022 *Changed from 31 January 2022*	Publish key materials from the stakeholder event (e.g. slides), and provide Ofgem with a list of invitees and attendees.	Completed on time Following decision to extend project trial, Ofgem was notified of this non-material change in July 2021

Table 3 Project SDRCs

8. Data access details

To view the full Innovation Data Sharing Policy, please visit UK Power Networks' website here.

UK Power Networks recognises that innovation projects may produce network and consumption data, and that this data may be useful to others. This data may be shared with interested parties whenever it is practicable and legal to do so and it is in the interest of GB electricity customers. In accordance with the Innovation Data Sharing Policy, UK Power Networks aims to make available all non-personal, non-confidential/non-sensitive data on request, so that interested parties can benefit from this data.

9. Learning outcomes

The project team recognises the importance of learning and dissemination. Specific lessons learned in each of the workstreams are captured in the workstream progress reports in Section 2 of this progress report.

During this reporting period, the project team hosted one external webinar to share learnings from the project with customers, regulators, DNOs, manufacturers and academia, gained from the installation work, commissioning and operation of the FLCB to date and other project progress as highlighted in Section 2.6. Following the event, SDRC 9.4.1 report was prepared and submitted to Ofgem to inform them about the stakeholder event key materials, invitees and attendees and can be found on this website.

SDRC 9.2.3 report included results and learnings from operating and maintaining a substation containing a FLCB, and technical performance of the FLCB and overall solution under real network conditions. All learning reports highlighted in Section 7 are available through UK Power Networks' website. Additional documents such as specifications, commissioning reports and standards are available to other GB DNOs upon request.

10. Intellectual Property Rights (IPR)

This section lists any relevant IPR that has been generated or registered during the reporting period along with details of who owns the IPR and any royalties which have resulted, and any relevant IPR that is forecast to be registered following the project completion.

IPR generated this period (January – August 2022)

IPR Description	Owner(s)	Type	Royalties
Data and performance of FLCB during network demonstration	ABB UK Power Networks	Relevant Foreground IPR	Nil
Webinar content	ABB UK Power Networks	Relevant Foreground IPR	Nil
Safety case documentation	ABB UK Power Networks Frazer Nash	Relevant Foreground IPR	Nil
SDRC 9.2.3 Final Learning Report – Demonstration of a FLCB for substations	ABB UK Power Networks Frazer Nash	Relevant Foreground IPR	Nil
SDRC 9.4.1 Share overall learning from the project with customers, regulators, other DNOs, other manufacturers, and academia via a stakeholder event	ABB UK Power Networks	Relevant Foreground IPR	Nil

Table 4 Project IPR generated during this reporting period

IPR forecast following project completion

IPR Description	Owner(s)	Type	Royalties
Closedown report	ABB UK Power Networks Frazer Nash	Relevant Foreground IPR	Nil

Table 5 IPR forecast following project completion

11. Risk Management

This section lists the risks highlighted in the FSP plus any other risks that have arisen in the reporting period. We have described how we are managing the risks we have highlighted and what we have learned. Risks 1-36 are captured in the FSP although some have been updated. The remaining risks were identified during the progress of the project. The risks and issues were monitored on a monthly basis where risk impacts and mitigation plans were updated. Due to the project completion, most of the risks are now closed and more information can be found on the table below.

