Annual Progress Report

The Power Potential Project

January – December 2019

Contents

Executive Summary

This report provides a summary of progress across all project workstreams from January 2019 to December 2019. Work has progressed across all workstreams towards readiness for trials of the Power Potential technical solution (DERMS, the Distributed Energy Resources Management System).

For a detailed report of progress and challenges, the project has published the SDRC9.4 document Customer Readiness Report and Performance of the Technical Solution in a Controlled Environment at the end of November.

From a technical perspective, delivery, testing and integration of the DERMS software has been carried out during this year. The project completed acceptance testing of the DERMS software on a cloud environment, with simulated network and customer behaviour. The DERMS software was then installed on a pre-production system of similar specification to the live production environment. Integration, functional, user-acceptance and non-functional testing on the pre-production system has been undertaken to support DER commissioning and the initial mandatory trials stage for each DER. Final checks before transfer to live are being completed during December 2019. The live production system has been set up and connectivity tested, with penetration testing begun, and the DERMS system is expected to go-live in December subject to a final DERMS software release that satisfies the go-live criteria.

Significant challenges have been identified, investigated and overcome in all these areas. A unit testing approach to functionality and integration has been taken, building up to demonstrate end-end integration and functionality scenarios.

During 2019, in response to the effort required to address these challenges it has become necessary to reschedule the project delivery plan and trials calendar. The anticipated delivery dates for the remaining SDRC reports and the expected project completion date were notified to Ofgem in December 2019 via a response to an email request dated 04 December.

In the commercial workstream, across the period, we have been actively responding to queries from DERs on both the final DER Framework Agreement and Market Procedures. During 2019, clarifications were made to the Framework Agreement, principally to:

1. amend the definition of a service window to allow participants to be available for a minimum of one settlement period across a service window;
2. reflect the reduction in the direction of the Wave 1 technical trials to 11 weeks (see workstream 4) without reducing the revenue opportunity to DER.

During this period the project team also published the Power Potential Reactive Power Commercial Procedure Wave 2 & Wave 3 document. This document provides an overview of how the commercial reactive power service will work for Wave 2 and Wave 3. The document is intended to help potential trial participants understand their potential revenue from the trial.

A laboratory space was created at a UK Power Networks' site to enable the testing of a customer's DER controller with a UK Power Networks RTU. During this period DERs brought five controllers to the laboratory for testing and this work has de-risked site-based commissioning. Further detail is presented in the workstream 2 section of this report.

A UK Power Networks 'Smart Delivery Working Group' was formed to gather capital project delivery and design expertise for projects including Power Potential and has helped progress site visits, review the commissioning procedure and identify commissioning engineers to perform on-site commissioning of the DER. Operational Telecoms' engineers will upgrade the UK Power Networks RTU to the latest logic developed and tested as part of the project to enable exchange of analogue and digital signals with the DER controller, and ensure that it communicates with the PowerOn network management system.

Detailed preparation for the trials has continued within both partners to ensure that operational teams, systems and processes are ready for the start of the trials.

At National Grid ESO:

- A business process to define the system requirements has been agreed for the Wave 1 technical trials, including Network Access Planning input for planned Grid Supply Point (GSP) splitting.
- The service request arising from this per GSP is passed to UK Power Networks through a Mvar instruction created through a PAS connection.
- A commercial procedure has been created establishing the approach to nominate the service required in response to system need.
- A business procedure has been developed for the wave 1 reactive power technical trials.
- A Settlements process has been created establishing how payments for services delivered will be reconciled with the service accepted by NGESO and the service delivered. A detailed standard operating procedure is in development and on track.

At UK Power Networks:

- A settlement process has been developed with introduction of a new PowerBI system. A manual settlement process has been scoped to accommodate mandatory trial and DER wishing to enter the trial at a later stage
- A Network Operating Procedure is being developed to identify new processes associated with the Power Potential service
- A Trial Guidelines report ('Guidance on Wave 1 Mandatory technical trial) has been published on the project website

The project team convened four meetings of the Regional Market Advisory Panel during 2019 to share progress and seek guidance. This has been particularly helpful on issues including strengthening the commercial proposition to potential DER participants in the trials; understanding the process and information needs to secure formal commitment and challenges for site commissioning.

DERMS Interim Solution – system live from December 2019

Used for Wave 1 Technical Trials: 'Mandatory' trials and 'Optional' reactive power service trial

Used for full commissioning of DER

Demonstrates PAS-DERMS-PowerOn-RTU-DER integration to deliver services

UK Power Networks restricts output of specific DER in network outage conditions

Demonstrates both self-dispatch and enhanced control

No commercial functionality

DERMS Full Solution – system live from late spring 2020

Used for Wave 2 and Wave 3 trials

Includes full commercial functionality – regional reactive power market for reactive and active power services

Day-ahead and real-time network load flows to determine secure network capability

Day-ahead forecasting of active power flows and active/ reactive service availability

Project Manager's Report

Work is progressing towards the project's trials with significant activities being delivered within the technical, commercial and business processes workstreams, supported by project management activity. As notified to Ofgem in November 2018 and August 2019, project delivery has been rescheduled in respect of the timing of remaining SDRC reports and the project end date. These changes result from two key developments in how we plan to deliver the Power Potential Trials – implementing a staged approach to trials, and day-ahead procurement of the service. These reflect a difference in approach to project delivery since the bid. The change request to SDRC9.4 in August 2019 allowed more time for the report to fully capture the evidence of customer readiness and system readiness for trial, as we approach our first go-live for the interim DERMS software as part of the wider Power Potential system.

System and infrastructure readiness and integration has been a substantial and complex challenge throughout 2019, with multiple technical activities running in parallel with numerous inter-dependencies, which has resulted in delays being incurred to the overall critical path to the trial start date, in spite of contingency time being built into the project delivery plan.

In the next phase of work, the project team is focussed on completing technical development, system integration and testing of the interim DERMS technical solution; securing the participation and completing the commissioning of DER. The first wave of technical trials will use the Interim version of DERMS. In parallel development, system integration and testing of the DERMS full technical solution will be completed for commercial trials during Waves 2 and 3.

Progress in project delivery workstreams is described in the following sections.

Project delivery is structured into five workstreams:

- Technical (WS1)
- Commercial (WS2)
- Business processes (WS3)
- Trials (WS4)
- Project management (WS0)

1. Workstream 1: Technical

Detailed information on the delivered technical solution and pre-trial testing has been covered in SDRC 9.4, but this section provides an overview of progress to date.

The DERMS Interim Solution is an intermediate configuration of the DERMS Full Solution system, which will be implemented earlier than the DERMS Full Solution. The DERMS Full Solution delivers the full scope of the project requirements as per the original bid.

The configuration of the Interim DERMS is chosen to mitigate existing delays within the project schedule by reducing the scope of the first go-live deployment and reducing or eliminating dependencies on external factors such as the availability of Common Information Model (CIM) export with consistent model data to support a valid load-flow calculation.

The Interim DERMS solution is intended to demonstrate the same infrastructure, interfaces and despatch as in the Full DERMS solution, but without the network modelling in the DERMS or the Wave 2 commercial functions. In most respects the detailed design of the Full DERMS solution applies to the interim solution.

The simplified architecture for the Power Potential solution is shown below in Figure 1 – all elements are delivered as part of the Interim Solution with the exception of UK Power Networks' SCADA data and the PowerOn network model for load modelling.

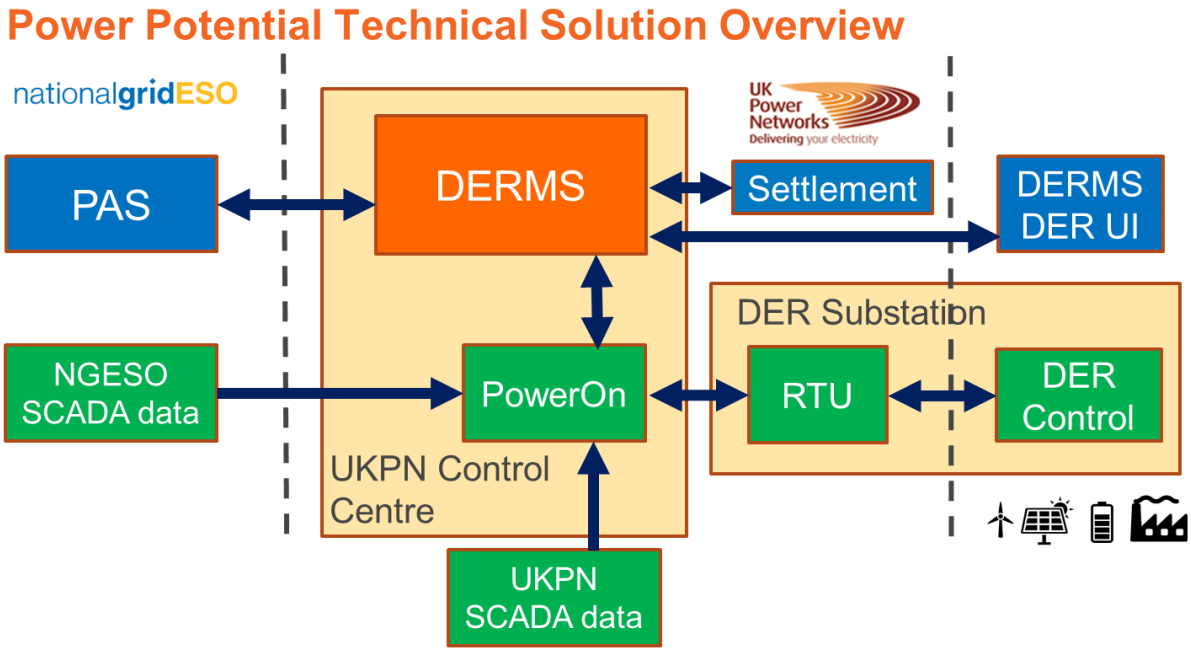


Figure 1: Simplified Power Potential system architecture

Overview of Technical Deliverables

The technical delivery team has worked closely with UK Power Networks and National Grid ESO technical teams and third party providers (ZIV Automation, CGI, TCS, Silversands, SI and Team Zen, Cyient and GE) on the development, implementation and integration of the key components of the Power Potential solution as defined in the Architecture Design Document and set out below.

Delivery of this project has a significant element of information systems setup, interface and associated fault-finding, requiring specialist external skill sets, and providing great learning for future service support and delivery. This implementation has been delivered alongside significant migration and upgrade work being undertaken with UK Power Networks' systems and infrastructure hosting.

