Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.

NIA Project Registration and PEA Document

Date of Submission

Sep 2019

Project Reference Number

NIA_SSEN_0041

Project Registration

Project Title

MERLIN (Modelling the Economic Reactions Linking Individual Networks)

Project Reference Number

NIA_SSEN_0041

Project Licensee(s)

Scottish and Southern Electricity Networks Distribution

Project Start

October 2019

Project Duration

2 years and 1 month

Nominated Project Contact(s)

Colin Mathieson

Project Budget

£338,600.00

Summary

The traditional approach to decision making on network reinforcements is done on an individual circuit by circuit basis i.e. System Planners will review the supply and demand characteristics of a circuit to determine if reinforcement is necessary based on future demand growth expectations. At this point it may be possible to reinforce via a traditional method e.g. install new overhead lines or possibly utilise a smart solution such as demand side response (DSR).

Preceding Projects

NIA_SSEN_0031 - Risk Assessment and Modelling of Smart nEtwork Solutions (RAMSES)

Third Party Collaborators

Opus One

CGI

RINA

Nominated Contact Email Address(es)

fnp.pmo@sse.com

Problem Being Solved

The traditional approach to decision making on network reinforcements is done on an individual circuit by circuit basis i.e. System Planners will review the supply and demand characteristics of a circuit to determine if reinforcement is necessary based on future demand growth expectations. At this point it may be possible to reinforce via a traditional method e.g. install new overhead lines or possibly utilise a smart solution such as demand side response (DSR).

The traditional Distribution Network Operator (DNO) approach causes a variety of problems, including:

· Contract uncertainty – An uncertain future means DNO's are unsure how long smart solutions will be needed for. It is likely that contracts will be over-estimated or under-estimated in length of time and required amount of service provision e.g. A Demand Side Response (DSR) solution may be contracted for four years to delay the need to reinforce a substation. However, sudden Electric Vehicle (EV) uptake within that area may force the need to reinforce the substation after two years. This means the DNO has unnecessarily paid for an additional two years of a contract it does not need.

· High costs of contracts – In order to meet strict DNO energy supply demands, smart solutions must provide a level of resilience that is acceptable for the DNO e.g. in the event that a smart solution can't supply the energy it is contracted to provide, such as when a technical fault occurs, it will incur large monetary fines by the DNO that may not be affordable for smaller energy providers and thus act as barriers to entry. Smart solutions must therefore seek alternative methods of providing energy during such a time e.g. they will need to have back up energy supply options on standby, which can be very costly. This means there is currently only marginal cost difference between traditional reinforcement options and smart solutions.

· Network risk issues – Engaging with smart solutions is a novel practice and the risks are poorly understood relative to traditional reinforcement approaches. Engaging with only one smart solution supplier for a period of time exposes the network to a host of risks e.g. The supplier may go bankrupt, get hacked, experience a technical fault, etc. All these risks can prevent energy being supplied at the required time, which can lead to blackouts and damage to existing network assets.

These issues pose a real risk to the efficacy of smart solutions being taken up and utilised to maximum potential. There is a need for DNO's to become 'enablers' rather than 'blockers' of smart solution technology. If this doesn't occur, it is likely that traditional reinforcement will continue to take place over smart solutions and cause upward pressure on the cost of electricity to our customers.

One solution to this problem is to move from a DNO model to a Distribution System Operator (DSO) model. In this future model a DSO will be able to act as an enabler of smart solutions, by acting as/or engaging with a neutral market facilitator. There is a lot of research into what a future DSO world will look like, but one area that is currently not being explored is Power Systems Economics.

Traditionally, DNOs have used the physics-based Power Systems Analysis to assess a power system's response to events in transient, dynamic and static timescales. However, to deliver a sustainable smart grid for consumers, understanding the effect economics has on the physics, and how the physics constrains or facilitates the economics, will become critical- this is known as Power System Economics.

