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

Jul 2024

Project Reference Number

NIA2_NGESO069

Project Registration

Project Title

The Implication for the ESO of 24/7 Carbon Free Energy Trading

Project Reference Number

NIA2_NGESO069

Project Licensee(s)

National Energy System Operator

Project Start

May 2024

Project Duration

1 year and 0 months

Nominated Project Contact(s)

innovation@nationalgrideso.com

Project Budget

£620,000.00

Summary

24/7 (hourly) matching of Carbon Free Energy (CFE), is a significant change from the status quo (annual matching), enabling consumers to meaningfully reduce GHG emissions in real time. Demand and regulatory changes mean that 24/7 matching could rapidly begin at scale. It is critical for ESO to understand implications for system operation, market design and dispatch patterns of this change. The study will consider the ESO roles and interactions with system objectives including coordination of CFE instruments, treatment of CO2 emissions, and management of transmission constraints.
Through this project the ESO will better understand the actions it can take to mitigate risks and maximise the benefits, from a system operation perspective, which arise from the development of 24/7 CFE trading.

Third Party Collaborators

AFRY Management Consulting Ltd

Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

Problem Being Solved

- Demand for 24/7 Carbon Free Certificate trading is already being seen in the market. Major energy consumers have set 24/7

matching commitments (e.g. Google, by 2030).

- The topic is being widely discussed globally given interest to address Scope 2 greenhouse gas emissions and prevent inaccurate claims (i.e. greenwashing). Some entities are proactively exploring potential arrangements (including Eurelectric and ENTSO-E).
- While its implementation in some form seems near certain, the scale and speed at which it develops is currently uncertain.
- The use of 24/7 certificates may change patterns of dispatch (and investment) for flexible resources, and it is critical for ESO to understand the circumstances in which dispatch patterns will change, whether these changes will be beneficial for system operation or otherwise, and the actions which ESO can take (directly or through influencing the design of the scheme) to ensure that the beneficial impacts are maximized and the non-beneficial impacts are minimized

Method(s)

The project will follow a 2 phase approach. The first phase will involve a series of workshops, case studies and discussions where the different market design options and modelling scenarios will be assessed, reviewed, agreed and documented.
In the second phase the modelling scenarios with be developed while the trading pilot takes place with the recruited market participants.
Scenario modelling will give insight of feasible timescales for the up-take of 24/7 CFE trading. Scenarios will be developed to, for example, consider the speed of up-take by different types of electricity consumer (including electrolysis), different consumption patterns, timing of market design impacts (zonal versus nodal), etc.
The implications (both positive and negative) for scheduling, dispatch and system operation will be explored, along with the associated impacts on ESO forecasts, processes, etc. Analysis will support ESO in understanding how market participant behaviour could change.
The degree to which 24/7 CFE trading may change asset operation and could provide additional value streams will be explored, for instance in storage or renewables, e.g. RES with lower output but greater diversity in timing of production.
There are many elements to consider to deliver the optimal outcome from the ESO's perspective. Key objectives will be defined (e.g. coordination of supply and demand with CFE instruments, treatment of CO2 emissions, management of transmission constraints etc.) and consider ESO response to the development of a 24/7 market including support for specific aspects of the arrangements.

Scope

The project's scope consists of 2 phases with defined work packages under each phase.
Phase 1 will take around 3 months and will be focussed on a series of workshops, discussions and case studies where the different market design options and modelling scenarios will be assessed, reviewed, agreed, and documented as outlined below:
Through a work package approach a number of case studies will be selected, defined, scoped and delivered. The Phase 2 scope will also be agreed and documented based on the outputs of the case studies.
The final deliverable of Phase 1 will be a Market Design Document including summary of feedback from participants, description of chosen bidding and auction design for Phase 2, draft market rules for phase 2, draft pricing principles (underlying drivers of hourly certificates) and a summary of implications and next steps.
Phase 2:
Phase 2 will develop models based on the key findings and analysis in phase 1. These will then be tested and further refined. This phase is approx. 8 months long. This phase it will look at the modelling scenarios with be developed while a trading pilot scheme takes place with the recruited market participants through a number of work packages:
Through a work package approach this phase will develop, test and refine a model based on initial results. Scenario integration and alignment will be documented.
The number of cases studies and sensitivities will be agreed but may include Scenarios of demand for CFE; Impacts of temporal mis-matching between consumption and production of CFE; Locational issues; Additional value streams; Inclusion of nuclear energy; Green hydrogen requirements.
The pilot design will be agreed with and then executed with stakeholders with results, learnings and implications for any future commercial roll-out detailed and provided.

Objective(s)

To evaluate the impacts on system operation:

- To better understand circumstances in which dispatch patterns could be impacted by 24/7 CFE trading, whether these changes will be beneficial for system operation or otherwise
- To identify the actions which ESO can take (directly or through influencing the design of the scheme) to ensure that the beneficial impacts are maximized and the non-beneficial impacts are minimised

To deliver insight on how 24/7 CFE trading will influence the market:

- To set up a pilot to explore potential trading arrangements, generating the first ever empirical data on green certificate price formation and insights for any future commercial roll-out detailed and provided

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

ESO does not have a direct connection to consumers, and therefore is unable to differentiate the impact on consumers and those in vulnerable situations. Benefits to all consumers are detailed below

Success Criteria

We would consider the project successful upon the delivery of:

- A quantitative assessment that illustrates a comprehensive set of scenarios/case studies, comprehensive by testing a broad set of potential impacts/extremes
- A robust qualitative assessment of the potential interactions with centralised dispatch/scheduling
- Sufficiently robust insights that enable ESO to decide on actions and next steps with confidence
- Pilot auction results that provide sufficient confidence for implementation and scale-up

