Active Response
Project Progress Report – August–December 2018
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1. Executive summary

1.1 Project background

The growth of Low Carbon Technologies (LCTs) will have a significant effect on electricity distribution networks. The Active Response project aims to demonstrate active reconfiguration of the network and the use of power electronics to support the growth of LCTs.

At UK Power Networks we strive to enable the uptake of LCTs at the lowest cost to customers. As such we are developing a toolbox of smart solutions to ensure we have the right solution for any challenge we might face. The Active Response project will deliver two physical smart asset solutions – also known as Power Electronic Devices (PEDs) – which can provide a range of benefits including the deferral of costly network reinforcement. These solutions are the second-generation Low Voltage (LV) Soft Open Point (SOP) and a novel High Voltage (HV) Soft Power Bridge (SPB). The project will also deliver an advanced optimisation and automation platform, a software solution which can deliver benefits over a wide area if the enabling technologies are in place. This advanced optimisation and automation solution will be part of a larger Active Network Management (ANM) platform. The SOP and SPB can control power flows, fault levels and voltages on the LV and HV networks respectively. In order to maximise network capacity, the ANM platform will optimise the network configuration through changing open points on the network and also optimise the behaviour of the SOPs and SPBs.

Active Response is funded through Ofgem’s Network Innovation Competition (NIC) funding mechanism. The project started in January 2018 and will complete in November 2021. It is a collaborative project with partners being Scottish Power Energy Networks (SPEN), Turbo Power Systems (TPS), CGI and Ricardo Energy & Environment. By partnering with SPEN we can ensure that the methods, once proven, are deployable to at least five of the 14 GB licence areas and hence wide applicability is highly likely.

If proven successful, Active Response could save customers across Great Britain (GB) £271m in reinforcement costs – approximately £9.34 from every customer’s bill – by 2030. As well as reducing reinforcement costs, the project will help reduce overloading on circuits; this in turn will reduce Customer Interruptions (CI) and Customer Minutes Lost (CML), the key parameters for measuring the frequency and duration of power cuts experienced by customers.

The project will initially trial the use of PEDs and ANM software in several trial areas. The trials will be broken down into two key methods:

1) **Network Optimise** – trialling the optimisation and automatic reconfiguration of HV and LV networks in combination, using remote control switches and SOPs

2) **Primary Connect** – trialling the use of controlled transfers between primary substations, using the SPB to share load and optimise capacity

Once Network Optimise and Primary Connect have been trialled successfully in isolation, they will be trialled in combination as the fully integrated Active Response trial. Further detail on the trial methods is provided in UK Power Networks’ Full Submission Pro-forma (FSP), which is available on our [Innovation website](#).
1.2 Summary of progress

This Project Progress Report (PPR) – the second for Active Response – covers the period August–December 2018. Our previous PPR, covering January–July 2018, is available from:


Collectively, these PPRs form the annual progress report required by Ofgem’s Network Innovation Competition Governance Document. The next reporting period will cover January–July 2019.

Overall, the project has made good progress across the design of the hardware and software during this reporting period. Furthermore, the project has derived a methodology for selecting trial sites. This methodology will be shared in Deliverable 2. The following section provides an update of key progress from each workstream.

Workstream 1 – Hardware development and deployment

The project has successfully met critical design milestones for the hardware components. The project team and internal stakeholders have signed off the preliminary design and critical design for the SOP and also the preliminary design for the SPB. In addition, the workstream has finalised the specification for the LV circuit breakers and link box switches.

Workstream 2 – Software development and deployment

The workstream has engaged extensively with internal (UK Power Networks) stakeholders, including control engineers, planners and operational telecoms engineers, to baseline the software requirements. In parallel, the workstream has been documenting the high-level design and specification of the advanced automation solution. The high-level design has been captured in Project Deliverable 1, which has been published on UK Power Networks’ Innovation website. The high-level design and specification are the basis for procuring the ANM platform. This is being procured as part of a broader UK Power Networks business initiative involving a wide range of stakeholders.

Workstream 3 – Project planning, trials and analysis

The workstream has baselined a draft of the project use cases and each of these has been reviewed by internal UK Power Networks stakeholders in project workshops. Potential trial sites have been selected using a methodology developed by the workstream and these will be covered in our Project Deliverable 2 report (Trial Site Selection Criteria and Process Outcome) in January 2019. As part of the trial site selection process, the team has installed various temporary monitoring devices at potential trial sites to determine their suitability.

Workstream 4 – Learning and dissemination

The workstream has developed a project communication strategy and plan for the project and has also engaged with SPEN to agree a joint dissemination plan for Power Electronics in Distribution Networks, which accounts for Active Response and SPEN’s LV Engine project. This joint dissemination plan ensures a collaborative approach to sharing the learning from both projects, to avoid duplication of dissemination activities. The workstream has liaised closely with Workstreams 1 to 3 to ensure that the project learning is disseminated successfully. The workstream has organised dissemination activities at a range of conferences, including the Low Carbon Networks Innovation (LCNI) conference.
By presenting at these events, the project team has raised the profile of the project and developed useful contacts who are interested in attending future Active Response dissemination events and workshops.

1.3 Risks and issues

The project continues to apply robust risk management procedures to reduce the probability and impact of risks materialising. Since the bid submission, a number of risks have been added to the risk register; these are shown in Section 11. A handful of risks mentioned in our previous report have materialised and are impacting some of the project activities. These issues are being closely managed on a weekly basis. Further detail is provided below:

<table>
<thead>
<tr>
<th>Ref</th>
<th>Issue</th>
<th>Impact</th>
<th>Mitigation</th>
<th>Target close date</th>
</tr>
</thead>
<tbody>
<tr>
<td>R29</td>
<td>Issue: There has been a delay in appointing the ANM supplier, due to the ANM procurement being part of a broader UK Power Networks strategic initiative and therefore not in the full control of the project.</td>
<td>There are delays in appointing the supplier, which is reducing the time available for the supplier to develop the solutions in readiness for the start of trials. This may ultimately impact Project Deliverable 4, which captures learnings from software testing.</td>
<td>Updated procurement timescales have been agreed in UK Power Networks at a senior management level. The team is agreeing/discussing delivery timescales with suppliers and exploring whether the removal of Trial 1 would allow the same learnings to be developed without impacting Project Deliverable 4 (due in January 2020).</td>
<td>Q1 2019</td>
</tr>
<tr>
<td>R38</td>
<td>Issue: Long lead times for PED components are impacting the build timelines for the SPB and SOP.</td>
<td>The build of the SOP and SPB is delayed, incurring delays to testing and commissioning of the devices. This could delay completion of Project Deliverable 3, which captures learnings from the testing of the SPB and SOP.</td>
<td>UK Power Networks is working closely with TPS to understand the detailed impact of delays to the delivery of components. During the next trial period, the team will determine whether the learnings can be delivered in August 2019.</td>
<td>Q1 2019</td>
</tr>
</tbody>
</table>
2. Project Manager’s report

The project made good progress during the reporting period (August–December 2018), focusing on the following areas:

- Ongoing project planning
- Publishing the high-level design for the advanced automation and optimisation solution
- Procuring a software supplier for the advanced automation and optimisation system (ANM platform)
- Documenting and approving the preliminary design for the SOPs and SPBs
- Documenting and approving the critical design for the SOPs
- Documenting the conceptual architecture design for the advanced automation and optimisation system
- Developing the site selection methodology and selecting project trial sites

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

Project Partner meeting updates

Over the last six months the project team has hosted two meetings in London for the Project Partners, one at the Energy Networks Association office on 4 September and one at Ricardo’s offices on 13 December. These meetings provided an opportunity for all Project Partners to discuss and review progress of the project to date and agree priorities for the coming months. At the September meeting it was agreed that Project Partner meetings should be held more frequently; the intention is to meet quarterly. The project team recognises the importance of close collaboration between Project Partners to successfully deliver such a complex innovation project.

The Project Partner meetings covered a number of key points including:

1) Workstream updates – each workstream lead provided an update on progress to date, the focus for the next period, risks and issues
2) Project governance – an overview of the current governance and a session to discuss what is working well and what can be improved
3) 2019 planning
4) Risks, issues and mitigation

Figure 1 shows the project team at the December Project Partner meeting.
Project Partner contracts

The overarching Collaboration Agreement (which includes all Project Partners) has been signed. In addition, all but one of the Project Agreements between UK Power Networks and the individual Project Partners have been agreed and signed. The final Project Agreement with SPEN is being finalised and is expected to be signed by the end of January 2019.

