Powerful-CB

Project Progress Report – June 2021

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Contents

Glossary

Term	Description
ABB	Our technology partner for Method 1
AMAT	Applied Materials, our technology partner for Method 2 (this method has been de-scoped from project following Ofgem approval of change request)
BAU	Business As Usual
CB	Circuit Breaker – Protection device that interrupts the flow of current in an electric circuit in the event of a fault
CHP	Combined Heat and Power: is a highly efficient process that captures and utilises the heat that is a by-product of the electricity generation process
COVID-19	Corona Virus Disease 2019
CT	Current Transformer
DG	Distributed Generation
DNO	Distribution Network Operator
EMC	Electromagnetic Compatibility
ENA	The Energy Networks Association
EPN	Eastern Power Networks plc
ENWL	Electricity North West Limited
FATs	Factory Acceptance Test
FCL	Fault Current Limiter – a FLMT that attenuates fault current by increasing its impedance (only) during a fault.
FLMT	Fault Level Mitigation Technology – a technical solution that reduces fault levels on the network
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
FNC	Frazer-Nash Consultancy
FSP	The Powerful-CB Full Submission Proforma - http://bit.ly/Powerful CB-fsp
GB	Great Britain
GT	Grid Transformer
HAZID	Hazard Identification
HMI	Human Machine Interface
HSE	The Health and Safety Executive
HV	High Voltage
Imperial	Imperial Consultants (Imperial College London's consultancy company)
IPR	Intellectual Property Rights
LCNI	Low Carbon Networks & Innovation Conference

LPN	London Power Networks plc
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
PPR	Project Progress Report
RIIO-ED1	The current electricity distribution regulatory period, running from 2015 to 2023
SCADA	Supervisory Control and Data Acquisition
SDRC	Successful Delivery Reward Criteria
SPN	South Eastern Power Networks plc
TRL	Technology Readiness Level
UKPN	UK Power Networks
VT	Voltage Transformer

1. Executive summary

1.1 Project background

The Powerful-CB (Power Electronic Fault Limiting Circuit Breaker) project aims to demonstrate that fault limiting circuit breakers (FLCBs) can enable distribution network operators (DNOs) to connect more distributed generation (DG) to fault level constrained 11 kV 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 been working 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 continues to work 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 June 2021 and the previous PPR covering July to December 2020 is available here. Collectively, these PPRs form the annual progress report required by Ofgem's Network Innovation Competition (NIC) Governance Document.

Overall, the project has made good progress during the reporting period, continuing the trial period, gathering trial data and analysing performance of the FLCB under network fault conditions.

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.

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, sees the FLCB operated as a bus coupler by opening the existing bus coupler BC2 and requires the FLCB to break the short circuit current fed from two transformers certain faults.

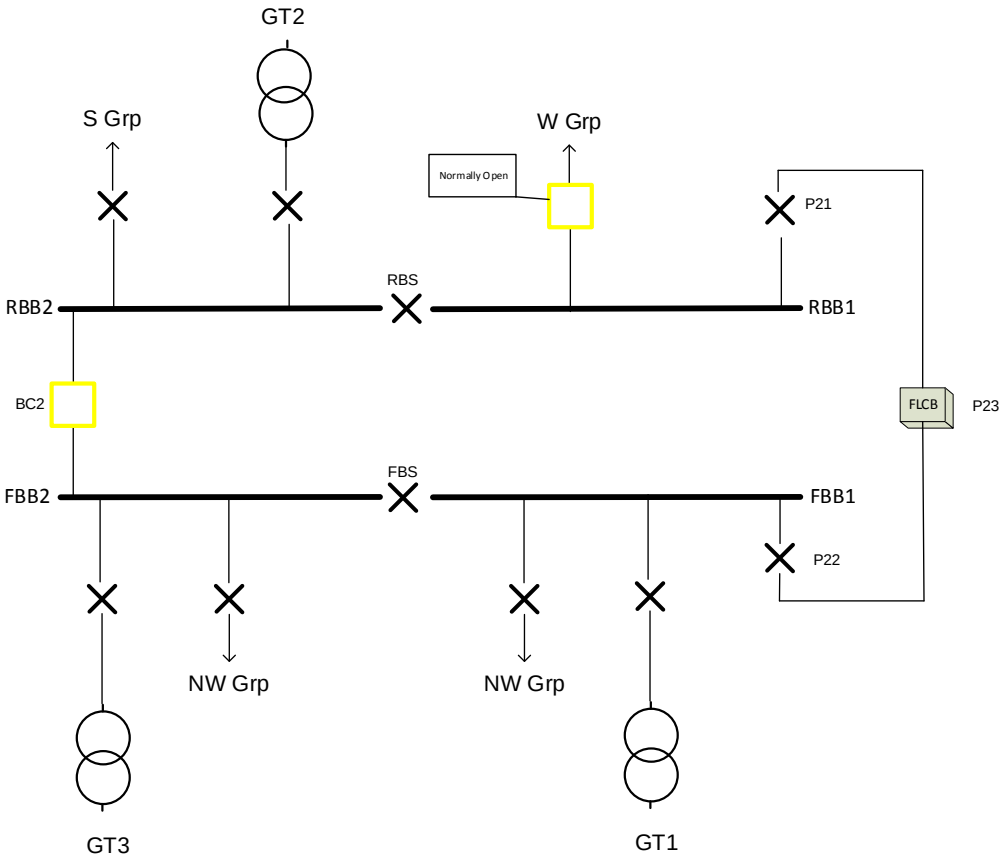

Figure 1 Running Arrangement 3. Note yellow indicates 'normally open'

In this reporting period we experienced two network faults, with the first occurring on 24 March 2021 and the second on 15 April 2021. In both instances these faults were caused by cable faults on our network and in both cases the FLCB operated correctly. The tripping value in the FLCB is set to 4kA and analysing the performance of the FLCB shows that when the fault current reached this level, the peak is limited after 0.7ms and is 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 second network fault which illustrates this fault limiting and interruption behaviour.