Key technical progress achieved during this period includes:

- Azure test infrastructure and environment (implemented for Factory Acceptance Testing): This is a cloud-based test Environment, enabling test of DERMS with a network/load simulator.
- Pre-production environment (implemented for Site Acceptance Testing, System Integration Testing and User Acceptance Testing): This is a replica of the Production environment for test and operational fault/defect analysis and testing of requirements with DERMS connected to all the required interfaces prior to delivery into Production.
- DERMS including the UK Power Networks and DER user interface (UI) websites: installed on the cloud and pre-production environments, with agreed software release and installation processes developed. Challenges with encryption issues disrupting the website traffic were resolved. DER technical details and user logins have been set up for test. Further detail of the components of DERMS is shown in Figure 2 overleaf.
- IBM Integration Bus (IIB) communication mechanism for communications between PAS and DERMS (developed, used in System Integration Testing).
- DERMS to PowerOn ICCP Link (implemented and tested).

- Power BI Settlement solution (manual solution implemented, integration to be tested with DERMS in January 2020).
- Upgraded logic for GE T5500 Remote Terminal Units: tested in lab including integration with DER controllers and the PowerOn network management system, ready to complete integration work in July to enable field deployment.
- National Grid ESO to UK Power Networks ICCP link to share 400kV GSP voltages, active power and reactive power data (implemented for Production and ready for testing in SIT and subsequent test phases).
- Backup and failover solutions (developed and being tested October – December 2019).

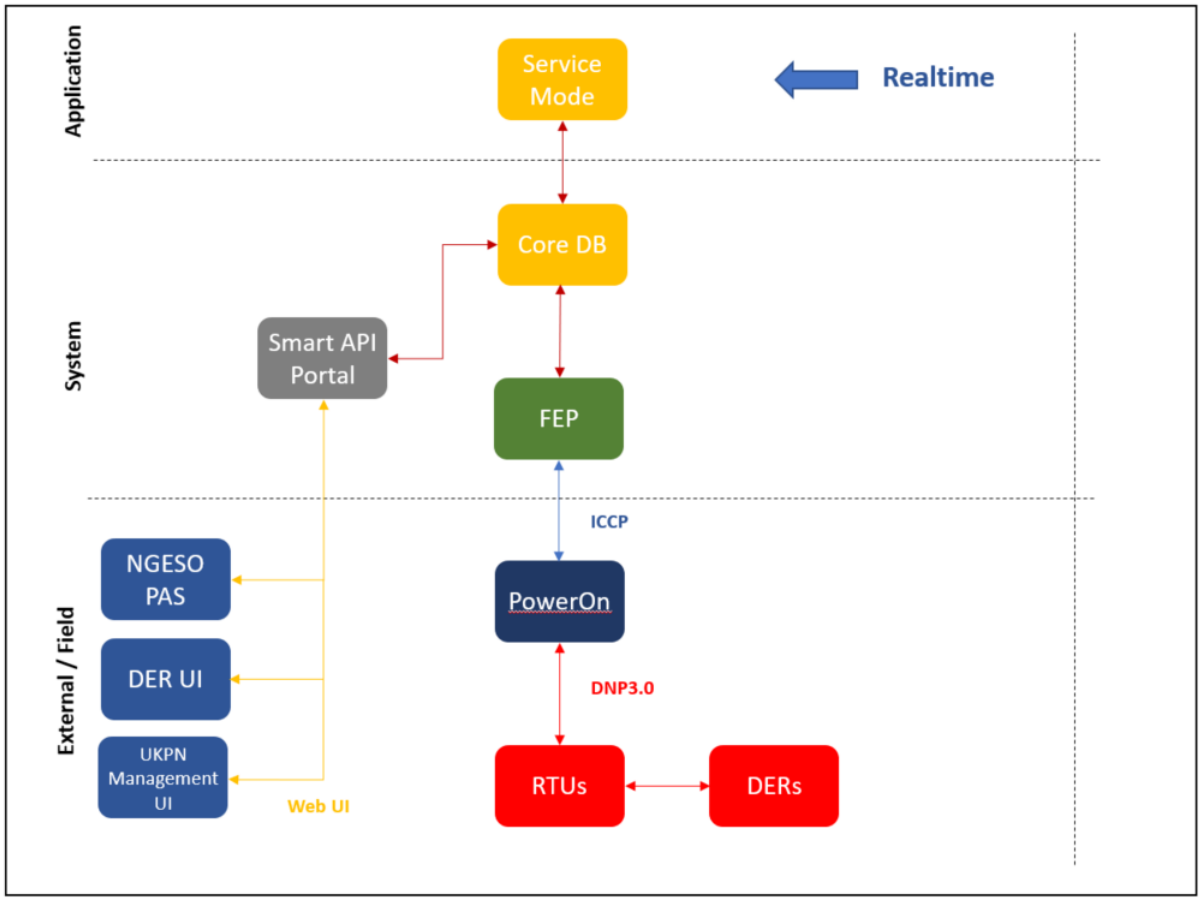


Figure 2: Simplified Power Potential system architecture

Table 1: Glossary for Figure 2

Core DB	DERMS core database
FEP	Front end protocol
PAS	Platform for Ancillary Services
PowerOn	UK Power Networks' network management system
RTU	Remote Terminal Unit
UI	User Interface (for DER and UK Power Networks to interface with DERMS)

System testing stages

In 2018, the project took the decision to split the DERMS software into the Interim Solution and Full Solution, and tailored the testing approach accordingly with an initial focus on the DERMS Interim Solution. In Autumn 2019, the project decided to focus successively on delivery of three levels of requirements – to support DER commissioning/Mandatory trials (Interim Solution), to support Optional trials (Interim Solution) and finally to support the Full Solution trials. The test effort was thus refocused to support system delivery from that perspective.

The following list captures the main testing stages conducted for the DERMS Interim Solution:

- Pre-release System Testing – ZIV Automation's testing on its AWS environment, prior to releasing the software to the project
- Factory Acceptance Testing (FAT) – Supplier's own testing of software, but installed on the UK Power Networks Azure cloud environment with simulation of network load and DER response
- System Integration Testing (SIT) – Validating the Power Potential End to End functionality (Functional and Commercial) with full integration of all supporting systems
- User Acceptance testing (UAT) – Verification of Power Potential solution against existing output from systems. Note: SIT and UAT were run as a combined phase
- Non-Functional testing (NFT) – To validate server/application related functions like backup & restore, data storage, user access, penetration/security, performance, resilience, and scheduled housekeeping tasks
- Operational Acceptance Testing (OAT) – Validation of processes to support Power Potential in live production including all interfaces with other systems. Where live connection/running is not possible e.g. iEMS, the pre-prod environment or live snapshot simulations are considered/adopted.
- Regression Testing throughout – To ensure that no errors or problems have been introduced and existing unchanged areas of the application/service still function as they did prior to the changes. This test is not a specific phase and will be conducted on Supplier's recommendation or at any time during the project lifecycle. Typically run after a major release.

During 2019, there have been continuing challenges delivering the interim DERMS, its integration and infrastructure to the high standards required by this complex project. It is a key to deliver a secure operational system. Work has been progressing to implement coding changes to address these challenges, but the timeframe to complete the system integration and associated integration/user acceptance testing has had to be extended. This has impacted the indicative trial start date as discussed in the workstream 4 section.

The DERMS Interim Solution is used to support DER commissioning, Mandatory Trials and Optional Trials. It delivers Mandatory Trials for the active and reactive power service, and Optional Trials for the reactive power service. The project has completed:

- all of the infrastructure build and integration testing on pre-production for DERMS Interim Solution
- functional testing required for DER commissioning and for Mandatory Trials, and
- a dress-rehearsal of connectivity checks for the 'cut-over' to the live system.

Figure 3**Error! Reference source not found.** below provides a high-level overview of the system test approach already described. This process is to be carried out for both Interim and Full DERMS solutions.

Objective	DERMS components work separately & together	DERMS satisfies functional requirements	DERMS installed correctly	Interfaces are designed & working correctly	PP solution satisfies requirements	Sign-off by NG & UKPN control engineers	PP solution performance, security, reliability
Who involved	ZIV Automation	NG & UKPN project teams	UKPN IT team	NG & UKPN IT teams	NG & UKPN project teams, DER	NG & UKPN business stakeholders	NG & UKPN IT teams

Figure 3: System testing stages

Testing of the interim DERMS solution started with Factory Acceptance Testing (FAT) between 18 February and 1 March 2019 followed by Site Acceptance Testing (SAT) of the DERMS onto a pre-production test environment during March. This site acceptance testing of DERMS is repeated with every DERMS release. This covered testing of 80% of the core DERMS functionality with defects raised during the test cycles. Defects are logged in a JIRA defect management system, with fixes will be delivered in releases 14, 15 and 16 of the DERMS, during the System Integration Testing (SIT) of the whole system and User Acceptance Testing (UAT) phases.

Detailed work has been completed to define the requirements and build the interface between the DERMS and National Grid ESO's Platform for Ancillary Services (PAS). This has been delivered through engagement between National Grid ESO's PAS team, ZIV Automation (the vendor for the DERMS solution), UK Power Networks and National Grid ESO teams responsible for key stages of the end-to-end processes for the project's reactive power service and active power service. Static testing has successfully taken place in April and May and full end-to-end testing including business logic of the interfaces is ongoing and expected to be completed prior to Mandatory trials start.

System Integration Testing and User Acceptance Testing commenced in early May, followed by a further cycles to cover defect review and initial end-to-end testing of the controller, and extending to full end-to-end system testing during November and early December 2019. This covers the integration and validation of DERMS-PowerOn-RTU-DER and NGESO-PowerOn-DERMS communication channels, and associated signal behaviour and functionality.

Non-Functional Testing (NFT) has taken place in parallel with the final SIT/UAT testing cycles. Penetration testing (conducted by a third party) was conducted between 18 and 22 November 2019, with the remedial actions addressed in the latest DERMS release delivered on 28 November 2019.

PAS-DERMS connectivity testing in readiness for the Optional Trials was completed by the end of August 2019, with functional testing PAS-DERMS and end-end testing due to take place in mid-December 2019.

DER laboratory testing

A laboratory space was created at UK Power Networks' site in east London to enable the testing of a customer's DER controller with a UK Power Networks RTU. This work de-risks site-based

commissioning, and further detail is presented in the workstream 2 section of this report. DER were offered the opportunity of return visits to the lab if necessary. Further information on laboratory testing was provided in the SDRC 9.4 report.

UK Power Networks began engagement with the DER controller configuration/integration teams in March 2019 and have hosted numerous telephone calls to assist them in preparing for lab testing.

Listening to DER feedback, the project team has updated the DER Interface Schedule and provided further clarity on:

- how the data between the DER controller and the UK Power Networks Remote Terminal Unit (RTU) will be exchanged
- how to configure Distribution Network Protocol 3 (DNP3)
- failsafe actions

To date UK Power Networks has hosted four DER and tested five controller types at its laboratory to bench test the communication link between DERMS <> PowerOn (UK Power Networks' control system) <> UK Power Networks' RTU <> DER controller. The integration lead is also reviewing simulation results provided by the DER and clarifying the mapping is as expected. Whilst the lab-based pre-commissioning was optional it has proved invaluable to both DER and UK Power Networks and will ultimately save time and effort at site-based commissioning.

