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NIA Project Registration and PEA Document

Date of Submission

Jun 2020

Project Reference Number

NIA_NGSO0035

Project Registration

Project Title

Optimal Coordination of Active Network Management Schemes and Balancing Services Market

Project Reference Number

NIA_NGSO0035

Project Licensee(s)

National Energy System Operator

Project Start

June 2020

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Tolulope Esan (NGESO) and Matthew Watson (WPD)

Project Budget

£325,000.00

Summary

There is a need to deliver an optimally coordinated design approach between ANM schemes and balancing services markets. It is important to ascertain and understand the synergies and conflicts associated with the potential for ANM schemes in networks inhibiting the delivery of ESO system support services through DER.

Third Party Collaborators

WSP UK Limited

Nominated Contact Email Address(es)

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Problem Being Solved

The installed capacity of Distributed Generation (DG) has increased to 31 GW in 2018 and is set to rise to a level of 38 – 69 GW by 2030 across all FES scenarios. This significant growth of DG together with the development and adoption of smart grid technologies means that Distribution Network Operators (DNOs) need to more actively manage flows on their networks. DNOs have been introducing Active Network Management (ANM) schemes to manage network assets, generation and demand dynamically to increase the utilisation of network assets without breaching operational limits, reduce the need for reinforcement, speed up connection timelines and reduce costs. The number and type of ANM schemes is set to increase over the coming years as much more DG wants to connect

to increasingly constrained networks.

Assets connected to ANM schemes can be controlled to manage distribution network constraints. Without coordination between the ESO and DNOs, there is potential for ANM schemes to counteract the ESO's balancing actions or to cancel out the effect of system services procured from Distributed Energy Resources (DER). This could lead to increased costs to the consumer and risk to security of supply if system services cannot be delivered when required. In addition, ANM systems need to be designed and operated in a coordinated manner during whole system emergency situations.

Method(s)

The project will be structured into six distinct work streams (WS):

WS1: Identify and review current ANM schemes on the transmission (e.g. Generation Export Management Scheme (GEMS) used in Dumfries and Galloway) and distribution networks and their impact on T&D coordinated activities. Analyse their associated technical and commercial requirements

WS2: Develop test cases and high-level assessment of potential benefits of these test cases. Evaluate the ability of DERs to participate in ANM activities and develop network case studies reflecting different types of ANM schemes and the potential synergies and conflicts of DERs participating in ANM activities.

WS3: Identification and definition of solutions to optimise coordination of ANM schemes and ESO balancing services market

WS4: Perform a cost benefit analysis of the coordinated ANM case studies through modelling and simulation. Identify limitations imposed by commercial frameworks.

WS5: Delivery plan for practical deployment of feasible solutions. Analysis of the simulated case studies, synthesis of key findings and identification of whole system principles of operation and control hierarchies for T&D.

WS6: Identify and develop a set of recommendations, produce a report and disseminate findings.

Scope

National Grid's Future Energy Scenarios (FES) and System Operability Framework (SOF) show that the installed capacity of Distributed Generation (DG) has increased to 31GW in 2018 and is set to rise to a level of 38 – 69GW by 2030 across all FES scenarios. This significant growth of DG together with the development and adoption of smart grid technologies means that network operators, both transmission and distribution, have the need and the means to more actively manage flows on their networks. Thus, network operators are introducing Active Network Management (ANM) schemes to manage network assets, generation and demand dynamically in real time to increase the utilisation of network assets without breaching operational limits, reduce the need for reinforcement, speed up connection timelines and reduce costs.

As network operators (most notably Distribution Network Operators (DNOs)) start taking a more active role in managing flows on their networks, greater collaboration and coordination with the Electricity System Operator (ESO) is required to efficiently manage the overall power system.

The SOF shows that there is an increasing number of constraints on DNO networks that are likely to be managed by ANM systems over the next five years. Meanwhile, wider access to the Balancing Mechanism has been introduced and the ESO is increasingly procuring ancillary services from Distributed Energy Resources (DER). Without coordination of activities between the ESO and network operators, there is potential for:

- ANM schemes to counteract the ESO's balancing actions or to cancel out the effect of system services (e.g. STOR, DSR) procured from DER
- DER connected to ANM arrangements to be unnecessarily blocked from participation in balancing services markets

Both could lead to increased costs to the consumer and pose a risk to security of supply if system services are not delivered when required.

Opportunity for optimal coordination between ANM approaches and balancing services

To this end, there is a need to deliver an optimally coordinated design approach between ANM schemes and balancing services markets. It is critically important to ascertain and understand the synergies and conflicts associated with the potential for ANM schemes in networks inhibiting the delivery of ESO system support services through DER. Hence, this project proposes to:

- Engage collaboratively with the ESO and the DNOs to understand:

    1. the range of existing ANM schemes and volumes of DER connected downstream of constraints managed by ANM schemes; and
    2. the restrictions placed on the participation in balancing services markets of DER connected behind constraints which are managed by ANM schemes under existing commercial arrangements.

- Identify issues which could arise from the participation in balancing services markets of DER connected downstream of constraints which are managed by ANM schemes;
- Evaluate the potential for DER connected downstream of an ANM managed constraint to participate in balancing services markets in a coordinated manner;
- Identify and define different approaches to coordinating ANM schemes with balancing services markets and their associated technical and commercial requirements;
- Quantify and assess the costs and benefits of the different approaches to coordinated ANM schemes from the perspective of whole system techno-economic efficiency to determine the optimal coordination approach(es);
- Identify a way in which that optimal coordination approach can be delivered through identification and proposed resolution of limitations and barriers in the existing approaches and commercial frameworks; and
- Develop whole system principles of operation and control hierarchies for the procurement of system services from DER in order to inform the development of best practice guidelines for delivering whole system coordination in respect of other services procured in the future.