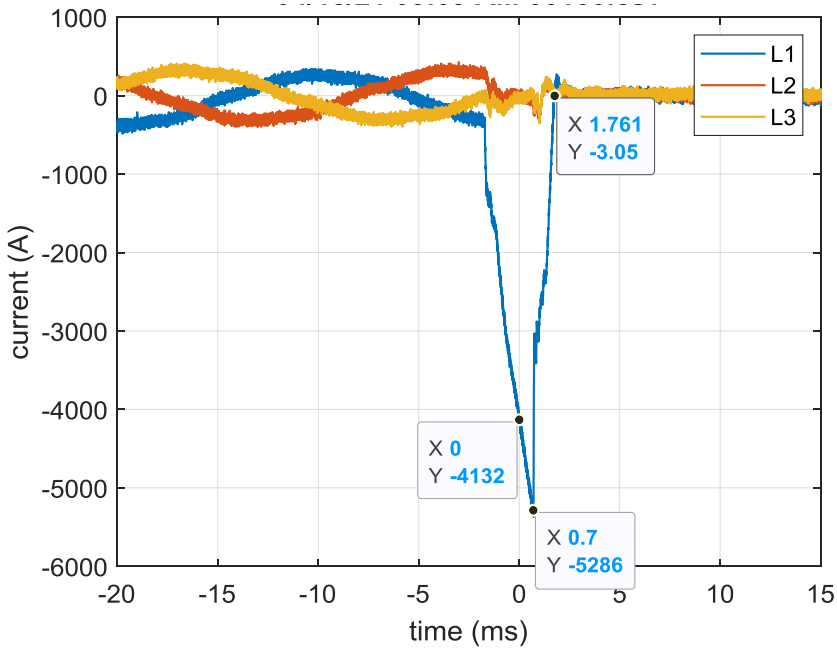

Figure 2 Fault current measured by the FLCB during network fault on 15 April 2021

Workstream 3 – Understanding Customers' Requirements

Following the removal of M2 from the project in the previous reporting period there are 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.

Workstream 4 – Knowledge Dissemination

During this reporting period, Workstream 4 (WS4) focussed on preparing and delivering a webinar to ABB stakeholders focusing on the motivation for the project, concept and development of the FLCB, installation and performance to date of the FLCB. In addition to sharing our experience, the webinar was used as an opportunity to discuss next steps with key ABB members and the FLCB strategy following the project.

The project also featured in UK Power Networks Annual Review 2020/21 highlighting the great work and progress of the project.

Following the two network faults experienced the project team engaged with colleagues from Asset Management, Capital Programme and Procurement and Network Operations to share the data captured, the 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.

1.3 Risks and issues

The project continues to apply robust risk management procedures to reduce the probability and impact of risks materialising. The full risk register and status of each can be found in Section 11. The project team have taken mitigating actions to reduce the impact of issues and are closely managing high risk items. Further detail is provided below:

Table 1 Risks and issues identified for this reporting period

Ref	Issue	Impact	Mitigation
R47	Potential extension to project trial end date (this is also linked to R9 included within the full risk register in Section 11 of this report)	Extension of overall project end date. 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 have impacted the trial start date.	The project team will monitor performance of the FLCB. Based on the number of network faults that are experienced, the team will assess whether or not an extension to the project trial is required. The reliability of our network means that network faults occur infrequently. Performance data of the FLCB under network faults is vital as this maximises the learnings generated through the project and provides confidence in the reliability of the FLCB.

During this reporting period risk R47 has impacted the project and overall schedule. As highlighted in the December 2020 PPR, part of the mitigation for this risk was to assess whether a trial extension is required based on the number of network faults. Although the project has now seen two network faults with the FLCB performing as expected the project team want to maximise the opportunity to generate valuable insights and to monitor the reliability of the FLCB over time and hence decided to extend the project trial.

We have decided to extend the project and based on this all future planned activities and deliverables for the project will be delayed including the project completion date. The project team will formally notify Ofgem with a non-material change letter in the next reporting period detailing the impact on project plan.

1.4 Outlook for next reporting period

During the next reporting period, the project team will continue with the trial period, gather and analyse data and disseminate knowledge. The activities include:

- Continuing to trial the FLCB under Running Arrangement 3;
- During the next reporting period ABB will attend the trial site for inspection and maintenance of the FLCB;
- Building on the publication of the preliminary safety case report in 2018, Phase 2 of the safety case will remain active for the remaining duration of the project. Phase 2 will include updating the preliminary safety case with any lessons learned and additional safety requirements identified during the preparation, installation, commissioning of the FLCB and any design changes during the trial; and
- Knowledge dissemination planned for the next reporting period includes delivering a webinar for external stakeholders to share knowledge gained from the installation work, commissioning and operation of the FLCB to date.

2. Project Manager's report

The project made good progress during this reporting period (January-June 2021) focusing on the following areas:

- Ongoing project planning;
- Continuing the trial period under Running Arrangement 3;
- Data gathering and analysis;
- Performance analysis of the FLCB under network faults; and
- Hosting a webinar for ABB global stakeholders to share experience to date of the project

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 continues to comprise of three dedicated roles:

Table 2 Project team roles

Role	Status	Start Date
Project Manager	Appointed	4 February 2019
Workstream 1&2 Lead	Fulfilled by Project Manager	23 March 2018
Workstream 3&4 Lead	Appointed	3 July 2017

The Workstream 1 (WS1) and Workstream 2 (WS2) Lead has moved to another team within UK Power Networks during the period and this role is now being fulfilled by the Project Manager. The role of the Workstream 4 (WS4) Lead remains unchanged for the period. 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.

2.2 Project Partners

As highlighted in the December 2018 Project Progress Report (PPR) our project partner ABB has signed onto a collaboration agreement with UK Power Networks and is progressing with developing and trialling of the FLCB. The M2 proposed project partner, AMAT, did not sign onto a collaboration agreement and subsequently withdrew from the project. The change request submitted to Ofgem has been approved and subsequently M2 was removed from the project. The removal of M2 impacts WS1, WS2 and WS3 and as such works relating to M2 will no longer be discussed in future PPRs.

The project continues to hold fortnightly Project Partner meetings to ensure successful delivery of the project. The Project Partner meeting covers 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; and

- Risks, issues and mitigation plans.

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 both a primary substation and customer site within London Power Networks (LPN). Following the removal of M2 from the project, a device will no longer be developed for trial at a customer site. For the remainder of the project, WS1 will focus 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 have been disseminated via SDRC 9.1.1. The test reports generated from WS1 are available to other Network Licensees and stakeholders upon request.

