# NIA Project Registration and PEA Document

## Date of Submission

Jan 2014

## Project Reference Number

NIA_NGET0016

## Project Registration

### Project Title

UK-wide wind power: Extreme and Variability

### Project Reference Number

NIA_NGET0016

### Project Licensee(s)

National Energy System Operator

### Project Start

August 2012

### Project Duration

1 year and 10 months

### Nominated Project Contact(s)

David Lenaghan

### Project Budget

£140,000.00

### Summary

The scope of this project is defined by 5 work packages:

- Work Package 1: Developing metrics

- Work Package 2: Obtaining and quality controlling data

- Work Package 3: Validating reanalysis and evaluation of metrics

- Work Package 4: Scoping for future work

- Work Package 5: Dissemination

### Third Party Collaborators

University of Reading

### Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

### Problem Being Solved

The generation mix in the UK is changing; controllable large thermal generation units located relatively close to centres of electricity demand are being closed down. Dispersed intermittent, predominantly wind generation located towards the periphery of the network are being developed. This is radically changing the nature of system management and increasing the complexity of the problem. Knowledge about generation patterns and network flows are essential to the appropriate placement of network outages as well as balancing the cost and risks of procuring necessary energy reserves.

Wind Power Forecasts (WPF) have become essential to the safe and economic operation of the GB transmission system. As experience has been gained in the process of generating forecasts and improving their accuracy it has become apparent that there is a need to better understand the risks associated with extreme meteorological events.`

## Method(s)

**Research**

This project will generate knowledge about extreme wind events and represent an essential first step in a chain of work to understanding how such events effecting security of electricity of supply in Great Britain.

The study will investigate three types of extreme events:-

- high wind events  (where the wind speed is in excess of the normal operating speed of a wind farm (usually 25 m/s at a turbine height of 60m above ground level)
- transition and ramping events  (where wind speed is rapidly changing and gusty)
- prolonged low wind events ( where the wind speed is low for several days)

Investigation into these events will enable analysis to be performed and knowledge gained on the frequency, severity and duration of such events.  This knowledge will allow National Grid to begin adapting its business-operating model to ensure extreme scenarios are effectively managed when they occur.

## Scope

The scope of this project is defined by 5 work packages:

- **Work Package 1: Developing metrics**
- **Work Package 2: Obtaining and quality controlling data**
- **Work Package 3: Validating reanalysis and evaluation of metrics**
- **Work Package 4: Scoping for future work**
- **Work Package 5: Dissemination**

## Objective(s)

Each of these weather events will cause significant challenges to the safe and secure operation of the national electricity transmission system and it is anticipated that this project will enable analysis to be performed and knowledge gained on the frequency, severity and duration of such events. This knowledge will allow National Grid to begin adapting its business-operating model to ensure extreme scenarios are effectively managed when they occur.

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

n/a

## Success Criteria

The success criteria for this project include the completion of by 3 specific deliverables:

Preliminary report:

- Initial documentation describing the specific meteorological metrics ("critical wind properties") associated with extreme power system events, identified and designed in discussion with National Grid

Mid-project report:

- Update on reanalysis surface wind dataset validation exercise
- Discussion of preliminary results of "critical wind properties" exercise (identifying the statistics and behaviour of these properties in the reanalysis dataset).  This will focus on assessing the statistics of raw meteorological properties (e.g., wind speed) rather than

transforming it into energy system properties (e.g., wind power output).

Final report:

- Results of reanalysis surface wind speed verification exercise (recap)
- Results of "critical wind properties" exercise, emphasising the nature and interesting features of the three extreme phenomena and their impact on the energy system
- Identification of aspects for future research

## Project Partners and External Funding

University of Reading.

## Potential for New Learning

Through this porject National Grid is seeking to improve its understanding of these exterme wind events and this study is recognised as an essential first step towards improving the security of network management.  It will also inform decisions regarding the appropriate and economic use of reserves in the evolving and challenging wind dominated generation environment.

## Scale of Project

The project will be limited in scale to lab-based studies and site investigation.

## Technology Readiness at Start

TRL2 Invention and Research

## Technology Readiness at End

TRL3 Proof of Concept

## Geographical Area

This project is being undertaken in Reading.

## Revenue Allowed for the RIIO Settlement

None

## Indicative Total NIA Project Expenditure

The total NIA project expenditure will be £140,000

# 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)

Wind Power Forecasts (WPF) have become essential to the safe and economic operation of the GB transmission system. As experience has been gained in the process of generating forecasts and improving their accuracy it has become apparent that there is a need to better understand the risks associated with extreme meteorological events. Approximately 1 GW of wind-power forecast error (approximately 15-20% of current installed wind capacity) that persists for around 12 hours can lead to additional costs to NG of between £100k and £400k.

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

This is not required for research projects

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

Although the primary objective of this project is to reduce the number and cost of actions required by the GBSO in the ancialliary services market for managing wind forecast uncertainty the learing from this project will also be valuable to other GB Network Licensees in nderstanding the effect that extreme wind events can have on network power flow and the effect this has n network capacity requirements in the future.

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

The cost of rolling out the method will be dependent on the findings of the research and is likely to involve further demonstration and development.

## 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

It is anticipated that the information provided by this project will assist the National Transmission System Operator to formulate a framework around the weather scenarios that have occurred in the past and hence provide guidance as to how best to manage them in the future.   Although the primary objective of this project is to reduce the number and cost of actions required bythe GBSO in the ancialliary services market for managing wind forecast uncertainty the learing from this project will also be valuable to other GB Network Licensees in nderstanding the effect that extreme wind events can have on network power flow and the effect this has n network capacity requirements in the future.

### 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.

Following a review of all GB network licensees IFI reports and registered NIA projects, the project engineer and academics confirm to the best of their knowledge that this does not produce any duplication of innovation work.

### 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