UK Power Networks facilitated capability testing 4 November 2019 with a DER to prove their ability to import and export Mvars onto the distribution network.

DER pre-commissioning

Preparation is underway for DER commissioning. A UK Power Networks 'Smart Delivery Working Group' was formed to gather capital project delivery and design expertise for projects including Power Potential, and has helped progress site visits, review the commissioning procedure and identify commissioning engineers to perform on-site commissioning of the DER.

Operational telecoms engineers will upgrade the UK Power Networks RTU to the latest logic developed and tested as part of the project to enable exchange of analogue and digital signals with the DER controller, and ensure that it communicates with the PowerOn network management system. They will work against a commissioning procedure based on the DER Technical Requirements and DER Interface Schedule (both published on the project website). A pre-commissioning stage was delivered for one DER in mid-November 2019 (see later in this section), with commissioning to follow in January 2020.

DER have received project support for their technical readiness, (i.e. to progress with signals configuration, lab testing and site upgrades) and UK Power Networks has offered each DER the option to complete pre-commissioning/integration testing on site (PowerOn<>RTU<>DER) while progressing in parallel with DERMS integration. Pre-commissioning does not include capability/performance testing or integration test to DERMS and it is an activity that will ease DER commissioning.

One DER chose this option and conducted this activity on 13 and 14 November 2019. The DER was unique in the fact it not only needed the Power Potential RTU logic to be deployed, but also new RTU hardware needed to be installed. The age/model of the existing RTU meant it would not be able to accept the software upgrade associated with the new RTU logic. The UK Power Networks operational telecoms engineer had visited the site to install the new RTU hardware and complete associated site works. The new RTU hardware was integrated successfully and the business as normal functions were proven with communication back to the UK Power Networks control system, PowerOn. The following signals were successfully tested.

Signal exchange

- 16-bit analogue inputs and outputs, including readbacks

    - active power setpoint using 0-1600, -100 to +100 MW (scaling imposed by RTU logic)
    - voltage power setpoint using 0-1600, 0 to 145,000 volts (scaling imposed by RTU logic)
- binary inputs and outputs, including readback

Functional checks

- V service, P service and contractual mode selected and confirmed DER response
- Lower and upper MW limits working, and scaling limits confirmed
- Voltage setpoint lower and upper limits working, and scaling confirmed
- Detection of communication link failure using DER link counter signal and DER auto recovery when link re-established

The opportunity to test the signal exchange 'in the field' proved extremely beneficial to both the DER and UK Power Networks. Further issues were identified which required further investigation, some site-specific and some of which, will most likely be applicable to the other DER participating. A return visit to site on 28 November 2019 addressed these, including a local issue with the MW analogue metering, and signal exchange between PowerOn<>RTU integration.

Setting up the exchange of voltage signals was found to be an extremely time-consuming aspect of the site setup for pre-commissioning.

- The current 16-bit integer format is resulting in a loss of resolution corresponding to volts
- Recommendation to format the signals to float (removing the need for scaling between 0-1600)

UK Power Networks will now change the approach to commissioning, separating the RTU upgrade activity from the other UK Power Networks site readiness activities. These other activities include installing all the required connection ports, mapping the digital meters and integrating the flows back to PowerOn. This makes the site ready to accept the RTU logic on the morning of the first day of the commissioning activity – this software upgrade is not expected to take more than one hour and is now included in the day one agenda for commissioning rather than the last part of site preparation. The initial site readiness visit reduces but does not eliminate the risk that unforeseen complications can arise during commissioning, which potentially, could impose severe delays to proceedings.

Taking into account DER feedback regarding the reduced resolution of values and additional coding requirements, UK Power Networks has brought forward an activity to remove the need for scaling by introducing the float format. The RTU release which encompasses this logic was expected to be introduced February 2020.

This would have meant DER who completed the commissioning activity between December and January would be required to complete regression testing of the integration tests. The RTU release with float format is now expected to be delivered mid-December with two weeks set aside for component and then end to end (DERMS<>PowerOn<>RTU<>DER) bench testing in the UK Power Networks laboratory. This will mean no additional coding for DER, more granular resolution and removing the need to complete integration testing twice, saving time and effort for both DER and UK Power Networks. Furthermore, although there is a slight impact on commissioning dates and the start of Mandatory Technical Trials, removing the second RTU logic deployment also removes a subsequent site visit and de-risks the start of Optional Technical Trials.

Full solution preparation

Development work being progressed and completed for the Full Solution includes the DERMS modules for day-ahead Future Availability (network security assessment and commercial functionalities), Forecaster CIM model convergence and network data correction. The Full Solution also extends from just reactive power services to include active power services.

The detailed approach to the full solution PAS-DERMS cost curves, the settlement system, active power service and network security analysis were agreed during 2019. Planning of the test phases for the DERMS Full Solution is ongoing (pre-FAT, FAT, SIT/UAT and NFT) and starting from December 2019. Testing for the full solution will follow the same phases as for the Interim solution with more focus during non-functional testing on performance and stress testing for volume and system availability.

Further details of all the development for the Interim and Full Solution are provided in SDRC 9.4.

2. Workstream 2: Commercial

The commercial workstream is responsible for the design and development of a route to market for DERs to deliver reactive power and active power services to National Grid ESO, for the review of the commercial implementation in the DERMS Full solution and for managing and learning from the customer experience through the project.

In this phase of the project, workstream 2 has focussed on contracting with interested DERs and continuing to recruit additional DER participants to ensure that the trials contain sufficient volume to maximise learnings from this innovative service, whilst preparing participants, their sites and capabilities for the trial to ensure readiness.

A summary of the progress made in 2019 is covered in this section and includes:

- finalising the commercial proposition
- recruitment and DER engagement to date
- publishing final contract and market procedures
- customer readiness.

The final commercial proposition

In the previous period, the project team agreed the commercial proposition taking into consideration feedback from DERs in a consultation and views from the Regional Market Advisory Panel, the key aspects of the proposal included:

- total participation payments of up to £45,000 per site (increased to ensure sufficient participation in the project given updated information received from DER on their upgrade and communications costs)
- adjustments to the performance thresholds in Wave 1 participation
- in the event of a no-go trial decision, guaranteeing full participation payment, based on invoiced work, to providers who have successfully demonstrated or are in the process of demonstrating their ability to deliver a service.
- termination rights within the Framework Agreement for DERs.

Details of the final commercial proposition are now embedded within the DER Framework Agreement available on the project website. Across the period, we have been actively responding to queries from DERs on both the final DER Framework Agreement and Market Procedures. In 2019, a minor clarification was made to the Framework Agreement, principally to amend the definition of a service window to allow participants to be available for a minimum of one settlement period across a service window. A further variation is being drafted to reflect the reduction in Wave 1 to 11 weeks (see workstream 4) without reducing the revenue opportunity to DER.

During this period the project team also published a Power Potential Reactive Power Commercial Procedure Wave 2 & Wave 3 document. This document provides an overview of how the commercial reactive power service will work for Wave 2 and Wave 3. The document is intended to help potential trial participants understand their potential revenue from the commercial trials. The document sets out:

- the principles that National Grid ESO utilises when assessing reactive capability delivered throughout the trial
- how the DERMS calculation will work and the impact of effectiveness on a provider's cost to National Grid ESO
- information on the budget for Waves 2 and 3 and how information will flow between the counter parties
- project ambition as it relates to a potential business as usual service

The aim of the document is to give potential participants a clear view of the revenue opportunity of participation in the trial as well as a better understanding of the competitive waves and how they work

Recruitment process and engagement to date

The project team continues to engage with key stakeholders ahead of the trials in 2019. To date five DERs have signed both a DER Framework Agreement and a 'Variation Agreement relating to a Connection Agreement' to indicate their intention to participate in the Power Potential trials. Further DER are still engaging but have needed more time to address technical and commercial queries related to their participation.

The engagement process has ensured that potential trial participants are kept up to date and are involved/consulted on the progress of developing the trials. The engagement process is led jointly by UK Power Networks and National Grid ESO. Both parties have utilised existing relationships with providers within the trial region, through the Business Development and Contracts and Settlements team within National Grid ESO, and the project's Stakeholder Engagement team, Connections' Project Managers and Infrastructure Planners at UK Power Networks.

Table 2 outlines the engagement activities that the team has undertaken to keep DERs informed of project progress, captured their views and established their interest in participating in the project's trials.

Theme	Engagement activities
Identify target audience	• Direct contact with potential trial participants • Project explained and DERs' interest gauged • Inclusion on mailing list for project updates
One-to-ones	• Follow up one-to-one sessions held with DERs as requested • One-to-one sessions covered DER's communications requirements, testing and commercial issues
Regional Market Advisory Panel	• Ongoing sessions with the Regional Market Advisory Panel providing discussion and challenges on key commercial themes within the project including progress on DER and systems readiness and continued feedback on the trial design, payment structures and contractual framework
Ongoing engagement	• Ongoing targeted engagement with DERs up to signing a contract • DER Framework Agreement Document Summary published

Theme	Engagement activities

	• Responding to legal queries raised on the DER Framework Agreement and Variation Agreement relating to a Connection Agreement
	• Ongoing engagement with DERs, post contract signature to support:
	  • self-billing registration
	  • SAP Sourcing registration for procurement process
	  • any upgrade works by DER or UK Power Networks on site
	  • commissioning tests
	  • communications installation
	  • readiness for trial
	  • settlement and payment handling
	  • inform DERs of key dates.

Table 2: Engagement activities for potential trial participants

Customer readiness

The project team has set out the DER journey to ensure DERs who sign on to a Power Potential DER Framework Agreement are clear on the process leading up to participation in the trial. A high level DER journey is detailed in Figure 4.