Progress during this reporting period

All WS1 activities for the development of the FLCB have been completed in earlier reporting periods.

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.

Outlook for next reporting period

The next reporting period will see minimal progress in WS1 as the FLCB has energised and will continue to be trialled under a number of running arrangements. The remaining activities include:

- Collating additional evidence documents required for the ongoing updates of the safety case (note that this has overlap with WS2).

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 will continue to collaborate with ABB, and our safety case expert, to develop the engineering knowledge necessary to safely and effectively demonstrate FLCBs on Great Britain (GB) networks. We will investigate 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 will be 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 will seek to engage with the Health and Safety Executive (HSE), the Energy Networks Association (ENA), and other Licensees, especially 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 will be captured in engineering policies, standards, and procedures and shared via learning dissemination activities.

Progress during this reporting period

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

- Continuing the trial period under the final running arrangement, Running Arrangement 3 (RA3). We transitioned to this running arrangement in the previous reporting period on 3 December 2020. This arrangement as shown in Figure 3, will see the FLCB operated as a bus coupler by opening the existing bus coupler BC2. Under RA3 we would require the FLCB to break the short circuit current fed from two transformers under certain faults;

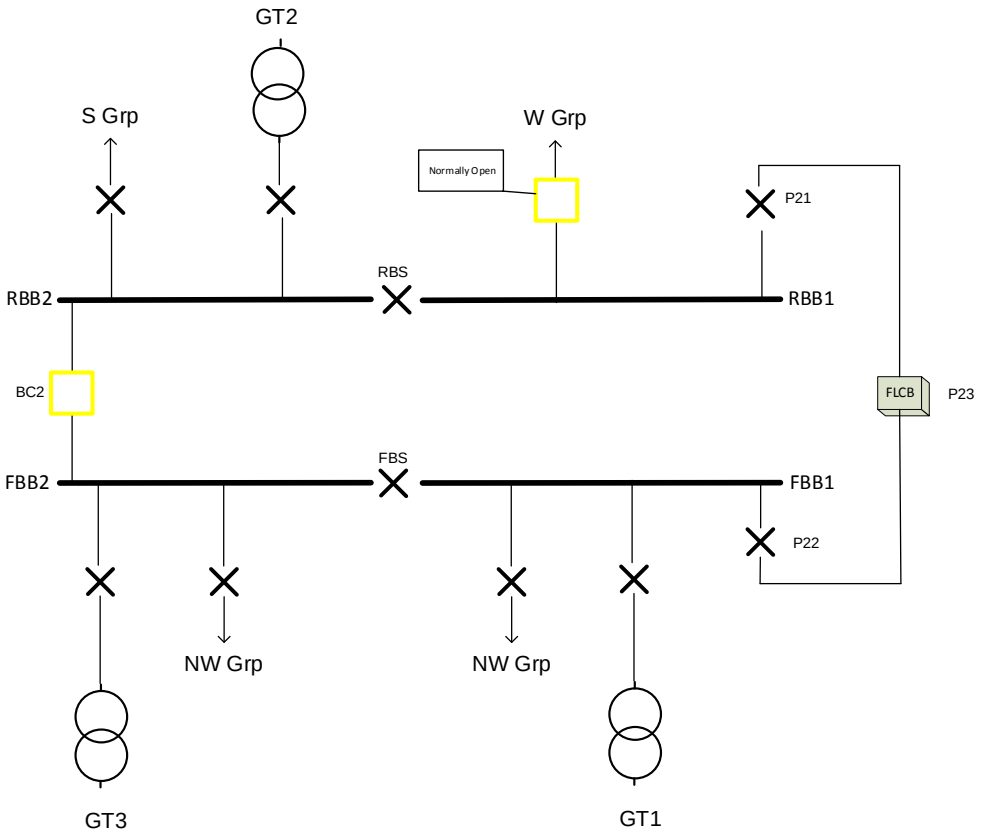

Figure 3 Running Arrangement 3. Note yellow indicates 'normally open'

- Gathering data and monitoring the health of the FLCB. Twice a day, the supervision unit within the FLCB receives 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 is 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 sends an updated cluster and a transient recording of the currents through the FLCB;
- As highlighted in previous reporting periods the project team have scheduled a monthly confidence switch where Network Control will send an open command to the FLCB and then close it a short time later;
- Analysing performance of the FLCB under network fault conditions following two faults experienced during this reporting period. The first fault occurred on 24 March and the second on 15 April and in both cases the FLCB successfully operated as expected and was reclosed shortly after. More details on the faults can be found in the Challenges and lessons learned subsection; and
- Updating the safety case with FNC by information/data which form part of the required evidence documents.

Challenges and lessons learned

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

The first fault occurred at 18:38 on 24 March 2021 on a feeder supplied by a designated panel (P10) and was caused by a cable fault. To illustrate this, Figure 4 presents the indicative current paths and current flowing through the substation to P10 located on the rear busbar RBB2.

