NIA Project Registration and PEA Document

Date of Submission

Mar 2019

Project Reference Number

NIA_NPG_031

Project Registration

Project Title

Health Index Study of Electrical Energy Storage Systems within Electricity Networks.

Project Reference Number

NIA_NPG_031

Project Licensee(s)

Northern Powergrid

Project Start

March 2019

Project Duration

1 year and 7 months

Nominated Project Contact(s)

Andrew Webster

Project Budget

£35,000.00

Summary

A small scale project to determine the feasibility of health indices for EES and to identify an initial methodology.

Nominated Contact Email Address(es)

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Problem Being Solved

Electrical energy storage (EES) systems, usually in the form of batteries of varying technologies, are increasingly being connected the distribution network. This is either by second or third-parties participating in market mechanisms to support the broader electricity system or, as is the case in NPg's Microresilience project, to provide local network support and resilience.

EES systems will become an increasingly important element of the overall electricity system. As such it is important that the general condition of EES is understood in the same way that other asset types are through health indices so that the overall system risk at any point in time can be ascertained and appropriate actions can be taken to manage that risk.
A great deal of work has been undertaken in the area of EES and the various degradation and failure modes that this technology is subjected to. This work has not been drawn together to provide a comprehensive approach to determining the health of EES assets in a way that is compatible with and analogous to current utility asset management methodologies

Method(s)

To address the problems described above, this six-month project will assess the health condition of electrical energy storage systems which are used in grid storage applications. It will consist of 3 stages, as follows:

- Stage 1: A literature review will be conducted to summarise the current state of electrical energy storage system technology, currently available health condition criteria and relevant health monitoring methods.

- Stage 2: The technology to be assessed will be identified. Health condition criteria that are applicable for the health index assessment of the chosen technology will be defined and a suitable health monitoring method will be chosen.

- Stage 3: A case study will be carried out to assess the health condition of the chosen technology using data provided by NPg, which will verify the applicability of the proposed method.

Based on the results gained from the case study, how to improve the health condition and potentially prolong the lifespan of the electrical energy storage system under study will be recommended. This will enhance current understanding on the dependability of storage systems.

Scope

The scope of this any EES system that is likely to be attached to the distribution network in a network support role. This may include HV and LV connected devices.
The technologies to be studies will be those that are perceived to be sufficiently mature that they are already on or likely to appear on the network over the next five to ten years.

Objective(s)

The objectives of this project are to

- summarise existing literature of energy storage system technology (e.g. types of batteries, power electronics etc.) for grid storage applications from technical, legislative, environmental and/or economic perspectives which is feasible within the project's lifespan;

- identify a technology, relevant parameters (for instance, age, likelihood of failure, dependability, capacity, system design such as a few large systems versus many smaller systems, usage etc.) and define health condition criteria i.e. significant factors that are key for further investigation in this project;

- analyse existing state of health monitoring methods, for instance, classification, characteristics, challenges, advantages, limitations, underlying concept and mathematic formulas of individual methods that are applicable to energy storage systems technology; and

- determine the health index of the chosen technology under study by defining selection criteria, choosing and applying the most suitable health monitoring method in the project.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Project success criteria are the successful delivery of the listed project objectives or the halting of the project, having concluded that the objectives are either not technically and/or economically feasible, at any of the project stage gates. In either case a successful outcome would include dissemination of the project findings and the learning developed.

Project Partners and External Funding

n/a

Potential for New Learning

The literature review and asset management tool using health index being carried out and developed in this project could provide opportunities to DNOs to practically strengthen their technical knowledge, deploy the innovative tool, and assist in their decision making in choosing electrical energy storage technology alternatives and/or planning for future usage and maintenance.

Scale of Project

The project is a small-scale desktop/literature study and development of a health index tool in line with others already deployed by DNOs. Network trials are not appropriate for this activity.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

N/A

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£35k

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)

The level of maturity of the technology is relatively low and the savings through the improved economic operation of the network are strill difficult to determine. However the project allows an initial attempt to understand asset life optimisation for a new asset class and as such will help to ensure economic efficiency, and therefore cost, is the best possible.

Please provide a calculation of the expected benefits the Solution

Low initial TRL N/A.

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

The method is entirely replicable across the GB network. Predcitions of EES take up cover an extremely large range.

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

Costs are negligible.

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

The asset class for which the study is being undertaken is already being deployed on all DNO networks and the trend direction , again for all operaors, is likely to be upwards. Learning is therefore directly applicable to all network licencess.

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

The project supports the two specific challenges of improving reliability and availability of the network through improved resilience and the need to support increasing needs of customer flexibility.

☑ 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.

No evidence can be found of health indices being developed for EES for use on the GB network. The first phase of this project, through a comprehensive literature search, will determine if this has been conducted elsewhere and to what standards.

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

Lack of technology roll-out and low technology maturity.

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

Project is low TRL and therefore at high risk of not delivering a BAU product. Further the project is future focussed; very wide scale deployment of EES is still subject to a wide range of economic, regulatory and technological headwinds. A successful project may also provide the bulk of the benefit, ultimately, to EES operators rather than DNOs.

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

Alterniatiuve funding at this scale has not been identified either within the business or through external call for projects which are currently open.

This project has been approved by a senior member of staff

☑ Yes