Issue 02

Transmission & Distribution Interface 2.0

(TDI 2.0)

Bi-Annual Progress report

July – December 2017

Contents

1. Executive summary

The Transmission and Distribution Interface 2.0 (TDI 2.0) project aims to create market access for Distributed Energy Resources (DER) to participate in ancillary service provision to National Grid via UK Power Networks' coordination. It is envisaged that the services provided by DER will alleviate both transmission and distribution constraints, unlocking whole systems benefits such as additional generation capacity and operational cost savings to customers. The project's approach will be trialled on the South East coast network where a significant uptake of low carbon energy resources has meant that technical constraints in the area are now having an effect.

This second 6-monthly report covers July to December 2017. It provides a summary of progress across all project workstreams, finances, communications and risks.

The TDI 2.0 project is on track. Substantial progress has been made in the detailed design of the TDI 2.0 solution and service, in line with the project plan and as evidenced in the SDRC9.2, to be published in January 2018. Throughout this period the primary focus of the project has been to complete the detailed technical and commercial design of the project and articulating the functional and non-functional requirements of the technology solution. This activity has ensured that the project is on track for moving to building and testing the technology solution in 2018 and delivering the trials in 2019.

Since July, the key milestones completed included:

- signing of the contract with ZIV Automation[1], the project's technology solution developer;
- completion of detailed technical requirements;
- agreement of detailed non-functional (Information System) requirements;
- mapping the detailed commercial requirements for the technology solution;
- undertaking workshops and close working with ZIV Automation to ensure that ZIV can translate the requirements into a detailed design solution;
- engagement with DER to consult on the commercial framework and encourage participation;
- presentation of the planned commercial framework for the trials to DER;
- signing contracts with Cambridge University and Imperial College for academic research activity to support the commercial workstream; and
- engagement with electricity system value chain stakeholders through conference presentations and the upgraded project website[2].

The project's innovation challenge for 2018 is the build and testing phase, translating the functional and non-functional requirements within the detailed design into a technology solution. This needs to provide the expected functionality and demonstrate its effectiveness through testing. Achieving this will be a major focus throughout 2018. This will require an ongoing focus on the project plan, risks, resourcing, budget and contingency through the lens of what scope is critical to deliver the project's objectives.

The project is focussed on the South East Coast area of England, where the project team has proactively engaged with DER and aggregators. The team has consulted on the development of the technical and commercial design. Meeting one-to-one and using webinars, the team has provided potential participants with early visibility of the proposed approach. It also allowed the team to understand what information they should provide to DER to help them to develop their commercial proposition to take part in the trials.

[1] https://www.ziv.es/
[2] https://www.nationalgrid.com/uk/investment-and-innovation/innovation/power-potential

Capacity to connect more generation in the South East of England covered by the project, namely Grid Supply Points (GSPs) in Canterbury, Sellindge, Ninfield and Bolney, is restricted due to upstream constraints on National Grid's transmission network. The constraints National Grid faces in this area have been triggered by the previous growth in low carbon technologies connecting to the distribution network and can be summarised as:

- high voltage in periods of low demand;
- low voltage under certain fault conditions; and
- thermal constraints during the outage season.

These constraints have led to the following challenges in the area:

- fewer low carbon technologies can connect to the network;
- a high risk of operational issues in the network which could affect customers; and
- a high cost of managing transmission constraints.

In order to provide voltage support in the area, increasing reactive compensation is needed. DER connected to the distribution network have the potential to provide reactive and active power services to the transmission system. TDI 2.0 seeks to give National Grid access to resources connected to UK Power Networks' South Eastern network to provide it with additional tools for managing voltage transmission constraints.

The TDI 2.0 project will include the creation of a regional reactive power market which will be the first of its kind in the Great Britain and help defer network reinforcement needs in the transmission system.

The project will help enable more low carbon resources to connect in the South East and give new and existing DER with the opportunity possibility of providing services to National Grid and accessing additional revenue streams. Services procured from DER will be coordinated such that operation of the distribution and transmission networks are kept within operational limits and constraints are not breached. When deployed, TDI 2.0 is expected to deliver:

- 3,720 MW of additional generation in the area by 2050
- Savings of £412m for GB consumers by 2050

2. Project Manager's Report

This is the second progress report, covering the period of July to December 2017. The technical workstreams (WS1), commercial workstream (WS2) and business processes (WS3) workstreams are progressing to plan. The fourth workstream (WS4) is the project trials, which are due to start in January 2019.

Work to complete the resourcing of the project team has progressed substantially, led by the commitment of National Grid and UK Power Networks senior staff and the steering committee. This has ensured that the project has the right resources in place to deliver the project's objectives. National Grid has made more resource available to deliver the commercial workstream with a Commercial lead and a Commercial Analyst joining the project team this period. UK Power Networks appointed a new technical workstream lead, a new commercial lead and secured project management resource after the previous project manager left the project. Interim resources have been deployed where necessary to fill gaps during the recruitment process.

The table 1 presents an overview of the project achievements so far.

What we set out to do	What we have achieved to date
Agree the functional requirements for the technology solution.	Completed and mapped the detailed functional requirements
Agree the non-functional (Information System) requirements for the technology solution.	Non-functional requirements agreed by National Grid & UK Power Networks IS teams and the project Technical Design Authority
Agree the commercial requirements for the technology solution	Commercial requirements mapped and added to the detailed design requirements.
Contract agreement with the selected vendor of the technology solution	Contract signed between UK Power Networks and ZIV Automation. Delivery underway to develop the technology solution.
Define the solution architecture and system communication interfaces	Mapped the DERMS software architecture and the communication interfaces with other applications within UK Power Networks and National Grid. This will be shown within the SDRC9.2 report.
Develop the detailed commercial framework	The commercial framework has been developed and consulted upon through the DER webinar and 1-2-1 meetings. It will be reported within the SDRC9.2 deliverable.
Engagement with DER to consult on the commercial framework	Webinar held 21 September with DER and aggregators to present the project's 'minded to' commercial framework and 1-2-1 meetings held. Guidance document[3] and webinar materials[4] published.

3 https://www.nationalgrid.com/sites/default/files/documents/Power%20Potential_Guide%20to%20participating_September%202017_0.pdf

What we set out to do	What we have achieved to date
Agree contract between National Grid and Imperial College	Contract signed and delivery underway.
Agree contract between National Grid and Cambridge University	Contract signed and delivery underway.
Identification of high level business process that will operate the solution.	Both project partners have collaborated to produce a mapping of the high level business processes
Identify how TDI 2.0 solution will impact existing and planned business processes.	The key business processes and stakeholders potentially impacted by the project and the TDI 2.0 solution have been identified and the project team has engaged to explore how it will impact existing and planned processes.
Complete resourcing of the project team	Appointments have been made to key technical and commercial roles within both National Grid and UK Power Networks' project teams.