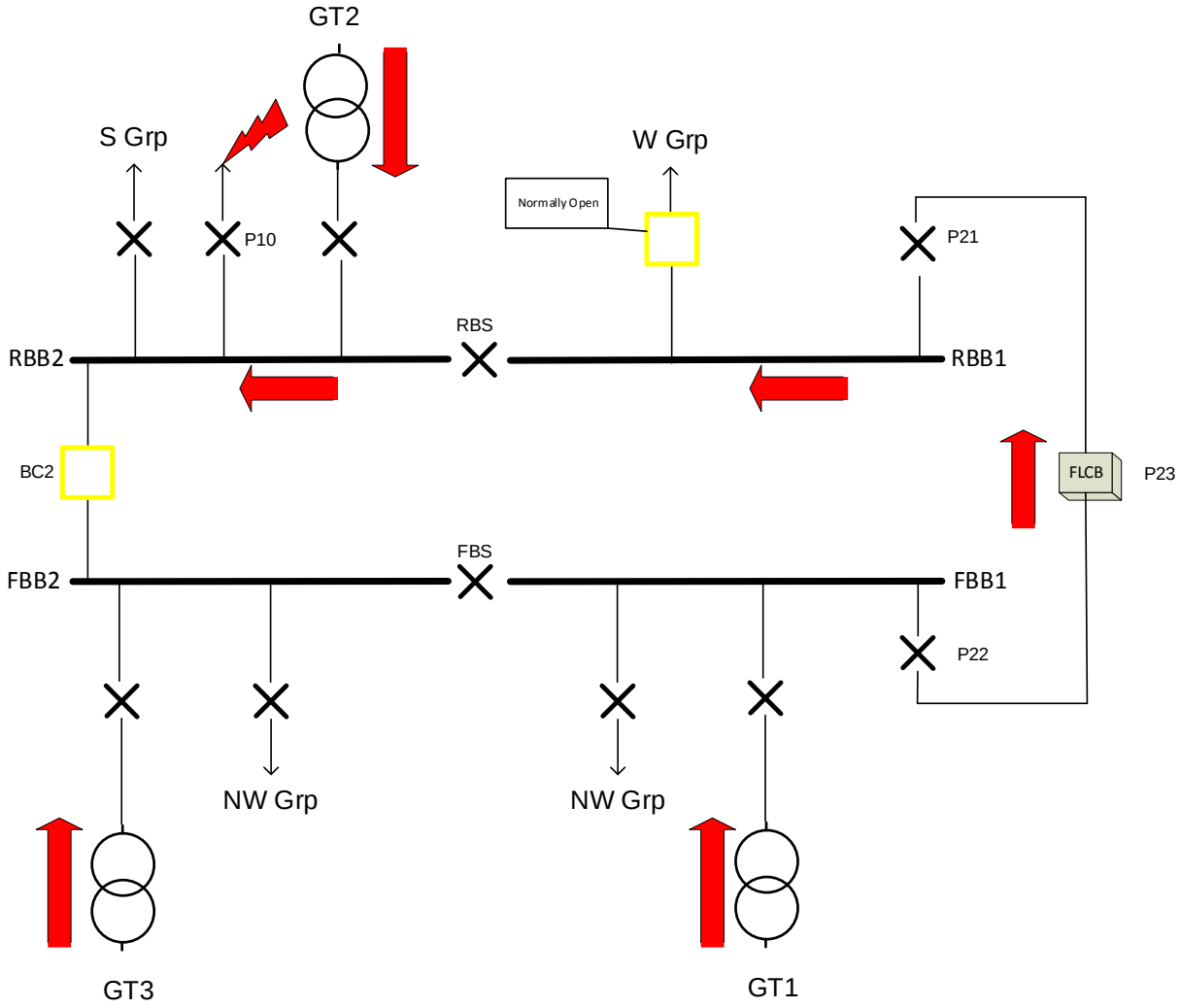

Figure 4 Network fault on feeder supplied by Panel 10 with indicative current flow direction shown with red arrows

As shown on the alarm list in Figure 5, the FLCB operated correctly by tripping first, followed by the two adjacent circuit breakers (P21 and P22) and finally P10. For this particular fault the FLCB interrupted the fault contribution from the front busbar, leaving PN10 to interrupt current from the rear busbar only.

24/03/2021 18:38:37.140	SYSTEM	GLAUCUS ST	On SUBSTATION cct Earth fault	ALARM
24/03/2021 18:38:37.180	SYSTEM	GLAUCUS ST	Panel 23 - On 023-FLCB-BC1 cct Protection operated	ALARM
24/03/2021 18:38:37.190	SYSTEM	GLAUCUS ST	Panel 23 - On 023-FLCB-BC1 cct Not ready for service	ALARM
24/03/2021 18:38:37.200	SYSTEM	GLAUCUS ST	Panel 23 - 023-FLCB-BC1 FLCB-BC1 11kV Air CB	DBI
24/03/2021 18:38:37.210	Adrian Hall	GLAUCUS ST	Panel 23 - 023-FLCB-BC1 FLCB-BC1 11kV Air CB	Unexpected Open
24/03/2021 18:38:37.220	SYSTEM	GLAUCUS ST	On AUTO-SWITCHING cct A-SW Inhibited	ALARM
24/03/2021 18:38:37.320	Adrian Hall	GLAUCUS ST	Panel 23 - On 023-FLCB-BC1 cct Protection operated	RESET
24/03/2021 18:38:37.750	SYSTEM	GLAUCUS ST	Panel 21 - 021-FLCB-INT1 11kV Vac CB	DBI
24/03/2021 18:38:37.760	Adrian Hall	GLAUCUS ST	Panel 21 - 021-FLCB-INT1 11kV Vac CB	Unexpected Open
24/03/2021 18:38:37.760	Adrian Hall	GLAUCUS ST	Panel 22 - 022-FLCB-INT2 11kV Vac CB	Unexpected Open
24/03/2021 18:38:38.140	SYSTEM	GLAUCUS ST	Panel 10 - (S1) THOMAS RD 40-42 IDNO 11kV Vac CB	DBI
24/03/2021 18:38:38.150	Adrian Hall	GLAUCUS ST	Panel 10 - (S1) THOMAS RD 40-42 IDNO 11kV Vac CB	Unexpected Open
24/03/2021 18:38:38.150	Adrian Hall	GLAUCUS ST	On SUBSTATION cct Earth fault	RESET
24/03/2021 18:38:38.190	SYSTEM	GLAUCUS ST	On SUBSTATION cct Backup prot operated	ALARM
24/03/2021 18:38:38.210	SYSTEM	GLAUCUS ST	On SUBSTATION cct Trip relay operated	ALARM
24/03/2021 18:38:38.210	Adrian Hall	GLAUCUS ST	On AUTO-SWITCHING cct A-SW Inhibited	RESET
24/03/2021 18:38:38.240	SYSTEM	GLAUCUS ST	GT2 11kV Vac CB	DBI
24/03/2021 18:38:38.250	Adrian Hall	GLAUCUS ST	GT2 11kV Vac CB	Unexpected Open

Figure 5 Alarm list received following network fault on 24 March 2021

The data acquisition of the supervision unit in the FLCB is triggered when the FLCB is tripped and the recording is saved 20 ms before the trigger and 80 ms after giving a total of 1 second of data. The shape of the current waveform for this fault as shown in Figure 6 is unusual in nature. On this particular fault, the time settings for the data acquisition turned out to be too narrow because the inception of this fault occurs in phase L3 in the network around t=-30 ms according to this time scale. In Figure 6 below the current level in L3 rises to just below 4 kA peak for one negative and one positive peak before it crosses the trip setting of the FLCB at 4 kA instantaneous current. After the FLCB trips, at t=0 ms, the current is limited to 4.4 kA after 700 µs and is then forced down to zero in approximately 0.9 ms.

