

NIA Project Registration and PEA Document

Date of Submission

Jan 2014

Project Reference Number

NIA_NGET0023

Project Registration

Project Title

Quantifying benefits and risks of applying advanced network control and demand response technologies

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NIA_NGET0023

Project Licensee(s)

National Grid Electricity System Operator

Project Start

October 2010

Project Duration

3 years and 1 month

Nominated Project Contact(s)

Amir Dahresobh

Project Budget

£750,000.00

Summary

The research will inform and develop tools for the business to establish the benefits and risks, in quantitative terms, of adopting complex control methodologies (Wide area control, automation & protection) in place of traditional reinforcement techniques. The project will run as three concurrent work-streams (Ph.Ds):

Nominated Contact Email Address(es)

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Problem Being Solved

The electricity industry is undergoing a period of rapid change across all sectors – new generation technologies in unprecedented volumes and in more remote locations. In addition demand characteristics are expected to change, and new transmission system technologies are being constructed to accommodate these changes. A full understanding of the impact of the changes and the potential benefits and risks associated with new technologies is needed, to ensure efficient development of the transmission system.

The use of control technologies will have significant impacts on the way the network is managed in the future. They have potential to reduce the need for difficult and expensive developments such as new circuits, and introducing greater flexibility for the system operator is likely to reduce system constraints. However, as control systems complexity increases, the consequences of their failure become much greater, impacting on system resilience and reliability.

Method(s)

This project will undertake work through 3 separate PhDs, under the same supervisor, with strong support from other staffs with relevant expertise, to establish this understanding and to develop strategies to make best use of them. A project board comprising NGET and Imperial College will be established in October 2011 to agree the work plan. It is intended that the project will complete in summer 2013. The project will deliver interim and final reports describing the findings of the work and strategies for the use of technologies. Tools allowing risks and benefits to be assessed will be delivered.

Scope

The research will inform and develop tools for the business to establish the benefits and risks, in quantitative terms, of adopting complex control methodologies (Wide area control, automation & protection) in place of traditional reinforcement techniques. The project will run as three concurrent work-streams (Ph.Ds):

Objective(s)

The objectives for this project will run as three workstreams; a, b and c.

- Workstream a will identify strategies for using advanced control systems to improve system flexibility as alternatives to system reinforcement and constraints. The costs and benefits of each strategy will be determined.
- Workstream b will develop methods for understanding the impact on system resilience of the use of more complex control schemes, including higher levels of intertripping. The method will provide quantitative measures to allow relative comparisons of a range of network development options.
- Workstream c will provide information about current and developing demand management technologies. It will identify the extent to which they can be used to benefit system design and operation, and identify optimum levels.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for this project include:

- Interim reports annual indicating project progress.
- Final PhD theses demonstrating key findings of the project.

Project Partners and External Funding

Imperial College, who are providing matched funding of £750,000.

Imperial College have confirmed that, although the terms entered into for delivering this project pre-date the publication of the specific requirements of the NIA, they will comply with the default requirements as set out in Ofgem's NIA governance document.

Potential for New Learning

This project will generate new learning with respect to the potential benefits and risks associated with emerging and complex transmission network control methodologies.

Scale of Project

Due to the size of the problem the project has been scaled to include three work streams all at a laboratory scale.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The project is being undertaken in London.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

The total NIA project expenditure will be £750,000, of which £310,000 under IFI.

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 use of control technologies will have significant impacts on the way the network is managed. In the design phase they have potential to reduce the need for difficult and expensive developments such as new circuits and introducing greater flexibility for the system operator is likely to reduce system constraints. However, as the control system complexity increases, the consequences of their failure become much greater, impacting on system resilience and reliability. The benefits of this project will be to establish a mechanism to provide informed decisions on when the use of new technologies instead of more expensive development is appropriate, and when the risks are too great.

In terms of cost impact, the failure to properly understand the risk and cost of a wide area control scheme could result in a range of impacts; ranging from an inability to reduce constraints across a boundary (£1-2m) to collapse or de-synchronisation between parts of the network and the cost of constraint or possible islanding which could be loss of demand and generation (£10m constraints and major public/consumer impact and disruption). The likelihood of such an event is small.

Please provide a calculation of the expected benefits the Solution

Not required - Research project

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

It is applicable to the whole GB network.

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

The circumstances under which and the degree to which the different control systems being assessed through this project are likely to be rolled out can not be quantified at this early stage of research. Further development and demonstration projects are likely to be undertaken before a full scale roll out, at which stage roll out costs will be estimated.

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

This information will be used to inform the design protection and control for the GB transmission network and the learning from it can be used by for this purpose by other transmissio network licensees.

The knowledge of the project will be disseminated on the ENA Smarter Portal as well as on www.nationalgrid.com/innovation. This project will also be disseminated through relevant national and international conferences and industry and academic forums.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIO-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 Network Licensees IFI reports and the academics reviews of the international literature, the project engineer confirms to the best of his knowledge this project does not result any unnecessary 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