Table 1: Overview of the current reporting period achievements

Progress in project delivery is described in the following sections:

2.1 Workstream 1 Technical Delivery (WS1)

Workstream 1 Technical Delivery (WS1) is responsible for making certain that the technical platforms required for the project are designed, built, tested and delivered on time and to budget for the trials.

Substantial progress had been made and key deliverables are detailed within the SDRC9.2 report, due in January 2018.

During this reporting period ZIV Automation (solution technology supplier) has been appointed to design, test, and implement the Distributed Energy Resource Management System (DERMS). The workstream has been working closely with ZIV Automation (ZIV) to ensure that the project requirements are fully understood by ZIV to enable them to deliver the detailed design phase. They are developing a detail design for DERMS, which is being reviewed by the project team and is scheduled to be approved by the project Technical Design Authority by January 2018.

With input from UK Power Networks and National Grid, ZIV have developed a series of draft designs. However, this has required additional project team resource to review extra drafts and attend additional workshops with ZIV to ensure that delivery remains on track. This design is documented in the SDRC9.2 report. The main sections of the design are:

- DERMS functional design definitions;
- DERMS software architecture and the interfaces with other applications within UK Power Networks and National Grid;
- IT infrastructure architecture; and

[4] https://www.nationalgrid.com/sites/default/files/documents/Power%20Potential%20webinar_21%20September%202017.pdf and https://www.nationalgrid.com/sites/default/files/documents/Power%20Potential%20webinar%20summary_September%202017.pdf

- Communication interfaces DERMS requires between National Grid, UK Power Networks and DER,

In parallel, the workstream has been agreeing the scope of work with General Electric (GE) for the electrical network model data extract from UK Power Networks' control system (PowerOn) in CIM format. This network model will be the fundamental input into DERMS to reflect accurate network changes at both National Grid's and UK Power Networks' electrical networks.

In the background, UK Power Networks have been conducting an exercise to analyse the quality of electricity networks' analogue values and are working on a plan to improve the data quality at source. Initial analysis indicates some adjustments are required to assets at substation level to increase confidence in data accuracy. This part of the project will ensure good quality data will be input into DERMS via the CIM export capability from PowerOn.

A key challenge identified during this period has been that of coordination of workshops and meetings required to discuss the design. This has been difficult due to the geographical locations of each stakeholder; ZIV are based in Ireland, National Grid's key representatives are based in Warwick and UK Power Networks' teams are operating from London. This challenge has been managed by having regular conference calls and organising a series of face to face workshops in a short period of time.

In the next reporting period, the workstream will focus on finalising the detailed design of the technical solution where decisions have not been concluded and enter the development phase of DERMS. This will include:

- Finalising detailed Design Specification from the technology platform vendor;
- start development in agile fashion to release and validate different functionalities at relevant stages;
- agree the testing strategy for the project;
- commence procurement of the testing environments and configuration of them in readiness for accepting DERMS software; and
- testing the software as it is released by ZIV's agile plan.

In summary, workstream 1 has remained on track with the planned deliverable dates for completion of the detailed design by the end of December 2017 in readiness for the development and testing of DERMS to commence during the next reporting period.

In 2018 workstream 1 will focus on the build and testing phase for the technology solution. This means overseeing and supporting ZIV in their translation of the detailed functional and non-functional requirements within the detailed design into a technology solution. This needs to provide the expected functionality and demonstrate its effectiveness through testing. This will require an ongoing focus on the project plan, risks, resourcing, budget and contingency through the lens of what scope is critical to deliver the project's objectives.

2. 2 Workstream 2 (WS2): Commercial framework

The commercial workstream is responsible for the design and development of a route to market for DER to deliver reactive power to National Grid as transmission network System Operator (SO) and constraint management to both National Grid and UK Power Networks.

Substantial progress had been made during this period and full details of deliverables are provided within the SDRC9.2 report, due in early January 2018. A summary is provided in this section, with key progress including:

- developing the commercial framework for the project trials;

- consulting DER and aggregators on the commercial framework during its development;
- understanding the perspectives of owner and aggregators of different DER types;
- defining a greater level of detail for the commercial proposition;
- establishing and communicating the value of historic reactive power;
- articulating the impact of DER location on the forecast effectiveness of service delivery at Grid Supply Point, through the creation of heat maps;
- establishing the commercial requirements of DERMS; and
- signing contracts with Cambridge University and Imperial College to undertake academic research to support the commercial workstream.

Image 1: The project's commercial workstream team has undertaken face-to-face meetings with DER and aggregators (here with Reactive Technologies)

Common themes arising from the consultation activity with DER have included:

- the ease of accurately forecasting the volume that would be available, particularly for active power (MW);
- metering requirements for verification of service delivery;
- interaction with other services or agreements; and
- the distinction between availability instructions and arming instructions for reactive power (Mvars).

A fundamental principle of the project is that the services will be procured through a market-based solution. As such, DER will be paid on the basis of the bids they submit in the tender, as opposed to

receiving a pre-agreed price. National Grid, UK Power Networks and commercial specialist contractor Baringa have worked to develop payment structures that aim to both deliver the project objectives and respond to DER and aggregator consultation feedback.

Historic requirements for reactive power have been analysed and shared, demonstrating the frequency, volume and value of service needed in the project area in previous years. Prospective participants shared details of what information would be most valuable to develop their commercial proposition to participate in the project trials. Issues such as the scale, frequency, duration and value of services were important factors in addition to the technical specifications to be able to participate (and the cost of installing these measures, if the DER does not already meet these requirements). Two particular considerations have been; how far ahead of service delivery would the service be tendered and the balance of payment structure between DER availability, utilisation and other factors.

However, it has been noted by some stakeholders that by not offering longer-term contracts it will be a challenge either to secure approval to undertake site works, or to engage potential participants or customers (particularly in the case of aggregators). DER and aggregators consulted to date believed that participation by assets should be feasible where there is little or no change required to their systems, or where the information on possible utilisation of services provides sufficient reassurance to encourage participation.

The project remains open to the possibility that further reassurances (through alternative or additional payments or by offering longer-term volume commitments) may be necessary to encourage wider trial participation. This needs to be considered in conjunction with the principle that this trial should be able to transition to business as usual.