Ref	WS	Status	Description	Mitigation/Planned Action	Current Status	RAG
R1	WS1	Closed	ABB's costs increase because of exchange rate movements due to Brexit developments.	ABB has agreed to hold their quoted price in GBP until the project commences. Once the project has commenced, we will agree the ABB contract price in GBP, or agree the price in EUR and take steps to hedge the exchange rate risk.	Now the contract has been agreed and signed in GBP, this risk is mitigated.	G
R2	WS3	Closed	Unable to find a suitable site/willing customer for customer trial.	We will engage with customers to understand their motivations for participating in the trial, so that we can design the trial and recruitment campaign to provide the right incentives and target the right customers. We will also consider relevant customer research and learning from ENWL's FCL Service trial.	We identified a potential customer and a location for trials.	G
R3	WS1	Closed	Delay and/or cost overrun – prototype development.	ABB and AMAT have agreed to take all risk of cost overruns within their control. UK Power Networks will use our existing change control procedures to minimise the risk of changes that cause additional costs for ABB and AMAT.	We have negotiated and signed the collaboration agreement with ABB to minimise the risk of cost overruns. The risk of delay in prototype development is still present. See risk R41 for more specific risk. FLCB was delivered to site 5 November 2019	G
R4	WS1	Closed	Delay and/or cost overrun – safety case (due to unforeseeable requirements).	We have allowed specific contingency for the safety case, based on FNC's experience of required effort in the event of unforeseen requirements.	FNC delivered the preliminary safety case within the given timescales. SDRC 9.1.3 and SDRC 9.1.4 are complete.	G
R5	WS1	Closed	Prototype as delivered is not fit for purpose.	UK Power Networks, ABB, AMAT, FNC to collaborate to develop the FLCB specifications; Safety consultant to develop safety case in parallel; engage with other HSE, ENA, and other DNOs.	Regular meetings and ad-hoc communications between ABB, FNC, and UK Power Networks technical experts has meant successful collaboration on the FLCB specification and safety case. The preliminary safety case is complete. The FLCB has undergone type testing and FATs	G
R6	WS1	Closed	Solution does not deliver the necessary reliability and/or redundancy to be able to prove the safety case.	Safety case feasibility study completed before full submission. Safety case to be developed in close collaboration with FLCB designers and engineering standards.	All key stakeholders, including ABB and UK Power Networks technical experts, attended the safety case workshops. The preliminary safety case is complete. Phase 2 of safety case has been completed during demonstration period.	G
R7	WS1	Open	Solution is not suitable for general population of GB sites due to operational or physical space constraints.	We will engage with other DNOs to understand any operational or physical space constraints that are unique to their networks.	Ongoing engagement with planning UK Power Network Planning teams to perform CBA on constrained substations. There are sites that unit couldn't be deployed due to its size. Risk will stay open as the space constrains could be applicable on a case-by-case scenarios.	A

Ref	WS	Status	Description	Mitigation/Planned Action	Current Status	RAG
R8	WS2	Closed	Trial site does not experience enough HV network faults to prove that the solution is safe and reliable.	We will use history of HV network faults as a criterion when selecting trial sites. We will use the safety case to determine how much data is required to prove that the FLCB is safe. Additionally, a 24-month trial period will be completed.	We have used historic fault data when looking at potential sites – recognising that fault history is not necessarily an indicator of future faults. The trial period has been reduced due to various delays experienced during type testing and commissioning. This includes delays linked to COVID-19 preventing energisation and commencement of the trial period. This risk is linked to risk R47 where a project extension is being considered and is dependent on the number of network faults experienced The following discoveries were sufficient to prove that solution was safe and reliable: - Four faults above the threshold occurred the FLCB - Three faults below the threshold but close enough occurred but didn't trigger the unit	G
R9	WS2	Closed	Trial fails to capture the data necessary to prove that the solution is safe and reliable.	We will ensure that our data capture solution has adequate reliability and redundancy so that we don't miss any opportunities to capture data from real network faults. Supervision units have been added to ensure data captured will be sent to ABB for their analysis.	Sufficient data was captured from network faults during this reporting period.	G
R10	WS2	Closed	Solution fails to operate correctly during field trial (i.e. fails to limit fault current).	We will not allow fault levels to exceed equipment ratings until the FLCB has been proven safe and reliable. This minimises the risk of an unsafe situation if the FLCB fails to operate correctly.	FLCB correctly operated for four network faults above the threshold in the previous reporting periods.	G
R11	WS2	Closed	Customer trial has adverse impacts on customer.	We will identify the potential impacts on the customer and work with them to ensure the risks are well managed.	M2 (customer site trials) will no longer be pursued as part of this project.	G
R12	WS4	Open	ABB decides not to offer a commercial product.	ABB have confirmed that if they are unable to offer their foreground IPR to Licensees in the form of a commercial FLCB product, they are willing, in principle, to licence any relevant foreground/ background IPR to a third party for the purpose of developing a commercial FLCB product.	In discussion with ABB about plans for commercialising the unit	G
R13	WS4	Closed	Solution is not accepted by other DNOs.	We will engage with other DNOs at key stages of the design and specification processes to ensure that their requirements and concerns are addressed.	Requirements and concerns have been addressed and solution could be utilised by other DNOs.	G
R14	WS1 and WS2	Closed	Project partners unable to deliver on commitments on time because of lack of resources and/or other commitments.	We will agree heads of terms and scopes for collaboration agreements with all project partners in advance of project kick-off.	Lead times of UPS and resource availability saw a second site visit for commissioning take place in February	G
R15	PM	Closed	UK Power Networks not able to deliver on commitments because project delivery team is under-resourced.	We will secure resources for the core project delivery team in advance of project kick-off and ensure adequate succession planning to manage the risk of staff movements.	UK Power Networks delivered its commitments on time	G
R16	PM	Closed	UK Power Networks not able to deliver on commitments because other teams supporting the project have operational resource constraints.	We have engaged the relevant business units within UK Power Networks to confirm their support of the project and will confirm resourcing commitments during project mobilisation.	Decommissioning has been completed and no further actions are required from UK Power Networks business units.	G