Objective(s)

The key objectives of this work can be described as follows:

- To identify and define different optimal T&D coordinated ANM schemes, their associated technical and commercial requirements as well as compatibility with existing industry codes and regulatory frameworks;
- To develop test cases and evaluate the ability of DER to participate in the ANM functions of the distribution system or in whole system balancing actions in a coordinated manner;
- To identify and define solutions that will optimize the coordination of ANM schemes with the balancing services market;
- To develop a delivery plan for deployment of the solutions
- To disseminate findings and recommendations to other network licensees.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Success criteria for this project includes the following:

- Identification of the optimal T&D coordinated ANM schemes and their technical and commercial requirements;
- Identification and quantification of the costs and benefits from holistic T&D coordinated ANM approaches;
- Evaluation of the capability of DER to participate in ANM schemes on the distribution system and to contribute to whole system balancing actions in a coordinated manner performed and results and analysis verified with project partners;
- Framework for the techno-economic balance across distribution network management and whole system support service requirements produced;
- Solutions to optimise coordination of ANM schemes and balancing services market developed;
- Completion of real world consideration across an ANM design case study, including identification of barriers and limitations with integrating the ANM design with current commercial frameworks. Complement with simulation of potential solution performance; and
- Successful dissemination of acquired knowledge to the relevant industry sectors, including stakeholder workshops as appropriate.

Project Partners and External Funding

The work is to be undertaken by a consortium made up of WSP, Cornwall Insight and Complete Strategy. The work will be supported by National Grid ESO and Western Power Distribution. The work will be joint funded by National Grid ESO and WPD.

Electricity North West will also participate in the project as non-funding stakeholder.

Potential for New Learning

The learnings from this project will be applicable to all DNOs as efficient methods for coordination of ANM schemes and balancing services will be developed. If applied, these learnings will lower costs for consumers, for reasons already outlined. The successful implementation of learnings would also promote further ANM rollout, facilitating more efficient connection and utilization of DER.

Scale of Project

The project will be desk based. It is expected that we will use 5 hypothetical test cases and 3 real test cases

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

All work will be conducted in the UK in the offices of the partners as the project will be desk based. 5 hypothetical test cases and 3 real test cases will be considered.

Revenue Allowed for the RIIO Settlement

None.

Indicative Total NIA Project Expenditure

£325,000

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)

Reduced cost to customers:
Increased coordination between ESO and DNOs will mean that more DER behind ANM schemes can participate in balancing services. Increased participation in balancing services markets leads to more liquidity and ultimately lower prices. This is difficult to estimate, but a 66% increase in FFR participation has led to 24% drop in prices. Currently 3.2GW of generation on ANM connections is unable to participate in balancing services markets, and this will increase as more ANM schemes are rolled out

Increased effectiveness of ESO balancing actions
Today. actions procured from service providers connected behind constraints could be offset by ANM actions. This project will propose a solution that will reduce the risk of offset.

More low carbon generation able to connect
Inability to participate in balancing services markets could make or break the business case for new generator.
ANM schemes properly coordinated between ESO and DNOs would allow more low-carbon generators connected to ANM schemes to participate in balancing markets, improving their business case and therefore their chance of being built.

Increased deployment of ANM
More coordination across the whole system could increase the penetration of ANM. ANM leads to:

- Ability to connect low carbon generation more quickly
- Lower costs by reducing network reinforcement needed

Please provide a calculation of the expected benefits the Solution

Not required as a research project.

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

The project aims to provide a universal methodology that could be rolled out to all DNO areas.

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

The project has identified a number of potential methodologies with different costs associated and the output of the project will be the most economic and efficient.

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 learnings of the project are designed to be fit for other Network Licensees, as a solution to align the outcomes of ANM systems and the Balancing Mechanism that can be applied across all network areas will be investigated. The learnings will be relevant to all ANM schemes used by the DNOs as the different types of ANM schemes and arrangements that have been implemented are being considered. Additionally, international references will be used to consider best practice abroad and how this may be applicable to the GB DNO's schemes. All learnings from the project will be documented, including a detailed plan for delivery of the proposed improved process.

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 against the following strategic priority areas as identified by the ESO in its Innovation Strategy published March 2020:

- Whole Electricity System
- Future Markets

☑ 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.

The research activities outlined in the project are unique and haven't been undertaken before based on the latest information. Other projects have been conducted that identify potential issues arising from the lack of coordination of ANM schemes and balancing market actions, but solutions have not been identified and explored as this project aims to do.

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 is the first innovation project looking to optimize the coordination of ANM schemes and the Balancing Services market. Other projects have identified potential issues arising from the lack of coordination between ANM schemes and the balancing market actions, but have not proposed a solution that can be applied across all network licenses or developed principles and guidelines for operation and control hierarchies for the procurement of system services that can be used by the industry.

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 models and proposed solutions developed in this innovation project will require validation before being tested and rolled out as BAU. Without such validation and testing, there would be significant operational and financial risk of the solution not working.

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 project allows the collaboration of multiple project partners and the learnings from the project can be shared more widely to the Network Licensees which couldn't be achieved if deemed as BAU activities. This project requires engagement with all DNOs and ESO to accurately address the issue and devise a solution that can be applied universally. Without NIA funding for this project, it is unlikely that an optimal coordination approach will be found, presenting an issue as more DER is deployed on the network, ANM schemes are implemented on more networks and a greater volume of balancing services are required.

This project has been approved by a senior member of staff

☑ Yes