2.1 Workstream 1 – Hardware development and deployment

Workstream 1 is responsible for hardware development and deployment. The workstream is delivered in partnership with Turbo Power Systems (TPS), who are developing the SPB and SOP. TPS are also supporting the specification and procurement of the LV circuit breakers and link box switches, which will add further capabilities to optimise the LV network during the trials.

Progress during this reporting period

During this reporting period, the workstream focused on the following activities:
The preliminary specifications of major components have been completed and approved for the LV SOP converters, including magnetics, capacitors, filters etc.

The preliminary specifications of major components have been completed and approved for the HV SPB, including transformers and input/output cubicles.

Initial identification of suppliers for the three phase solid state switches and the secondary 11kV transformers.

The preliminary design documentation has been completed and signed off for both the SOP and the SPB.

Printed Circuit Boards (PCBs) have been identified and are in development with the processor control board nearing completion and the PED snubber board now being laid out, with components identified.

Master control software is in development with the micro control and the Field Programmable Gate Array (FPGA) designs as follow-on tasks.

Initial contact with an external test facility has been established and the requirements specification for the SPB has been shared with the Project Partners.

SPB critical design review (on track for completion Q1 2019).

The LV SOP converter has undergone critical design review in this period and has been approved by the Technical Design Authority. The critical design activities included:

- Detailed Schematics
- Detailed 3D mechanical model
- Software requirements and verification plans
- Test plan
- EMC plan
- Procurement activities

Parallel testing of Silicon Carbide (SiC) devices and testing of the processor and interface boards has been completed – see Figure 2.

Completion of specifications for LV remote control circuit breakers and LV link box switches.

Selection of an academic partner to review and feedback on the design for the PEDs. This is known as Research Package 1 in the Active Response project.

Activities related to the PEDs are on track; however, as described below, we have encountered issues with the SiC devices and with finding a suitable supplier for the LV circuit breakers and link box switches.

Challenges and lessons learned

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

- In November 2018 TPS (the Workstream 1 lead) were informed of a severe delay from a subcontractor who was providing the SiC devices for the PEDs. TPS had an agreement to deliver the SiC devices by Q1 2019 – however, the subcontractor highlighted that this was no longer possible. TPS are now working closely with the subcontractor to determine and agree revised delivery dates and are exploring in parallel whether alternative suppliers can provide the SiC devices within the required time frame. Over the next few weeks/months the Workstream 1 lead will closely monitor progress and determine the impact of these delays on the overall Active Response project.

- If a new subcontractor is required to deliver these devices, they will require further testing to determine their suitability. Figure 2 shows the testing of the SiC metal-oxide semiconductor field-effect transistor (MOSFET) modules provided by the subcontractor. These MOSFETs will be used in the PEDs.
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Figure 2 – Testing of SiC MOSFET modules

- Initial findings from monitoring conducted during site visits indicated that a voltage phase angle difference at open points where the SPB was to be installed was higher than anticipated. A decision was reached early in the preliminary design phase to perform further on-site testing, and TPS, with representatives from all the Project Partners, witnessed the simulation of the impact of the network topology on the voltage phase angle (a key parameter for the SPB performance) in a controlled environment condition at UK Power Networks’ testing facilities. Upon this investigation it was found that the recommended test equipment (Outram PM7000) was causing an unstable signal and not providing the required measurement reliability. As a result oscilloscopes were introduced to verify the phase angle measurements. Using the new equipment, results were noticeably better and, as expected, were comfortably within the requirements of the SPB. The positive results have meant that TPS can continue with the critical design phase of the project and monitor site voltage angles in parallel during the winter months.

- During the preliminary design phases of both the SOP and the SPB, the project team identified that Workstreams 1 and 2 would need to work closely together to determine the supervisory control design and Remote Terminal Unit (RTU) communication design. Although these design activities were to be delivered by separate workstreams, the team recognised that close interaction was required to ensure that any dependencies were clearly communicated across workstreams. The team hosted a number of workshops to clarify design requirements for both these critical interdependent activities.

- The team carried out several simulations and conducted analysis as part of the preliminary design phase to understand the limits and potential fault scenarios in both the SOP and SPB working environments. This was useful in demonstrating the robustness of the SPB and SOP during fault conditions. The results from the simulations are a good indicator of how both systems will perform in the working environment and therefore are considered successful learning. Simulations will continue as part of the design process, to give us confidence in our design logics, and further learning on this will be shared throughout the project.
TPS and UK Power Networks have worked closely to determine an appropriate specification for the LV circuit breakers and link box switches. In the previous PPR it was highlighted that a limited number of suppliers were able to meet the requirements specification that had been drafted. The specific challenge raised by suppliers was the high fault current breaking capacity. Derived by UK Power Networks, and based on fault current in the London interconnected network area, it occurs where fault current is higher than usual due to interconnection. To overcome this challenge, UK Power Networks engaged with internal subject matter experts to determine whether the draft specification could be refined prior to initiating a formal procurement process. The revised specification will consider that Active Response will not trial solutions in the London interconnected network area. The team anticipates that although suppliers may not be able to deliver the full set of agreed requirements, they will be able to deliver a minimum viable product which can be used for the Active Response trials.

**Outlook for next reporting period**

The next period will see significant progress in the design and build of the PEDs. Key activities are described below:

- Critical design reviews for the SPB devices. Following approval of the critical design review, the team will start the build of the SPB; however, progress of the build is dependent on the availability of SiC devices, mentioned earlier in this section.
- The prototype SOP units will be built and tested during the qualification testing phase. Following successful testing of the prototypes, the team will focus on building the SOPs for Trials 2 and 4.
- The concept tender modelling is to be completed and shared with the suppliers. The delivery dates need to be agreed with the suppliers so that the team can maximise the time available for testing. The testing of the 11kV ‘string’ system needs to be clarified during the SPB critical design review and if required, a suitable test facility needs to be identified.
- The workstream will finalise and seek approval from the Technical Design Authority (TDA) for the specification for the LV circuit breakers and link box switches. Once the specification is approved, the workstream will proceed with the procurement of these devices.
- The workstream will work with the selected academic partner to start the review of the PED designs. It is expected that the academic partner will provide feedback on the preliminary and critical designs in the next reporting period.

**2.2 Workstream 2 – Software development and deployment**

Workstream 2 oversees the development, deployment and application of the advanced ANM software platform for the Active Response optimisation algorithm. For reference, a high-level architecture diagram is presented in Figure 3. The workstream is also responsible for developing the various interfaces with other business as usual (BaU) solutions, such as the Advanced Distribution Management System and data historians. The ANM software will be developed by a supplier who is currently being selected via a competitive procurement process. The optimisation algorithms (e.g. Active HV, Active LV, Network Optimise, Primary Connect and Active Response) will be developed collaboratively by the ANM supplier and the Active Response project team as well as UK Power Networks’ control engineers and planners.
Workstream 2 will appoint an academic partner to conduct a solution design review. The appointment will follow a competitive procurement process and the work will be conducted predominantly as a desktop study. The review will focus on the software design and concentrate on such topics as hierarchical control philosophy, data handling, optimisation and state estimation techniques, dynamic asset ratings, and single phase connection apportioning. The feedback from the academic review will be used to fine-tune the optimisation algorithms as well as the logical architecture of the ANM platform.
Progress during this reporting period

During this reporting period, Workstream 2 focused on the following activities:

