SIF Discovery Round 2 Project Registration

Date of Submission

Apr 2023

Project Reference Number

10060474

Project Registration

Project Title

Powering Wales Renewably

Project Reference Number

10060474

Project Licensee(s)

National Grid Electricity System Operator

Project Start

Apr 2023

Project Duration

3 Months

Nominated Project Contact(s)

Dozie Nnabuife dozie.nnabuife@nationalgrideso.com

Project Budget

£155,791.00

Funding Mechanism

SIF Discovery - Round 2

SIF Funding

£135,491.00

Strategy Theme

Data and digitalisation

Challenge Area

Preparing for a net zero power system

Lead Sector

Electricity Distribution

Other Related Sectors

Funding Licensees

Lead Funding Licensee

NG ESO - National Grid ESO

Collaborating Networks

National Grid Electricity Distribution, National Grid Electricity Transmission

Technology Areas

Digital Network

Equality, Diversity And InclusionSurvey

Yes

Project Summary

In 2019, the Welsh Government set ambitious targets to meet 70% of its electricity requirements from Welsh renewable energy sources by 2030 and has set binding climate targets that align with UK Government's commitments to a 78% reduction in carbon emissions by 2035.

Despite Wales' significant renewable energy opportunities, considerable planning and co-ordination challenges across multiple stakeholders is preventing the acceleration of renewable energy adoption in a sustainable way.

To resolve these challenges, the project will take a whole electricity system approach to deliver an innovative digital twin of the network (the first to include both transmission and distribution in Wales). The Welsh Government and network operators will work together and identify priorities for progressing Wales' world-leading decarbonisation plans, increasing renewable electricity hosting capacity and delivering net benefits to Wales' citizens and communities.

ESO and Welsh Government will partner to ensure an adequate and accelerated response to Net-zero goals/ challenges. Network partners (NGET, NGED) will provide subject matter expertise, ensuring a whole electricity system approach. CGI will be responsible for developing intelligent modelling solutions.

The Digital twin will utilise detailed electricity system models to:

- Provide complete visibility of current network status, enabling transmission and distribution coordination opportunities for Wales
- Deliver a connections and capacity management tool, enabling a better understanding of the bi-directional whole system relationship between reinforcement options and type of low carbon technology solutions.
- Deliver flexibility markets coordination interface, optimising network operators' flexibility requirements across multiple trading platforms and response providers, thereby reducing consumers' costs.
- Facilitate new distributed energy resource site identification and connection, and enable constraint coordination across networks, allowing Welsh Government to set priorities, support net zero progress and enable network change through stakeholder collaboration.
- Address local needs by enabling home-produced, low-cost renewable electricity generation.

Powering Wales Renewably addresses Innovation Challenge 2: Preparing for a net zero power system:

- Establishing Wales' first whole electricity system model, enabling Wales to reach its full Renewable Energy (RE) potential and reduce carbon emissions.
- Accessing novel system support by enabling flexibility coordination across the whole electricity system, reducing RE curtailment and facilitating constraint management.
- Enabling electricity system integration through additional connections, increased outputs, and access for flexibility services.

Currently, only separate pieces of the jigsaw are available; this common representation of the whole electricity network will complete the puzzle to enable local and regional policy makers, investors and community leaders to work with network operators to deliver net zero.

Project Description

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Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

Project Description And Benefits

Applicants Location (not scored)

NATIONAL GRID ELECTRICITY SYSTEM OPERATOR LIMITED

1-3 Strand,London, WC2N 5EH

CGI IT UK LIMITED

20 Fenchurch Street, 14th Floor, London, United Kingdom, EC3M 3BY

WELSH GOVERNMENT

Cathays Park, Cardiff, CF10 3NQ

NATIONAL GRID ELECTRICITY TRANSMISSION

1-3 Strand,London, WC2N 5EH

NATIONAL GRID ELECTRICITY DISTRIBUTION PLC

Avonbank,Feeder Road, Bristol, BS2 0TB

Project Short Description (not scored)

Using the whole electricity system approach, local Government and network operators will collaboratively identify innovation priorities to progress Welsh decarbonisation plans and increase renewable electricity hosting capacity whilst delivering net benefits to Wales's citizens and their communities.

Video description

https://bcove.video/3i0Bqkg

Innovation justification

Whole electricity system coordination is required to ensure networks optimally enable the Welsh Government's strategic energy transition plans. Specifically, innovation is needed to provide a basis for stakeholder whole electricity system collaboration to enable priorities to be established, flexibility co-ordination, and how constraints and connections are optimised.

The Welsh Government will provide the project's strategic direction focusing on meeting local needs and customer benefits. Coordination of data, flexibility and constraint management will be addressed. Addressing slowed economic development, customer connection queues and impeded uptake for renewables and ensuring connections of off-shore renewables benefit the local needs.

