SP Energy Networks

SIF Project Registration

Date of Submission

Mar 2022

Project Reference Number

10025639

Project Registration

Project Title

Digi-GIFT

Project Reference Number

10025639

Project Licensee(s)

SP Energy Networks Transmission

Project Start

March 2022

Project Duration

2 Months

Nominated Project Contact(s)

Michael Eves

Project Budget

£141,657.00

Project Summary

We will design a holistic data connector (Digi-GIFT) to communicate directly to asset monitors pulling back real-time asset data, alerts and analytics. In the Discovery phase, we plan to:

·   Define the scale of the problem and quantify the benefits for solving the problem Deliver details of a Digi-GIFT platform design and functional specifications using commercially available technologies

·   Identify requirements for data driven cyber security methods

·   Technology review of AI and machine learning based cyber intrusion detection and response

·   Identify and evaluate potential suppliers

As a result, we will have a clear functional specification, detailed cost-benefit analysis and a technology appraisal. Outputs will provide recommendations for the Alpha phase, where the use cases will be identified for a practical demonstration in Beta, the first time in the UK energy sector.

This project meets the scope of the call though:

·   Interconnecting assets that allow network customers and consumers to interact through a common interface, improving the visibility of infrastructure and assets Enabling interoperability of digital products and data exchanges between different parts of the organisation

·   Securing the platform to allow operators and customers better access to data and

·   improving the resilience of networks against cyber attacks

· Acting as an enabling function for potential digital benefits (i.e. FITNESS, Constellation) across all electrical network operator and allowing deployment of new applications across an increasingly secure, automated, and digitalised environment

SP Transmission – network licensee covering the Central belt of Scotland leading the industry on substation digitalisation. This includes pioneering work on Future Intelligent Transmission NEtwork SubStation (FITNESS). We will be a user as well as taking overall accountability for delivery.

SP Distribution – works closely with SPT on the digitisation and services for customers. SPD will contribute specialist network knowledge, demonstration resources, industry contacts, and access to datasets.

University of Manchester – one of the top global Universities with key expertise in digital substations, digitalization, communications, and cyber security. They possess prior experience in delivering digital innovation with UK TOs.

National Grid Energy Transmission – licensee for England and Wales, both NGET and UoM have worked closely with SPT covering transmission and cyber security over the past years. They are also user of the solution and will input into the requirement development.

With this consortia, we will ensure our users' (UK TOs) needs for secure, standardised high-speed data sharing are accelerated so that they can realise the benefits from a digitised electricity network.

Third Party Collaborators

The University of Manchester

Nominated Contact Email Address(es)

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Problem Being Solved

To realise Net Zero, we need to digitise our network; this forms a core part of our innovation and business as usual activities. However, there are key barriers in how current practice achieves this in electricity networks. Specifically, the lack of standardised data formats that we use within our organisations and 3rd parties spans many different formats, protocols, and standards. Asset monitors currently either utilise a connection to the RTU or the use of bespoke software – often HTTP (unencrypted, internet transferred) to deliver analytics back to system analyst. For example, this does not maximise the benefits of the IEC 61850 standards used in the digital substations for communication.

In addition, as we digitise, our networks are highly attractive for cyber-attackers. Increasing Cyber-attack sophistication is rapidly growing and has a fundamental impact on the services we provide:

· In 2020 36.9% of ICS (industrial control systems) used by the energy sector identified and blocked malicious objects.

· Furthermore, 2015 Cyber-attacks in Ukraine show malicious actors causing widespread outages. This caused 30 electrical substations to be offline and around 230,000 customers were without supply for 6 hours; the equivalent of £18.5m in CI/CML. The problem is greater where secure data exchange is required across parties such as TSOs, DSOs, generators, and customers.

The secure and seamless data exchange across parties is essential for system planning, operation, protection and automation; this has been reflected with over £100m of cyber security investment across the UK Electricity Network Operators.