Ref	WS	Status	Description	Mitigation/Planned Action	Current Status	RAG
R17	PM	Closed	Partner withdraws from project for financial, commercial, or technical reasons.	If one technology partner withdraws from the project, we will consider using the same technology at both substation and customer sites, or if this would not provide value for customers' money, we would de-scope the project to only trial one method. If FNC withdraw from the project, we will seek an alternative partner who can provide the necessary safety case expertise.	AMAT did not sign the collaboration agreement and have withdrawn from the project. Following this change, we engaged with the market to find an alternative partner for M2. However when no suitable replacement could be found, the project team decided to request a change from Ofgem to remove M2 from the project.	G
R18	WS2	Closed	Customer (trial participant) withdraws from the project because the trial is impacting their business activities.	To minimise probability, we will only consider customers where the risk of adverse impact on their business activities is minimal or can be managed.	Risk no longer valid. M2 (customer site trials) will no longer be pursued as part of this project. Change request submitted to remove M2 from the project.	G
R19	PM	Closed	Breach of data protection regulations.	We will ensure that all customer's details are handled and stored in accordance with our data protection procedures. Method 2 now descoped so there is no impact to the client	N/A this period.	G
R20	WS2	Closed	Solution has adverse impacts on protection grading, causing unacceptable fault clearance times.	We will complete a protection coordination study to ensure that the solution does not have any adverse effects on protection coordination.	We have engaged with the protection team and they have not indicated any issues.	G
R21	WS2	Closed	Solution fails, causing unplanned outages.	We will install additional circuit breakers that enable the FLCB to be remotely bypassed and isolated to minimise the risk of unplanned outages in the event that it fails.	No fails have been reported and risk has been closed following the end of the trial.	G
R22	WS2	Open	Solution is not suitable for general population of UK Power Networks sites due to operational or physical space constraints.	We have already completed a preliminary feasibility study on a sample of LPN sites, and will complete a feasibility study on a sample of LPN, EPN, and SPN sites as part of the project.	Ongoing engagement with planning UK Power Network Planning teams to perform CBA on constrained substations. There are sites that unit couldn't be deployed due to its size. Risk will stay open as the space constraints could be applicable on case-by-case scenarios.	A
R23	WS3, WS4	Open	BAU method cost is higher than expected.	If we discover any issues that could increase the BAU method cost to the point where the project business case is no longer viable, we will assess whether the project should be halted or de-scoped.	ABB reported that the unit cost will be in the range of £300-400k which is lower than the assumed figure in the FSP (£500k). Risk will remain open until unit commercialisation.	G
R24	WS1	Closed	Equipment fails to pass high power type tests.	ABB and AMAT have both allowed adequate contingency to build another prototype, in the event that the device intended for the field trials fails catastrophically during type testing and cannot be salvaged.	Four of five type tests passed. Internal arc withstand will be re-tested. Re-test of IAC test completed in July 2019	G
R25	WS2	Closed	Unable to find a suitable site for substation trial.	If we are unable to find a suitable site in LPN (e.g. there are sites that would be suitable for a BAU deployment but not suitable for a trial for business/commercial/safety reasons), we will also consider sites in SPN or EPN that have similar operational and/or physical constraints as typical LPN sites.	This risk is closed as a trial site has been selected within LPN.	G
R26	WS4	Closed	Learning from the project is not disseminated effectively to the DNO community.	We will benchmark our knowledge dissemination strategy against other projects and other DNOs to ensure its effectiveness. Two external webinars took place in 2021 and Q&A session was held in ENIC conference Closedown external webinar took place on 18 August 2022	Closedown external webinar took place on 18 August 2022 which DNOs attended	G