The commercial workstream team have also made progress in consideration of other key factors within the commercial approach, such as how under-delivery of service by participating DER will be treated during the trials and how to deal with situations where DER are providing multiple services.

At a high level the commercial data and financial flows comprise of the following steps:

- **Pre-tender qualification**: validating that DER are able to provide the required services and populating the DERMS with technical data regarding the assets;
- **Bid submission:** DERs submit bid prices and volumes for each service in which they wish to participate the following day;
- **Bid stacking:** DERMS collates the bids, accounting for DER effectiveness and any distribution network constraints, and passes the bid stack to National Grid;
- **Bid acceptance:** National Grid assesses the bid stack against its other constraint management or reactive power options, and (if economic) accepts a proportion of the stack up to 100%, indicating this acceptance to the DERMS, which in turn indicates acceptance to the relevant DER;
- **Arming signal:** a reactive arming signal will be sent to those DERs who are held available for that period, providing instruction. For active power, a dispatch signal will only be sent when the MW are required;
- **Post-event verification:** on a monthly basis, DER will provide the DERMS with metering data (or similar) demonstrating their behaviour during the availability windows. In the case of under-delivery, a performance-related adjustment may be required; and
- **Settlement and payment:** UK Power Networks informs National Grid of any performance-related adjustment, and requests the appropriate payment for the preceding month's services. UK Power Networks then pays the corresponding DERs their payments, accounting for any performance-related adjustments.

The commercial workstream is also leading on research being conducted under contract by the University of Cambridge and Imperial College addressing four themes:

- Modelling to determine the most cost optimal solution for commercial contracts (of different durations) taking into account system condition driven changes;
- Evaluating the commercial synergies between distribution and transmission systems and understanding the value of reactive power to the DSO;
- Identification of a best practice conceptual market applicable to DERs; and
- A full cost benefit assessment of the project and the proposed solution.

The next phase of the project will focus on finalising the commercial arrangement – including establishing a robust settlement approach – 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.

2.3 Workstream 3 (WS3): Business Change

The key business processes and stakeholders potentially impacted by the project and the TDI 2.0 solution were identified in January to June 2017 and since July the project team has engaged to explore how it will impact existing and planned processes. The project team has shared the goal of TDI 2.0 with internal stakeholders and the benefits this will bring to system stability and cost control as we transition to a low carbon system. The project team are maintaining dialogue throughout the project to plan for the future and to identify and mitigate issues and risks. Training plans created to ensure new tools and processes are adopted effectively.

The trial period will begin in 2019 hence all training is planned to take place in 2018. Building of the solution is scheduled from January to June 2018 while testing phase will be from June to December 2018. Training will impact existing work priorities so management endorsement is critical in order to ensure new tools and process are adopted effectively.

Further details of key business processes and stakeholders impacted by the project are provided within the SDRC9.2 report.

2.4 Project steering committee

The project Steering Committee has met monthly throughout the reporting period through a combination of physical and virtual meetings / teleconferences with senior managers of UK Power Networks and National Grid. A standing agenda ensures that actions raised are addressed, financial performance reviewed, key risks discussed, each workstream presents progress against plan and project communications discussed. In addition to the standing agenda, the Steering Committee has taken an active role in key delivery challenges, through holding 'deeper dive' meetings and teleconferences to address topical themes such as DER recruitment and the commercial proposition, developing options for DNO/DSO incentives and the progress in developing the detailed design of the project solution.

2.5 Technical Design Authority

The project's Technical Design Authority has been established, led by the Design Authority lead at UK Power Networks and meets regularly to challenge and review technical progress, agree and document design decisions.

2.6 Project progress against SDRC9.2 milestones

The project is in a key phase of delivery when the detailed technical and commercial requirements are designed in accordance with the project plan. The SDRC9.2 description is as follows:

SDRC9.2 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*

2.6.1 Stakeholder consultation findings

The project team has continued to broaden and deepen engagement with key stakeholders. As the technical and commercial design of the TDI 2.0 service has developed during this detailed design phase, the project team has shared its latest thinking and 'minded to' approach for operating the TDI 2.0 solution with interested parties. This has been carried out through one-to-one meetings, a webinar, at industry conferences and publishing materials on the project website. Progress has been made in understanding the perspectives of owners and aggregators of different DER types, defining a greater level of detail for the commercial proposition, establishing and communicating the value of historic reactive power, establishing requirements of DERMS and working with academic partners.

This stakeholder engagement has both provided early signals to potential service providers (DER and also aggregators interested in bringing together DER) and valuable feedback to inform the detailed design and the information that the project provides to help encourage participation.

During this period, key channels for stakeholder engagement and sharing learning outcome (see section 10) have included:

- Direct engagement with DER within the project's geographic area, including existing energised DER and prospective DER with accepted connections;
- Webinars – to present progress to date and the 'minded to' approach for undertaking the TDI 2.0 trials;
- The ENA Open Networks Project and its workstreams provide the principal channel for engaging other Network Licensees (in addition to the ENA's Low Carbon Network Innovation Conference);
- Industry conferences, workshops and meetings with professionals throughout the electricity system value chain;
- Project Website – the TDI 2.0 project website[5] provides details on the projects objectives, latest progress and documents for download;
- Published project materials (e.g. the Guide to Participating, September 2017) as downloadable reports on the project website as well as sharing directly with webinars participants and in direct communications with interested parties; and
- Engagement with UK Power Networks and National Grid teams.

[5] https://www.nationalgrid.com/uk/investment-and-innovation/innovation/system-operator-innovation/power-potential

2.6.2 Functional Specification Documents

The DERMS technical solution provides the capability to handle the following services:

- Reactive Power Service; and
- Active Power Service re-dispatching of MWs from DER.

As shown in the diagram below, the solution is a server based solution located within the UK Power Networks' ICT network interfacing with various internal & external services. These include the existing UK Power Networks' DMS (PowerOn), the National Grid's EMS and the various DER.

