

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

Apr 2015

### Project Reference Number

NIA\_WPD\_004

## Project Registration

### Project Title

Solar Storage

### Project Reference Number

NIA\_WPD\_004

### Project Licensee(s)

National Grid Electricity Distribution

### Project Start

April 2015

### Project Duration

3 years and 10 months

### Nominated Project Contact(s)

Jenny Woodruff

### Project Budget

£864,182.00

## Summary

- 1) Complete Design of BESS.
- 2) Procure equipment, install and commission.
- 3) Run trials and write report.
- 4) Identify changes necessary for participation on the Balancing Mechanism.

## Problem Being Solved

Integrating storage with renewable generation offers a route to addressing some or all of the following issues:

- (i) Renewable generation does not predictably match peak local demand.
- (ii) Renewable generation is often 'spikey', which can introduce short-term impacts on grid voltage or other quality of supply factors.
- (iii) Unpredictability, lack of control mechanisms and power quality mean grid operators use very conservative rules to allocate grid connections.
- (iv) Grid operators have to introduce new equipment to manage power quality, a service which could be provided by operators of utility scale renewable installations.
- (v) Without the ability to respond quickly to local surges in load, grid operators manage network capacity within tighter limits than might otherwise be possible.
- (vi) Introducing two or more active storage or quality management devices onto the same HV circuit may cause them to interact with each other and have a negative impact on power quality.

## Method(s)

A battery and control system will be integrated with a 1.3MW PV array connected to WPD South West's 11kV network. Analysis of the detailed data set created by carrying out a set of well defined trials (usage cases) will form the technical core of the project. The use cases will demonstrate:

- 1) Sale of energy stored in the battery for a higher price;
- 2) Better matching of generation profiles to demand profiles;
- 3) Use of storage to peak lop PV generation above a (dynamic) power threshold;
- 4) Import electricity from the grid at times of low demand;
- 5) Absorption and supply of reactive power to help manage the network voltage;
- 6) Reduced connection capacity requirement per MWp generation capacity;
- 7) More predictable PV output through smoothing PV's steep ramp rates;
- 8) Raise or lower the export power threshold depending on thermal or voltage constraints;
- 9) Show the control system allows smart co-ordination of multiple storage systems.

Analysis of the data will quantify the potential value of each use case.

The project team will work with stakeholders and project participants to propose potential changes to regulations, grid code, balancing mechanisms etc to allow reward for investment in storage.

## Scope

- 1) Complete Design of BESS.
- 2) Procure equipment, install and commission.
- 3) Run trials and write report.
- 4) Identify changes necessary for participation on the Balancing Mechanism.

## Objective(s)

- 1) Quantify the potential value to network operators and others of integrating storage with DG.
- 2) Use real-world operation of an integrated utility scale storage:generation system to provide data to regulators and potential investors.
- 3) Demonstrate safe, reliable operation of the system under operational conditions.

## Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

## Success Criteria

Phases 1 to 4 above completed safely, on time and on budget. All usage cases are investigated and a comprehensive analysis of all data collected undertaken. Useful and applicable conclusions generated from the data analysis. Effective communication of the project's results and conclusions to the UK renewable energy and power distribution community. Successful engagement with stakeholders, influencing the development of relevant governing mechanisms such as the grid code or balancing mechanism (BM).

## Project Partners and External Funding

British Solar Renewables Ltd will provide the use of the solar park and contribute 5467 hours of engineering to the project, worth £259,571.64

The National Solar Centre (Building Research Establishment) will contribute 57 hours of technical expertise to provide oversight from an independent third party.

## Potential for New Learning

A manual for the business case for future solar energy storage systems will be produced covering:

- A control system for this application that only imports electricity when intended.
- The size of battery and clipping probability required for a given level of peak lopping.
- The fraction of the battery used and the typical duty cycles, informing design requirements.
- Best operation strategy and optimum revenue streams.

Learning will be shared by presentations at the LCNF conference and DG forums, and a final report.

## Scale of Project

A system smaller than 300kW would not make a measurable difference to voltage levels on a 11kV network. A prototype on this scale

is desirable to give industry stakeholders sufficient confidence for a larger roll out to be possible.

We have used real-time 15s data from other installed PV systems in the same area to identify the lowest Storage:Generation ratio compatible with quick delivery of the project.

### **Technology Readiness at Start**

TRL7 Inactive Commissioning

### **Technology Readiness at End**

TRL9 Operations

### **Geographical Area**

Somerset, UK

### **Revenue Allowed for the RIIO Settlement**

Nil

### **Indicative Total NIA Project Expenditure**

£684,738

## 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 estimated saving from unlocking an extra 10GW of capacity at the high-cost project threshold of £200/kW is about £2 billion.

#### Please provide a calculation of the expected benefits the Solution

DNO annualised cost for current conventional method is £570/MVA

DNO potential annualised cost of the Method being trialled is (£13K/MVA+£5k)/year

DNO expected financial benefit is £570k/MVA-(£13k/MVA+5k)/year

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

The Method can be applied to any large solar farm, and much of the learning will apply to any other large renewable generator. It will be suitable for approximately 700 solar sites with an average size of 5MW.

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

DECC's target for solar deployment in the UK is 20GW by 2020, of which approximately half will be from Large Photo-voltaic generators. The cost on roll would be around £1350k per 1MW 3MWh system. As the costs for The Method scale linearly this totals just over £945m for 700MW.

### 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 same system connection architecture and communications system could be used for any behind the meter energy storage system and will demonstrate one way of implementing alternative connections with reduced curtailment from distributed generation.

#### 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 addresses the challenge of managing ever higher levels of distributed generation connections.

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 other project in the UK is looking at the specific benefit to DNOs of energy storage co-located with large photo-voltaic generators on the 11kV network.

#### 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

n/a

#### 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**

n/a

**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**

n/a

**This project has been approved by a senior member of staff**

Yes