- Finalising and publishing Project Deliverable 1 – High Level Design Specification of Advanced Automation Solution
- Launching the tendering process for the ANM software platform, which will host the Active Response optimisation algorithms. The Active Response team took part in a technical assessment of vendor solutions. During this reporting period, procurement has proceeded to the final stage of vendor selection – commercial negotiations
- Baselining the Functional and Non-Functional Requirements for Active Response prior to the ANM vendor selection; the requirements will be reviewed once the ANM vendor is on-board
- Progressing the detailed design and technical architecture documents for the Active Response optimisation solution (including ANM software):
  - Conceptual Architecture Design Document (pre-ANM vendor version) – this has been approved by UK Power Networks’ Architecture Review Board. The purpose of the Conceptual Architecture Design Document (CADD) is to document the high-level vision of the Information Technology (IT) architecture for the Active Response solution that will be developed and delivered to UK Power Networks. The majority of this will comprise modules of the ANM platform that UK Power Networks is procuring to support a number of current and future smart grid developments. The CADD is used by the project team during the initial analysis phases as an input to the development of functional and technical requirements
  - Logical Architecture Design Document (LADD) – this has been drafted prior to the ANM supplier being selected. The ANM supplier will have significant input to the document; therefore it will be updated after the supplier is appointed. This document outlines the Active Response solution architecture. It describes the new software solution and how it interacts with existing BaU systems, such as the Advanced Distribution Management System (ADMS) and the PEDs (SOPs and SPBs) which are installed within the HV and LV network. It lists the key architectural design principles, such as Supervisory Control and Data Acquisition (SCADA) architecture, RTU communication, and PED local control logic
  - RTU specification document – this outlines the specification for the RTU enhancements that UK Power Networks will require to support the Active Response trials. It expands on such topics as the analogue change reporting mechanism and PED controller facilities
  - Data catalogue – this lists the data sources needed to perform Active Response optimisations
  - High-level release, integration and test strategy – this defines the overall release, integration and test strategy for the Active Response Information Technology/Operation Technology (IT/OT) solution, including new and modified network devices (e.g. RTUs and PEDs), telecontrolled LV switchgear and their associated RTUs. It expands on the key testing objectives, methods of testing of new functions, total time and resources required, as well as the testing environment
Active Response work package definitions for the following interfaces/components:

- ANM platform
- ADMS
- Data historian

Selection of an academic partner to review the Active Response software solution design. The academic partner will be appointed and start work in the next reporting period. This is known as Research Package 2 in the Active Response project.

Challenges and lessons learned

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

- The main challenge was developing the hardware and software requirements definition without the ANM supplier being on-board. It proved very challenging to estimate the amount of work required to implement an optimisation algorithm without knowing the final architecture and functionality of the ANM platform. As mentioned in the previous PPR, UK Power Networks is combining procurement of the Active Response software solution with procurement of a wider enterprise ANM solution. Procurement of a single ANM platform is a highly strategic, complex project that requires input from a large number of stakeholders and therefore is taking longer than anticipated in the bid submission. It should be noted that procurement of the ANM platform is still ongoing and is expected to be completed in Q1 2019. This is significantly later than anticipated in the bid submission plan and consequently the Active Response trial start date will most likely be delayed by a few months to account for reasonable software development and system deployment times. Although there is a risk that delays in on-boarding of the ANM supplier could impact Project Deliverable 4, it is anticipated that the project can still deliver the full project learning within the overall project timescales. This risk has been captured as R29 in Section 1.3. Furthermore, by aligning procurement of the BaU ANM supplier with procurement of the Active Response software supplier, the project will reduce the complexity involved with BaU solution transitions, as the supplier products are already embedded within BaU activities.

- UK Power Networks’ standard RTU design will need to be enhanced to deliver the Active Response solution requirements. We have found that the current secondary network RTU polling frequency will not be sufficient to perform network optimisations with the desired accuracy. It will need to be modified or an alternative measurement reporting method implemented to achieve the required optimisation results.

- The LV network model is still not available in UK Power Networks’ ADMS system. This is a known dependency that will need to be resolved before Trial 2 starts. As a mitigation, it has been agreed that the relevant parts of the LV network (e.g. secondary substation feeders participating in the trial) will be hand-drawn in the ADMS.

- One of the lessons learned is the fundamental importance of cross-workstream communication. Due to the fact that project partners are geographically spread out across the UK, it is not always easy to organise ad-hoc meetings and workshops. As a mitigation, project partners have tried to schedule key project events well in advance.

- Hardware and software development are highly interconnected. The project team has held a number of meetings to understand the dependencies and work around existing BaU constraints. A particular challenge is supervisory control of the PED, as it encompasses many aspects of the Active Response solution (i.e. safe network operation, control philosophy, data, protocols, communication, interfaces and software components).
Plan for next reporting period

During the next reporting period, Workstream 2 will focus on the following activities:

- On-boarding of the ANM supplier
- Baselining the logical design architecture documents
- Progressing the physical architecture design documents
- Baselining the Active Response IT/OT requirements based on feedback received from the ANM supplier
- Establishing test and live environments for Active Response and addressing the crucial integration work between ANM and the ADMS systems
- Commencing the ANM software deployment and development work
- Commencing the development and configuration of RTUs and PED device controllers
- Writing the Interface Control Documents for the ANM platform solution
- Starting work with the academic partner who will review the software solutions designs

2.3 Workstream 3 – Project planning, trials and analysis

Workstream 3 covers:

- Project planning
- Project progress monitoring
- Use case development
- Engineering concept design
- Trial site selection
- Trial design and management
- Trials analysis
- Business case review

Progress during this reporting period

The main activities undertaken by Workstream 3 are discussed in more detail below.

Project planning

Workstream specific plans are maintained for Workstreams 1, 2 and 3. Summaries from these are fed into an overall project plan that is reviewed and updated on a monthly basis as part of our internal innovation procedure. The overall project plan was revised on 17 August 2018 following updated plans from Workstreams 1 and 2.

During the reporting period, a consolidated Products List was compiled which itemises the documents that are expected to be generated throughout the course of the project. The parties responsible for the product, contributors, reviewers and approvers are also listed. The UK Power Networks Project Manager uses the Products List to coordinate the production, review and approval of documents.

A responsibility assignment matrix (Responsible, Accountable, Supportive, Consulted, Informed or RASCI) was also developed in this reporting period to indicate the scope of responsibility for each high-level activity in the project plan.
**Project progress monitoring**

Project progress calls were held with all workstream leads and key contributors to discuss the progress of all current tasks and dependencies. Up until September 2018 these calls were held on a weekly basis (during the requirements gathering stage), but since October they have been held every two weeks on average. A weekly call was necessary in the early months of the project to coordinate the initial activities of the workstreams, but fortnightly calls are now sufficient, as the project has established efficient working procedures and workstreams are focused on delivering long-term tasks. Workstream progress calls are held on a weekly basis and are managed by the leads.

The overall project calls considered the high-level activities and those involving cross-workstream contributions and dependencies, whereas the specific workstream weekly calls captured the detailed actions and activities. On the weekly workstream calls, actions were logged and tracked. Project risks were also logged and transferred to the project risk register on a monthly basis.

**Use case development**

The initial set of use cases was developed between April and July 2018 to inform the engineering concept design and specifications of the PEDs in Workstream 1 and the high-level design in Workstream 2. These were summarised in Project Deliverable 1 (High Level Design Specification of Advanced Automation Solution). When developing the use cases it was important to map out the existing business processes for network planning and network operation and this was undertaken following workshops with UK Power Networks’ planning and operational teams. Once the project team understood the existing business processes, use cases were developed for the various internal users, including control engineers, distribution planners and infrastructure planners.

The use cases were revisited and revised in this reporting period. Two separate documents were created from the original use-case document:

1. Business Process Use Cases
2. Functional Use Cases

The Business Process Use Cases were focused on describing how UK Power Networks users would interact with the Active Response solution, while the Functional Use Cases dealt with the technical use cases to inform the design of the software systems and hardware devices.

The use cases will be reviewed regularly at key stages of the project to confirm their validity.

**Engineering concept design**

The engineering concept design was initially developed between April and June 2018 as a basis for discussing options for control architecture, data transmission and the approach to controlling smart hardware. These were discussed with UK Power Networks’ stakeholders (including the Network Planning, Network Operations and Operational Telecommunications teams) and Project Partners and the preferred options were selected and documented accordingly.

During this period, the engineering concept design was further developed to include details of the supervisory control of hardware devices and present solutions for the protection of equipment. A two-day workshop was held in October to discuss these topics, with representatives from UK Power Networks, CGI, Ricardo and TPS present.
The Active Response solution will require increased switching operations of conventional network equipment, such as ring main switches. The effect of this on asset life, network operations, safety requirements and risk management will be examined in Research Package 3 (Impact on Conventional Network Equipment) through a combination of field trials and laboratory tests. The enquiry documents for Research Package 3 were developed in this reporting period so that procurement of the services can proceed in 2019.