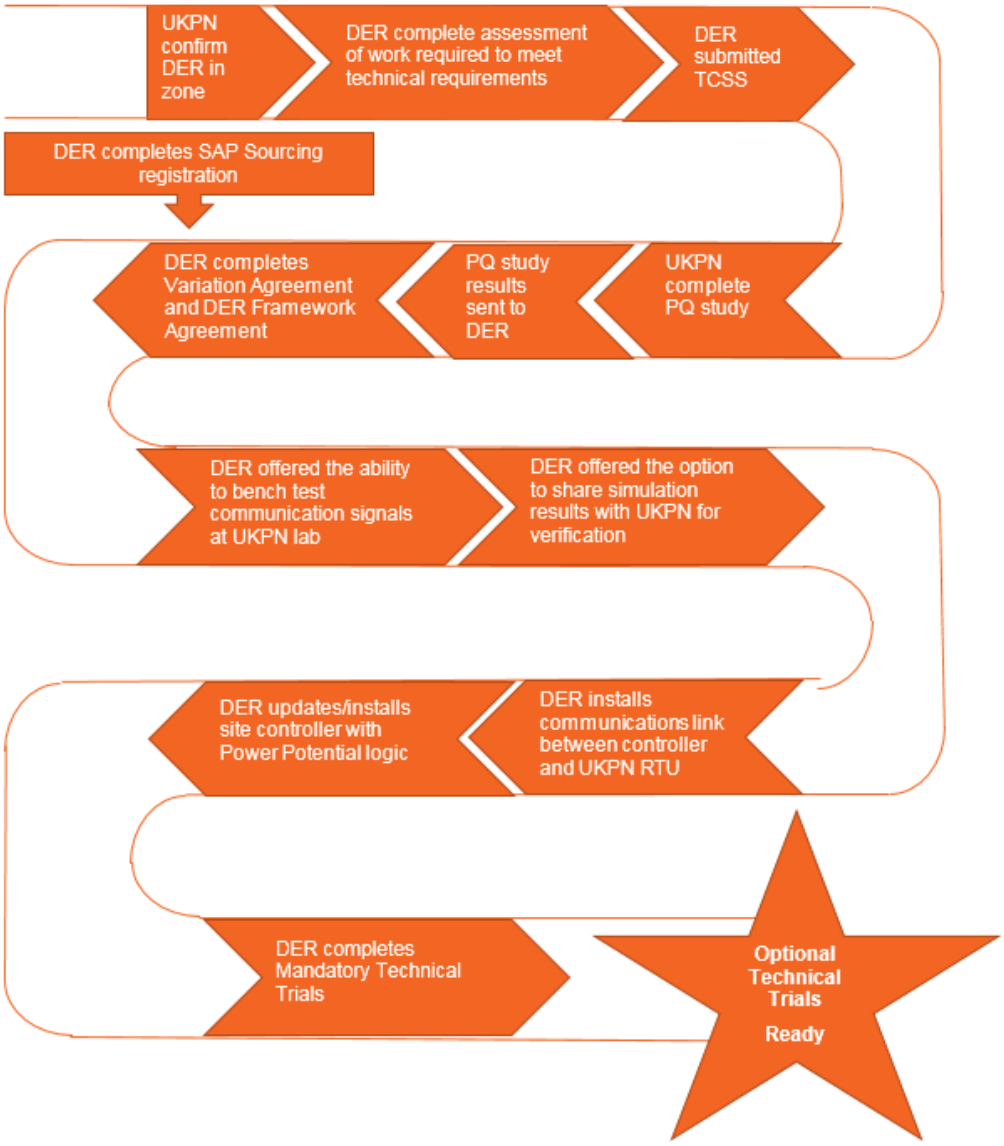


Figure 4: DER journey

3. Workstream 3: Business processes

National Grid ESO

Preparations for the trials have continued with business processes developed for the key elements of National Grid ESO's operation during service delivery. The trial design developed by the commercial workstream and trials delivery workstream identifies a series of trial waves, each of which will necessitate different business processes and work instructions to be developed and agreed with training for the affected business functions. The business processes have been developed as summarised in Table 3 and detailed work instructions/standard operating procedures are being prepared for each wave of trials. Training has been undertaken for control room colleagues who will deliver the service during the trials, with further training to take place immediately before trials begin.

NGESO Process changes adopted for the Power Potential trials		
Theme	**Purpose**	**Description**
Requirements	Providing initial advice for the Control Room on system needs	Business process agreed for the Wave 1 technical trials including Network Access Planning input for planned GSP splitting.
Service request per GSP	To create Mvar instruction on VPP in PAS	Main information exchange through PAS connection. Additionally, 400kV measurements exchange occurs through the existing ICCP connection between NGESO iEMS and UK Power Networks' PowerOn.
Nomination	Establishes the approach to nominate the service required in response to the system need	Commercial procedure in place for Structuring and Optimisation Team to undertake nomination process.
Dispatch	To define Control Room responsibilities	Business procedure has been established for the Wave 1 reactive power technical trials.
Settlements	To establish how payments for services delivered will be reconciled with the service accepted by NGESO and the service delivered.	High level process agreed and detailed Standard Operating Procedure on track

Table 3: NGESO Process changes adopted for the Power Potential trials

Next steps

Training for trial operation will be scheduled before each wave of the trials to ensure that colleagues in key business units are ready to deliver the Power Potential services.

Further details of business readiness for trials are provided in the SDRC 9.4 report.

UK Power Networks

Preparations for the trials have been progressing well during the second half of 2019. Set out below is a summary of key milestones which were required for business readiness sign-off. A preliminary Organisation Impact Assessment was completed in Q2 2019 which assessed the impact of the Power Potential project on UK Power Networks' operations in the near term. The assessment provided a general overview of the impacted business units and helped the team understand potential overlaps and interdependencies with other ongoing programs, such the Active Network Management (ANM) and Flexible Distributed Generation (FDG).

Project Stakeholder Engagement plan

Over the course of the project, the project team has been engaging with a number of business units to inform, consult and collaborate to deliver project outcomes. The Project Stakeholder Engagement plan helped outline the way in which stakeholder engagement should be structured and tracked over the course of the project. It supported the project team to monitor and control communication across the project and assess the progression of relationships across project delivery.

Business process log

A business process log was created to keep track of the progress of the business change activities and assess readiness before the trial.

The activities were largely grouped into four categories: those which are related to DERMS delivery, those related to PowerOn, those related to NGESO/UK Power Networks' operations and those related to UK Power Networks' operations only. Approximately forty processes were defined, with most of them required for the trial setup, for example change control activities such as DER contract management, DER Lab testing, DER commissioning, RTU logic upgrade.

The business process log has assisted the project team to identify required changes to existing business policies, processes and procedures and helped organise the definition and documentation of these processes with input from the different stakeholder.

To date (30 November 2019), 50% of the defined processes for the interim solution were Green with the remaining part (50%) were Yellow (on track but not delivered or fully documented yet).

Business engagement example- settlement dry-run June 2019

Historically, there was no settlement function in UK Power Networks so the project team had to prepare and test a settlement process from the beginning. The objective of the settlement dry-run which took place in June 2019 was to capture the process end-to-end, understand the business involvement and communicate key dates and milestones during the trial.

A broad team from UK Power Networks was involved including: the PMO desk, Procurement, Finance and Tax and PowerBI teams.

Further work and details of key processes have been provided as part of the business readiness to trials overview in the SDRC 9.4 report.

4. Workstream 4: Trials Delivery

In terms of conducting the trials, workstream preparations are progressing well, with data capture, analysis and reporting strategies established.

Since the last Annual Summary Report in December 2018, the trials delivery team has prepared and issued guidance documents on Wave 1 Mandatory and Optional trials. The guidance documents explain the purpose and nature of the trials and identify the testing to be carried out, including the data to be captured, expected outcomes and resources required. The documents have been available for internal consumption since early 2019 and an external version of the Wave 1 Mandatory Trials guidance document was published on the Power Potential website in May 2019, for public awareness.

Considering further challenges in delivering DERMS to the required quality and in DER readiness, the project team will be amending the trial calendar that has resulted in a reduction in the duration of the trials, though the revised schedule will be designed to maximise the amount of learning that can be achieved within the project.

The Wave 1 availability hours were modified to still ensure DER can still earn up to £45k. Similarly, the timescales for Wave 2 and Wave 3 will be adjusted, with the commitment to run the market for 1,800 hours still in place so there is no impact on DER potential revenue from Wave 1 or Wave 2.

The trials have been rescheduled. The project team has agreed with DER participants, that a revised notice period for the start of the trials is now 14 days, therefore close communication and preparation for trial readiness will continue. This schedule was announced to DER, Ofgem and BEIS at the 11 December Regional Market Advisory Panel:

- Wave 1: Mandatory Technical trials 29 January 2020
- Wave 1: Optional Technical trials 20 February 2020
- Wave 2: Commercial Trials – approximate May 2020 start (date not yet confirmed)
- Wave 3: Commercial Trials – to be agreed

5. Business Case Update

The business case has been updated and is reported in detail within the SDRC 9.5 Cost Benefit Analysis report. As notified to Ofgem in November 2018, the SDRC9.5 report was submitted in March 2019 to Ofgem, but its publication is being withheld until the project's commercial trials are completed to avoid distorting participant behaviour during these trials. The SDRC9.5 report provides a view following the cost benefit analysis completed by the University of Cambridge on the Power Potential project. The University of Cambridge completed analysis on the benefit of the project within the trial region, formed by four GSPs. Replication studies were then conducted to determine where else the project has the capability to add value.

Following the trials there is expected to be a short review of the CBA with bid and accepted prices containing updates to actual/forecast DER volumes to understand how this impacts the potential project benefits. An appendix with these findings will be included in SRDC 9.6 (Trials Report).

6. Project Against Plan

The project has made progress to the point where the start of the Power Potential trials is imminent, although reaching this point has taken more time and been more complex and challenging than

originally envisaged, as described within the preceding workstream updates and in more detail within the SDRC9.4 report.

The Power Potential system is extremely complex with a chain of 20 components from National Grid ESO via UK Power Networks to the DER. Certain aspects of the IT solution (such as resolving specific integration issues) for this project have proved to be more challenging than initially expected. As a result, it has become necessary to delay the trial trials whilst all readiness activities are completed. The project team has adapted delivery activities to mitigate the impact of these delays, running activities in parallel wherever possible and challenging dependencies throughout the delivery plan. For example, by ensuring that functionality required for later stages of the trials does not prevent progress to the initial phases of trial. As a result of this, the following functionality required for Mandatory and Optional trials is being delivered.

- DERMS technical solution and defect resolution
- System integration including all IS hosting aspects
- DERMS-PowerOn integration over ICCP links, and new PowerOn screens (developments to apply to a live operational environment) Signal integration DERMS-ICCP-PowerOn-RTU-DER controller had to be fully tested and proven on pre-production to enable deployment to live, and
- Development of RTU upgrades to enable the signal exchange so that DER can deliver the Power Potential service – this is a pre-requisite for DERMS-PowerOn- DER site commissioning.

The trials have been rescheduled as illustrated in the high-level plan presented in Figure 5. This schedule was announced to DER, Ofgem and BEIS at the 11 December Regional Market Advisory Panel as outlined in section 4.

The plan for building, testing and deploying the technology solution has been further adapted during 2019 to incorporate learning and address issues that have arisen to minimise disruption to both the project trials beginning in 2019 and the commercial proposition that has been presented to the market.

