

## NIA Project Registration and PEA Document

### Date of Submission

May 2017

### Project Reference Number

NIA\_NPG\_015

## Project Registration

### Project Title

Geospatial PV Mapping

### Project Reference Number

NIA\_NPG\_015

### Project Licensee(s)

Northern Powergrid

### Project Start

May 2017

### Project Duration

1 year and 1 month

### Nominated Project Contact(s)

NPG – Paris Hadjiodyseos (Lead network), SPEN – Andy Wilcox

### Project Budget

£210,000.00

## Summary

The Project will be split into four work packages –

### PV panel mapping -

- Acquire recent VHR satellite imagery and other geospatial datasets of four trial areas
- Map existing and potential PV panel locations and installation size based on roof size/slope/orientation/shading/roof obstructions
- Merge with Ordnance Survey mapping/addressing to determine actual and potential PV installations at individual property level
- Run a comparison of the existing PV panel installation database against an OFGEM FIT database and produce a comparison report

### PV panels mapped into the GIS LV network and develop modelling software

- Map existing and potential PV panel connections into the GIS LV network
- Review DNOs modelling capabilities to simulate existing and potential PV panel power flows in the GIS LV network
- Agree scope of modelling for the project
- Identify how the use of satellite imagery can contribute to identifying voltage rise hotspots on the LV network, and “at risk” secondary transformer locations
- Develop interactive tool to enable DNOs to model different PV energy input scenarios

### Improve Solar Irradiation forecasting

Integrate existing solar irradiation data with the modelling software and develop improved solar irradiation forecasting models for

medium- and longer-term horizons. This work will be led by the Satellite Application Catapult in partnership with the Met Office. The results of this will then be integrated with the modelling software developed in the previous stage to allow improved forecasting to be applied at a local scale i.e. with the LV network map. Test PV energy generation forecasting model to predict energy generation from installed (and potential) PV panels on the LV network at various timescales.

## Final report

Final report detailing the methodology undertaken, the project results, deliverables and economics.

## Nominated Contact Email Address(es)

yourpowergrid@northernpowergrid.com

## Problem Being Solved

It is difficult to correlate data from a DNO PV panel installation database with the Ofgem feed In tariff (FIT) database, to quantify connection points to the LV distribution network and assess the impact of PV panels on the DNO network.

PV panel affordability, coupled with carbon-friendly policies (even if the incentives to install panels have fallen sharply in recent years), will inevitably lead to an ever increasing number of PV panels connected to the LV distribution network. The increased penetration of PV panels and lack of their visibility on the LV network is likely to give rise to a range of network management issues. Examples include:

- Identification of PV panel concentrations on the LV network;
- PV panels not able to export due to the LV network voltage rise, leading to PV panel inverters tripping off;
- Potential reverse power flows through the transformer at the secondary substation;
- Difficulties in planning network maintenance and outages due to potential reverse power flows; and
- The need to forecast PV panel energy generation.

## Method(s)

The project aims to utilise satellite imagery to identify existing rooftop solar installations. These datasets will be integrated with Ordnance Survey MasterMap digital mapping and address information. Then using software already developed by Geospatial Insight potential PV output will be calculated, for both existing PV installations and for potential installations for each property in the selected areas.

Additional software integrated and created in the project will be added to this, to enable the output from existing and potential PV installations to be estimated throughout any given time period (hourly/daily/weekly etc.) based upon the time of day/time of year. Furthermore, this would allow forecasting of future output through the combination of this functionality with satellite based weather forecasts in the short-, long- and medium-term. This functionality would then be integrated with a DNO's LV network data and software developed in this project would be used to model solar PV impacts on the network capacity in both planning and operational timeframes.

The individual project elements have never been bought together before. The project aims to integrate these elements and to assess whether they can deliver the required outputs with the required quality.