**Trial design and site selection**

A trial design document was developed using outputs from the use cases and engineering concept design. The document described the requirements for each of the four project trials so that candidate sites could be selected. This process is shown in Figure 4.

During the selection process, operational data from UK Power Networks’ licence areas was used to identify potential sites with loading profiles that were suited to the Active Response solution. Shortlists of potential sites were developed and discussed with field engineers and site visits were conducted to identify sites with equipment physical characteristics that would be suited to the installation of the Active Response solutions. A key consideration for selecting sites will be space constraints on-site. Details of site selection criteria, derivation of the selected methodology and details of the networks selected for the four project trials will be published in our Project Deliverable 2 report (Trial Site Selection Criteria and Process Outcome).

Investigations continued to measure phase angles between normally open points on operating HV networks (a typical measurement process is shown in Figure 5). This information was used to assist with the design of the solution tools and equipment. The investigations found that the original specifications for the SPB were likely to be suitable to handle the range of operating conditions on typical HV networks. Operational data will continue to be taken over the next few months to increase confidence in the results and obtain readings in multiple seasons.
Business case review

The workstream created specifications for Research Package 4, which will investigate LCT adoption rates and evaluate the business case for the project. Research Package 4 is currently being procured by UK Power Networks.

Challenges and lessons learned

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

- As mentioned in Section 2.1, the measurement of phase angles between HV normally open points proved to be more challenging than expected. Since data on phase angle differences at these locations is not usually of interest to DNOs, no established measurement method was available. The project team originally devised a method that involved taking readings from the LV side of capacitor bushings (in the range of 30V) using power meter equipment designed to measure voltages in the 400V range (Outram PM7000). This method provided unreliable results and so more suitable equipment (an oscilloscope) was subsequently used. However, this only allows the team to undertake spot checks. Figure 7 shows the voltages measured at either side of Riverside Road secondary substation. These voltage measurements were taken using the PM7000 and it can be seen that there is a misalignment between the voltages, therefore a significant voltage phase angle of greater than five degrees. Figure 6 shows the voltages at the same substation over a similar time period, using an oscilloscope to measure the voltages. Using the oscilloscope, the voltage phase angle difference across the open point was significantly less (approximately one degree). The revised methodology was then validated at UK Power Networks’ testing facility and provided results that were within the limits stated in the specification for the SPB. Subsequently, the team has designed a datalogger to record how the voltage phase angle changes with load. This device will be installed at the SPB trial sites to verify that the phase angle is within the specification of the SPB for longer periods of time during the next reporting period.
Figure 6 – Voltage measurements using the oscilloscope

Figure 7 – Voltage measurements using the PM7000
One of the primary challenges of the project is to define the requirements of UK Power Networks’ stakeholders within the BaU scenario. The solution needs be designed for use in BaU operations if it is to be rolled out at the end of the project. The team engaged with the project stakeholders throughout this reporting period and identified that stakeholder availability is a key consideration when planning the engagement sessions, as it can influence the progress of the project. This will be accounted for in the project plan. In particular, when planning these workshops with stakeholders it is important to give significant indications of timings in advance so that these business-critical resources can manage their workload with sufficient advance notice.

Another challenge was to fully understand UK Power Networks’ operating technology systems, equipment specifications and other innovation/development projects that could influence Active Response. Extensive stakeholder engagement has been ongoing to address this challenge and gather the necessary information.

To demonstrate the Active Response solution effectively, the trials will need to be conducted at sites where equipment is approaching capacity limits and where there are dissimilar load profiles on adjacent parts of the network.

None of the challenges mentioned above has developed into an issue affecting the agreed project direction.

Outlook for next reporting period

The following activities are planned for Workstream 3 during the next reporting period:

- Updating the project plan following further detailed planning exercises for Workstream 2 after the ANM supplier is appointed
- Publishing Deliverable 2 – Trial Site Selection Criteria and Process Outcome
- Procuring Research Package 3
- Site-specific design for the four trials
- Supervision and review of LCT adoption rate study within Research Package 4

2.4 Workstream 4 – Learning and dissemination

Progress during this reporting period

Workstream 4 is responsible for learning and dissemination activities. These are critical aspects of the project and will ensure that DNOs across GB can build on Active Response and avoid unnecessary duplication of work at customers’ expense. The project website is the main portal for sharing learning and is regularly updated with the latest learning documents. Internal stakeholder engagement activities also play an important role in guiding deployment of the new technologies and practices within the business and support the successful transition into BaU. A dedicated communications strategy has been created and will be used and updated throughout the project to plan, track and monitor engagement with key stakeholders.
During this reporting period, the first major knowledge dissemination activities were undertaken through presentations on the UK Power Networks stand at the LCNI conference 2018 (see Figure 8), which raised awareness of project objectives and concepts to stakeholders across the wider industry.

The project was also presented at two industry events which included:

1) DistribuTECH Africa 2018 in July in Johannesburg. The project was showcased in a paper and presentation, "Leveraging International Innovation for Africa in Distribution Networks." The objective of the dissemination was to show how the Active Response methods are applicable in distribution networks worldwide. Approximately 3,000 people attended the event, representing the electricity industry from around the world.

2) The Pixie Energy Conference on 10 September in Norwich. This was attended by a number of industry stakeholders including Ofgem, energy suppliers, technology vendors, consultants and council representatives. The objective of the dissemination was to build awareness of the project.

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1 Available at URL: https://www.researchgate.net/publication/328306292_Leveraging_International_Innovation_for_Africa_in_Distribution_Networks
3) GIS4SmartGridConference on 21 November in Amsterdam. This was attended by a number of industry stakeholders including international DNOs, TNOs, technology vendors and consultants. The objective of the dissemination was to build awareness of the project in the international community and invite feedback on the project.

In addition, a collaborative knowledge dissemination strategy was agreed with our project partner, SPEN. This has two main objectives:

1. To showcase the significant role Active Response and LV Engine play in investigating the innovative use of PEDs on distribution networks to support a low carbon future
2. To identify actions for UK Power Networks and SPEN to collaboratively demonstrate and share learning of the technology used with other DNOs to raise the capabilities of all DNOs to support the uptake of LCTs, including:
   a) Providing project support and inputs (including the role of the TDA)
   b) Jointly developing a document on ‘Power Electronics in Distribution Networks’
   c) Hosting a joint stakeholder event in 2021 on ‘The use of Power Electronics in Distribution Networks’

The joint plan outlines the objectives for regular joint dissemination activities and events, culminating in the joint report and event in 2021, and demonstrates both parties’ commitment to collaboration to ensure that the valuable learning generated in this field is shared and disseminated effectively between DNOs and across the industry.

An abstract for a paper on the project was accepted for presentation at the CIRED 2019 conference, which will be held in the next reporting period. This will be an opportunity to publicise the project and present some of the findings to date at this prestigious event, which will be attended by DNOs from around Europe (including GB). During this period, work began on preparing the paper for submission.

Engagement with Western Power Distribution (WPD) in relation to their Network Equilibrium project was undertaken at the LCNI conference 2018, with the scope of analysing key similarities and differences in testing strategies between WPD’s Flexible Power Link and the SPB in Active Response so that the projects could learn from each other and share good practice. As a result of this engagement session, WPD released their testing strategy including their lessons learned, demonstrating the positive collaboration between the two DNOs and the commitment to deliver successful innovation projects on both sides.

During the next reporting period, knowledge dissemination activities will focus on publishing the next major learning report on site selection (Project Deliverable 2) and will be promoted using various communication channels, including blog posts and press releases. The team will also begin preparations for the first joint dissemination event in late 2019.