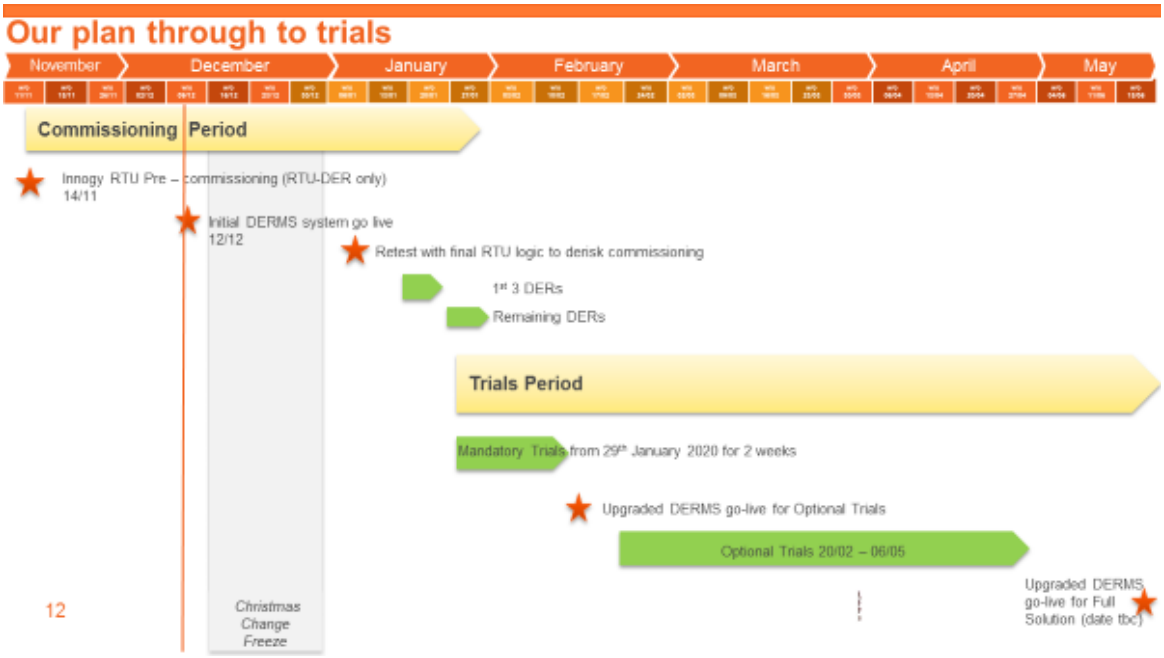


Figure 5: Trial schedule presented to stakeholders, 11 December 2019

A detailed schedule for the trials has been developed and was published in the Market Procedures document in August 2018. It was then updated in December 2018. It will be further updated in January 2020.

In December the project notified Ofgem of the timing of the remaining Successful Delivery Rewards Criteria (SDRC) reports. These have been revised to reflect the updated project delivery plan and the revised delivery dates are summarised in Table 4 below.

The project closure report has been rescheduled to 26 February 2021, in line with these SDRC reporting dates.

Table 4: Revised schedule for the remaining SDRC reports

	SDRC 9.5	SDRC 9.6	SDRC 9.7
Title	Cost Benefit Analysis	Trial Phase Report	DSO risk-reward framework for providing wider system services
Original submission date	31 December 2018	31 December 2019	31 December 2019
Revised submission date, notified to Ofgem November 2018	31 March 2019 (confidential for Ofgem only to prevent distorting the trials) 30 April 2020 (published date)	30 April 2020	31 March 2020
Anticipated submission date	13 November 2020	13 November 2020	27 November 2020

7. Project Against Budget

Refer to the Confidential Annex

8. Project Bank Account

Refer to Confidential Annex

9. Successful Delivery Reward Criteria

Table 5: Status of the project's Successful Delivery Reward Criteria

SDRC	Progress
SDRC 9.1: Technical High Level Design The high-level design of the technical solution and high level business processes which will operate the solution. Evidence: • Alternative design options considered and selection criteria • High level design specification • Functional design document • High level business processes • Review of anticipated synergies and conflicts	Completed and submitted on time. Published on time.
SDRC 9.2: Commercial and Detailed Technical Design **Stage Gate 1** – The agreed detailed technical design (Partner/s, National Grid, UK Power Networks, Customers) and Commercial Framework for the trial. Evidence: • Stakeholder consultation findings • Functional Specification Documents • Finalised Commercial Framework • Detailed Business Processes	Completed and submitted on time. Published on time.
SDRC9.3: Commercial Tendering Process Report and Finalised Trials Approach **Stage Gate 2** – Outline the learnings from the tendering rounds for the reactive power services and the engagement on the active power services. Based on this process and the trials approach, to advise which customers will be utilised during each trial phase and the forecasted effectiveness. Evidence: • Report on tendering approach, including technical and contractual requirements for participation, barriers to entry and measures to alleviate these • Proposed commercial framework and interaction with SO and DNO incentives • Review of technologies and volumes under contract • Initial forecasts of availability and utilisation volumes • Signed commercial contracts • Trials Approach and Methodology	This SDRC was delivered and published on time as planned by National Grid ESO, interpreting 'signed commercial contracts' as requiring signing of the inter-operator agreement between National Grid ESO and UK Power Networks and as described in the SDRC. The agreed inter-operator contract was further revised after the SDRC was submitted, in line with final format of the framework agreement with DER providers.

SDRC	Progress
SDRC9.4: Customer Readiness Report and Performance of the Technical Solution in a Controlled Environment **Stage Gate 3 –** Update on the effort required to ready customers to take part in the trial (technical, business processes, etc.) and the performance of the technical solution in a controlled environment and expected performances in the live environment. Evidence: • Test Report – End to End Testing Business Change Implementation Report • Customer Readiness Assessment • Technical Solution – GO / NO-GO Criteria Results • Customer and Business – GO / NO-GO Criteria Results	This SDRC delivery date has been revised to 30 November 2019. Published on time.
SDRC9.5: Cost Benefit Analysis Analysis assessing the financial case for the trial to date and for extending the approach into the future Evidence: Detailed assessment of the costs and benefits of TDI 2.0, to include: • analysis of the net benefit of extending the trial into the future (using Ofgem's CBA framework), replication study assessing the viability of, and case for, extending TDI 2.0 to other DNOs and for providing a wider set of services	Completed and submitted on time for the revised delivery date of 31 March 2019, based on theoretical analysis from the University of Cambridge before the trial. This cannot be published due to the risk of distorting participants' bids during the trial. Thus, we have not published the report at this time. We will update the SDRC9.5 report in 2020 with additional learning from the trial (accepted bid prices and volumes, and latest view of the delivery and support costs of the technical solution). We propose this updated version of the SDRC9.5 with the CBA will be following completion of the project trials in 2020, accompanying the SDRC9.6 trials report to be submitted 13 November 2020.

SDRC	Progress
SDRC 9.6: Trial Phase Reports **Stage Gate 6** – Trials Report The completion of the trials in line with customer agreements and review of the performance of the trial; the closure of the project (potentially moving into BAU) in line with customer agreements Evidence: • Trials Phase Report including adequacy of contracted volumes to meet requirement, availability/reliability of DER and control system, accuracy of sensitivity and accuracy forecasting, evidence of competitive bidding, evidence of conflicts • Report summarising the financials of each party (subject to DER commercial confidentiality), an in particular the costs incurred by the DNO, the uplift applied to DER bids, and hence the net revenue that the DNO receives • Assessment of scheme design and operation to cover how well it worked, where conflicts arose, and how the governance arrangements performed • Plan for transitioning trial participants into enduring solution	This SDRC report has been rescheduled, as a non-material change, to 13 November 2020. Detailed planning for trial delivery continues including ensuring that business processes are developed and reviewed, responsibilities assigned and training scheduled. Early discussions are underway to establish the plan for transitioning trial participants to an enduring solution following completion of the trials.
SDRC9.7: DSO risk-reward framework for providing wider system services A paper describing the incentive framework used for the project and recommendations for an enduring incentive framework for an active DSO Evidence • Analysis of the costs, risks and revenues for the services included in the trial • Assessment of mechanism used within the trial and comparison against alternative incentive mechanisms • Assessment of the applicability of these incentive schemes to a DSO providing a broader set of system services and interaction with the wider SO incentives	This SDRC report has been rescheduled, as a non-material change to 27 November 2020. Early discussions are underway to review the potential options and how the pros and cons of these can be further developed through the learning generated by the project trials.

10.Data Access Details

Interested parties can access any network and consumption data gathered because of this project in accordance with National Grid ESO's published policy. UK Power Networks follows a similar innovation data-sharing policy.

11.Learning outcomes

Dissemination activity from the Power Potential project has continued throughout this reporting period to keep raising awareness and the profile of the project and encourage trial participation with key stakeholders and audiences within the industry. Engagement with DERs and aggregators has been critical to successful delivery of the projects' trials and overall project objectives.

The projects' engagement strategy continues to communicate the key benefits that the Power Potential service will bring, including:

- making a material contribution to voltage control and constraint management on the National Electricity Transmission System
- providing an additional revenue opportunity for DERs
- gathering evidence on the level consumer savings that could be achieved through adoption of the Power potential approach following the trials.

The engagement process has ensured that potential DERs being targeted for participation in the trial are kept up to date and are involved/consulted on the progress of developing the trials. The engagement process is led jointly by UK Power Networks and National Grid ESO. Both parties have continued to utilise existing relationships with providers within the trial region, through the Business Development and Contracts and Settlements team within National Grid ESO. The key channels used in this reporting period are listed below.

Project website

Maintaining a good website is one of the best ways to promote an activity. To ensure the project is connecting with its stakeholders, the project website has been updated regularly. On the project website, users can learn about the project at a high level, or find more technical detail using the sign posted tabs, such as finding out about requirements for participation in the project, or learning about the DERMS platform. The website hosts all the relevant documents DERs need to learn about participation requirements, or complete to take part. To make the site user friendly and help navigation, the website now includes signposted document folders. A direct link has been added to the website which means users can request to join the mailing list.

The project website includes an 'events and news' section, which allows stakeholders to follow the project's external engagement activities. A dedicated email address (box.PowerPotential1@nationalgrid.com) appears at the top of the page, allowing for further questions or queries to be submitted directly to the team.

As the project trials begin, and as the project publishes results and more guidance for interested parties, the project team will be able to track the number of visitors to the website. This will help the project team understand how many visitors are reading the project material and give them an indication as to the levels of interest in participating.