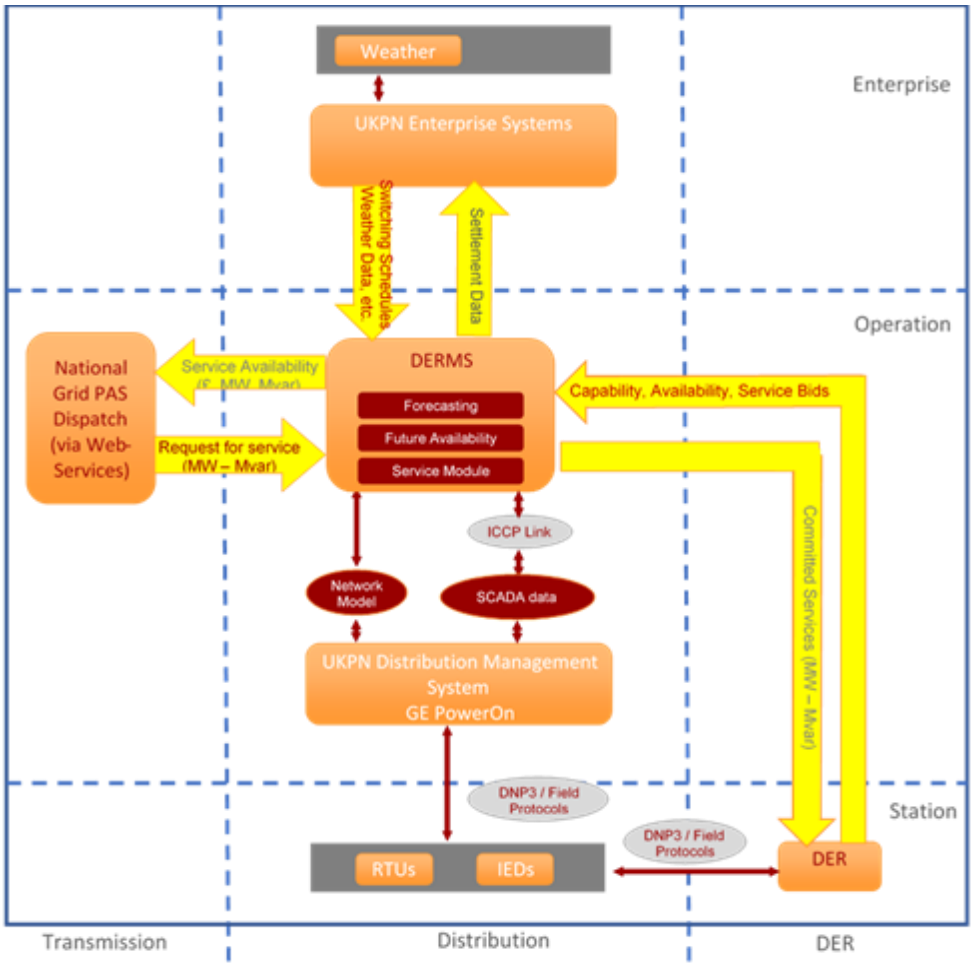


Image 2: Illustration on the TDI 2.0 technology solution

At the core of the solution is the facility to align the requirement for voltage stability required by National Grid with the capability of the DER to provide voltage stabilisation services.

This detailed design is further described in the SDRC9.2 report.

2.6.3 Finalised Commercial Framework

This section covers the latest developments related to the commercial arrangements for TDI 2.0 and the proposition presented to DER. Throughout autumn 2017, the TDI 2.0 team has engaged with a number of interested parties to promote the opportunities available and seek feedback to shape the commercial arrangements of the project.

Progress has been made in understanding the perspectives of owner and aggregators of different DER types, defining a greater level of detail for the commercial proposition, establishing and

communicating the value of historic reactive power, establishing requirements of DERMS, and working with academic partners.

The next phase of the project will focus on finalising the commercial arrangements – including establishing a robust settlement approach – continuing to engage with interested DER and seeking to recruit additional DER to maximise learnings from this innovative service trial.

The finalised commercial framework is described in detail in the SDRC9.2 report.

2.6.4 Detailed Business Processes

This deliverable identifies the functions and processes with National Grid and UK Power Networks that will be impacted by the introduction of the TDI 2.0 service. It also explains the strategy for managing changes and the required training to adapt to the new processes and roles and is described in detail in the SDRC9.2 report.

3. Business Case update

The robust business case that was described during the Network Innovation Competition bid process[6] has not changed. This has been substantiated by the 2017/18 Network Options Assessment report[7] which confirmed that there are no changes expected to the South East network. This prediction strengthens the case made for implementing TDI 2.0; as such, the business case for the project will be re-evaluated in 2018.

4. Progress against plan

The project has made substantial progress throughout the period in developing the detailed design of the TDI 2.0 technology solution as described in section 2 of this report. Full details of the project's major deliverables during the July to December 2017 period are available within the SDRC9.2 report, which will be published in January 2018. Table 1, within the Project Manager's Report chapter, details the project's achievements between July and December 2017.

A key success has been completing the detailed definition of functional and non-functional requirements across technical, Information Systems and commercial considerations. ZIV is under contract to develop the technology solution. The project team has worked closely with ZIV to ensure that ZIV can translate the requirements into a detailed design solution that will be ready to move to build and testing phases in 2018.

A challenge for the next period includes translating the detailed functional and non-functional requirements effectively into a detailed design and building the solution. This must provide the expected functionality, demonstrated through testing, and it is perhaps the greatest innovation challenge within this project. This will be a significant focus for project delivery during 2018. This will require an ongoing focus on the project plan, risks, resourcing, budget and contingency through the lens of what scope is critical to deliver the project's objectives.

The project has proactively engaged DER and Aggregators within the South East Coast project area, to consult on the commercial framework during its development. This has been both through a webinar and also one-to-one engagement with interested parties. This has been valuable in providing potential participants with early visibility of the project team's proposed approach. This

[6] https://www.ofgem.gov.uk/ofgem-publications/107804
[7] https://www.nationalgrid.com/uk/publications/network-options-assessment-noa

approach has also secured feedback on what information it would be most valuable for the project team to provide to help DER develop a commercial proposition to take part in the trials. Contracts have been signed and delivery commenced with Cambridge University and Imperial College to undertake academic research to support the commercial workstream.

During 2018, the commercial workstream's overall challenge will be converting the positive interest from DER into formal commitments to participate in trials. This will require presenting a compelling commercial opportunity and minimising barriers to entry, wherever possible. At the same time the project will continue to focus on the overall goal of developing a new and cost competitive alternative market solution to address transmission system challenges.

Appendix 1 presents the high-level project plan through to the end of 2019. In the period to December 2018, the following SDRCs are due:

- SDRC9.3, July 2018: Commercial Tendering Process Report and Finalised Trials Approach
- SDRC9.4, 31 December 2018: Customer Readiness Report and Performance of the Technical Solution in a Controlled Environment
- SDRC9.5, 31 December 2018: Cost Benefit Analysis

5. Progress against Budget

Progress against budget is detailed within the confidential appendix to this report.

6. Project Bank Account

The statement from the project bank account is provided within the confidential appendix to this report.