**Challenges and lessons learned**

No challenges were encountered with respect to Workstream 4 during the reporting period. However, a Lessons Learned Log has been created and filed in a central location and all team members have been encouraged to use this throughout the project’s lifecycle.
Plan for next reporting period

The following activities are planned for the next reporting period:

- UK Power Networks’ ‘Better Networks’ conference where the Active Response project team will present an overview of the project, progress to date and learnings. The target audience for this event is peer DNOs, who have the opportunity to gain a more in-depth understanding of the project.
- Utilising the communications strategy to effectively disseminate and promote a key project milestone.
- Further engagement with UK Power Networks’ internal stakeholders during trial design and review of how the project use cases will influence business processes.
- Preparation for the first joint external stakeholder engagement event with SPEN.
- Presentation at the CIRED conference in June 2019 in Madrid.

Figure 9 shows the high-level dissemination activities which are planned throughout the project lifecycle. These have been highlighted in the FSP. Workstream 4 has developed a more detailed communication strategy and plan which will be published in the next reporting period.

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**Figure 9 – High-level dissemination plan**
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.

Figure 10 shows the total expected benefits of Active Response when rolled out across GB, split between the two Active Response solutions. The blue bars show the benefits realised from the Network Optimise solution. The green bars show the benefits realised from the Primary Connect solution.

![Figure 10 – Benefits of Active Response](image)
4. Progress against plan

Figure 11 shows the high-level project plan for Active Response. In the next few sections we describe the progress of more specific items in the detailed project plan.

Figure 11 – High-level project plan
4.1 Summary of changes since the last PPR

Since the last reporting period, the following notable changes have been made to the project plan:

- The start date for Trial 1 is projected to be delayed slightly, due to delays in procurement of the ANM software (see Section 4.3 for further details)
- The start date for Trial 4 has been moved back by about three months to allow time to incorporate learnings from Trial 3 into the design of the SPB for Trial 4

The project team is working with suppliers for the ANM software and SiC devices to determine the impact of the delays on the wider project. These issues have been described in the relevant workstream reports. Once these issues have been resolved, the project team will have more confidence in the deliverable dates.

4.2 Detailed progress in the reporting period

The project has made significant progress during the reporting period, as shown below.

<table>
<thead>
<tr>
<th>Task description</th>
<th>Workstream</th>
<th>Status at start of period</th>
<th>Status at end of period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finalise Project Partner Agreements</td>
<td>-</td>
<td>In progress</td>
<td>In progress</td>
</tr>
<tr>
<td>Measure phase angle difference between primary substations for SPBs</td>
<td>1 and 3</td>
<td>In progress</td>
<td>Complete</td>
</tr>
<tr>
<td>Develop high-level requirements for IT/OT architecture</td>
<td>2</td>
<td>In progress</td>
<td>Complete</td>
</tr>
<tr>
<td>Develop high-level requirements for other project elements</td>
<td>3</td>
<td>In progress</td>
<td>Complete</td>
</tr>
<tr>
<td>Develop specifications for link box switches and remote controlled circuit breakers</td>
<td>1</td>
<td>In progress</td>
<td>Complete</td>
</tr>
<tr>
<td>Develop engineering concept design</td>
<td>3</td>
<td>In progress</td>
<td>Complete</td>
</tr>
<tr>
<td>Develop draft data catalogue</td>
<td>2</td>
<td>In progress</td>
<td>Complete</td>
</tr>
<tr>
<td>Develop IT/OT architecture conceptual design</td>
<td>2</td>
<td>In progress</td>
<td>Complete</td>
</tr>
<tr>
<td>Engage with UK Power Networks’ internal stakeholders in design phase</td>
<td>-</td>
<td>In progress</td>
<td>Complete</td>
</tr>
<tr>
<td>Write progress report 2</td>
<td>-</td>
<td>Started in period</td>
<td>Complete</td>
</tr>
<tr>
<td>Preliminary design of SOPs</td>
<td>1</td>
<td>In progress</td>
<td>Complete</td>
</tr>
<tr>
<td>Preliminary design of SPBs</td>
<td>1</td>
<td>In progress</td>
<td>Complete</td>
</tr>
<tr>
<td>Critical design of SOPs</td>
<td>1</td>
<td>Started in period</td>
<td>Complete</td>
</tr>
<tr>
<td>Critical design of SPBs</td>
<td>1</td>
<td>Started in period</td>
<td>In progress</td>
</tr>
<tr>
<td>Procurement of SOP components</td>
<td>1</td>
<td>In progress</td>
<td>In progress</td>
</tr>
<tr>
<td>Procurement of SPB components</td>
<td>1</td>
<td>In progress</td>
<td>In progress</td>
</tr>
<tr>
<td>Manufacture of prototype modules for SPB</td>
<td>1</td>
<td>Started in period</td>
<td>In progress</td>
</tr>
<tr>
<td>Procurement of Research Package 1 – PED Design Review</td>
<td>1</td>
<td>Started in period</td>
<td>Complete</td>
</tr>
<tr>
<td>Develop IT/OT detailed requirements</td>
<td>2</td>
<td>Started in period</td>
<td>In progress</td>
</tr>
<tr>
<td>Develop IT/OT architecture logic design</td>
<td>2</td>
<td>Started in period</td>
<td>In progress</td>
</tr>
</tbody>
</table>
### Task description

<table>
<thead>
<tr>
<th>Task description</th>
<th>Workstream</th>
<th>Status at start of period</th>
<th>Status at end of period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procurement of Research Package 2 – Active Response Solution Design Review</td>
<td>2</td>
<td>Started in period</td>
<td>In progress</td>
</tr>
<tr>
<td>Definition of work packages for solution components</td>
<td>2</td>
<td>Started in period</td>
<td>In progress</td>
</tr>
<tr>
<td>Trial design and site selection</td>
<td>3</td>
<td>Started in period</td>
<td>In progress</td>
</tr>
<tr>
<td>Specifications for ring main units</td>
<td>3</td>
<td>Started in period</td>
<td>Complete</td>
</tr>
<tr>
<td>Procurement of Research Package 4 – Application and Business Case Review</td>
<td>3</td>
<td>Started in period</td>
<td>In progress</td>
</tr>
<tr>
<td>Write Deliverable 2</td>
<td>3</td>
<td>Started in period</td>
<td>In progress</td>
</tr>
<tr>
<td>Procurement of Research Package 3 – Conventional Equipment Impact Study</td>
<td>3</td>
<td>Started in period</td>
<td>In progress</td>
</tr>
<tr>
<td>Set up project website and upload preliminary project documents</td>
<td>4</td>
<td>Started in period</td>
<td>Complete</td>
</tr>
<tr>
<td>Link up knowledge dissemination plan between UK Power Networks and SPEN</td>
<td>4</td>
<td>In progress</td>
<td>Complete</td>
</tr>
<tr>
<td>LCNI conference – prepare presentation materials and attend</td>
<td>4</td>
<td>Started in period</td>
<td>Complete</td>
</tr>
</tbody>
</table>

### 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 Active Response is provided in Section 11. However, during this period it can be reported that two risks have begun to impact the schedule of specific project activities.

The following issues have been reported in the workstream reports and are also captured below.

<table>
<thead>
<tr>
<th>Ref</th>
<th>Risk/iue</th>
<th>Impact</th>
<th>Mitigation</th>
<th>Target close date</th>
</tr>
</thead>
<tbody>
<tr>
<td>R29</td>
<td>Issue: There has been a delay in appointing the ANM supplier, due to the ANM procurement being part of a broader UK Power Networks strategic initiative and therefore not in the full control of the project.</td>
<td>There are delays in appointing the supplier, which is reducing the time available for the supplier to develop the solutions in readiness for the start of trials. This may ultimately impact Project Deliverable 4, which captures learnings from software testing.</td>
<td>Updated procurement timescales have been agreed in UK Power Networks at a senior management level. The team is agreeing/discussing delivery timescales with suppliers and exploring whether the removal of Trial 1 would allow the same learnings to be developed without impacting Project Deliverable 4 (due in January 2020).</td>
<td>Q1 2019</td>
</tr>
</tbody>
</table>
### 4.4 Key achievements and notable events

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

- Preliminary designs for PEDs signed off
- Detailed critical design for SOPs signed off
- Engineering concept design baselined
- IT/OT architecture conceptual design signed off
- Procurement of Research Packages 1 and 2
- Set-up of project website with project documents uploaded
- Attended LCNI 2018 conference

### 4.5 Look-ahead to next reporting period

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

- Manufacture of first SOPs for qualification testing (Workstream 1)
- Sign off detailed critical design for SPB (Workstream 1)
- Build and test SPB prototype (Workstream 1)
- Manufacture of SPB for Trial 3 (Workstream 1)
- Conduct Research Package 2 – Design Review of PEDs (Workstream 1)
- Procure additional hardware for Trials 1, 2 and 3 (Workstream 1)
- Appointment of ANM software supplier and development of specifications for optimisation algorithm for Trial 1 (Workstream 2)
- Development of optimisation algorithm within ANM software (Workstream 2)
- Finalisation of IT/OT logic architecture design (Workstream 2)
- Finalisation of IT/OT physical architecture design (Workstream 2)
- Develop specification for remote terminal units (Workstream 2)
- Submission of Project Deliverable 2 – Trial Site Selection Criteria and Process Outcome (Workstream 3)
- Detailed design of trial sites (Workstream 3)
- Conduct low carbon technology adoption study (Workstream 3)
- Specification and procurement of Research Package 3 – Impact on Conventional Network Equipment (Workstream 3)
- Coordinate and deliver first external stakeholder engagement event (Workstream 4)
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. **Project Deliverables**

This section provides an overview of progress against each of the deliverables set out in the Project Direction. The text describes progress on the evidence for each Deliverable.