Ref	WS	Status	Description	Mitigation/Planned Action	Current Status	RAG
R27	WS4	Open	Solution is not approved by UK Power Networks.	We will involve key UK Power Networks stakeholders to champion the design and specification of the solution to ensure that it is accepted. Key UK Power Networks stakeholders (i.e. technical experts) have formed an internal working group to discuss issues that may arise in the BAU adoption of FLCB technology.	Relevant standards will be developed and approved by the key UK Power Networks stakeholders	G
R28	WS3	Closed	Solution is not accepted by customers.	We will engage with customers to understand their requirements and motivations, and ensure the solution is designed to meet their needs.	The customer based solution for M2 was removed from the scope of the project.	G
R29	WS2	Closed	Delay and/or cost overrun – civil works.	We will leverage the expertise of our in-house capital delivery teams to ensure that all site works are well managed.	Civil works completed this period	G
R30	WS2	Closed	Delay and/or cost overrun – electrical installation works.	We will leverage the expertise of our in-house capital delivery teams to ensure that all site works are well managed.	Risk closed as installations have been completed	G
R31	WS1	Closed	Project kick-off delayed by negotiations with project partners.	We agreed heads of terms and scope for collaboration agreements with all project partners before full submission.	AMAT withdrew from the project and ABB have signed the collaboration agreement.	G
R32	WS1, WS2	Closed	Project delivery team lacks necessary technical expertise.	We have engaged technical experts within the business to serve as the project design authority. We will also engage an expert on power electronics to provide assurance on ABB designs and specifications.	We are working closely with any relevant business units where necessary.	G
R33	WS2	Closed	Delay and/or cost overrun – commissioning.	Costing exercise is under way to estimate remobilisation costs and forecast time required to complete remaining works to minimise the use of contingency costs	Additional site works have completed commissioning in February 2020, R44 and R45 requiring time and cost in the future has impacted the budget planned for commissioning	G
R34	WS3	Closed	Delay and/or cost overrun – customer engagement/recruitment.	We will leverage the expertise of our in-house capital delivery teams to ensure that all site works are well managed.	WS3 was removed from scope of project as it was related to M2.	G
R35	WS2	Closed	ABB-provided (conventional) circuit breakers do not comply with UK Power Networks' requirements.	We have allowed adequate contingency for UK Power Networks to supply approved circuit breakers, which would be connected to the FLCB by joggle panels[2].	The CBs used in the project have been retrofitted from existing ones and we have used the same supplier for the retrofit before.	G
R36	WS3	Closed	Delay in contract phase with the customer.	Shortlist a number of potential customers should the customer withdraw from the project. Engage with the customer and legal team early to allow sufficient time for contracts to be drawn up.	WS3 was removed from scope of project as it was related to M2.	G
R37	WS1	Closed	Unable to sign contract with Method 2 supplier.	Find an alternative supplier. Efforts were made to find an alternative supplier but were unsuccessful. The decision was made to remove Method 2 from the project and a change request was submitted to Ofgem. We are awaiting official response from Ofgem but has been agreed in principle.	Method 2 has been removed from the project.	G
R38	WS2	Closed	Delay in delivery of retrofitted CBs.	We have allowed adequate time contingency for ABB UK to supply approved circuit breakers.	The CB retrofit is complete and ready has been delivered to site.	G

[2] Joggling is a metalworking technique to attach two metal sheets together. It is an offset bending process in which the two opposite bends are each less than 90°,and are separated by a neutral web so that the offset (in the usual case where the opposite bends are equal in angle) is less than five work piece thicknesses. Often the offset will be one work piece thickness, in order to allow a lap joint, which is smooth on the 'show-face'.