Website statistics for 19 November 2018 – 18 November 2019 for the project webpage. Note that this date excludes webpage visitors from within the National Grid network):

- Page Hits: 4,687
- Visitors: 4,008
- Downloads: 2,474
- Average time on page: 8 minutes 03 seconds

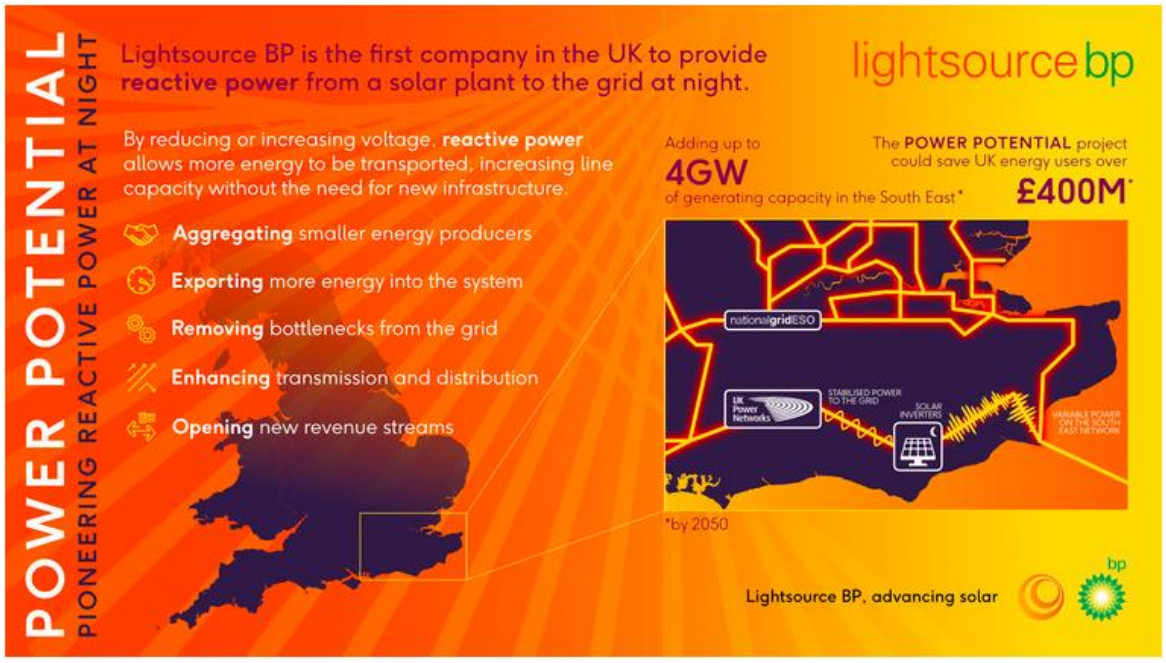
External engagement

National and trade media coverage of Power Potential

In November, one of the DER participating in the project, Lightsource BP published a press release, including an infographic (see Figure 6), following successful site testing ahead of the trials. This

secured national media coverage by the Guardian and Observer newspapers, in several trade media publications[1] and international coverage (Reneweconomy, Australia).

Figure 6: Illustration from Lightsource BP's press release, 25 November 2019



Link to coverage in The Guardian:

https://www.theguardian.com/environment/2019/nov/24/solar-farms-keep-uk-lights-on-at-night

Smart Grid Forum Conference – London, September 2019

Power Potential Project Leads, Biljana Stojkovska NGESO, and Rita Shaw, UK Power Networks presented at the DER Smart Grid Flexibility Forum Conference 2019. There was great interest in the presentation, with the event featuring on the UK Power Networks and National Grid ESO Linked-in accounts.

Low Carbon Networks Innovation Conference – Glasgow, October 2019

Rita Shaw (Power Potential Project Lead, UK Power Networks) and Inma Martinez-Sanz (National Grid ESO technical lead) presented jointly on the development of the Power Potential integrated communications and technology solution, as part of the well-attended Commercial Evolution deep-dive session.

DSO-focussed session at All-Energy – Glasgow on 15 May 2019

Biljana Stojkovska, Power Potential Project Lead at NGESO, was invited as a panellist at the All-Energy Conference in Glasgow. The session: *Distribution System Operator (DSO) – Opportunities for DER at all scales. What is DSO, and what opportunities does it present for DERs?* introduced the workstreams in the Open Networks Project outlining what is changing, what future opportunities

[1] Trade media coverage includes EnergyLive News, BusinessGreen, CurrentNews. Original press releases available at BP and National Grid ESO

will be for DERs at all scales. Panellists were invited representing their projects, all of which impact DERs.

Industry awards

The project has been shortlisted for three awards (Real IT, British Renewable Energy Awards, Network Awards), and won at the National Technology Awards (IoT category) and the South East Energy Efficiency Awards (Figure 7) during this reporting period:

Figure 7: Award wins for Power Potential

Energy Efficiency Awards (South East region)

The South East Regional Energy Efficiency Awards were launched in September 2016 following the changes in Government Energy Efficiency Policy. The aim of the Energy Efficiency Awards is to provide public recognition for the excellent work the Energy Efficiency sector is doing in implementing greener energy scheme and to help encourage best practice within the Energy Industry as it works to improve UK housing stock. The Power Potential project received a special award for Infrastructure Innovation and this success was communicated through National Grid System Operator's internal e-newsletter and via LinkedIn and Twitter social media channels.

National Technology Awards

The third annual National Technology Awards celebrate the pioneers of new technology and help drive standards and encourage excellence. The Power Potential project's submission focussed on the DERMS technical solution and was shortlisted in both the Innovation of the Year and IoT Project of the Year categories and was successful in winning the IoT Project of the Year category. Team members attended the awards ceremony on 16 May.

Social media

Where the project has enjoyed award successes, these have been shared internally and externally (Figure 8, overleaf, for example) to enhance the profile of the project. Posts have linked to the wider objective of DER trial recruitment.

Figure 8: NGESO Twitter awards post which includes a call to action to enhance DER recruitment

UK Power Networks internal engagement

In 2019, an internal newsletter was created to update stakeholders on the project, and an internal stakeholder group was created on the Power Potential DSO transition to business as usual. Further details are presented in the WS3 section of SDRC 9.4.

National Grid internal engagement

Within the NGESO directorate, a weekly newsletter, *Soundbites,* is circulated. The project has been included in this communication when we have had any project successes, (for example in Figure 9, overleaf).

Figure 9: Example of NGESO's internal newsletter where the project team share success stories/updates.

12.IPR

To meet the requirements to publish Intellectual Property (IP) developed within this project, National Grid ESO and UK Power Networks notify the project manager promptly after identifying any joint result that it believes to be patentable or capable of protection by any other similar registered IPR.

National Grid ESO or UK Power Networks may apply for any number of patents or other protection in the respect of the joint results. Such applications may be filed in the name of National Grid ESO and UK Power Networks and their employees may be named as inventors or co-inventors in any such patent application. Up to 30 November 2019, the following IPR has been generated:

Table 5: IPR up to 30 June 2019

Workstream	IP description	IPR Owner
WS1	TDI 2.0 solution requirement specification document	UK Power Networks
WS1/2	DER Operating Characteristics document	National Grid ESO and UK Power Networks
Project	Project Handbook	National Grid ESO and UK Power Networks
WS1/2	Use cases Definition	National Grid ESO and UK Power Networks
WS2	Communication and DER Engagement Plan	National Grid ESO and UK Power Networks
WS1/2/3	SDRC 9.1 report	National Grid ESO and UK Power Networks
WS1/2	Functional and non-functional requirements for TDI 2.0 technology solution	National Grid ESO and UK Power Networks
WS1/2/3	SDRC 9.2 report	National Grid ESO and UK Power Networks
WS1/2/3	SDRC 9.3 – Commercial Tendering Process Report and Finalised Trials Approach	National Grid ESO and UK Power Networks
WS1	Detailed Design for the DERMS Solution	ZIV, UK Power Networks and National Grid ESO
WS1/2	SDRC 9.5 Cost Benefit Analysis Report	National Grid, UK Power Networks and Cambridge University
WS1	Power Potential Test Strategy	UK Power Networks
WS1/2/3	SDRC 9.4 Customer Readiness Report and Performance of the Technical Solution in a Controlled Environment	National Grid ESO and UK Power Networks
WS4	Mandatory and Optional trial guideline documents	National Grid ESO and UK Power Networks

The following IP is forecast to be generated in the next reporting period:

Table 6: IP forecasted to be generated in the next reporting period

Workstream	IP description	IPR Owner
WS4	SDRC9.6 – Trials Report	National Grid ESO and UK Power Networks
WS2/3	SDRC 9.7 – DSO risk-reward framework for providing wider system services	National Grid ESO and UK Power Networks
WS1	Learning from DER commissioning for Power Potential	UK Power Networks

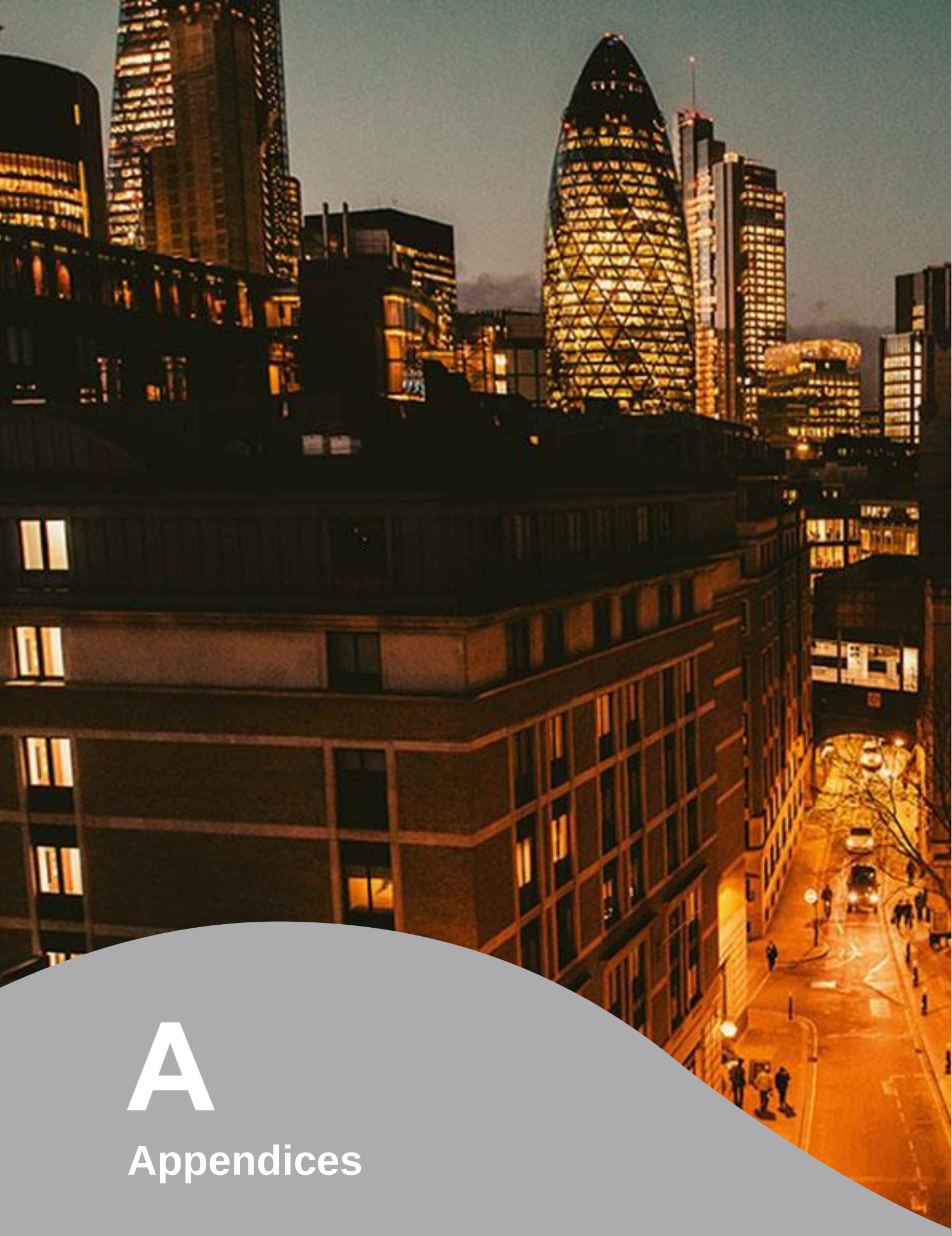
13. Risk Management

A robust project structure and governance process means that any potential issues or changes that could affect project delivery are identified quickly and actions are put in place to resolve them. The risk register is attached as Appendix A.