<table>
<thead>
<tr>
<th>Project Deliverable</th>
<th>Deadline</th>
<th>Evidence</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Level Design Specification of Advanced Automation Solution (Deliverable 1)</td>
<td>15 August 2018</td>
<td>Report outlining the requirements and options for the Active Response software solution (WS2)</td>
<td><strong>Successfully submitted.</strong></td>
</tr>
<tr>
<td>Trial Site Selection Criteria and Process Outcome (Deliverable 2)</td>
<td>31 January 2019</td>
<td>Description of possible site selection criteria, derivation of the selected methodology and details of the networks selected for the four project trials (WS3)</td>
<td>The deliverable remains on track. The project team has selected sites for the trials based on historical network data and feedback from UK Power Networks’ operations staff. In addition, the team has installed further monitoring devices at specific site locations to determine the suitability of these sites.</td>
</tr>
<tr>
<td>Learning from Hardware factory tests (Deliverable 3)</td>
<td>15 August 2019</td>
<td>Details of the key learning from the hardware specification, design and testing process (WS1)</td>
<td>There is a risk that this deliverable could be impacted by delays to the Workstream 1 programme – see Section 2.1 for further details.</td>
</tr>
<tr>
<td>Learning from Commissioning and Operation of Active Response Software Solution tools (Deliverable 4)</td>
<td>31 January 2020</td>
<td>Report outlining the key learning from the initial offline trials of the project software tools (WS2)</td>
<td>There is a risk that this deliverable could be impacted by delays to the Workstream 1 programme – see Section 2.2 for further details</td>
</tr>
</tbody>
</table>
Initial Learning from the Installation and Commissioning of Active Response Hardware (Deliverable 5) 31 March 2020 Report outlining the key learning from the initial installation and commissioning of the project hardware (WS1) The deliverable remains on track, however no significant progress has been made.

Project technology handover, rollout and adoption into BaU plan (Deliverable 6) 29 January 2021 Implementation Plan for the adoption of the project solutions into Business as Usual (WS4) The deliverable remains on track, however no significant progress has been made.

Review of the Active Response Methods applicability in Scottish Power Energy Network licence areas (Deliverable 7) 30 June 2021 A report by SPEN detailing the number implementations in their licence areas that the project methods provide benefits (WS3) The deliverable remains on track, however no significant progress has been made.

Presentation of findings from the project trials (Deliverable 8) 31 August 2021 Analysis and findings from the four project trials, including key learning and recommendations (WS3) The deliverable remains on track, however no significant progress has been made.

Review of solution applications and project business case (Deliverable 9) 30 November 2021 Comparison of the project technology following the trials against that envisaged at inception, and review of applications and benefits (WS3) The deliverable remains on track, however no significant progress has been made.

8. Data access details

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

http://innovation.ukpowernetworks.co.uk/innovation/en/contact-us/InnovationDataSharingPolicy.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 2017/18, 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 ‘best in class’ learning and dissemination. Specific lessons learned in each of the workstreams are captured in the workstream progress reports.

The following documents are available to other GB DNOs upon request:

- Active Response project storyboard
- Engineering concept design
- Project use cases
- Project Deliverable 1 – High Level Design Specification of Advanced Automation Solution
- SOP and SPB specification
- SOP and SPB preliminary design
- High-level requirements for the IT/OT solution
- IT/OT architecture conceptual design
- RTU specification
- Trial site selection methodology
- Specifications for link box switches and remote controlled circuit breakers

During the next reporting period, the project team will publish the report for Project Deliverable 2 on the Active Response website. In addition, UK Power Networks will host a dissemination event on ‘Better Networks’. The Active Response project team will disseminate initial progress and learnings at this event to all peer DNOs and industry stakeholders.

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 last period (August–December 2018)

<table>
<thead>
<tr>
<th>IPR Description</th>
<th>Owner(s)</th>
<th>Type</th>
<th>Royalties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Updated engineering concept design</td>
<td>UK Power Networks, Ricardo</td>
<td>Relevant Foreground IPR</td>
<td>Nil</td>
</tr>
<tr>
<td>High-level requirements for Active Response solution</td>
<td>UK Power Networks, CGI, Ricardo</td>
<td>Relevant Foreground IPR</td>
<td>Nil</td>
</tr>
<tr>
<td>Deliverable 1 – High Level Design of Advanced Automation Solution</td>
<td>UK Power Networks</td>
<td>Relevant Foreground IPR</td>
<td>Nil</td>
</tr>
<tr>
<td>Site selection methodology</td>
<td>Ricardo</td>
<td>Relevant Foreground IPR</td>
<td>Nil</td>
</tr>
</tbody>
</table>
## IPR forecast next period (January–July 2019)

<table>
<thead>
<tr>
<th>IPR Description</th>
<th>Owner(s)</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Deliverable 2 – Trial Site Selection Criteria and Process Outcome</td>
<td>UK Power Networks</td>
<td>Relevant Foreground IPR</td>
</tr>
<tr>
<td></td>
<td>Ricardo</td>
<td></td>
</tr>
<tr>
<td>Logical Architecture Design Document (LADD)</td>
<td>UK Power Networks</td>
<td>Relevant Foreground IPR</td>
</tr>
</tbody>
</table>
## 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 1-26 are captured in the FSP. We identified Risks 27-46 during the first 12 months of the project. The project continues to monitor risks and issues on a monthly basis, at a 'deep-dive' risk management meeting. At this meeting, risk impacts and mitigation plans are updated.