MERLIN (Modelling the Economic Reactions Linking Individual Networks) is a collaborative project that is part BEIS and part NIA funded. The BEIS funding objective is to bring best practice innovation concepts from Canada into the UK. MERLIN is the UK's first attempt at utilising Power System Economics and will assist with the transition from DNO to DSO. We are partnering with Canada based Opus One Solutions who are currently able to deliver a model that utilises the principles of Power System Economics. We are also partnering with the University of Cambridge who will conduct research into alternative models that deal in Power System Economics. They will also conduct additional research into market rules and regulations that are optimal for Distributed Energy Resources (DER) uptake. This research will then be used to assist with developing the Opus One Solution tool, so that it is able to provide best value to the UK market. The learnings from the project will establish best practice market rules/regulations and modelling requirements for the future DSO world(s).

In summary, Project MERLIN delivers a first-of-a-kind transactive energy management system in the UK that will help:

· Optimise economic network investment

· Maximise the business case of industry investors

· Deliver cost efficient energy to the wider consumer

Method(s)

MERLIN is split into 4 key phases

Phase 1 – Define

Tasks in this phase include:

· Understanding the use of smart platforms such as the Opus One Grid OS tool that will be used in this project

· Uploading SSEN network data into partners smart platform tools

· Understanding the influence of policies/regulation on smart platform performance

· Creating a tool to value the effectiveness of DER

· Defining investment scenarios to be utilised in future phases

Phase 2 – Model

Tasks in this phase include:

- Building load/generation forecasts for the model
- Defining market rules to be used in the model
- Define data requirements
- Customise the Grid OS IDP tool based on previous research findings
- Model distribution planning scenarios within the Grid OS IDP tool

Phase 3 – Implement

Tasks in this phase include:

- Performing a trial model run utilising Fort William data
- Create a cost benefit analysis (CBA) to evaluate findings
- Define power systems economics requirements based on findings

Phase 4 – Operate

Tasks in this phase include:

- Performing a model run utilising Oxfordshire data and involving live participants i.e. DER players
- Create a CBA to evaluate findings
- Report on findings

There will be ongoing dissemination of findings during key milestones through the Open Networks Group and at industry events.

Scope

MERLIN is focused on two geographical areas, Fort William, which represents a rural network and Oxfordshire, which represents an urban network. The project is limited to understanding power systems economics and the influence it has under various scenarios. It will do this by implementing a smart platform tool that is currently used in North America.

The project is not focusing on forecasting or any other DSO functions. It will link closely with the LEO and transition projects and other DSO projects if outputs are available during the life-time of this project.

Objective(s)

This project has three high level objectives:

1. Understand how System Planners can utilise the Grid OS system in order to make more effective investment decisions in a future DSO world from an economic perspective.

2. Understand what information needs to be provided to DER players in order to make more effective investment decisions in a future DSO world from an economic perspective.
Understand what information needs to be provided to control engineers in order to make more effective operational decisions in a future DSO world from an economic perspective.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project will be a success if:

1. We can improve our understanding on how to make more effective economic decisions from a System Planner, DER player and Control Engineer perspective.

2. We are able to provide learning of implementing a smart platform tool, such as Grid OS, to the wider DSO community.
We can improve our understanding of how external factors such as Regulation and Policies impact the effectiveness of smart platforms.

Project Partners and External Funding

Project partners and external funding information is shown below.
Scottish Hydro Electric Power Distribution

Total Estimated Cost: £817,871.46

Total BEIS Funded: £479,271.46 (59%)

Total NIA Funded: £338,600 (41%)

Opus One Solutions
Total Estimated Cost: £930,413.25

Total BEIS Funded: £697.809.94 (75%)

Total Partner Funded: £232,603.31 (25%)

Open Grid Systems Ltd

Total Estimated Cost: £409,370

Total BEIS Funded: £307,027.50 (75%)

Total Partner Funded: £102,342.50 (25%)

EPRG Cambridge

Total Estimated Cost: £152,848.63

Total BEIS Funded: £152,848.63 (100%)

Total Partner Funded: £0 (0%)

Hydro Ottawa

Total Estimated Cost: £138,490.48

Total BEIS Funded: £83,094.29

Total Partner Funded: £55,396.19

Potential for New Learning

The main new learning objectives are:

1. Improve the understanding of smart platform utilisation within the UK

2. Understand external factors e.g. Regulation, policy, etc. and their effect on smart platforms

3. Understand the economic requirements for smart platform optimisation

Scale of Project

The total monetary value of the project is £2.4 million, spread over 19 months, between 5 partners and across two countries. A smaller scale project would not be able to achieve significant learning outcomes due to the collaborative multi-party nature of the project requiring speciailised disciplines from academics, IT developers and DNOs.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

Project MERLIN will physically trial in the UK, specifically the county of Oxfordshire which sits within SSEN's Southern licence area. Oxfordshire provides the strong base of active customers needed and other demonstrator projects in this area allow MERLIN outputs to be directly compared against.

