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

Dec 2013

### Project Reference Number

NIA_NGET0019

## Project Registration

### Project Title

Reliability Assessment of System Integrity Protection Schemes (SIPS)

### Project Reference Number

NIA_NGET0019

### Project Licensee(s)

National Grid Electricity Transmission

### Project Start

October 2012

### Project Duration

1 year and 6 months

### Nominated Project Contact(s)

Ray Zhang

### Project Budget

£125,000.00

### Summary

The reliability of System Integrity Protection Schemes (SIPS) (called Operational Tripping Schemes (OTS) in National Grid) to manage circuit thermal and network stability issues, will become increasingly important, with the expansion and increased utilisation of the transmission network.

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Over the next 10 to 20 years, it is expected that the transmission system will grow and change significantly, as larger off shore renewable generation is connected, new and larger nuclear stations built to replace the existing fleet and many of the existing coal fired power stations close down. In addition, with more HVDC connections from off shore wind farms, connections to Europe and Scotland and with more use of dynamic reactive plant (such as series compensation), new system stability and circuit loading constraints could emerge. At the same time, significant substation and circuit asset renewal and upgrade programmes will take place which will require SIPS to be used more frequently used and the consequences of failure more significant.

### Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

### Problem Being Solved

The probability of failure and adverse operations encompasses the impacts of both dependability and security- based mis-operation and also delayed operation cases. As the number and complexity of SIPS in operation increases in National Grid (to overcome these challenges of a future constrained and stressed network infrastructure), it must be ensured that their performance and cost is optimised against the risks, to ensure the necessary the reliability requirements of National Grid's network continue to be met and to prevent and manage undesirable situations occurring.

Some work has been done by this researcher already on the evaluation of SIPS reliability from data gathered from North America and these techniques have been applied as an example to National Grid's Dinorwig Intertrip scheme to demonstrate applicability, this has been identified as the main causes of SIPS mis- operations and proposes a method for assessing SIPS reliability and how this could be applied to the Dinorwig Intertrip Scheme.

In addition there are potential risks introduced to the transmission system by unintended interactions between neighbouring and overlapping SIPS and these will also be investigated.

SIPS have typically been designed for dependability rather than security; however security will become increasingly important with the potential technical and economic impact of mal-operations on a more dynamic, complex and constrained system.

## Method(s)

The method that has been proposed for this project includes the following;

- Review of National Grid's historical database. Identification of SIPS misoperations and their main causes. Report
- Impact assessment of communication services reliability on SIPS overall reliability. Identification of bottlenecks of the existing communication system. Benefits of implementing IEC 61850. Report
- Reliability-based design refinement. Recommendations for increasing SIPS reliability. Report
- Risk assessment of undesirable interactions between SIPS. Proposal of techniques for effective

coordination between different and independent SIPS. Report

- Review and Final Report

## Scope

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## Objective(s)

The key objective of this project is to carry out a reliability assessment of existing System Integrity Protection Schemes (SIPS) (called Operational Tripping Schemes (OTS) in National Grid). The project will evaluate current architectures and technical solutions already deployed and the business and network impacts faced by the probabilistic risks in setting, arming and, failure to operate and mis-operation of these schemes.

This will support the development of policies and specifications to help direct future requirements for SIPS architectures, which may need to meet higher levels of security and dependability, in a more uncertain and flexible transmission network.

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

n/a

## Success Criteria

This work will be successful if we deliver a reliability assessment of existing SIPS in National Grid.

## Project Partners and External Funding

n/a

## Potential for New Learning

n/a

## Scale of Project

This is a laboratory based project.

## Technology Readiness at Start

TRL3 Proof of Concept

## Technology Readiness at End

TRL5 Pilot Scale

## Geographical Area

This project is being delivered in Manchester.

## Revenue Allowed for the RIIO Settlement

Zero

## Indicative Total NIA Project Expenditure

IFI=£59k

NIA=£66k

# 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)

An estimation of the saving is the problem is solved is unknown.

This work addresses understanding of the consequences of low probability, high impact events and how systems can be specified and maintained to reliably manage these events throughout their life.

Ensuring reliability and availability of the National Grid network is maintained, while it expands and changes to meet the needs of the "gone green" scenario.

Understanding of the optimised risk, cost and performance balance for future SIPS investments which typically cost > £1m.

Ensuring SIPS technical designs are able to deliver reliably, the business and technical requirements for the future.

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

Research Project - N/A

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

This is applicable to all sites

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

This is a research project, the knowledge will be bought back into NGET and built on.

## 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

The learning that will be generated could be used by relevant Network Licenses as the project will support the development of policies and specifications to help direct future requirements for SIPS architectures, which may need to meet higher levels of security and dependability, in a more uncertain and flexible transmission network.

### 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.

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