14. Accuracy Assurance Statement

This progress report has been produced in agreement with the entire project hierarchy. The report has been written and reviewed by all project partners. The report has been approved by Graham Stein, Network Operability Manager on behalf of Julian Leslie, the project sponsor. Every effort has been made to ensure all information in the report is true and accurate.

Graham Stein,
Network Operability Manager
NG ESO



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Appendices

Appendix 1: Risk Register

Two risk tables are presented below:

1. Table 7: Status of risks from the original bid document
2. Table 8: Additional risks identified and managed during project delivery

Table 7: Status of risks identified in the original bid submission

Risk #	Area/theme	Risk & Impact description	Mitigation/Update	Status
1	General	Final funding not awarded.	Funding secured.	Closed
2	General	Significant changes to South East Coast network make the TDi2.0 solution no longer suitable.	Future developments and scenarios considered and the solution continues to be relevant.	Green
3		Number not used.		
4	General	Insufficient resources allocated to the project.	Project plan developed and actively managed. Partners committed to resourcing delivery of key project milestones. Contingency fund overseen by Steering Committee.	Closed
5	General	Loss of key staff delays delivery.	Ensure project handbook and file sharing systems are in place and ongoing engagement with team managers across both partners.	Green
6	Technical	Technical limitation of ICCP interoperability between National Grid ESO and UK Power Networks cannot deliver required data transfer causing delay.	Detailed analysis undertaken of options and Steering Committee has closed this risk, agreeing use of web services.	Closed
7	Technical	Specification of the technical solution is insufficient to deliver requirements.	Specification developed with subject matter experts from across both project partners to ensure that it is fit for purpose.	Closed
8	Technical	Control system fails to perform leading to unsatisfactory trial results.	Control system to be subject to performance testing using benchmarking or simulations under various operating conditions.	Closed
9	Technical	Interoperability issues may delay response and reduce ability to control the system.	Agreed common standards for components and interface protocols.	Amber

Risk #	Area/theme	Risk & Impact description	Mitigation/Update	Status
10	Commercial	Risk that 5 DER / 40 Mvar volume will not be recruited and commissioned in time for the trials	Ongoing engagement has enhanced the commercial proposition and increased the value of the payments to DER budget for the trials.	Closed
11	Commercial	Volume and price risk associated with each DER's sensitivity to transmission constraint it is being asked to alleviate.	Payments to DER fund in place and value increased to bolster commercial proposition.	Closed

Table 8: Additional risks identified and managed since bid submission

Risk #	Area/theme	Risk & Impact description	Mitigation/Update	Status
12	General	Ways of working at each partner creating silos.	Progress made to develop productive way of working across partners.	Closed
13	General	Project is disjointed.	Project handbook developed, weekly cross-partner workstream meetings and monthly steering committees established.	Closed
14	Finance	Budget not agreed between partners.	Budget split between partners agreed.	Closed
15	Technical	CIM integration takes longer, delaying project	Revised project delivery plan agreed with interim approach to reduce delays to trials.	Closed
16	Commercial	Delay in producing detailed workstream plan risk project delay.	Detailed project plan in place with dependencies mapped to other workstreams.	Closed
17	Technical	Risk that SDRC9.1 scope definition is compromised and not delivered in full.	SDRC9.1 delivered on time and to scope/quality.	Closed
18	Technical	CIM Export too costly or cannot be delivered.	Budget for costs has been agreed. Delivery plan rescheduled to allow more time for CIM Export delivery without delaying trials.	Closed
19	Technical	SDRC9.1 not delivered on time as regulatory and business review takes longer than anticipated.	Parallel reviews with National Grid ESO and UK Power Networks' management/regulatory teams. Delivered on time and to scope/quality.	Closed

Risk #	Area/theme	Risk & Impact description	Mitigation/Update	Status
20	Commercial	The project does not have a joint communication plan for the projects participants.	National Grid ESO and UK Power Networks carrying out joint engagement and weekly meetings ensure good co-ordination agreed to close this risk, November 2017. Communications and engagement plan produced and the plan has been approved by National Grid ESO and UK Power Networks' communication teams.	Closed
20a	Commercial	Risk that aggregators see UK Power Networks as a competitor	Engagement with DERs to clarify roles and responsibilities of partners, including through published documentation. Ongoing consideration of this risk to progress though discussion on migration to business as usual for the SDRC9.6 report.	Green
21	Commercial	Risk of rushed procurement before agreement of proposed solution.	Technical solution requirements and design completed before publication of the Framework Agreement and Market Procedures documents for DER to participate in the trials. Procurement of service is now planned for day ahead, rather than a year in advance, therefore agreed to close this risk.	Closed
22	Commercial	Resourcing delivery of TDI 2.0 and RDP projects at same time.	Resourcing between the two initiatives has been resolved.	Closed
23	Commercial	Misalignment of TDI 2.0 and RDP deliverables.	Liaison between the two initiatives is well established. Technical, commercial and PMO linkages in place.	Closed
24	Commercial	Provision of services by DERs to National Grid via UK Power Networks is insufficient to measure impact at GSP	40 Mvar combined volume of DER participating in the trials has been set as a goal by the Steering Committee, to ensure sufficient volume to measure impact.	Closed
25	Commercial	Insufficient recruitment of DER for the project trials.	DER recruitment on going, with positive response to published Framework Agreement and Market Procedure.	Closed

Risk #	Area/theme	Risk & Impact description	Mitigation/Update	Status
26	Technical	There is a risk that analogue values polled from RTUs may reflect inaccurate values.	UK Power Networks analysis undertaken of bad data and engagement with Asset Management team to agree a way forward. Action to refresh the PowerOn system with correct lines data from planning tool underway. Ongoing risk to keep under review.	Closed
27	Technical	There is a risk that tap changer control in both SGTs and Grid (distribution) transformers is not adequate for the project.	Evidence within available information demonstrates that this is not critical for minimum viable product, but will be considered for next stage.	Closed
28	Technical	There is a risk that the time delay in measurements of parameters of the 400kV system to the DERMS is too long.	This issue is being addressed through the detailed design discussions and technology solution specification. Initial testing NGESO-PowerOn-DERMS on pre-production indicated data transfer in around 1ms.	Green
29	Technical	There is a risk that the time delay in an instruction sent to the DER from DERMS is too long (more than 10 seconds).	This issue is being addressed through the detailed design discussions and technology solution specification.	Green
30	Technical	There is a risk that the intensity and duration of WS1 activity needs more NG SME input than budgeted for	January 2019 – Steering Committee approved additional resource from contingency budget to cover NGESO costs.	Green
31	Commercial	There is a risk that the commercial proposition is not compelling enough to persuade DERs and Aggregators to participate in the project.	Risk closed as adequately covered by Risk 9 Webinar held 21 September and concerns captured. 1-2-1s to be proactively sought. Guidance to be adapted and published online.	Closed
32	Technical	There is a risk that the IS Vendor (ZIV Automation) cannot deliver the detailed design and build of the solution envisioned by the project team.	Risk ongoing and to be reviewed regularly. Walk-through of revised detailed design for the interim solution is complete. Full solution design agreed. Progress is being made, but not fully resolved yet.	Amber

Risk #	Area/theme	Risk & Impact description	Mitigation/Update	Status
33	Technical and commercial	There is a risk of insufficient sharing of data between the project partners.	To be kept under review and within consideration of regulatory requirements.	Green
34	Commercial	Adding secondary optimisation may impede delivery of the project's Minimum Viable Product.	Agreed that secondary optimisation is out of scope for the project's MVP, whilst agreeing to explore options for inclusion without detriment to MVP.	Closed
35	Business readiness	There is a risk of delay if workstream 3 leads are not identified and mobilised in time.	Workstream leads confirmed and delivery plans included within project plan.	Closed
36	Robust plan	There is a risk that the project plan is not effectively driving delivery.	Re-planning underway following delays to delivery and ongoing revision of logic of critical dependencies.	Amber
37	Commercial	There is a risk that DER will be deterred by the uncertainty regarding how trials will work during 2019/20.	Market Procedure and market calendar for the trials have been published, giving greater visibility of the approach. Engagement ongoing.	Amber
38	Commercial	There is a risk that we do not have enough budget to deliver the success criteria for DER recruitment.	Steering Committee approved revising the level of contingency allocated to boosting payments to trial participants, reflecting the latest forecast participation level. Publication of the commercial proposition for the trials has been well received.	Green
39	Commercial	There is a risk that the RMAP advocates a different approach to that planned within the trials.	Engage RMAP on developing approach and consider their feedback in finalising the project's approach. Framework Agreement and Market Procedure now published.	Closed
40	Technical	There is a risk that the IS architecture elements of the detailed design cannot be agreed.	Architecture has been signed off.	Closed
41	Technical	There is a risk that the testing schedule risks delay in delivering SDRC9.4 and the start date for trials.	Review testing requirements for SDRC9.4 (i.e. testing in controlled environment). Align plan with proposed trial design (start dates).	Closed

Risk #	Area/theme	Risk & Impact description	Mitigation/Update	Status
42	Technical	There is a risk that the project approach to large embedded generators is not agreed.	Steering Committee agreed to engage large embedded generators to gauge their interest. MW despatch to remain under ENCC (NG) control. Mvars despatch to be considered through DERMS.	Closed
43	Technical	There is a risk of not having proper Transmission and Distribution data to develop DERMS solution.	Detailed plan developed and progress is being tracked through the project's Technical Question governance approach (Reference "TQ8"). The Technical question approach is used to raise and track resolution of outstanding technical design issues.	Closed
44	Technical	There is a risk that PAS-DERMS interface delivery increases project costs or risks.	Plan and costs agreed for this activity.	Amber
45	Commercial	There is a risk that SDRC9.3 is not delivered in full and on time.	Delivered on time and to quality/scope.	Closed
46	Commercial	There is a risk of not having clear idea about the interface for Aggregators.	Steering Committee agreed that aggregator approach cannot now be pursued through the available project timescale and budget.	Closed
47	Commercial	There is a risk that the project will incur costs without securing trial results data and insight (if the trials are cancelled after DER complete commissioning tests).	Raised at 24 May Steering Committee and risk accepted in order to bolster commercial proposition to DER participants.	Amber
48	Technical	There is a risk that Active Network Management (ANM) in the project area affects performance or on-time delivery of DERMS.	Commitment by ANM project to fund any relevant costs.	Green
49	Technical	There is a risk that the GE CIM export may not be fully tested and may not be compatible with ZIV algorithms/or delay in providing the export.	Project delivery plan rescheduled to minimise delay to the trials caused by delay in CIM Export readiness. Initial GE CIM export accepted and transformed by ZIV in March 2019. IS transfer solution to deliver multiple CIM	Amber

