WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

**Date of Submission**

**01/04/2015**

# NIA Project Registration and PEA Document

*Notes on Completion:* Please refer to the **NIA Governance Document** to assist in the completion of this form. Please use the default font (Calibri font size 10) in your submission. Please ensure all content is contained within the boundaries of the text areas. The full-completed submission should not exceed 6 pages in total.

## Project Registration

**Project Title**

Solar Storage

**Project Reference**

**NIA_WPD_004**

**Funding Licensee(s)**

Western Power Distribution (East Midlands)
Western Power Distribution (West Midlands)
Western Power Distribution (South West)
Western Power Distribution (South Wales)

**Project Start Date**

Apr 2015

**Project Duration**

3 years (Apr 2018)

**Nominated Project Contact(s)**

Steven Gough – WPD Innovation & Low Carbon Engineer

**Project Budget**

£1,751,478

**Problem(s)**

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.

**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).

**Technology Readiness Level at Start**

Technology Readiness Level 7.

**Technology Readiness Level at Completion**

Technology Readiness Level 9.

**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.

**Geographical Area**

Higher Hill Farm, Butleigh, Somerset, BA6 8TW.

**Revenue Allowed for in the RIIO Settlement**

0

**Indicative Total NIA Project Expenditure**

£1,483,304

## Project Eligibility Assessment

### Specific Requirements 1

**1a. An 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 systems and 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 | ☐ |

### Specific Requirements 2

**2a. Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees** ☒

Please answer one of the following:

i) Please explain how the learning that will be generated could be used by relevant Network Licenses.

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.

ii) Please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the Project.

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

Is the default IPR position being applied?

| | |
|---|---|
| Yes | ☒ |
| No | ☐ |

If no, please answer i, ii, iii before continuing:

i) Demonstrate how the learning from the Project can be successfully disseminated to Network Licensees and other interested parties

ii) Describe how any potential constraints or costs caused, or resulting from, the imposed IPR arrangements

iii) Justify why the proposed IPR arrangements provide value for money for customers

**2b. Has the Potential to Deliver Net Financial Benefits to Customers** ☒

Please provide an estimate of the saving if the Problem is solved.

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 financial benefits of a Development or Demonstration Project (not required for Research Projects). (Base Cost – Method Cost, Against Agreed Baseline).

| Problem sub-issue | Potential annualised cost of the Method being trialled. | Most efficient Method currently in use (HV OH, £35k/km for how many kW?) | Annualised cost |
|---|---|---|---|
| Generator costs (potential future costs @ £600k+£200/kWh + £150/kW, 1MW, 3MWh) | | | |
| N/A Generator only | £1350k/MVA | Over size solar park and increase curtailment. | £750k/MVA |
| | | Increased network reinforcement . | £150k/MVA |
| Sub total | Generator Method cost £1350k/MVA | | Generator Base case £900k/MVA |
| Generator financial benefit -£450k/MVA | | | |
| DNO costs. | | | |
| (i) | 0 | As above plus rotate arrays westwards | £200k/MVA |
| (ii) | £2k/MVA/yr | Network reinforcement / backup generation | £100k/MVA |
| (iii) | £2k/MVA/yr | Network reinforcement. | £100k/MVA |
| (iv) | £3k/MVA/yr | Statcoms or capacitor banks. | £20k/MVAR |
| (v) | £3k/MVA/yr | Increased curtailment network reinforcement . | £75k/MVA |
| (vi) | £3k/MVA/yr | Network reinforcement. | £75k/MVA |
| (vii) | £5k/year OPEX | N/A | 0 |
| Sub total | DNO Method cost (£13k/MVA +£5k)/year | | DNO Base case £570k/MVA |
| DNO financial benefit £570k/MVA-(£13k/MVA+£10k)/year | | | |

Please provide an estimate of how replicable the Method is across GB in terms of the number of sites, the sort of site the Method could be applied to, or the percentage of the Network Licensees system where it could be rolled-out.

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.

## 2c. Does Not Lead to Unnecessary Duplication ☒

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