7. Project Successful Delivery Reward Criteria (SDRC)

SDRC		Progress	Date
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.	3 July 2017

SDRC		Progress	Date
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	This SDRC is at an advanced state of preparation and is on track for delivery as planned. Further detailed commentary is provided in section 2 of this report	2 January 2018
9.3	**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 remains on schedule to be delivered as planned. The development of guidance to participants during this period has articulated the 'minded to' approach for technical and contractual requirements for participation. Engagement with the National Grid and UK Power Networks business units that will be involved or impacted by the commercial arrangements for the trial is progressing well to develop the processes and materials necessary to fulfil this SDRC deliverable.	2 July 2018

SDRC		Progress	Date
9.4	**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 remains on schedule to be delivered as planned. DER engagement and the development of guidance to participants during this period has articulated the 'minded to' approach for technical and contractual requirements for participation, which provide advance signals to potential participants and begin to escalate their readiness.	31 December 2018
9.5	**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	This SDRC remains on schedule to be delivered as planned. Analysis of historic requirements for reactive power within the study area have been undertaken in the area to inform the scale, frequency and value of provision of this services, which will contribute to the overall CBA.	31 December 2018

SDRC		Progress	Date
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 DERs 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	No change.	30 December 2019

SDRC		Progress	Date
9.7	**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 remains on schedule to be delivered as planned. 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.	31 December 2019

8. Project Deliverables

This section is not applicable as the Project Direction for the project was issued before 2017/18.

9. Data access details

Interested parties are able to access any network and consumption data gathered as a result of this project in accordance with National Grid's published policy[8]:

10. Learning Outcomes

Since July, the project communications plan has been refreshed, and includes an activity tracker which all team members can contribute too. This allows visibility of communications activities across the project team, and is structured to ensure the project team members are always working with business outcomes in mind. It also accounts for metrics to ensure the project is capturing the effectiveness of communications.

The following sections (10.1 to 10.6) provide details of the project's engagement activity and examples of external communications.

[8] https://www.nationalgrid.com/sites/default/files/documents/National%20Grid%20NIC%20and%20NIC%20Data%20Sharing%20Policy%20September%202017.pdf

A communications call takes place regularly with team members from National Grid and UK Power Networks. Led by the Communications Lead and using the activity tracker from the communications plan as reference, the call allows us to summarise any activity since the previous call, discuss forthcoming activity and whether or not support is needed. The call also ensures that the project team are all aligned and have a clear understanding of all ongoing activity.

10.1 DER and Aggregators

Engagement with DER and Aggregators is critical to successful delivery of the project's trials and overall project objectives and as such this engagement is covered at within sections 2.2 and 2.6.1 of this report.

10.2 Regional Market Advisory Panel

A Regional Market Advisory Panel (RMAP) is being established to provide a formal channel for engagement and consultation with key stakeholder groups including Ofgem, DER and their representatives, National Grid and UK Power Networks.

The RMAP will be overseen by an independent chair, to be appointed in early 2018. The Steering Committee oversaw and reviewed a short list of potential chair persons and identified key attributes to make the role a success. Following this a chair has been proposed and approached and engagement is underway to confirm this appointment. Terms of Reference have been developed for agreement with the RMAP in the initial meetings.

10.3 Network Licensees

National Grid and UK Power Networks colleagues participate in the ENA Open Networks Project, throughout its workstreams, and this is a key channel for the project team to engage other Network Licensees on the progress of the project. In addition the project exhibited and presented at the ENA's Low Carbon Network Innovation Conference (see below).

The project team has proactively written a blog[9] for the ENA website. The post went live on 14 November and was shared using National Grid and UK Power Network's social media channels, the ENA LinkedIn profile and UK Power Networks' LinkedIn profile. This was a further opportunity to reach out to network licensees and to enhance the project's profile.

Image 3: UK Power Network's Twitter account promoting the project's ENA blog article

[9] http://www.energynetworks.org/blog/2017/11/14/open-networks-monthly-blog-delivering-on-our-power-potential/

10.4 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, both current and new, the project website[10] has been updated. As described earlier in the report, the project has been re-named Power Potential in external communications and the project's communications have been streamlined to reflect this. On the project website, visitors can learn about the project at a high level, or delve into 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 at the core of the project.

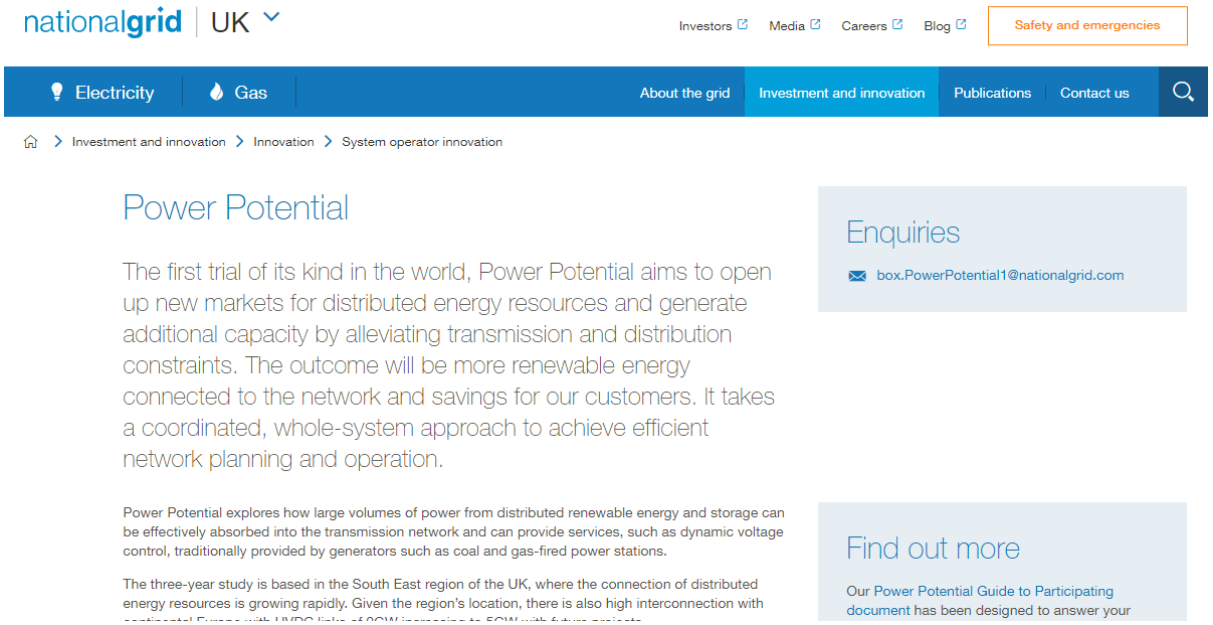


Image 4: Project landing page on website

The project website includes a 'news' page, 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 moves towards the trials, and as the project publishes more detailed guidance for interested parties, the project will be able to track growth in the number of visitors using figures from before the pages were refreshed as a baseline.