Risk #	Area/theme	Risk & Impact description	Mitigation/Update	Status
			extracts to be delivered in December 2019.	
50	Technical	There is a risk that DERMS produces inaccurate results due to poor quality data.	A data correction solution has been investigated, tested and rolled out across the whole trial area.	Closed
51	Technical	There is a risk that DERMS produces inaccurate results due to incorrect inputs. (Data quality – transducers).	Data risks reviewed in order to reframe them more effectively.	Closed
52	Technical	There is a risk that DERMS produces inaccurate results due to incorrect inputs (data quality – PowerOn).	1) Key aspects of PowerOn operational model have been updated from PowerFactory (planning model) 2) Plan for dealing with missing directional data in PowerOn – being addressed as part of state estimation.	Amber
53	Technical	There is a risk that the intensity of activity proposed during build/test in 2018 cannot be fully resourced by the available team.	Additional UK Power Networks resource secured for testing and integration.	Green
54	General	There is a risk that SDRC9.4 delivery is delayed by technical, commercial and/or business readiness.	Delivered on time and to quality/scope.	Closed
55	Technical	There is a risk that the PowerOn upgrade (version number POA 6.4.1) will be delayed, including functionality that DERMS requires to get automatic update of the CIM network model.	Priority – liaise with GE and UK Power Networks control room to determine scale of delay, implications of running DERMS before the POA 6.4.1. Upgrade to PowerOn. To investigate whether it may be possible to manually update the CIM model on monthly basis. Update – PowerOn Advantage upgrade delivered July 2019.	Closed
56	Technical	There is a risk that no mobile controllers will be available for use in the test lab and this part of the solution will not be	Mobile controller purchased, therefore risk is closed. Also five customer DER controllers were brought to lab for testing.	Closed

Risk #	Area/theme	Risk & Impact description	Mitigation/Update	Status
		used or tested until SIT starts in February 2019.		
57	General	There is a risk of SDRC9.5 not being delivered on time and with the required scope and quality.	SDRC9.5 delivered on time and to quality/scope. Notified Ofgem of the need to delay publication until completion of the project trials to avoid distorting commercial behaviour of participants during the trials	Green
58	General	There is a risk of the 12-monthly report not being delivered on time and with the required scope and quality.	Plan for drafting, review and approval agreed.	Green
59	Communication	There is a risk that insufficient planning and focus result in a poor 30 October Showcase event.	Plan agreed and Tracked. Success event delivered.	Closed
60	Commercial	Risk that migration to BAU will be delayed due to the requirement for different commercial arrangements.	Work underway to develop detailed plan for migrating participants to an enduring solution once the trials finish in 2020. This includes mapping what different approaches might be required for BAU (versus those in the trial), to minimise delay. Also acknowledge to all stakeholders that this is an innovation project and there is an underlying risk that the project may not be successful.	Red
61	Technical	There is a risk that implementation of new Volt Select 400kV SCADA points from National Grid ESO into UK Power Networks' systems is not successfully completed.	The design was progressed through the project's Technical Question governance approach (reference to this risk is "TQ4") and was delivered in 2019.The Technical question approach is used to raise and track resolution of outstanding technical design issues.	Amber
62	Technical	There is a risk that PAS testing does not meet project objectives on time/in full that ensure nomination, dispatch and settlement functionalities within DERMS.	Discussion held with ZIV and National Grid ESO to agree PAS testing strategy after process definitions are closed (i.e. paper walkthrough meetings). PAS-DERMS pre-production connectivity proven end August	Amber

Risk #	Area/theme	Risk & Impact description	Mitigation/Update	Status
			2019. PAS-DERMS business logic testing still to be scheduled.	
63	Not in use			
64	Not in use			
65	Technical	There is a risk that in real time the DER technical availability volume of the reactive power service is inaccurate.	Likelihood and impact deemed low given volume in trial. Mitigation include % of plant in service available signal in list of mandatory signals. Need a process to utilise this in future.	Green
66	Business processes	Risk that the workstream 3 plan does not adequately cover the risks associated with the Staged Delivery approach.	National Grid ESO and UK Power Networks teams have revised workstream 3 plans for interim and full solution and migration to BAU and appraised the risks for each of these.	Green
67	Trials	There is a risk that the project risks during the trial delivery phase are not fully documented.	To be developed by the Trial manager at each partner before trial delivery.	Amber
68	Business readiness	There is a risk that the new Power Potential service software and displays may not be installed in the Control Room in time for the trials.	Included within Control Room calendar for 2019.	Green
69	Business readiness	Risk that the detailed documentation for despatch is not ready on time.	Project lead and despatch lead to walk-through WS3 requirements for interim, full and fall-back manual solutions.	Amber
70	Business readiness	Risk that control room personnel are not trained to use the Power Potential service in time.	Training has begun and further training will be scheduled before each phase of trials.	Green
71	Business readiness	Risk that the business procedure and detailed documentation for nomination is not ready in time.	To revise plan for WS3 nomination to reflect staged Delivery plan.	Amber
72	Business readiness	Risk that nomination personnel are not trained to use the Power Potential service in time.	To revise plan for WS3 nomination to reflect staged Delivery plan.	Amber

Risk #	Area/theme	Risk & Impact description	Mitigation/Update	Status
73	Business readiness	Risk that the business procedure and detailed documentation for settlement is not ready in time.	Business procedure agreed, Standard Operating Procedure in development.	Amber
74	Business readiness	Risk that settlement personnel are not trained to use the Power Potential service in time.	To revise plan for WS3 nomination to reflect staged Delivery plan.	Amber
75	Business readiness	The testing and training manual for PAS are not ready in time.	PAS team at NGESO to schedule time to develop training manual and delivery training for operational teams for the trials.	Amber
76	Commercial	There is a risk that the active power service being trialled under Power Potential will not align with future EU regulation I (TERRE).	Commercial analyst is investigating the commercial requirements for the Trans European Replacement Reserve Exchange project (TERRE) in order to map against the project approach and establish if there is an issue and how to address.	Amber
77	Commercial	There is a risk that the methodology to test DER capability strays beyond the specification currently drafted in DER Technical requirements	Test specification now written. UK Power Networks committed to only test requirements set out in the DER Requirements. NGESO reviewed the test specification.	Closed
78	Commercial	There is a risk that DER are deterred from involvement in the project due to inconsistent messages from the project team.	FAQs in place as well as agreeing key messages and approaches in 1-2-1s beforehand.	Closed
79	Trials	There is a risk that the trials do not give enough data to provide an adequate conclusion of trial success.	The duration of trials, the number of DER participants and their reactive power capability have all been carefully considered to ensure sufficient data can be captured during the trials.	Green
80	Trials	There is a risk that generator dispatch impacts trial length or data to determine trial success.	Pre-trial training and monitoring activity during the trials will seek to ensure despatch are fully briefed on the trial service approach and encouraged to deploy the service, where appropriate.	Green

Risk #	Area/theme	Risk & Impact description	Mitigation/Update	Status
81	Technical	There is a risk that DER effectiveness for prolonged impacts on voltage is nullified by tap changers (identified from customer's test).	1. Share DER list with Outage Planning and request that taps locked for duration of Trial. 2. Discuss design decision with NGESO and then with customer. 3. Plan to program tap changer optimisation in ZIVs algorithm for BAU.	Amber
82	Technical	Risk of trial delay when migrating from the interim technical solution to the full solution.	Testing of the full solution before migration has been scheduled during the initial wave of trials (using the interim solution) to reduce risk of delay	Red
83	Technical	There is a risk that the project solution may not be compliant with the Electricity Balancing Guidelines (EBGL) for December 2019.	Reviewing whether existing PAS solution for EBGL for the PAS-STOR delivery is also appropriate for Power Potential	Red
84	Trials	Risk of lack of resource from requirements and nomination to deliver the Wave 2 and 3 trials.	Colleague identified at NGESO to lead on requirements and nomination	Amber
85	Technical	Risk on co-ordination of specific point testing for communications.	Plan to have one test environment for each of the pre-production and production set-up of the technical solution	Green
86	Technical	Risk of delay if GE fail to deliver RTU Logic on time.	Detailed planning with GE to ensure tracking against key delivery dates	Amber
87	Trials	Risk that trials take place at time that historically has low service requirements	Review trial calendar and implications on likely operational scenarios occurring.	Green
88	Technical	Risk that test platform resource to commission not available on time	Delivery rescheduled with test resource allocated.	Green
89	Commercial	Risk of delays to DER signing Framework Agreement and variation to Connection Agreement	FAQs developed to address common questions and ongoing stakeholder engagement to close out queries	Green
90	Commercial	Delay in DER studies	Contractor resource in place to facilitate efficient progress of DER studies	Amber

Risk #	Area/theme	Risk & Impact description	Mitigation/Update	Status
91	Technical	Risk that the SCADA data quality is poor	For trial, data correction algorithm to be applied (see risk 50). For BAU, state estimator approach to be implemented – initial version implemented as described in SDRC 9.4	Amber
92	General	Risk of a freeze in system changes during Brexit transition	Corporate contingency planning has established potential two week freeze in system change if a dis-orderly Brexit takes place.	Amber
93	Financial	Insufficient budget to deliver project due to extended project duration	Steering Committee approved allocation of contingency and business funds to enable delivery of the extended project through to completion and close-down in 2020	Amber
94	Technical	PAS-DERMS interface risks	Delivered – PAS-IIB-DERMS connectivity test completed end August 2019	Closed
95	Technical	Risk of delay to IIB / ESB solution delivery	Delivered – PAS-IIB-DERMS connectivity test completed end August 2019	Closed
96	Technical	Risk of project not being given high enough priority to mobilise UK Power Networks resource	Continuous monitoring with operational teams and against other projects, including escalation to senior management	Amber
97	Technical	Risk of Outage Planning activity being delivered late	Risk to Full solution (considering synergies with the UK Power Networks Network Vision project), activity for DERMS Interim Solution already delivered	Amber
98	Technical	Risk of delay in securing release of the User Interface design	DER user interface being design specified in early 2019 for all waves.	Closed
99	Technical	Risk of delays to ICCP readiness	ICCP links delivered summer 2019	Closed
100	Technical	Risk of delays in ICCP-PowerOn-RTU	ICCP-PowerOn-RTU signal integration proven	Closed

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