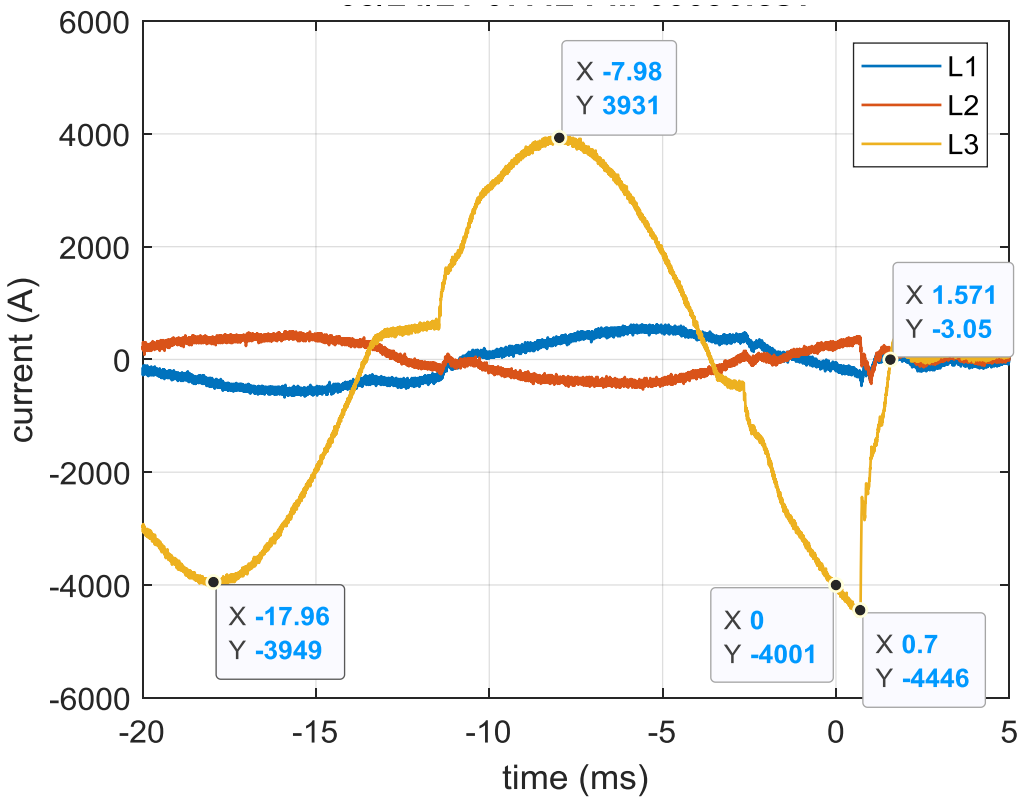

Figure 6 Fault current measured by the FLCB during network fault on 24 March 2021

In addition to the current data captured by the supervision unit in the FLCB, two additional fault recorders are installed and associated with the adjacent circuit breakers P21 and P22 to ensure that any event is captured in the case the FLCB does not react to a fault. Figure 7 below shows the recorded currents from one of those fault recorders and the data is consistent with the data recorded in the supervision unit. It should also be noted that the current waveforms are recorded for longer in the fault recorders compared to the supervision in the FLCB.

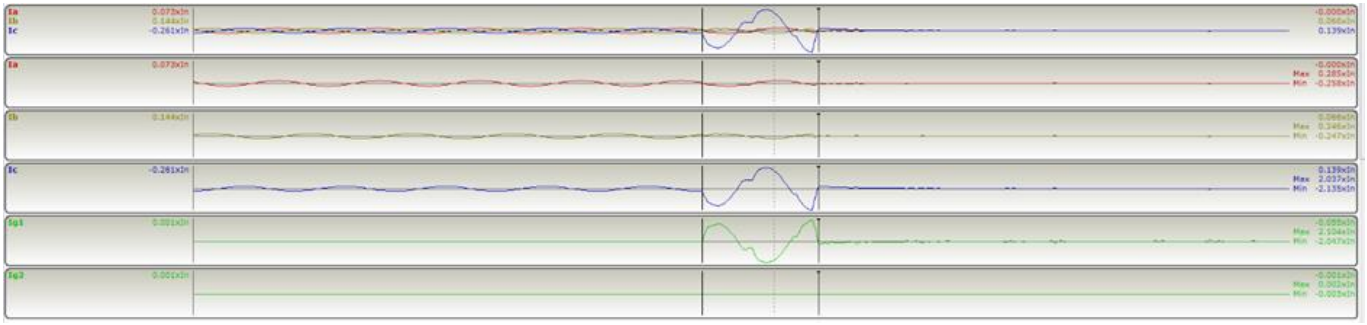

Figure 7 Fault current measured by one of the external fault recorders during network fault on 24 March 2021

A second fault occurred at 02:04 on 15 April 2021 for a feeder supplied by Panel 13 (P13) and the cause of this was also a cable fault. This fault shows a more typical current shape where there is a rapid increase in current as can be seen in Figure 8 below. Prior to the fault, the system measured symmetrical currents in the order of hundreds amperes in the three phases. When the fault occurred in phase L1, the current rapidly rises with a negative value. When the current passed 4 kA, the FLCB was tripped and the interruption sequence started. Similar to the performance of the FLCB in the first fault, at 700 µs, the current reached its peak, in this case 5.3 kA and is forced to zero in about one millisecond.

