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# NIA Project Registration and PEA Document

### Date of Submission

Dec 2018

### Project Reference Number

NIA_NGTO0031

## Project Registration

### Project Title

Feasibility study to unlocking flexibility from within industrial and commercial users.

### Project Reference Number

NIA_NGTO0031

### Project Licensee(s)

National Grid Electricity Transmission

### Project Start

March 2019

### Project Duration

1 year and 7 months

### Nominated Project Contact(s)

Amrit Sehmbi

### Project Budget

£214,000.00

### Summary

This study aims to develop, improve and adapt some of the techniques that could be used to unlock flexibility for large industrial and commercial customers. This will allow participation in a wider range of ancillary services. To demonstrate the validity of the techniques proposed the steel making industry will be used as a case study. The practicalities of different solutions (e.g. Demand Side Response, Black Start, Balancing DNO/DSO/SO requirements) will be assessed considering the technical constraints and adaptions that may be required.

### Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

### Problem Being Solved

Steel production is an energy intensive process and a large carbon dioxide emitter. For example Tata Steel's site in Port Talbot consumes large amounts of coal, electricity and natural gas.

Port Talbot's typical demand for electricity is 120MW. The site generates a proportion of its electricity from waste gases on a day to day basis. This allows the site to reduce electrical import, therefore reducing gross carbon emissions. The average generation operating capacity currently is 60-70 MW. At the moment, the site boosts generation and reduces demand over the traditional winter 'triad' load management season.

Untapped and significant additional flexibility may exist for large industrial customers (e.g. steelmaking sites) beyond traditional winter load management activities. This study will investigate the extent of this flexibility in the context of DNO/DSO/SO requirements and what technical and rule constraints may prevent this in the context of a complex industrial site. Tata Steel's site in Port Talbot will be used as a case study.

Steel industry in the UK has developed a high public profile as an energy intensive user who has highlighted the existence and impact

of uncompetitive UK energy prices. The government's growing priority is to support industries in developing new and innovative methods of reducing energy consumption. An example of this is by using waste heat to generate energy. Energy intensive users are also encouraged to participate in evolving energy markets from which additional revenue can be derived, and to help support the evolving electricity system.

As the power generation from intermittent renewable energy sources is expected to increase significantly in the next 20 years, this reduces the predictability of electricity generation and increases the need for flexibility in electricity demand. The need for new sources of flexibility is one of the most important challenges facing the energy industry. Steel production processes are amongst the industrial processes with the highest Demand Response potentials. If energy flexibility is unlocked from integrated steelmaking sites/large industrial customers, this can support local Distribution Network Operators (e.g. Western Power Distribution) and National Grid System Operator (SO) requirements.

## Method(s)

The project being undertaken by an academic partner aims to assess the feasibility of flexibility at large industrial sites for participation in a wider range of ancillary services. The practicalities of different solutions (e.g. Demand Side Response, Black Start, Balancing DNO/DSO/SO requirements) will be assessed considering the technical constraints and options for economic and safe amendments by the site operator.

An optimisation modelling tool will be built to identify the sources of flexibility and quantification of the amount per source available for participation in the ancillary services.

Tata Steel will then be used as a case study to demonstrate the proposed optimisation solutions.

## Scope

The work packages that will be completed as part of this study are:

**WP1: Literature Review**
**WP1.1:** Review of ancillary services previously dominated by large thermal generation plant.
**WP1.2:** Review of the existing innovative solutions tested in Low Carbon Network Fund, Network Innovation Competition projects and assess the applicability of these solutions to the Port Talbot site.
**WP1.3:** Identify the most lucrative ancillary services and applicable schemes that are technically feasible or make them applicable with minor adjustments for large industrial customers/steel sites.
**WP1.4:** The work packages that will be completed as part of this study are:
**WP1.5:** Review of technical demand response potential of the integrated steelmaking sites.

***Deliverable: Ancillary services report with a focus on integrated steelmaking sites***

**WP2: Modelling Studies**
**WP2.1 Development of an optimisation model to calculate the balancing capacity potentials**

**WP2.1.1**: Identification of sources of flexibility on integrated steelmaking site and quantification of the amount of flexibility per source available for participation in the ancillary services (balancing market, demand side response) for large industrial customer / commercial customer.
**WP2.1.2:** Identification of the storage technology for meeting the local balancing requirements in terms of capacity, charge/discharge rates and flexibility.
**WP2.1.2:** Development of a balancing model using optimisation tools.
**WP2.1.3:** Investigation of flexible connections in case of additional import requirements.

