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

Aug 2015

Project Reference Number

NIA_NGET0170

Project Registration

Project Title

PV Monitoring Phase 2

Project Reference Number

NIA_NGET0170

Project Licensee(s)

National Energy System Operator

Project Start

August 2015

Project Duration

2 years and 1 month

Nominated Project Contact(s)

Jack Barber

Project Budget

£438,888.00

Summary

Development of a solar estimation model, a data provision service and its integration into National Grid forecasting operations.

Nominated Contact Email Address(es)

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Problem Being Solved

The level of solar photovoltaic (PV) generation in Great Britain (GB) has boomed over the last five years. This has been driven by the FiT and RO incentive schemes. We now have close to 600,000 individual sites with over 6,400 MW of total capacity; the installation rate is currently moving at 100MW per month. Assuming this modest level of continued growth, we estimate that GB solar capacity will be about 13 GW by 2020, similar to the current level of wind generation.

All PV installations are connected directly to the distribution network. This causes significant issues for the National Grid. Solar PV installations are quite small (typically 4KW home installations with larger commercial solar farms ranging from 1MW up to 40MW) and have no obligation to provide metering to National Grid. The impact is that these installations suppress the electricity demand at a National and a Grid Supply Point level. This apparent reduction is challenging to forecast without metering. This project's aim is to obtain near real time metering and historical data to improve electricity demand forecasting.

Many of the challenges we face with solar generation are similar to those faced with wind; both have highly variable weather dependant output, and both are embedded in the distribution network. The critical difference is that for wind generation, 70% of GB's installed

capacity has transmission system metering. This has allowed us to develop and train our forecasting techniques over time; as such we forecast wind generation to a high level of accuracy. For solar, we can not benefit from this feedback mechanism. The energy forecasting team has developed new methods for forecasting solar generation. However, with no direct visibility of output it is difficult to optimise models. As such daytime demand forecast error has increased steadily as the level of solar capacity has grown.

At its current level of capacity, solar generation is contributing an estimated 450 MW towards summer daytime demand forecast error. This will increase with installed capacity. In order to manage solar generation on the network now and in the future, National Grid needs visibility of real-time output.

Method(s)

This project builds on previous work done through the NIA project PV Monitoring Phase 1. The method is to use metered generation data from a sample of regionally distributed sites to estimate GB solar generation. Phase 1 investigated whether this was possible by utilising National Grid's sites. The learning from this was that though this is possible, the time required to develop our own monitoring network is too great to address the problem. This project will accelerate this process by working with Sheffield Solar, a research group at the University of Sheffield.

Sheffield Solar was set up to investigate solar generation. Through their work, they have built up unique expertise in gathering validating and making available data on renewable generators. They own and maintain the Microgen Database; this stores output data from over 6500 UK based sites. These are mostly small scale and well distributed across the UK.

This project will utilise the Microgen Database to develop techniques for estimating solar generation based on sample data. This will be used to provide a real-time estimate of GB and regional solar generation to National Grid. Model outputs will be tested and trained against National Grid metered data, with an aim to integrate the data into operational processes.

Scope

Development of a solar estimation model, a data provision service and its integration into National Grid forecasting operations.

Objective(s)

The project will be delivered over two years with the following objectives:

- Develop methodology for using metered generation data from a sample of solar sites to estimate total GB solar generation. Establish a good understanding of the local variation of solar generation and the confidence levels in the estimation. Use methodology to develop a historic estimate of output for testing against observed National Demand data.
- Use developed methodology to calculate an estimate of real-time estimation of GB solar output at half hourly resolution. Establish a real-time data feed providing GB estimate to National Grid for operational use. Continue to test and train national model.
- Develop methodology for a higher geographic resolution model, investigating the benefits of using additional variables such as weather data to enhance outputs. Develop historic estimates for testing outputs against GSP metered data.
- Use enhanced methodology to provide real-time estimates of solar generation at a regional level.
- Develop National Grid based solution as operational backup.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

- The project will provide a methodology for using sample data to predict national and regional solar generation
- The project will establish a live data feed of national and regional solar generation with National Grid. Data will be integrated into National Grid's electricity forecasting operations.

Project Partners and External Funding

n/a

Potential for New Learning

Although solar generation has been present in the UK since 2010, we still do not know how much power is being generated or how it impacts the UK's power networks. This project aims to get visibility of solar generation; such that it can be integrated into the power networks and fully utilised as a technology. This benefits not only transmission, but also distribution and the wider solar industry.

Scale of Project

The project will involve National Grid's Energy Forecasting team and Sheffield Solar.

Technology Readiness at Start

TRL7 Inactive Commissioning

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

GB

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

Indicative NGET NI expenditure is £438,888

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)

This project will reduce demand forecast error that results from embedded solar generation; subsequently reducing system balancing costs and leading to significant savings to the Industry and to National Grid.

Please provide a calculation of the expected benefits the Solution

On the basis that through this methodology we can achieve similar forecast performance for solar as we have with wind we can expect a saving in reserve holding in the region of £6.25 million annually. In addition to this there are further savings through the balancing mechanism through a reduction in control room actions.

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

This is a GB solution.

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

No additional 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

All outcomes and lessons following the implementation of the project will be disseminated through the National Grid Innovation Strategy website, the ENA website, at the annual NIA conference and in the final year report.

Real-time solar estimation outputs will be shared with the industry via the Microgen Database website and National Grid's Operational Data webpage.

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

n/a

☑ 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.

NGET can confirm that no unnecssary duplication will occur as a result of this 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

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