[10] https://www.nationalgrid.com/uk/investment-and-innovation/innovation/system-operator-innovation/power-potential

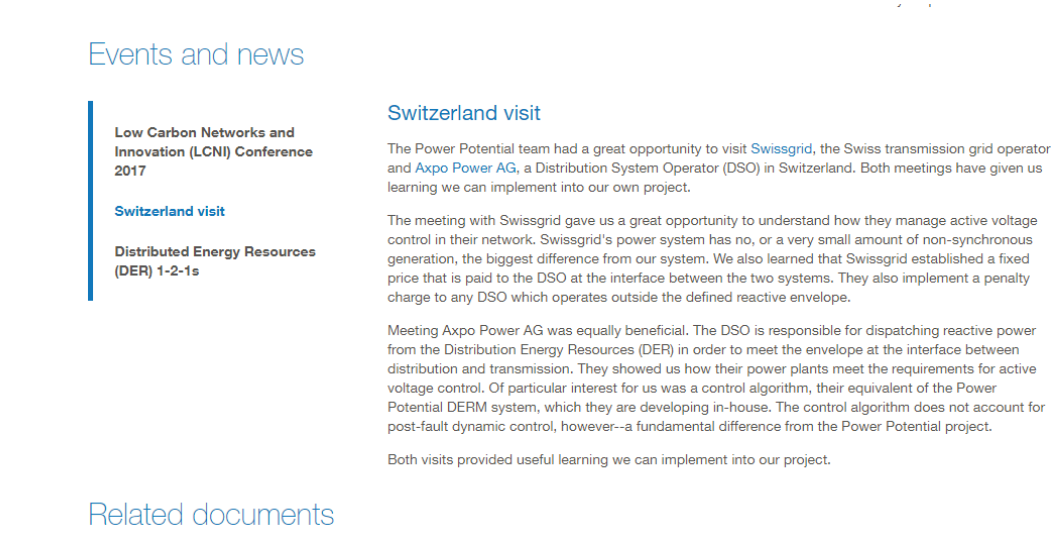


Image 5: Example webpage from the project's 'news and events' section

Further reference to the project and links to its webpages are made on LinkedIn. Updates about visits, meetings, or any other activity the project would like to share to enhance the project's profile are posted on the National Grid Innovation showcase page. The project's Communications Lead can source analytics from each post, such as the percentile level of engagement, how many clicked to read the full message.

Image 6: Example of a project post on LinkedIn (within Innovation at National Grid), also showing statistics for interactions with the post.

10.5 Conferences

The project has been showcased at a series of stakeholder events, visits and conferences this period:

- **Low Carbon Network Innovation conference, 6-7 December 2017** – Biljana Stojkovska (Project Lead at National Grid) and Ali Reza Ahmadi, Lead Power Systems Engineer (UK Power Networks) made a joint presentation within the breakout session on *Active Network and Demand Side Response.* An interactive demonstration was displayed on both National Grid and UK Power Networks' exhibition stands, supported by the project team, demonstrating the project's TDI 2.0 solution in a number of scenarios from both the transmission and distribution network perspectives.

Image 7: Screen-shots from the interactive demonstration showing both the transmission and distribution network challenge and opportunity.

- **Visit to Swiss Grid and AXPO Power AG, Switzerland, 16-17 October 2017** – To investigate approaches to reactive power across the transmission and distribution system boundary within Switzerland and to present the project's solution to this challenge.
- **CIGRE & IET event '*Solving Electricity Network Challenges*', Birmingham, 18 October** – presentation on the project by project lead Biljana Stojkovska to an audience of technical subject matter experts. **EWiRE (Entrepreneurial Women in Renewables), 16 November 2017** – Panel discussion on "*a smart decentralised system*" included project lead Biljana Stojkovska
- **Power Responsive Conference 2017, Emirates Stadium, London, 27 June 2017,** – Presentation by Sotiris Georgiopoulos, project Steering Committee member at UK Power Networks to an audience of several hundred professionals across the electricity system value chain.
- **Solar Trade Association's Storage Seminar**, **London, 7 November** – Paz Mehta, Project Lead at UK Power Networks participated

10.6 National Grid Internal Engagement

Since June, the project team submitted the project into two internal awards within National Grid; The Chairman's Awards and the System Operator Awards (SO Awards) to support raising the profile of the project internally across the business and to seek recognition for the ground-breaking fit-for-the-future nature of the project.

Our submission for the Chairman's Award was entered into the Fit for Future category, with this category celebrating new ideas for projects that demonstrate new ways of doing things**.**

For the SO Awards, the project entered into the 'Project/initiative success' category, the scope of which included 'lead the changes to the SO's future in the evolving energy network and markets.

Whilst the project was not successful in winning the awards, at this early stage of project delivery, the entries to each competition have provided good opportunities to engage colleagues across National Grid, and the System Operator particularly, on the purpose of the TDI 2.0 project, the technical and commercial challenges it is tackling and the benefits it is seeking to deliver.

The project team continues to promote project activities on National Grid's internal social networking site 'Yammer'. Monthly 'SO Communications Forums' ensure TDI 2.0's Communications Lead meets with the SO communications team, and other communication staff from the business area to ensure our plans are shared in a timely manner and we are aligned with the wider business messaging.

11. Intellectual Property Rights (IPR)

To meet the requirements to publish Intellectual Property (IP) developed within this project, National Grid 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 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 and UK Power Networks and their employees may be named as inventors or co-inventors in any such patent application.

During the current reporting period the following IPR has been generated:

Workstream	IP description	IPR Owner
WS1	TDI 2.0 solution requirement specification document	UK Power Networks
WS1/2	DER Operating Characteristics document	National Grid and UK Power Networks
Project	Project Handbook	National Grid and UK Power Networks
WS1/2	Use cases Definition	National Grid and UK Power Networks
WS2	Communication and DER Engagement Plan	National Grid and UK Power Networks
WS1/2/3	SDRC9.1 report	National Grid and UK Power Networks
WS1/2	Functional and non-functional requirements for TDI 2.0 technology solution	National Grid and UK Power Networks
WS1/2/3	SDRC9.2 report	National Grid and UK Power Networks

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

Workstream	IP description	IPR Owner
WS1/2/3	SDRC9.3 – Commercial Tendering Process Report and Finalised Trials Approach	National Grid and UK Power Networks
WS1/2/3	SDRC9.4 Customer Readiness Report and Performance of the Technical Solution in a Controlled Environment	National Grid and UK Power Networks
WS1/2/3	SDRC9.5 Cost Benefit Analysis	National Grid and UK Power Networks

12. 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 an Appendix [2] provides an update of the project risk register.