This project proposes to enhance substation security and data access by replacing the RTU connection with a direct connection to analytic servers removing the connection between the RTU and asset monitors. Specifically, we will design a holistic data connector (Digi-GIFT) to communicate directly to asset monitors pulling back real-time asset data, alerts and analytics to analysts. In addition to the direct benefits of real-time information and improved security, this would also act as an enabler to wider benefits from concepts such as the Digital Twin and unlock the benefits in line with the GB energy network digitalisation strategy priorities.

Through the Digi-GIFT project, we will advance standardised secure data sharing in the energy system, and over build on over £500m investment in digitalisation projects, realising:

· Reduction in frequency and impact of cyber security events

· Improved energy system planning, optimised operation and improved Interoperability of platforms and data sharing with other infrastructure sectors

Project Approaches And Desired Outcomes

The Big Idea

The Digi-GIFT project addresses the SIF aims by delivering a standardised, interoperable, and holistic data connector (Digi-GIFT) with real time data stream processing capability and integrated cyber reaction capability required to "improve data monitoring, availability, quality, collection, interoperability, across energy systems in order to improve the system planning, operation, efficiency, security and resilience of energy networks."

Examples of specific technologies to be considered are:

· Application of IEC Common Information Model (CIM) standards to standardise data exchange interfaces for improving data connectivity and interoperability among all digitised products both at an energy company level and sharing across whole energy system.

· Use data streaming process and cleaning technologies to facilitate the integrity and quality of real time data monitoring, collection and sharing among different digital products within or between organisations, including the customer access.

· Use AI and machine learning technologies to develop data-driven cyber security intelligent to ensure the cyber security of data exchange and sharing among various digital products.

Business Readiness:

The building blocks for this next generation solution already exist, as we have reliable IP communications to our substations. We would need to develop a standard data polling solution with a partner as part of the Alpha and Beta phases.

Currently data is returned to analysts via the RTU or via bespoke software solutions. To combine this into a data standard solution, asset monitors can provide information regarding what analytics they provide – there would be no need to have bespoke connections for different monitoring types or manufacturers and their data can be polled either on-demand or as an ongoing connection stream.

Development will bring together existing open standards, vendor platforms and new data processing and cyber security techniques. This will maximise the interoperability of the platform. This proposal will comply with default IPR arrangements and we will consider the impact of vendor platforms as part of the Discovery phase.

Innovation Justification

Innovation Foundation

SPEN, National Grid and University of Manchester have been working together on digitisation projects with the focus of adopting IEC 61850 for data exchange and communication limited to the substation. This delivered a substation interoperable digital interface among multi-vendors digital products and assessed cyber security considerations for substation control systems bringing benefits of interoperability and reducing costs. Furthermore, SPEN is a project support for Constellation, the follow-on innovation project led by UKPN.

Innovation Opportunity

To enable a greater provision of information exchange across parties, the industry identified the required common grid level data model standards, i.e. CIM standards, and fast data processing platform, but no trials of an interoperable and fast data sharing platform (such as the proposed solution, Digi-GIFT) across TSOs, DSOs, generators and customers in the UK energy industry exist. Examples we found within the energy sector are from non-real time applications.

International CIM-based integration models for various digital products, such as the conversion from IEC61850 substation models to CIM IEC 61970 based CIM acquisition models, have been reported in the literatures only but not verified by demonstration to our best knowledge.

To operate and balance the intermittency of renewables, fast data exchange to improve the coordinated control of generation and load demand response is required. We also require very fast data exchange for protection and control to ensure grid stability and resilience under unplanned events, such as extreme weather.

Cyber intrusion response/defence methods are critical against malicious cyber threats to prevent cascaded false tripping causing

energy system blackout. There is currently no interoperable data stream processing platform for critical operational real time applications we found through our research.

To meet the need for digitalisation interfaces between different digital products and the data exchange interoperability learnings from the previous digitisation projects, the novelties of Digi-GIFT are:

·   Deliver data exchange interoperability among digitised products

·   Intelligent analysis and estimation algorithms for data integrity and assurance Rapid data stream processing algorithms for low latency data exchange including real time application requirements

·   Harness advanced AI and ML technologies to develop data driven cyber security intelligent and to ensure the gird cyber security when adopting open standards.