Ahead of physical trial the solution will be tested and refined through near real-time simulation. The focal point for this implementation phase will be Fort William which sits within SSEN's North of Scotland licence area. This is designed to ensure developed methodologies are transferable and that benefits can be realised by consumers UK wide.

A BEIS funded sister project is also occurring within Canada, and learnings will be shared between projects.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

Total NIA Spend:£338,600
90% NIA Funded: £304,740
10% SSEN Funded: £33,860

Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

n/a

How the Project has potential to benefit consumer in vulnerable situations:

n/a

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

NA. This is a research-based project, but if successful the project will be able to provide insight into how customer savings can be achieved.

Please provide a calculation of the expected benefits the Solution

NA. This is a research-based project, but if successful the project will be able to provide insight into how customer savings can be achieved.

Please provide an estimate of how replicable the Method is across GB

The findings from this project will be replicable across all DNOs. Learnings will be shared in order to assist with implementation.

Please provide an outline of the costs of rolling out the Method across GB.

NA. This is a research-based project, but if successful the project will be able to provide insight into roll out costs.

Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

☑ A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).

☐ A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)

☑ A specific novel operational practice directly related to the operation of the Network Licensees system

☐ A specific novel commercial arrangement

RIIO-2 Projects

☐ A specific piece of new equipment (including monitoring, control and communications systems and software)

☐ A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven

☐ A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)

☐ A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology

☐ A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution

☐ A specific novel commercial arrangement

Specific Requirements 4 / 2a

Please explain how the learning that will be generated could be used by the relevant Network Licensees

· DNOs will be able to implement their own Smart Platform tools without having to go through the same research and development (R&D) as the TRL will be higher and proven to work in the UK

· Improving understanding of Power System Economics will assist other DNOs in making more informed investment decisions and help with the transition towards a DSO.

· Additional areas of research may be identified where other DNOs can explore to help the transition towards DSO.

· An improved understanding of DER player requirements can assist DNOs in making more informed investment decisions.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

NA: This project is aimed at filling research gaps proposed by the Open Networks Project with the aim of moving to a future DSO world.

☑ Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

Is the default IPR position being applied?

☑ Yes

Project Eligibility Assessment Part 2

Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

Power Systems Economics has not yet been researched within the UK. This is a first of its kind project.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

n/a

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

The project is innovative as it is trailing a novel smart platform for economic analysis that has not been done in the UK before now. It hasn’t been done before as it has only recently been identified by the Open Networks Group as an area that needs to be researched in order to assist with the transition towards DSO.

Relevant Foreground IPR

n/a

Data Access Details

n/a

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

There are no funds available within the RIIO-ED1 settlement to perform such a large and complex project and no funds were made available as it was not envisaged that such a project would be necessary. The TRL of the tool being developed is also too low to be funded by BaU and as such requires additional resources to be spent on it before it can reach BaU readiness.

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project

Commercial risk: NIA funds reduce the commercial risk of the project by providing readily available funds specifically for R&D activities. There is a risk that if BaU funds were available, they could be re-allocated elsewhere to fund BaU needs that are deemed business critical. Without NIA funds this long-term vision of innovation development would not be possible. Regulatory risk: SSEN does not have the technical capabilities to perform this project alone. It requires collaboration from multiple parties. Without NIA funds to support SSEN in this collaborative project, we would be excluded from the BEIS funding element, which takes up 60% of the project costs. As lead partners in this project it would cause the project to be significantly delayed or not take place at all.

This project has been approved by a senior member of staff

☑ Yes