The project is radical in its ambition, delivering:

- A national foundation representation of the whole electricity system to enable, collaboration and prioritisation.
- Paradigm shift in user defined T&D data exchange, stimulating additional innovation opportunities.
- An holistic approach by which constraints and flexibility requirements can be coordinated across Network Operators, multiple markets, and response providers.
- Connections and Capacity Management; visibility, of upstream reinforcement, and the relationship with alternative local non-reinforcement technology options.

Key risks are: technical challenges in establishing a detailed federated model across multiple network operators, and achieving consensus across stakeholders.

We are building a detailed national model (first for Wales) of a combined Transmission and Distribution systems. By leveraging open data and federating to existing BAU intelligent models, we are pioneering the application of whole electricity system engineering. It is recognised that data is being more open, but not always aligned to a customer need. Industry forums are working on setting

frameworks, but this project will instantiate a national foundation to release the customer value of open data. We will utilise learnings from previous demonstrators, and drive the change needed to reach Net Zero.

In answers to Question 5 and 6 we quantify the following benefits:

Value

- Distribution Network Capacity -- £4.65M in ED2
- Hydrocarbon displacement effect on Customer Energy Bills - £7.6m per annum
- Renewable Generation curtailment - £28.2M per annum for GB

Sustainability

- COl reduction -- 66,960 tons of COl per annum

The project addresses the "Preparing for a net zero power system" challenge. Given the urgency and innovation required to achieve Net-Zero goals, SIF is the most appropriate funding route for this project due to its scale, complexity, risk and need for a collaborative approach. The net zero challenge is driving change of such scale, that the project's key mission is to accelerate multi-party collaboration well beyond current arrangements.

Benefits Part 1

Environmental - carbon reduction – direct CO2 savings per annum against a business-as-usual counterfactual
Financial - cost savings per annum for users of network services
Financial - cost savings per annum on energy bills for consumers
Financial - future reductions in the cost of operating the network
New to market – products, processes, and services

Benefits Part 2

At Discovery submission stage, we will establish confirmed benefits and associated metrics through:

- A collaborative approach defining priorities and plans for Welsh Government and other partners
- Refining processes using advanced digital technologies
- Establish the key areas where the project will make an impact and agree how these can be attributed and captured

A subset of the key candidate benefits identified at this stage are described in this section, further detail and evidence will be developed throughout the project:

- **Financial - future reductions in the cost of operating the network**

- Secure greater output energy volumes from existing DER where possible through reduced curtailment (£/MWh). Reduced curtailment by at least 10%, saving GB £28.2m per annum, (2020 data, Imperial College London).

- **Financial - cost savings per annum on energy bills for consumers**
Energy price reduction between gas generation costs and renewables. Based upon 19TWh per annum electricity consumption of Wales, if just 1% (190GWh) of gas fired generation were displaced by renewables, then an overall saving of £7.6M would be achieved. This assumes a historical 4p/kWh generation cost saving. In the current environment that saving could be significantly greater. The metric would be £ saved per household.

- **Financial - cost savings per annum for users of network services**

- The project is targeted to improve network capacity utilisation. Based upon ED2 proposed Primary Reinforcement costs alone, of £49m in South Wales and £44m for SPM, if a 5% improvement of utilisation were achieved this could equate to a saving of at least £4.65m over that review period. This figure does not include any benefits that would be realised at the Transmission level.

- **Environmental - carbon reduction -- direct CO*l* savings per annum against a business-as-usual counterfactual**

- Reducing connection queues, increases the fossil fuel displacement by renewables. Based upon 18TWh per annum of gas generation of Wales, if just 1% (180GWh) of that generation were displaced by renewables, then a COl saving of 66,960 tons would be realised.

- **New to market -- products, processes, and services**

- 1 gigawatt (GW) of Welsh owned renewable energy capacity in Wales to be locally owned by 2030. The proposed metric would be Megawatt capacity owned.

We would expect to start tracking benefits against an agreed baseline early in the project (Alpha and Beta) and increase granularity as the project matures and is embedded into BaU.

Project Plans And Milestones

Project Plan and Milestones

Overview:

Delivery will be achieved via five themed Work Packages (WPs). WP1 and WP2 will primarily use workshops and structured interviews to obtain information to support the subsequent WPs and the creation of the outline specification for the Powering Wales Renewably: Alpha phase.

Project Management, using an agile approach with fortnightly scrum-style updates, will assess progress and define the work programme for future sprints, while keeping the required outputs in mind.

A Gantt chart showing timings is included within Q7 Appendix - Project Plan.

Participants:

Stakeholders, including representatives and subject matter experts (SMEs) from partner organisations, will be engaged in the tasks, as required.