**WP2.2 Modelling studies of the electricity network, assessing the application of energy storage and the feasibility of using ancillary schemes in some areas of the site.**
**WP2.2.1:** Power flow analysis to identify efficient and appropriate sub-metering points and classification of metering to identify localised sites for National Grid Transmission (NGT) ancillary service.
**WP2.2.2**: Conduct simulations for real switching operating regime based on information from the site operator to understand the potential load shedding (e.g. for reserve products).
**WP2.2.3:** Conduct a network-wide simulation to validate the proposed coordination methods using different scenarios of switching schemes at the sites.

**WP2.3 Technical amendments on site to facilitate participation in balancing market and demand side response.**

**WP2.3.1:** Optimisation model to allow flexibility study at the site.
**WP2.3.2:** Further development of highly technical schemes procured by NGT to access flexibility from industrial sites

***Deliverable: Unlocking flexibility report with associated models.***

**WP3: Black start capability assessment**
**WP3.1:** Identify the technical, operational, commercial and regulatory requirements for large industrial sites and their participation in black start services.
**WP3.2:** Theoretical overview of technical amendments on site to facilitate participation in National Grid black start services based on regulatory frameworks and codes in place.
**WP3.3:** Undertake network scenarios studies to understand the ability to black start and restore from generation and storage at the steelmaking site.

***Deliverable: Identify criteria and factors that should be accounted for large industrial site participation in Black Start services.***

## Objective(s)

This feasibility study will identify technical features to unlock energy flexibility from within industrial and commercial users.

The main objectives of the project are to:
(i) Identify optimisation models for electrical load using a combination of automated demand control, local embedded electricity storage and generation flexibility allowing the flexibility study at the industrial site.
(ii) Identify a set of criteria to improve the flexibility at the industrial site.
(iii) Identify the technical, operational, commercial and regulatory requirements for industrial site participation in Black Start services.

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

n/a

## Success Criteria

The projects will be deemed successful if we:
(i) Develop an optimisation model to allow the flexibility study.
(ii) Cleary identify a set of criteria that will improve flexibility at the industrial site.
(iii) Identify criteria and factors that should be accounted for in Black Start.

## Project Partners and External Funding

An academic partner will be carrying out this research project. Tata Steel will be providing data to enable validation of the model being developed within this project.

## Potential for New Learning

Understanding and applying technical services to complex industrial sites will be of interest to other industrial sites. Network licencees will learn more about dynamic grids on a smaller scale.

The findings from the research will also feed in to other projects such as FLEXIS and the recently approved project Decarbonisation Vision for South Wales (NIA_NGTO021).

## Scale of Project

It is considered that a desk based feasibility study is adequate to meet the objectives of this project.

## Technology Readiness at Start

TRL2 Invention and Research

## Technology Readiness at End

TRL3 Proof of Concept

## Geographical Area

This project is desk based.

## Revenue Allowed for the RIIO Settlement

None

## Indicative Total NIA Project Expenditure

£214,000

# 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)

Industrial customers can provide flexibility much more cost-effectively helping to build a smarter, more responsive system. This supports renewables and the wider UK transition to a zero-carbon economy by reducing reliance on fossil fuel power stations. The steel sector is identified with high demand response potential.

This will reduce the energy costs of the industrial user, through plant optimisation in response to market and wider system requirements.

The work to be undertaken is still at proof of concept level therefore financial benefits can not be quantified. If all the problems are solved a significant reduction in energy cost and CO2 emissions can be achieved.

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

It is not possible to quantify this yet as this is early research. A better understanding of flexibility at the site through this feasibility study will help quantify the financial benefits with more confidence.

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

If the feasibility study is successful the solution could be replicated at other large industrial sites.

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

n/a

## 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

This work will identify technical features to unlock energy flexibility which could be used by other utilities. Shifting industrial consumption will bring benefits also to the network operator, especially in areas and regions where the grid capacity is close to its limits.

This project is not asset specific and therefore not focussed on mature ancillary services that are already adopted by end-users. End users will be able to use the tool to help determine flexibility to meet their needs

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

This project fits within the Service Delivery (Developing new service-based propositions and business models) and Corporate Responsibility (Doing the right thing) value areas of the Electricity 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.

We have completed a search on the ENA portal and there are no other projects that will duplicate this 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

This study combines detailed investigations of demand response, black start and power flow analysis to pull together a detailed picture of the flexibility options available for industrial consumers. It is innovative because these studies have never been combined before or at this level of detail. To the best of our knowledge such techniques and optimisation methods do not exist in full.

## 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

The nature of a research programme means it inherently carries a risk that the research may be unsuccessful or identify unforeseen costs/barriers to implementation. The NIA funding offers the most appropriate route for National Grid Electricity Transmission (NGET) to assess the viability of utilising demand response from industrial customers to support network power management.

## 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

The inherent risk of the project is detailed above and the learning from the project will be directly relevant to all Network Licensees. For this reason, NGET believes this project is appropriately funded through NIA, and material from the project will be available to the general public via the ENA portal.

## This project has been approved by a senior member of staff

☑ Yes