13. Accuracy Assurance Statement

This TDI 2.0 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 the TDI 2.0 Steering Committee and 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

14. Material change information

Not applicable.

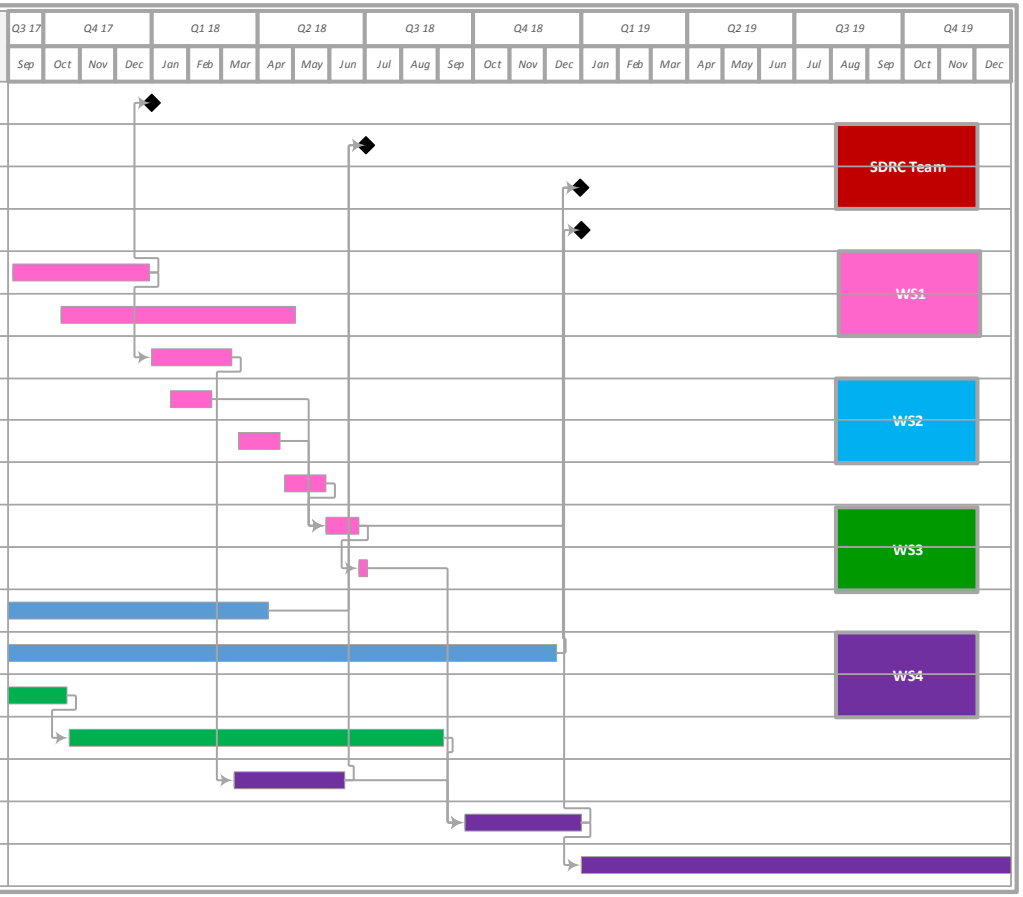
Appendices:

1. High-level project plan
2. Risk register
3. Glossary

Note – Progress against budget and project bank account are appendices in a separate file.

Appendix 1 – Project Plan

ID	Task Name	Start	Finish	Duration
1	SDRC 9.2 Complete	01/01/2018	01/01/2018	0d
2	SDRC 9.3 Commercial Tendering Process Report and Finalised Trials Approach	02/07/2018	02/07/2018	0d
3	SDRC 9.4 Customer Readiness Report & Performance of the Technical Solution	31/12/2018	31/12/2018	0d
4	SDRC 9.5 Cost Benefit analysis	01/01/2019	01/01/2019	0d
5	Detail Design	05/09/2017	29/12/2017	84d
6	Build	16/10/2017	02/05/2018	143d
7	Procure and install IT infrastructure	01/01/2018	09/03/2018	50d
8	Testing FAT/SAT GSP1	17/01/2018	20/02/2018	25d
9	Testing FAT/SAT GSP2	16/03/2018	19/04/2018	25d
10	Testing FAT/SAT GSP3	24/04/2018	28/05/2018	25d
11	Integration Testing	29/05/2018	25/06/2018	20d
12	UAT	26/06/2018	02/07/2018	5d
13	Commercial Framework	01/09/2017	09/04/2018	157d
14	DER Recruitment and contracts	01/09/2017	10/12/2018	332d
15	Business Change Readiness	01/09/2017	20/10/2017	36d
16	Business Change	23/10/2017	05/09/2018	228d
17	Trails Preparation	12/03/2018	13/06/2018	68d
18	Cost Benefit Analysis	24/09/2018	31/12/2018	71d
19	Trails Phase 2	01/01/2019	29/01/2020	282d



Appendix 2 – Risk Register

Full Submission (BID Risks) – update

Ref BID #	Workstream /Area	Risk & Impact Description	BID Mitigation	Mitigation Update	Status
1	General	Final funding not awarded	Ensure high bid quality, regular reviews, clear differentiation and stakeholder engagement.	The project successfully gained Ofgem funding.	Closed
2	General	Significant changes to the South Coast electricity system during the life of the project	We have considered future developments and scenarios. We have ensured usefulness of solution matches. We will take into consideration the NOA decision accordingly	Outcome of latest Network Option Assessment means no impact. Risk to be reviewed on a quarterly basis – ongoing.	G
3	General	Insufficient resources allocated for the project in time	A project plan has been produced and partners have been asked to allocate resources to achieve the milestones. Budget allocation has been made for consultants/contractors to make sure project is resourced from the beginning and for all critical activities.	Project team resources in place and agreed to close this risk, November 2017	Closed
4	General	Critical staff leave National Grid, UK Power Networks, or our project partners	Knowledge of and responsibility for, the project to not rest with one person. Ensure documentation and guidance exists to assist anyone joining project team. Thorough handover processes to be in place.	Project handbook and securing hand-over periods between departing and arriving colleagues have supported transition process during staff changes	G