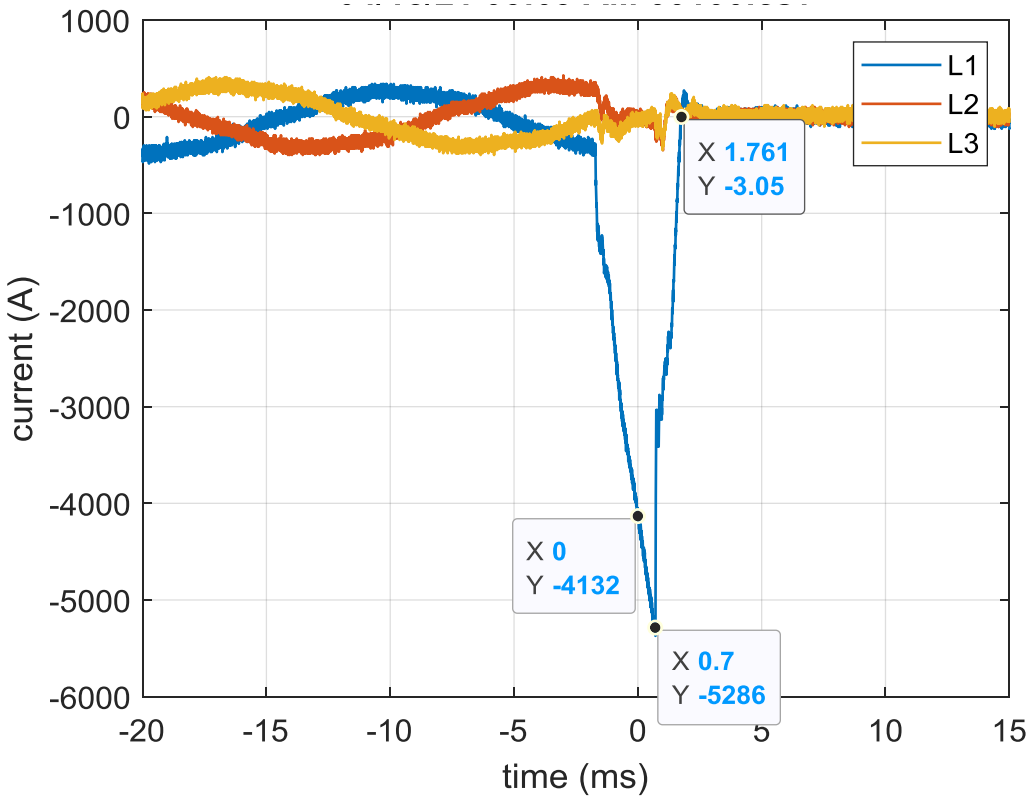

Figure 8 Fault current measured by the FLCB during network fault on 15 April 2021

While the supervision unit in the FLCB captured the necessary data when operating for the two network faults, it did not capture the current waveform for the fault that occurred on 24 March 2021 at the point of inception of the fault. Although the external fault recorders did record from this point, the project team and ABB have decided to update the settings in the supervision unit such that the duration of the recorded data, including pre-trigger data, is increased. This activity will be completed by ABB when they carry out the inspection and service of the FLCB on site.

Outlook for next reporting period

The next period will see the project team continue to monitor and analyse the performance of the FLCB while awaiting for any possible network faults to occur. In this running arrangement, the device is likely to experience a fault fed from two transformers which is the running arrangement where the most benefits can be realised under BAU.

ABB plan to carry out the inspection and service of the FLCB in the next reporting period along with updating the settings of the supervision unit following the lessons learned highlighted in the previous subsection.

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.

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.

Challenges and lessons learned

The project team experienced no challenges under WS3.

Outlook for next reporting period

During the next reporting period the project team intends to continue engaging with all interested stakeholders as M1 progresses.

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.

Progress during this reporting period

The project team together with ABB delivered a webinar on 9 June 2021 to a wide audience of ABB stakeholders focusing on the purpose of the project, the concept and development of the FLCB as well as the installation and performance of the FLCB to date. In addition to sharing our experience, the webinar was used as an opportunity to discuss next steps with key ABB members regarding the FLCB strategy following the completion of the project. The webinar targeted the following groups within ABB:

- Global Product Group management team members;
- Local Product Group Germany;
- Utility Segment Manager for ELDS division; and
- Product Marketing Directors.

As part of our NIA project called EDGE-FCLi we continue to share our experiences and learnings from the Powerful-CB project with WPD providing them insights into the installation and performance of the FLCB.

The project features in UK Power Networks Innovation Annual Review highlighting the great work and progress of the project team.

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. Following the two network faults experienced the project team engaged with colleagues from Asset Management, Capital Programme and Procurement and Network Operations to share the data captured, the performance of the FLCB and interaction with existing protection. Engagement with internal stakeholders is 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.

Challenges and lessons learned

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

- The project team was still unable to organise site tours to Glaucus St for internal stakeholders to showcase the FLCB and explain how the FLCB works, its components and connection to the network due to COVID-19 restrictions and the need to limit the number of people visiting confined spaces.

Outlook for next reporting period

The following activities are planned for the next reporting period, subject to COVID-19 restrictions:

- Building upon feedback from the ABB webinar, we will develop and deliver a webinar for wider external stakeholders;
- The project is planning to feature in other UK Power Networks' led external events or webinars;
- Complete tours to key internal stakeholders to showcase the FLCB; and
- Continued updating of the project website.

3. Business case update

We have not discovered any new information that affects the business case; thus the business case remains consistent with our FSP. During this period the change request submitted to request the removal of M2 from the project has been approved by Ofgem. Based on this, 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 June 2021. It describes issues we faced and how we managed them, key achievements, notable events, key planned activities for the next reporting period and any issues we expect in the next reporting period.

4.1 Summary of changes since the last Project Progress Report

Figure 9 below shows the key activities and changes to the project plan during the current reporting period.