WP1: Capture / Review Key Stakeholder Requirements [£21,049.00; Lead: CGI]

Outputs:

- List of government and community stakeholders' requirements.
- List of system / network operators' requirements.
- Understanding of how the solution deliverables will be coordinated, so that the needs of Wales, ESO and the network operators are aligned

WP2: Identification of Project Dimensions and Alpha Phase Scope [£23,694.00; Lead: CGI]

Outputs:

- Understanding of how the Powering Wales Renewably solution will fit alongside other current initiatives.
- Creation and rationalisation of user stories to frame how the system will operate.

WP3: Clarification of Functionality [£29,194.00; Lead: ESO]

Outputs:

- Expected functionality within the Foundation use case.
- Expected functionality within the Coordination use case.
- Expected functionality within the Capacity use case.
- List of data items required to support the use cases.

WP4: Realisation Definition Stream [£37,194.00; Lead: CGI]

Outputs:

- Identifying the sources of necessary data.
- Outline of how decision support information will be presented to other systems and end users.
- Outline of proposed technologies to support the delivery.

WP5: Report Project Findings and Outline Trial Specification [£24,090.00; Lead: CGI]

Outputs:

- Final Project Report

Deliverables & Milestones

Deliverables:

- WP5-D1 -- Report of findings from Powering Wales Renewably: Discovery. [02/06/2023]
- WP5-D2 -- Outline specification for Powering Wales Renewably: Alpha [02/06/2023]

Milestones:

- WP2-M1 - Delivery of Agreed Requirements and User Stories [05/05/2023]
- WP4-M1 - Delivery of Outline Technology Specification [19/05/2023]
- WP5-M1 - Delivery of the Report [02/06/2023]
Risk Management Strategy

Risk Management will be a continuous process, monitored by the Project Manager. An Identify, Assess, Control, Record approach will be used. Risks will be a standing item in the regular progress meetings. Mitigation activities, owner assignment and progress will be discussed. Escalation, with appropriate management, will be considered, where required.

Regulatory Barriers (not scored)

Barriers

At this stage, no policy or regulatory barriers to this project have been identified, both in project delivery and subsequent transition to BaU. This is an area that will be explored further during Discovery.

This project will leverage existing data standards and will test these standards in an operational environment, providing feedback on any issues that current approaches may raise. Hence, there are areas where greater policy and regulatory clarity could accelerate progress, including:

- Evolution of standards to facilitate data interoperability between energy system actors, building on the work of the ENA Data Working Group, Energy Digitalisation Taskforce, Energy Data Taskforce", the Virtual Energy System programme Common Framework and Icebreaker-One. This work is included within Work package 3 of our plan.
- Development of market structure/architecture and mechanisms to facilitate data access by system actors.
- Development of roles and obligations of energy system actors. This would help system actors to understand what they can reasonably expect from other system actors. Addressed in Work Package 2 of our plan, through the creation of User Stories.

Policy considerations

- The obligation to procure the most economically advantageous services in the future might be supplemented by a consideration of the carbon content.
- It remains an open question as to how future data services are best funded.

These will be considered within the Alpha phase of the project, but the focus of this project is to determine the value for each stakeholder, not how these services are to be funded.

Evidence

Industry stakeholders will be engaged during the Discovery Phase, Work Package 1 to discover what challenges they face in each of the three use cases. A report of these challenges will be compiled, including options for how they might be addressed in policy and regulation.

Derogations

It is not anticipated that there will be the need for a derogation for the project, as we are federating data from known BAU systems which are compliant with current license conditions.

As the project progresses through the different stages (Discovery, Alpha and Beta), continuous assessment of any (new or existing) potential regulatory barrier will be carried out and tackled by engaging with the relevant stakeholders.

Commercials

Route To Market

Our adoption strategy will provide an uninterrupted progression from Beta to BaU. The project will be aligned with existing BaU systems and processes, thereby eliminating barriers to rapid adoption, and;

- leveraging existing data models & systems, and Open Networks, ESC and EDiT outputs;
- enhancing existing business processes (flexibility management and network scenario analysis);
- federating real network data and demonstrate real data exchange between partners;
- adopting standards-based approaches (CIM, open transport protocols; VES Common Framework).

We are fully aligned with Open Data principles and are exploring data accessibility and usage for ALL stakeholders, while conscious of the potential for gaming, security, privacy, and the risk of proprietary locking of bespoke solutions. The project openness will allow other stakeholders to directly engage and have a clearer understanding of energy networks which serve their communities.

The project will demonstrate a scalable, BaU-ready solution, and this will not preclude competitive procurement based on requirements informed by the learning from this project. Allocation of industry coordination roles against organisations will inform the procurement and ownership of the systems. The project is agnostic and focused on the realisation of customer benefits at scale, informing requirements and models for future procurement.

ESO, as lead partner, will be central in the co-ordination of multi-party solution requirements and potentially single or multi-party procurement of the implementation services. CGI are pioneers in data solutions for network operators and supporting industry change.