Ref	WS	Status	Description	Mitigation/Planned Action	Current Status	RAG
R39	WS2	Closed	Delay in completion of electrical design (CPP).	Close support of the electrical design team from the project team. Monitoring of progress and assistance from the supplier.	Electrical design completed.	G
R40	WS1	Closed	Delay in testing and/or FAT of FLCB device.	Change order of type tests depending on what is causing the delay.	This risk became an issue due to the original high power test laboratory having a fault with the generator required for the type testing. Due to the long lead time (three to four months) for repair of the generator, an alternate high power test laboratory has been booked. This will minimise the impact on the readiness of the FLCB for delivery to site. The FLCB failed the first internal arc classification (IAC) test so an investigation and panel modification were made. The re-test was completed in July 2019 but this did impact the delivery to site.	G
R41	WS2	Closed	Delay in installation of FLCB due to leak in the roof at Glaucus St Substation is present above where the FLCB will be installed.	Conduct repair the work or provide a temporary fix until roof can be repaired.	Defect repaired and installation complete	G
R42	WS2	Closed	Delay in energisation and commencement of trial period (due to defect identified in QF switchgear (retrofit circuit breakers)). A defect was discovered with a batch of retrofit VOR-M CBs of the same type as the ones being used for the trial site. The defect caused capacitor failures due to a defective batch and they form part of the magnetic actuator mechanism. Failure of the capacitor would prevent the CB from opening/tripping	Project team have identified that the retrofit CBs procured for the project are not part of the defective batch of capacitors so the risk of failure is low. UK Power Networks proposed that in the unlikely event of a DC power supply failure of the substation a portable power pack should be developed by ABB so that the CB can be operated.	ABB designed and produced portable power pack for the retrofitted circuit breakers.	G
R43	WS2	Closed	GT1 cable fault cannot be repaired until sinkhole near where excavation is required is fixed first. Trial site has three transformers in total and the impact of GT1 being out of service is that GT2 and GT3 cannot also been taken out of service as two must be in service. The result of this is that both the auto-close scheme and the fault recording relays cannot be fully commissioned.	Return at a later date to commission auto-close scheme and fault recorders to mitigate delay in energisation. Auto-close scheme is required for running arrangement three and the FLCB has its own fault recording devices.	GT1 cable fault was repaired and GT1 put back into service.	G

Ref	WS	Status	Description	Mitigation/Planned Action	Current Status	RAG
R44	WS2	Closed	Replacement of R43. Delay in GT1 cable fault repair. Trial site has three transformers in total and the impact of GT1 being out of service is that GT2 and GT3 cannot also been taken out of service as two must be in service. The result of this is that both the auto-close scheme and the fault recording relays cannot be fully commissioned.	Return at a later date to commission auto-close scheme and fault recorders to mitigate delay in energisation. Auto-close scheme is required for running arrangement three and the FLCB has its own fault recording devices.	GT1 cable fault was repaired and GT1 put back into service.	G
R45	WS2	Closed	Delay modification of HV compartment door interlock on the FLCB due to COVID-19 restrictions. This impacts energisation of the FLCB.	Currently no mitigation is possible until site works can safely recommence. Prior to the full lockdown measures implemented by UK Government on 23 March 2020, ABB were scheduled to complete site works 25-27 March 2020. ABB Germany were unable to travel due to aforementioned restrictions. To mitigate the uncertainty as to when ABB Germany could travel again, the project team arranged for ABB UK to carry out the modifications as directed by video for ABB Germany while maintaining safe distances between employees on site.	The FLCB was energised 12 August 2020.	G
R46	WS2 and WS4	Closed	Delay in publication of learning report SDRC 9.2.1 – Interim Learning Report – Demonstration of a FLCB for substations.	To minimise the impact of delays the project team has already starting drafting SDRC 9.2.1 with our learnings to date from installation and commissioning.	SDRC 9.2.1 has been completed.	G
R47	WS2	Closed	Extension to project trial end date (also linked to R9).	The project team will monitor performance of the FLCB once the trial period has started. If a number of network faults are experienced, the team will assess whether or not an extension to the project trial is required.	Delays encountered during type testing, approval to energise the retrofit circuit breakers due to the defect linked to R42 (outside the scope of the project), issues arising during commissioning and COVID-19 have impacted the trial start date. There were two network faults encountered during this reporting period. The FLCB performed as expected and generated valuable insights so the decision was made by the project team to extend the trial period to continue building confidence in the FLCB.	G

Table 6 Project Risk Register

12. Material change information

No material changes have been encountered during this reporting period.

13. Other information

Currently there is no other information to report to Ofgem.

14. Accuracy assurance statement

The project has implemented a project governance structure as outlined in our innovation policies and procedures that effectively and efficiently manages the project and all its products. All information produced and held by the project is reviewed and updated when required to ensure quality and accuracy. This report has gone through an internal project review and a further review within UK Power Networks to ensure the accuracy of information.

We hereby confirm that this report represents a true, complete and accurate statement on the progress of the Powerful-CB project in its eleventh six-month reporting period.

Signed: 

Date: 31 August 2022

Suleman Alli

Director of Customer Service, Strategy, Regulation & IS

UK Power Networks