As a result, we will create a secure, seamless and efficient information exchange platform for our networks to facilitate information sharing between DSO, TSO, Generators and customers.

Project Plans And Milestones

Project Plan And Milestones

Pre-project preparation will include (from project award to 28/02/2022):

· Form project advisory group from users who will provide industry contacts, suitable datasets; industrial insights and contribution to the project and report review

· Agree selected use cases for Cost Benefits Analysis Identify, gather, required data sets

Project management: SPEN will provide a robust project management and coordination support for the discovery phase. Project risks affecting Alpha and Beta stages will be identified during this phase. A communication plan will be created including weekly meetings and coordination between parties

Technical packages

WP1 – Requirements definition (Weeks 1-2); Led by SPEN

Tasks:

· Define and propose criteria for success

· Preparation of requirements report

This task will produce requirements report detailing a definition of requirements for application

WP2 - Cost benefit analysis (Following WP1, Weeks 3-6); Led by UoM

Tasks:

· Define and quantify current methods and scale of the problem

· Identify and quantify the benefits of use of CIM (common information model) and data sharing platform.

· Investigate the most needed applications on net zero challenges and identify the most cost-effective solutions.

This task will produce a Cost benefit analysis report on the enabling capability and test applications

WP3 – Technical Appraisal (In parallel with WP2, Weeks 3-8); Led by UoM

Tasks:

· Identify core technologies and supplier engagement

· Confirm current status and evolving solutions in the literature relating to digital technologies, such as IEC standards and existing products

· Create scoring criteria for platforms to deliver requirements

· Define data source(s), quality, and required accuracy for inputs

· Identify operational constraints and interoperability

· Identify use case and vendor engagements

This will produce a written specification of project data requirements, including means of access, storage and security requirements.

Following WP1 and WP2 a report on recommendations for next phase development and trails based on above deliverables including platform, partner, vendor and application scope.

Route To Market

For solution users, the key benefits will be realised in pushing innovation into BaU and the form as efficiency savings, and cyber-attack protection. As SPT, we will work with leading academic institutes such as Strathclyde University and vendors, such as Open Grid Systems, to commercialise the IPR within the framework of the SIF through all project stages.

It is our ambition to ensure the Digi-GIFT has national and international impact, and to contribute to the successful transformation for the GB as an Energy Innovation Silicon Valley:

· The Digi-GIFT, using open standards, will provide the basis for rollout of the secure real time data sharing digitalisation platform. The platform will enable engineers, analysts and operators access to high quality datasets including real time data from which they can improve their decision making and build the next generation of applications. The platform will also enable seamless and secure data sharing between TSOs, DSOs, generators, and customers.

· Using open standards will facilitate interoperability with other infrastructure sectors and allow multiple vendors to generate more interoperable commercial products and facilitate future investment. This will offer value for money to users through competitive procurement of the standards.

· To guide the implementation into business as usual a working group will be setup to report to the Energy Networks Association and the Authority to guide the project through its development. This will result in the appropriate support, operations and maintenance, and hardware definition to support the rollout. IT policies will allow utilisation into BAU.

· As a commercial organisation, SPT will work with the selected project partners through the Beta phase to develop and deploy the platform. Partners will have opportunities in both national and international energy markets. The default IP arrangements will enable knowledge sharing to facilitate competition.

· As part of the Iberdrola group, the project would have instant access to an international audience for dissemination across the EU, including Landsnet (Iceland) who are working on the digital substation. Sharing the IP and methodology after a successful demonstration through events and workshops will increase the project impact.

The relevant IP will be disseminated along with the project learnings from the implementation to ensure the maximum benefit to energy networks and customers. The Digi-GIFT learnings are highly transferable across the power networks, oil and gas, and railway as an enabler for the digitalisation of those sectors.

Costs

Total Project Costs

141657

SIF Funding

136637

This project has been approved by a senior member of staff

☑ Yes