### RISK & ISSUE LOG

<table>
<thead>
<tr>
<th>ID</th>
<th>Risk / Issue</th>
<th>Status</th>
<th>Description (there is a risk that…)</th>
<th>Impact (the impact will be…)</th>
<th>Risk Probability</th>
<th>Risk Impact</th>
<th>Risk Score</th>
<th>Mitigation / Planned Actions</th>
<th>Mitigated Probability</th>
<th>Mitigated Impact</th>
<th>Mitigated Score</th>
<th>Target</th>
<th>Last Updated</th>
<th>Date Closed</th>
<th>Date Updated</th>
<th>Date Updated</th>
</tr>
</thead>
<tbody>
<tr>
<td>R01</td>
<td>Risk Open</td>
<td>Project costs for high value items are significantly higher than expected</td>
<td>Project overspend requiring additional partner contribution or request to Ofgem for additional funds</td>
<td>3</td>
<td>2</td>
<td>15</td>
<td>Positive costs within contingency included in project budget.</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>10/02/2019</td>
<td>16/11/2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R02</td>
<td>Risk Open</td>
<td>Obtaining funding for future innovation projects is difficult</td>
<td>Project costs at the end of each project phase and revision of cost forecast and scope as appropriate</td>
<td>4</td>
<td>4</td>
<td>12</td>
<td>Project scope is based on an integration and evolution of existing techniques.</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>10/02/2019</td>
<td>16/11/2018</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>R03</td>
<td>Risk Open</td>
<td>Project costs for high value items are significantly higher than expected</td>
<td>Positive costs within contingency included in project budget.</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>Project scope is based on an integration and evolution of existing techniques.</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>10/02/2019</td>
<td>16/11/2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R04</td>
<td>Risk Open</td>
<td>Equipment development is more complex than initially envisaged</td>
<td>Potential overspend on device development or scope reduction</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>Positive costs within contingency included in project budget.</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>30/02/2019</td>
<td>16/11/2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R05</td>
<td>Risk Open</td>
<td>Methods do not deliver anticipated benefits</td>
<td>Lower than anticipated value delivered</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>Positive costs within contingency included in project budget.</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>05/01/2021</td>
<td>16/11/2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R06</td>
<td>Risk Open</td>
<td>Project must be delayed or rescoped</td>
<td>Project costs at the end of each project phase and revision of cost forecast and scope as appropriate</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>Project scope is based on an integration and evolution of existing techniques.</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>10/02/2019</td>
<td>16/11/2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R07</td>
<td>Risk Open</td>
<td>External perception of poor performance may impact</td>
<td>Project costs at the end of each project phase and revision of cost forecast and scope as appropriate</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>Project scope is based on an integration and evolution of existing techniques.</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>10/02/2019</td>
<td>16/11/2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R08</td>
<td>Risk Open</td>
<td>Project costs for high value items are significantly higher than expected</td>
<td>Positive costs within contingency included in project budget.</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>Project scope is based on an integration and evolution of existing techniques.</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>10/02/2019</td>
<td>16/11/2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R09</td>
<td>Risk Open</td>
<td>Project costs for high value items are significantly higher than expected</td>
<td>Positive costs within contingency included in project budget.</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>Project scope is based on an integration and evolution of existing techniques.</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>10/02/2019</td>
<td>16/11/2018</td>
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<tr>
<td>R10</td>
<td>Risk Open</td>
<td>Project costs for high value items are significantly higher than expected</td>
<td>Positive costs within contingency included in project budget.</td>
<td>3</td>
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<td>12</td>
<td>Project scope is based on an integration and evolution of existing techniques.</td>
<td>1</td>
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<td>4</td>
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<td>Project costs for high value items are significantly higher than expected</td>
<td>Positive costs within contingency included in project budget.</td>
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<td>Project scope is based on an integration and evolution of existing techniques.</td>
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<td>R12</td>
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<td>Project costs for high value items are significantly higher than expected</td>
<td>Positive costs within contingency included in project budget.</td>
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<td>12</td>
<td>Project scope is based on an integration and evolution of existing techniques.</td>
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<td>4</td>
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<td>10/02/2019</td>
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<table>
<thead>
<tr>
<th>ID</th>
<th>Risk / Issue</th>
<th>Status</th>
<th>Description (there is a risk that…)</th>
<th>Mitigation / Planned Actions</th>
<th>Mitigated Probability</th>
<th>Mitigated Impact</th>
<th>Mitigated Score</th>
<th>Target Closed Date</th>
<th>Last Updated Date</th>
<th>Close Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>B13 Risk Open</td>
<td>Lack of awareness support for the project from key departments</td>
<td>Project suffers delays or cannot proceed</td>
<td>3 4 8</td>
<td>30/12/2018: Collaboration with stakeholders to prevent misunderstanding or confusion</td>
<td>4 4 4</td>
<td>30/11/2018</td>
<td>30/11/2018</td>
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<tr>
<td>B14 Risk Open</td>
<td>Project costs rise outside of tolerances</td>
<td>Project suffers delays or cannot proceed</td>
<td>3 5 8</td>
<td>30/07/2019 – 22/10/2018: Rigorous budget control and cost monitoring on all projects</td>
<td>4 4 4</td>
<td>30/11/2018</td>
<td>30/11/2018</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>B15 Risk Closed</td>
<td>The communications system is not adequate for the site</td>
<td>Project suffers delays or cannot proceed</td>
<td>3 4 8</td>
<td>30/02/2019 – 30/11/2018: Early discussion of relevant standards during inception phase.</td>
<td>4 4 4</td>
<td>30/07/2018</td>
<td>30/07/2018</td>
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<tr>
<td>B16 Risk Open</td>
<td>Equipment/supplier costs are underestimated in RFIs</td>
<td>Project suffers delays or cannot proceed</td>
<td>3 4 8</td>
<td>21/08/2018: Organise workshop with UKPN protection engineers to agree method/design</td>
<td>1 5 3</td>
<td>30/10/2018</td>
<td>30/10/2018</td>
<td></td>
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<tr>
<td>B17 Risk Open</td>
<td>Equipment/supplier costs are underestimated in RFIs, RFIs etc.</td>
<td>Project suffers delays or cannot proceed</td>
<td>3 4 8</td>
<td>22/10/2018: Early engagement with stakeholders to agree comms for LV linkbox switches and PEDs.</td>
<td>1 5 3</td>
<td>30/06/2019</td>
<td>30/11/2019</td>
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<tr>
<td>B18 Risk Open</td>
<td>The specification and build of equipment takes longer than anticipated</td>
<td>Project suffers delays or cannot proceed</td>
<td>3 4 8</td>
<td>26/11/2018: Equipment cannot be installed</td>
<td>2 4 4</td>
<td>20/11/2018</td>
<td>20/11/2018</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B19 Risk Open</td>
<td>The specification and build of equipment takes longer than anticipated</td>
<td>Project suffers delays or cannot proceed</td>
<td>3 4 8</td>
<td>20/11/2018: Participants identify alternative solutions to LV failure and UKPN.</td>
<td>2 4 4</td>
<td>20/11/2018</td>
<td>20/11/2018</td>
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<tr>
<td>B20 Risk Open</td>
<td>The communications system is not adequate for the size or length of the data</td>
<td>Project suffers delays or cannot proceed</td>
<td>3 4 8</td>
<td>22/10/2018: Site selection to be completed by trial Oliver</td>
<td>1 5 3</td>
<td>30/10/2018</td>
<td>30/10/2018</td>
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<td></td>
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<tr>
<td>B21 Risk Open</td>
<td>The specification and build of equipment takes longer than anticipated</td>
<td>Project suffers delays or cannot proceed</td>
<td>3 4 8</td>
<td>22/10/2018: Site selection to be completed by trial Oliver</td>
<td>1 5 3</td>
<td>30/10/2018</td>
<td>30/10/2018</td>
<td></td>
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<tr>
<td>B22 Risk Open</td>
<td>The specification and build of equipment takes longer than anticipated</td>
<td>Project suffers delays or cannot proceed</td>
<td>3 4 8</td>
<td>22/10/2018: Site selection to be completed by trial Oliver</td>
<td>1 5 3</td>
<td>30/10/2018</td>
<td>30/10/2018</td>
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<tr>
<td>B23 Risk Open</td>
<td>The specification and build of equipment takes longer than anticipated</td>
<td>Project suffers delays or cannot proceed</td>
<td>3 4 8</td>
<td>22/10/2018: Site selection to be completed by trial Oliver</td>
<td>1 5 3</td>
<td>30/10/2018</td>
<td>30/10/2018</td>
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**Updated: 22/10/2018**
### RISK & ISSUE LOG