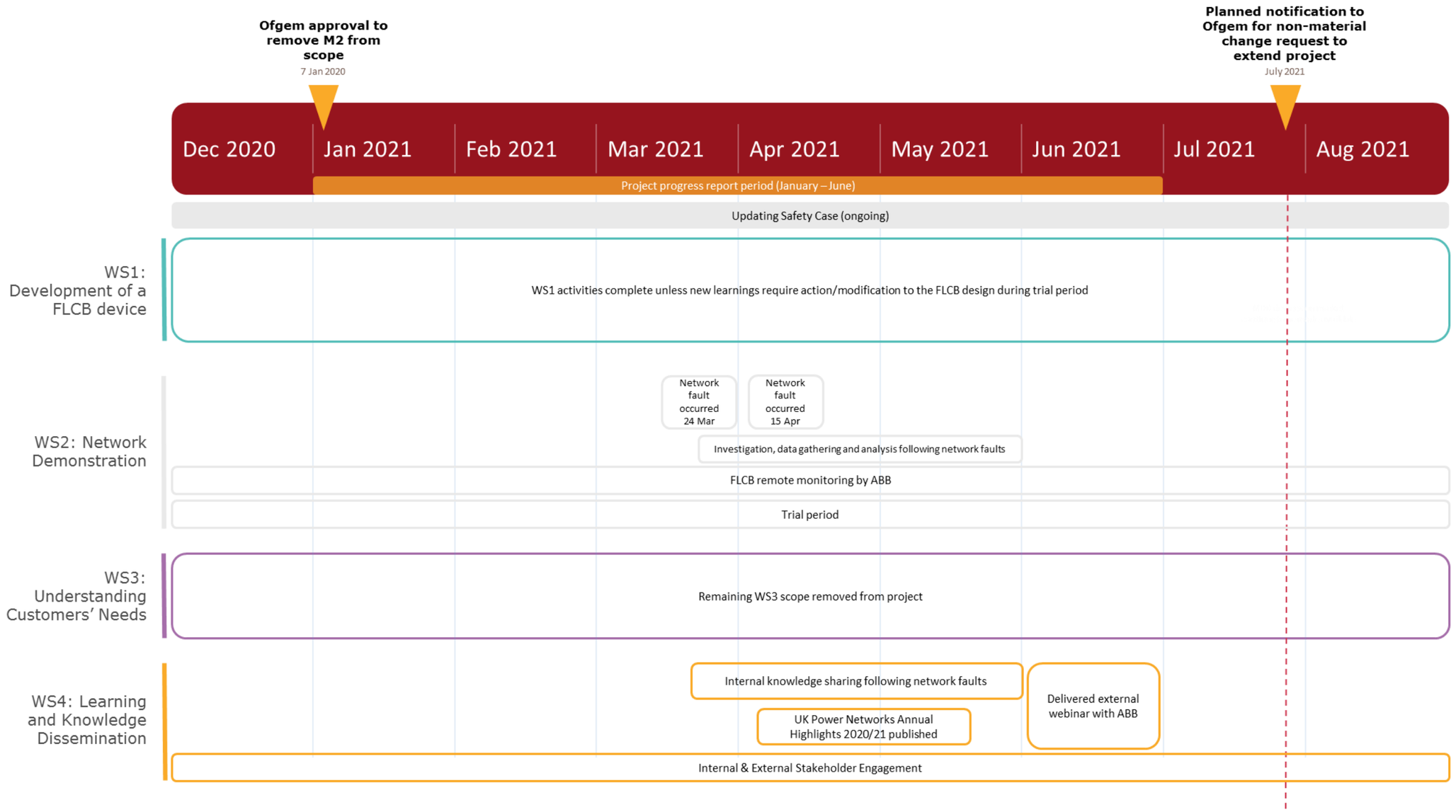

Figure 9 High level project plan highlighting changes during the current reporting period.

As previously highlighted in the December 2020 PPR, during this reporting period the project team assessed whether to extend the trial end date. Following the network faults experienced and the valuable insights this produced, we have decided to extend the project in order to maximise our learnings and continue to build confidence in the performance of the FLCB. Based on this all future planned activities and deliverables for the project will be delayed including the project completion date. The project team will formally notify Ofgem with a non-material change letter in the next reporting period detailing the impact on the project plan. All remaining SDRCs and project completion date will be rescheduled to be delivered later compared to the Project Direction.

4.2 Detailed progress in the reporting period

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

Table 3 Project progress during this reporting period

Task description	Workstream	Status at start of period	Status at end of period
Trial – Running Arrangement 3 phase	2	In progress	In progress
Data monitoring and analysis of performance of FLCB	2	In progress	In progress
Delivered webinar for ABB stakeholders	4	Not started	Complete

4.3 Identification and management of issues

The project team recognises the importance of robust risk management methodologies for any project, but more specifically for complex innovation projects. Due to the nature of complex innovation projects, it is likely that certain risks will impact the overall project activities in some form. A full list of project risks identified for the project is provided in Section 11.

During this reporting period it can be reported that risk R47 has impacted the project and overall schedule. As highlighted in the previous reporting period, part of the mitigation for this risk was to assess whether a trial extension is required based on the number of network faults. Although the project has now seen two network faults with the FLCB performing as expected, the project team plans to maximise the opportunity to generate valuable insights and monitor the reliability of the FLCB over time.

As highlighted in Section 4.1, Ofgem will be notified of this decision by a non-material change letter in the next reporting period. The following issues have been recorded in the workstream reports and are also captured below. .

Table 4 Risks and issues impacting project during this reporting period

Ref	Issue	Impact	Mitigation
R47	Potential extension to project trial end date (this is also linked to R9 included within the full risk register in	Extension of overall project end date. Delays encountered during type testing, approval to	The project team will monitor performance of the FLCB. Based on the number of network faults that are experienced, the

Ref	Issue	Impact	Mitigation
	Section 11 of this report)	energise the retrofit circuit breakers due to the defect linked to R42 (outside the scope of the project), issues arising during commissioning have impacted the trial start date.	team will assess whether or not an extension to the project trial is required. The reliability of our network means that network faults occur infrequently. Performance data of the FLCB under network faults is vital as this maximises the learnings generated through the project and provides confidence in the reliability of the FLCB.

4.4 Key achievements and notable events

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

- Continuation of the network demonstration period under Running Arrangement 3 (WS2); Collection of network data to monitor performance of the FLCB (WS2);
- Experienced two network faults where the FLCB was required to operate (WS2); and
- Delivered a webinar to ABB stakeholders (WS4).

4.5 Look-ahead to next reporting period

The following major tasks and milestones are planned for the next reporting period:

- Continuing network demonstration of the FLCB (WS2);
- Updating Phase 2 of the safety case (WS1 and WS2);
- Presenting a webinar for wider external stakeholder (WS4); and
- Presenting at UK Power Networks hosted event where possible (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. The narrative describes progress towards the SDRCs and any challenges we may face in the next reporting period. As

demonstrated on the Table below, we have struck-through the SDRCs that were removed as part of the change request to remove M2.