The project is targeted at enabling the Network Operators to engage with their customers, including the Welsh Government, communities and renewable Distributed Energy Resource operators and owners. The Primary Customers are the ESO and network companies, who may use an existing market service entity to operate on their behalf. As a federated model, Open API's will be developed to enable data feeds to other parties, e.g. Data Map Wales.

Value Proposition

- Economic value through increased Network infrastructure hosting capability and renewable generation, and reduced connection costs.
- Sustainability value through hydrocarbon generation displacement.
- Innovation gearing -- rich data set available for additional use cases

In a later phase a detailed cost-benefit analysis will be developed enabling network operators to justify post-project BaU implementation. The project dissemination will enable the relevant stakeholders to collaborate, invest and deliver to market the BaU solution, and identify additional benefits enabled by this project.

Intellectual property rights (not scored)

Powering Wales Renewably project partners will comply with the default IPR conditions set out in Chapter 9 of the SIF Governance Document. Partners have identified and agreed background IP they expect to use in the Discovery phase and have in place the mechanisms to capture Foreground IP as it emerges.

The ownership model will be laid out in the contract and agreed before the project commences. It will comply with SIF Governance Document regarding IPR. These output findings will be included in the published report.

Network partners have confirmed that they do not anticipate any IP related constraints or concerns with the Powering Wales Renewably project. This will be reflected in a legal agreement amongst the project partners prior to beginning the Discovery project.

The lead, ESO, will publish project reports on the Energy Networks Association's Smarter Networks Portal. These will not include any commercially sensitive market information or any Critical National Infrastructure sensitive operational information. Following appropriate and proportional data assessment and agreement amongst the project partners, reports will be publicly accessible to share learnings widely.

The foreground IP generated will be software, methods and process. Existing background IPR mainly resides with CGI IT UK Ltd in the reuse of the Integrated Network Model CIM compliant data structures that serve Wales and are made available to the industry through

the WPD CIM project. This is a key accelerator for the creation of the Whole System Foundation model. In addition, CGI has already secured internal investment for the provision of a dynamic network model capability to add to the establishment of the Foundation, which will be made available to the project. Output findings will be included in the published report.

Where findings in the report are derived from project partner's Background (e.g., models, data or technologies), this Background IP will not be included in the report or made publicly available without the agreement of the IP Owner to protect the IP rights of project partners, as set out in Chapter 9.

Costs and value for money

Total Project Cost: £155,791.00

Total Project Funding Required: £135,491.00

Project Contribution: £20,300.00 (equivalent to 13.03% Project Contribution)

ESO (lead partner) will provide a 10% contribution relating to time required to provide expertise and ensuring coordination and successful delivery of the project.

The Welsh Government will provide guidance for setting strategic priorities/ plan for achieving Net-Zero goals and will provide a 100% contribution to the project.

CGI incur significant portion of the costs, as they are the expert data and digitalisation partner and will provide their expertise and digital know-how. CGI's contribution of 10% will be provided through contributions in kind from existing investments in background IPR, as well as a 10% discount in day rates.

There will be minimal costs for the other project partners. Their contributions will be time and expertise provided in project meetings and working groups that require minimal cash funding and are as follows:

- NGED: 10%
- NGET: 10%

The balance of costs/ SIF funding across partners reflects the effort required from partner for delivery of the work packages/ milestones (please see Question 12 Project Management Book for more details).

Sub-contractors

None. However, note that, as a government body, Partner 2 (The Welsh Government) has been entered as a sub-contractor of the lead partner on the portal to circumvent limitations of the IFS portal. Please note Welsh government, for purposes of assessment should be considered a partner and not a subcontractor. In addition to this, we would like to highlight that the Welsh Government is providing 100% contribution in benefit in kind.

Value for Money

The project will create a digital twin that not only delivers Wales' first at-scale whole electricity network digital twin, but also validates and delivers benefits to customers, citizens and communities working with the industry and regional government via the detailed model held within the twin.

The project delivery ensures value by leveraging previous innovations in the domain of data and digitalisation within the networks.

During Discovery we will explore the stakeholder relationship with digital representation of the energy networks and design the subsequent project phases to maximise the benefits.

Document Upload

Documents Uploaded Where Applicable

Yes

Documents:

SIF Discovery Round 2 Project Registration 2023-04-26 2_23

Other_Systems_and_Initiatives-v1.0-finalised.pdf

PWR Risk Register.pdf

Powering Wales Renewably Show and Tell 20230620 v1.0.pdf

Powering Wales Renewably Use Case Definitions and Personas.pdf

PWR Show and Tell v1.0.pdf

ESO 738261_ESO PWR Stakeholder Priorities and Benefits Report v 1.0.pdf

This project has been approved by a senior member of staff

☑ Yes