Ref BID #	Workstream /Area	Risk & Impact Description	BID Mitigation	Mitigation Update	Status
5	WS1 – Technical Solution Delivery	Technical limitations of ICCP interoperability between proposed control system and National Grid/UK Power Networks communications link	Early engagement as part of bid preparation completed. ICCP trial involving all affected stakeholders to ensure operability at an early stage in project.	Detailed analysis undertaken of options and Steering Committee has closed this risk, agreeing use of web services.	Closed
6	WS1 – Technical Solution Delivery	Technical specification is either to abstract or too descriptive	Produce a technical specification that has inputs from different areas of the business, as well as from the different partners, ensuring that it is not too prescriptive so as to impede further innovation during project delivery.	Detailed requirements have been jointly developed and agreed to close this risk in November 2017	Closed
7	WS1 – Technical Solution Delivery	Control system fails to perform to specification	The control system will be subject to performance testing using benchmarking or simulations under various operating conditions. Control system requirements to be defined at design stage and suitable control system chosen for the purpose of the trials. Service Level Agreements (SLAs) to be agreed for control system solution.	UK Power Networks are including liability and flexibility clause within the supplier contract. Ongoing, to be reviewed during testing phase in 2018.	G

Ref BID #	Workstream /Area	Risk & Impact Description	BID Mitigation	Mitigation Update	Status
8	WS1 – Technical Solution Delivery	Resource interoperability	Agree common standards for all controllable components through standard interface protocols which will be agreed upon by all controllable resources. Plan demonstration without critical requirement for communication path to all response providers.	Requirement for Communications based on common standards. Ongoing risk to be kept under review.	A
9	WS2 – Commercial	DER under recruitment	Early and continuous engagement. Customer feedback from the engagement sessions helping shape the commercial and technical designs. Commercial contingency budgeted for.	Engagement with DER and aggregators continuing, identifying and responding to participation queries raised.	G
10	WS2 – Commercial	Provision of services by DERs to National Grid via UK Power Networks	Contingency fund in place to allow these risks to be absorbed. Agreed trials approach to mitigate impact. Learning will be fed to affect any regulatory changes required for the rollout.	Contingency funds confirmed. Risk merged with risk 9. Risk 10 closed as a result.	Closed

Risks added to the project Risk Register since bid submission:

Ref #	Workstream /Area	Risk & Impact Description	Mitigation	Status
11	Contract	The contract between National Grid and UK Power Networks is not signed	Signed May 2017	Closed

Ref #	Workstream /Area	Risk & Impact Description	Mitigation	Status
12	Ways of working	At the start of the project Individual companies were working in silos	Progress has been made to improve working relationships, with project team members working on occasion in the other company premises. Agreed to close risk, November 2017.	Closed
13	Ways of working	The project is disjointed	Project handbook providing the governance structure and details of project structure. Weekly PMO meetings. Weekly workstream meetings with governance supporting them have commenced. Monthly Project Steering group. Agreed to close, November 2017.	Closed
14	Budget/Finance	The budget between National Grid and UK Power Networks is not agreed	Budget has now been split and agreed	Closed
15	WS1 – Technical Solution Delivery	CIM integration takes longer than planned	Agreed plan in place with provider to deliver to schedule.	A
16	WS2 – Commercial	Workstream 2 had a delay in providing the project plan	Overall High Plan in place following the kick-off of workstreams 2 and 3.	Closed
17	WS1 – Technical Solution Delivery	SDRC9.1's scope definition is compromised and the design will be conceptual rather than high level	SDRC9.1 delivered on time. Risk closed.	Closed
18	WS1 – Technical Solution Delivery	CIM Export: CIM Export too costly or cannot be delivered within the timelines of the project	Budget for costs has been agreed. Risk closed.	Closed
19	WS1 – Technical Solution Delivery	SDRC9.1 not delivered within agreed timescales because regulatory and business review takes longer than anticipated	Parallel reviews planned with National Grid and UK Power Networks' management/regulatory teams	Closed

Ref #	Workstream /Area	Risk & Impact Description	Mitigation	Status
20	WS2 – Commercial	The project does not have a joint communication plan for the projects participants	National Grid 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 and UK Power Networks communication team	Closed
21	WS2 – Commercial	Risk of rushed procurement before agreement of proposed solution	Agreed this is resolved and can be closed.	Closed
22	WS2 – Commercial	Resourcing delivery of TDI 2.0 and RDP projects at same time	Resourcing between the two initiatives has been resolved.	Closed
23	WS2 – Commercial	Misalignment of TDI 2.0 and RDP deliverables	Liaison between the two initiatives is well established. Technical, commercial and PMO linkages in place.	A
24	WS2 – Commercial	Insufficient recruitment of DER for the project trials	DER recruitment on going, better feedback after the one-2-one sessions had with the DER. Still need to continue to recruit more	G
25	WS1 – 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.	A
26	WS1 – 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	G
27	WS1 – 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	A

Ref #	Workstream /Area	Risk & Impact Description	Mitigation	Status
28	WS1 – Technical	There is a risk that the time delay in an instruction sent to the DER from DERMS is too long (more than 10 secs)	This issue is being addressed through the detailed design discussions and technology solution specification	A
29	WS1 – Technical	There is a risk that the intensity of activity proposed within the first draft detailed design phase delivery plan cannot be resourced by the available National Grid IS team.	Ongoing delivery activity with additional workshops scheduled with ZIV. UK Power Networks and National Grid resourcing in place. Risk of limited National Grid IS resource availability if this continues beyond current plan.	A
30	WS2 – 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. 1-2-1's to be proactively sought. Guidance to be adapted and published online.	Closed
31	WS1 – Technical	There is a risk that the 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. A series of draft designs have been created by ZIV and feedback provided by the project team. Progress is being made, but not fully resolved yet.	A
32	WS1 & 2	There is a risk of insufficient sharing of data between the project partners	To be kept under review and within consideration of regulatory requirements	A

Appendix 3 – Glossary

CIM	Common Information Model
DER	Distributed Energy Resources
DERMS	Distributed Energy Resources Management System
DNO	Distribution Network Operator
DSO	Distribution System Operator
ICCP	Inter-Control Centre Communications Protocol
ICT	Information and Communication Technology
KASM	Kent Active System Management
NGET	National Grid Electricity Transmission
NOA	Network Option Assessment
RDP	Regional Development Programmes
RTU	Remote Terminal Unit
SCADA	Supervisory control and data acquisition
SDRC	Successful delivery reward criteria
SGT	Super Grid Transformer
UKPN	UK Power Networks