Table 5 Project SDRCs

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.	Complete
~~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.	Complete
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.	Complete
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	30 November 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.	Complete Delayed by four months due to COVID-19 as notified in the

Project Deliverable	Deadline	Evidence	Progress
11kV substation (Method 1)	*changed from 31 July 2020*		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 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.	Following decision to extend project trial, Ofgem will be notified of this non-material change in the next reporting period
~~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			
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.	Complete
~~9.3.2 Assess the (commercial) business case based on the technical and customer findings, focusing on~~	~~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

Project Deliverable	Deadline	Evidence	Progress
~~investment decision criteria and trade-offs, such as cost, time to connect, space and impact on security of supply~~			
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 January 2022	Publish key materials from the stakeholder event (e.g. slides), and provide Ofgem with a list of invitees and attendees.	Following decision to extend project trial, Ofgem will be notified of this non-material change in the next reporting period

8. Data access details

To view the full Innovation Data Sharing Policy, please visit UK Power Networks' website here: https://innovation.ukpowernetworks.co.uk/wp-content/uploads/2019/11/UKPN-Innovation-Data-Sharing-Policy-7-Nov-19.pdf

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, published in 2019, 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 a webinar with our project partner, ABB, to share our experience to date of the project as highlighted in Section 2.6. Previous learning reports highlighted in Section 7 are also available through this website. Additional documents such as specifications, commissioning reports and standards are available to other GB DNO's 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 in the next reporting period.

IPR generated this period (January – June 2021)

Table 6 Project IPR generated during this reporting period

IPR Description	Owner(s)	Type	Royalties
FLCB and control system status snapshots (as necessary)	ABB	Relevant Foreground IPR	Nil
Data and performance of FLCB during network demonstration	ABB UK Power Networks	Relevant Foreground IPR	Nil

IPR forecast next period (July – December 2021)

Table 7 Project IPR forecast for next reporting period

IPR Description	Owner(s)	Type	Royalties
Data and performance of FLCB during network demonstration	ABB UK Power Networks	Relevant Foreground IPR	Nil

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 project continues to monitor risks and issues on a monthly basis where risk impacts and mitigation plans are updated.

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	-	-	NOT USED.	NOT USED.	NOT USED.	-
R4	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
R5	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
R6	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
R7	WS1	Open	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 to be completed during demonstration period.	G
R8	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.	N/A this period.	G
R9	WS2	Open	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.	G

Ref	WS	Status	Description	Mitigation/Planned Action	Current Status	RAG
					This risk is linked to risk R47 where a project extension is being considered and is dependent on the number of network faults experienced	
R10	WS2	Open	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.	Sufficient data was captured from network faults during this reporting period.	G
R11	WS2	Open	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 two network faults during this reporting period.	G
R12	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
R13	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.	N/A this period.	G
R14	WS4	Open	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.	N/A this period.	G
R15	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 UPSs and resource availability saw a second site visit for commissioning take place in February	G
R16	PM	Open	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.	N/A this period.	G
R17	PM	Open	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.	N/A this period.	G
R18	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
R19	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
R20	PM	Open	Breach of data protection regulations.	We will ensure that all customer's details are handled and stored in accordance with our data protection procedures.	N/A this period.	G
R21	WS2	Open	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 initial issues.	G
R22	WS2	Open	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.	N/A this period.	G
R23	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.	N/A this period.	G

Ref	WS	Status	Description	Mitigation/Planned Action	Current Status	RAG
R24	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.	N/A this period.	G
R25	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.	4 of 5 type tests passed. Internal arc withstand will be re-tested. Re-test of IAC test completed in July 2019	G
R26	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
R27	WS4	Open	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.	N/A this period.	G
R28	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) are forming an internal working group to discuss issues that may arise in the BAU adoption of FLCB technology.	G
R29	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
R30	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
R31	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.	See R17 for the delay in electrical installation works.	G
R32	WS1	Closed	Project kick-off delayed by negotiations with project partners.	We have agreed heads of terms and scopes for collaboration agreements with all project partners before full submission.	AMAT withdrew from the project and ABB have signed the collaboration agreement.	G
R33	WS1, WS2	Open	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
R34	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 to complete commissioning in February, R44 and R45 requiring time and cost in the future has impacted the budget planned for commissioning	G
R35	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
R36	WS2	Closed	ABB-provided (conventional) circuit breakers do not comply with UK Power Network's 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[1].	The CBs used in the project are retrofitted from existing ones and we have used the same supplier for the retrofit before.	G
R37	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
R38	WS1	Closed	Unable to sign contract with Method 2 supplier.	Find an alternative supplier.	Method 2 is removed from the project.	G

[1] 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
				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.		
R39	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 to be delivered to site. The CB retrofit were delivered to site	G
R40	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 in this period. The risk remains open for any changes that might be identified during commissioning.	G
R41	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 has become 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 (3-4 months) for repair of the generator, an alternate high power test laboratory has be 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
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. UKPN has 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 to design and produce portable power pack. Asset management have requested that the energisation of these CBs does not take place until this has been received.	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 3 and the FLCB has its own fault recording devices.	Have been in contact with London Borough of Tower Hamlets to discuss when the sinkhole will be fixed.	G
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	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 3 and the FLCB has its own fault recording devices.	Delay in GT1 cable fault repair Due to the redundancy in our network, this cable fault is currently not affecting customers or security of supply. In May cable fault was found and repaired however a second fault has been identified.	G

Ref	WS	Status	Description	Mitigation/Planned Action	Current Status	RAG
			that both the auto-close scheme and the fault recording relays cannot be fully commissioned.			
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 March 23, ABB Germany were unable to travel due to 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.	This prevented energisation of the FLCB until site works safely recommenced.	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.	To fulfil the requirements of SDRC 9.2.1 energisation of the FLCB needs to be complete.	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

12. Material change information

No material changes have been encountered during this reporting period and none are foreseen for the next 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 ninth six-month reporting period and an accurate view of our understanding of the activities for the next reporting period.

Signed 

Date 16/06/2021

Suleman Alli
Director of Customer Service, Strategy, Regulation & IS
UK Power Networks