Project Partners and External Funding

Project partner: AFRY. No external funding contribution

Potential for New Learning

- Developing practical insights for any future commercial roll-out on CFE across the GB system
- Draw conclusions on the operation of the GB system. For example, depending on the scenario: comparatively low 24/7 CFE demand in Scotland leads to similar energy and 24/7 CFE market prices. The dispatching of technologies to help ESO prepare for the development
- Better understanding of the circumstances in which dispatch patterns could be impacted by 24/7 CFE trading, whether these changes will be beneficial for system operation or otherwise.
- Considerations are needed to other aspects of market design such as a potential move to a zonal or central dispatch market, and the extent to which a 24/7 CFE traded product could provide a suitable CFD replacement. We will evaluate design features that best support the development and adoption of 24/7 CFE trading, and how ESO could interact with the scheme to maximise benefits

Scale of Project

This project will be the first of a kind (globally) to explore the impact of CFE trading on dispatch. It is small in scale, involving minimum modelling necessary to test impacts on system operation under a range of conditions and to run a sufficiently liquid auction that will deliver price formation insights.

Technology Readiness at Start

TRL1 Basic Principles

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The scope of the project will cover the whole GB system.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£620,000

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:

Energy Attribute Certificates (EACs) have existed for over 20 years as the mechanism for consumers to reliably attribute electricity from a particular source without the risk of double counting or other fraud. These certificates have been incorporated into European legislation as 'Guarantees of Origin' (GOs) since 2006 and are known as REGOs in the UK, managed by Ofgem. Like nearly all EACs today, GOs are still based on 'annual matching' of supply and demand. This means that solar energy produced during daylight hours in summer can be claimed at any point throughout a 12-month window. Transitioning this system to a sub-hourly matching period would support more credible green energy products and create an important new price signal for energy storage and flexible resources, including demand-side response.

While wholesale energy price signals are highly granular - and could be more so if a locational element would be included - low energy prices do not always align with low carbon intensity in real-time. 24/7 CFE certificates provide consumers with the opportunity to prioritise carbon (over price) by paying a premium via the certificate that verifies the carbon content. The scheme has the potential to accelerate carbon emissions reduction. While 24/7 CFE scheme design might impact system operation (main purpose of this project to explore), it might also impact carbon emissions, which will also be considered by this project.

The project will provide scenario modelling and will give insight of feasible timescales for up-take of 24/7 CFE trading. Scenarios will be developed to, for example, consider the speed of up-take by different types of electricity consumer (including electrolysis), different consumption patterns, timing of market design impacts (zonal versus nodal), etc.

The analysis will support ESO in understanding how market participant behaviour could change. The project will explore the degree to which 24/7 CFE trading may change asset operation and could provide additional value streams.

This project will aid considerations to other aspects of market design such as a potential move to a zonal or central dispatch market, and the extent to which a 24/7 CFE traded product could provide a suitable CFD replacement. Afry will evaluate design features that best support the development and adoption of 24/7 CFE trading, and how ESO could interact with the scheme to maximise benefits for the consumer.

How the Project has potential to benefit consumer in vulnerable situations:

24/7 CFE trading benefits consumers, including those that are vulnerable, by improving the accuracy of green claims (i.e. preventing greenwashing).

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)

N/A

Please provide a calculation of the expected benefits the Solution

Improved decision-making based on early identification of any emerging trends, opportunities, or potential risks provide the ability to respond quickly to changes in the market.
The results, learnings and implications will aid ESO for any future commercial roll-out detailed and provided analysis will support ESO in understanding how market participant behaviour could change in certain market conditions i.e. Renewable/ Storage

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

The project explores the implications of implementing a 24/7 carbon free electricity (CFE) certificate trading scheme for system operation. The project will provide insights on the design features of relevance to ensuring efficient system operation and beneficial outcomes for electricity consumers and society. If a national scheme is to be introduced, the findings of this project could inform its design. If successful, the design could be promoted in other jurisdictions/countries.

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

The scope of the project will cover the whole GB system, therefore no geographical rollout is required.

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 ESO intends to gain insights from the research for system operation. There might also be some insights relevant to DNOs and these will be shared.

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

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 are not aware of any similar project being conducted within ESO or externally.

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

The output of this project will be novel in two ways:

- It will generate the first ever empirical data on GC price formation
- It will explore the implication of 24/7 CFE for scheduling, dispatch and system operation.

Both of these aspects are absent from the global literature and existing SIF/NIA funded projects

Relevant Foreground IPR

Reports
Design insights for the CFE scheme and auctions.

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the new Strategic Innovation Fund (SIF) can be found or requested in a number of ways:

A request for information via the Smarter Networks Portal at https://smarter.energynetworks.org, to contact select a project and click 'Contact Lead Network'. National Grid ESO already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.
Via our Innovation website at https://www.nationalgrideso.com/future-energy/innovation
Via our managed mailbox innovation@nationalgrideso.com
Details on the terms on which such data will be made available by National Grid ESO can be found in our publicly available "Data sharing policy relating to NIC/NIA projects" at https://www.nationalgrideso.com/document/168191/download.

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

We do not have the internal resources or expertise to undertake this project as part of BAU activities. This project will be NIA funded due to the uncertainty surrounding future market arrangements, and because we believe that the potential impacts of 24/7 CFE trading on system operation have not been explored in GB (or even globally).

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 ESO does not have the internal capabilities to generate this understanding nor disseminate the findings as part of BAU practices.

This project has been approved by a senior member of staff

☑ Yes