## Scope

The Project will be split into four work packages –

### PV panel mapping -

- Acquire recent VHR satellite imagery and other geospatial datasets of four trial areas
- Map existing and potential PV panel locations and installation size based on roof size/slope/orientation/shading/roof obstructions
- Merge with Ordnance Survey mapping/addressing to determine actual and potential PV installations at individual property level
- Run a comparison of the existing PV panel installation database against an OFGEM FIT database and produce a comparison report

### PV panels mapped into the GIS LV network and develop modelling software

- Map existing and potential PV panel connections into the GIS LV network
- Review DNOs modelling capabilities to simulate existing and potential PV panel power flows in the GIS LV network
- Agree scope of modelling for the project
- Identify how the use of satellite imagery can contribute to identifying voltage rise hotspots on the LV network, and “at risk” secondary transformer locations
- Develop interactive tool to enable DNOs to model different PV energy input scenarios

### **Improve Solar Irradiation forecasting**

Integrate existing solar irradiation data with the modelling software and develop improved solar irradiation forecasting models for medium- and longer-term horizons. This work will be led by the Satellite Application Catapult in partnership with the Met Office. The results of this will then be integrated with the modelling software developed in the previous stage to allow improved forecasting to be applied at a local scale i.e. with the LV network map. Test PV energy generation forecasting model to predict energy generation from installed (and potential) PV panels on the LV network at various timescales.

### **Final report**

Final report detailing the methodology undertaken, the project results, deliverables and economics.

### **Objective(s)**

The objectives of this project are to:

- Deliver a GIS database of existing and potential solar output, at a property-by-property level, in each study area
- Produce a dynamic software model of the LV networks in each study area, where changing impacts of actual and potential PV energy flows can be simulated and future uncertainties quantified
- Produce an improved solar irradiation forecasting method and software that can be integrated into the dynamic software model
- Assess the economics and efficacy of using satellite data for this and similar types of application.

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

n/a

### **Success Criteria**

The Project will be successful if :

- It is shown that the solar PV data delivered offers an improvement in the understanding of current PV deployment in comparison to the data available from OFGEM and other sources
- The solving of actual and potential solar PV network impacts can be recognised as having real benefits to the networks
- The Proof-of-Concept online service is intuitive to use
- The Proof-of-Concept online service allows flexible analysis of identified issues
- The solar irradiation forecasts service can be identified as improving knowledge and intelligence over and above existing forecasting services used by the DNOs
- The finished Proof-of-Concept materially improves the DNO's ability to predict the impact of changes in PV output, in the short-, medium- and long –terms on LV network performance and safety

### **Project Partners and External Funding**

n/a

### **Potential for New Learning**

n/a

### **Scale of Project**

The project will be limited to utilising satellite imagery of four urban areas, as examples typical of the GB network, each 2 km by 2km in size. No network equipment will be installed.

### **Technology Readiness at Start**

### **Technology Readiness at End**

TRL3 Proof of Concept

TRL6 Large Scale

## Geographical Area

Desktop analysis based on network areas in the NPg and SPEN licence areas.

## Revenue Allowed for the RIIO Settlement

None

## Indicative Total NIA Project Expenditure

£210,000

## 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 project outcomes potentially provide an opportunity to reduce planning costs and to optimize re-inforcement programmes at low voltage to allow the implementation of low carbon technologies such as domestic PV.

We estimate that the avoidance of just two LV reinforcement scheme per DNO per annum would provide savings of £1.24m each year, say £10m over a price control period. In reality we would expect the applicability of this technology to be higher, and certainly so in future.

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

Project has initial TRL of 3 and benefits are not yet clear or confirmed.

The benefits are likely to be similar to other projects aimed at understanding the impact of low carbon technologies on the low voltage network. This benefit has been co-calculated at around £51k per avoided intervention. Only limited applicability of the project outputs are therefore required to produce a positive business case and net benefit for the customer.

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

The approach is relevant and applicable to all GB DNOs.

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

Roll-out costs across the whole of the GB network are estimated at less than £1m.

### 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

#### RIO-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 project learning could be utilized by all UK DNOs that have PV installations connected to their networks. The issues that this creates are common to all DNOs.

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

The Northern Powergrid innovation strategy specifically details the needs to apply new technologies and techniques to operational and planning, both to drive down the cost of network management and to support the changes required to implement low carbon technology. This project supports all of those challenges. Similar challenges are detailed in the SPEN innovation strategy.

☒ 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.

n/a

#### 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