<table>
<thead>
<tr>
<th>ID</th>
<th>Risks</th>
<th>Status</th>
<th>Description (there is a risk that...)</th>
<th>Impact (the impact will be...)</th>
<th>Risk Probability</th>
<th>Risk Impact</th>
<th>Risk Score</th>
<th>Mitigation / Planned Actions</th>
<th>Mitigated Probability</th>
<th>Mitigated Impact</th>
<th>Mitigated Score</th>
<th>Target Closure Date</th>
<th>Last Updated</th>
<th>Date Closed</th>
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<tbody>
<tr>
<td>R27</td>
<td>Risk</td>
<td>Open</td>
<td>Three are recognised issues in regards to advanced automation solution being developed in the pilot or trial site.</td>
<td>3</td>
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<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>15/05/2018</td>
<td>15/05/2018</td>
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<tr>
<td>R26</td>
<td>Risk</td>
<td>Open</td>
<td>A number of risks have been raised to the trial site and project teams.</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>1</td>
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<td>1</td>
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<td>15/05/2018</td>
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<tr>
<td>R25</td>
<td>Open</td>
<td></td>
<td>There has been a delay in starting the pilot or trial site.</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>16</td>
<td>30/01/2019</td>
<td>26/11/2018</td>
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<td>R24</td>
<td>Open</td>
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<td>There is a delay in starting the pilot or trial site.</td>
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<td>3</td>
<td>9</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>16</td>
<td>30/01/2019</td>
<td>26/11/2018</td>
<td>26/11/2018</td>
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<tr>
<td>R23</td>
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<td>4</td>
<td>16</td>
<td>4</td>
<td>16</td>
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<td>26/11/2018</td>
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<td>R22</td>
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<td>3</td>
<td>9</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>16</td>
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<td>26/11/2018</td>
<td>26/11/2018</td>
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<td>R21</td>
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<td>There is a delay in starting the pilot or trial site.</td>
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<td>4</td>
<td>16</td>
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<tr>
<td>R20</td>
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<td>There is a delay in starting the pilot or trial site.</td>
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<td>4</td>
<td>16</td>
<td>4</td>
<td>16</td>
<td>30/01/2019</td>
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<td>26/11/2018</td>
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<tr>
<td>R19</td>
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<td>There is a delay in starting the pilot or trial site.</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>16</td>
<td>30/01/2019</td>
<td>26/11/2018</td>
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<tr>
<td>R18</td>
<td>Open</td>
<td></td>
<td>There is a delay in starting the pilot or trial site.</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>16</td>
<td>30/01/2019</td>
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<tr>
<td>R17</td>
<td>Open</td>
<td></td>
<td>There is a delay in starting the pilot or trial site.</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>16</td>
<td>30/01/2019</td>
<td>26/11/2018</td>
<td>26/11/2018</td>
<td></td>
</tr>
</tbody>
</table>

**Risk:** A critical failure event that represents a potential threat to business viability or revenue generation. **Status:** The status of the risk in the project. **Description:** The description of the risk and its potential impact. **Impact:** The potential impact of the risk on the project. **Risk Probability:** The probability of the risk occurring. **Risk Impact:** The impact of the risk on the project. **Risk Score:** The calculated risk score. **Mitigation / Planned Actions:** The planned actions to mitigate the risk. **Mitigated Probability:** The probability of the risk being mitigated. **Mitigated Impact:** The impact of the risk being mitigated. **Mitigated Score:** The calculated mitigated risk score. **Target Closure Date:** The target date for closing the risk. **Last Updated:** The date the risk was last updated. **Date Closed:** The date the risk was closed.
## Active Response
### Project Progress Report – August–December 2018

**RISK & ISSUE LOG**

<table>
<thead>
<tr>
<th>ID</th>
<th>Risk / Issue</th>
<th>Status</th>
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<th>Risk Impacts</th>
<th>Risk Score</th>
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<th>Mitigated Probability</th>
<th>Mitigated Impact</th>
<th>Mitigated Score</th>
<th>Target &amp; Date Closed</th>
<th>Last Updated &amp; Date Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>R41</td>
<td>Risk Open</td>
<td>Deliverable 3 is delayed following clarification of design/development timelines of the PEDs</td>
<td>The build of the SPB and SOP is delayed, therefore delaying the testing and commissioning of the devices. This may result in a delay to completion of Deliverable 3, which captures learning from testing the SPB and SOP.</td>
<td>3 3 30</td>
<td>26/11/2018: UKPN is working closely with TPS to understand the detailed impact of delays in delivery of components. During the next reporting period, the team will determine whether the learnings can be delivered in August 2019.</td>
<td>3 9 15</td>
<td>14/12/2018</td>
<td>26/11/2018</td>
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<td></td>
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<tr>
<td>R40</td>
<td>Risk Open</td>
<td>LV monitoring installations are delayed</td>
<td>Long lead times for PED components are impacting the build timelines for the SPB and SOP</td>
<td>1 2 15</td>
<td>26/11/2018: Consider scalability in design stage. Affect the delivery plan for WS1</td>
<td>2 2 2</td>
<td>26/11/2018</td>
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<tr>
<td>R39</td>
<td>Risk Open</td>
<td>Risk that the design cannot be finalised if supervisory control methods cannot be agreed</td>
<td>During the LV CBs and LV linkboxes procurement we identify that none of the suppliers can deliver the full set of requirements.</td>
<td>3 3 9</td>
<td>26/11/2018: Work with TPS to agree WS1 plan and understand if deliverable 3 will be delayed. If it is, we will inform Ofgem early.</td>
<td>3 3 9</td>
<td>26/11/2018</td>
<td>26/11/2018</td>
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<tr>
<td>R38</td>
<td>Risk Open</td>
<td>Delay in a Deliverable to Ofgem</td>
<td>Long lead times for PED components are impacting the build timelines for the SPB and SOP</td>
<td>4 4 16</td>
<td>26/11/2018: Early engagement with suppliers. Ensure we approach a wide audience when inviting suppliers to tender. Phased delivery of silicon carbide. Lead time is currently 22-24 weeks.</td>
<td>2 2 4</td>
<td>30/12/2018</td>
<td>26/11/2018</td>
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<td>R37</td>
<td>Risk Open</td>
<td>LV monitoring installations are delayed</td>
<td>Long lead times for PED components are impacting the build timelines for the SPB and SOP</td>
<td>6 6 20</td>
<td>26/11/2018: Workshop to discuss supervisory control methods cannot be agreed. Affect the delivery plan for WS1</td>
<td>4 4 16</td>
<td>30/12/2018</td>
<td>26/11/2018</td>
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<td>LV monitoring installations are delayed</td>
<td>Long lead times for PED components are impacting the build timelines for the SPB and SOP</td>
<td>3 3 9</td>
<td>26/11/2018: Work with TPS to agree WS1 plan and understand if deliverable 3 will be delayed. If it is, we will inform Ofgem early.</td>
<td>3 3 9</td>
<td>26/11/2018</td>
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<td>LV monitoring installations are delayed</td>
<td>Long lead times for PED components are impacting the build timelines for the SPB and SOP</td>
<td>4 4 16</td>
<td>26/11/2018: Consider scalability in design stage.</td>
<td>2 2 4</td>
<td>26/11/2018</td>
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<td>Risk Open</td>
<td>LV monitoring installations are delayed</td>
<td>Long lead times for PED components are impacting the build timelines for the SPB and SOP</td>
<td>5 5 20</td>
<td>26/11/2018: Work with TPS to agree WS1 plan and understand if deliverable 3 will be delayed. If it is, we will inform Ofgem early.</td>
<td>4 4 16</td>
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<td>R33</td>
<td>Risk Open</td>
<td>LV monitoring installations are delayed</td>
<td>Long lead times for PED components are impacting the build timelines for the SPB and SOP</td>
<td>2 2 4</td>
<td>26/11/2018: Consider scalability in design stage.</td>
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**Active Response Progress**

- **Ofgem Deliverables**: Identified in the scope, which may potentially impact the project business case or deliverables to Ofgem.
- **Ofgem early**: The project will not deliver the full set of requirements anticipated.
- **PowerOn early**: Trials will be delayed as re-testing is required.
- **PowerOn early**: Releases, integration and testing strategy will be shared with project team by October 2018. Explore availability of facilities and to make best use of them. Design tests with knowledge of the facilities available and to make best use of them.
- **PowerOn early**: Early engagement with suppliers. Ensure we approach a wide audience when inviting suppliers to tender. Engage with UKPN Ops teams to determine critical functionality. Determine whether solution can be designed to accommodate the Active Response trials.
- **PowerOn early**: Monitoring of PEDs in PowerOn will take longer than expected as this is first of a kind. The post-2022 demand for LV monitoring will be installed.
- **Ofgem early**: The build of the SPB and SOP is delayed, therefore delaying the testing and commissioning of the devices. This may result in a delay to completion of Deliverable 3, which captures learning from testing the SPB and SOP.
12. 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 Active Response project in its second six-month reporting period and an accurate view of our understanding of the activities for the next reporting period.

Signed ..................................................

Date ................. 16.11.2019

Suleman Alli
Director of Safety, Strategy & Support Services
UK Power Networks

13. Material change information

No material changes have been encountered during this reporting period and none are foreseen for the next reporting period.

14. Other information

Currently there is no other information to report to Ofgem.