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for energy consumers

Network Innovation Competition Screening Submission Pro forma

Notes on completion

Before completing this form, please refer to the relevant Network Innovation Competition (NIC) Governance Document(s).[1]
Please use default font (Verdana size 10) in your submission and retain 1.5 line spacing.
We will only accept the text visible in the text entry areas.
The text entry areas are predetermined and should not be changed.
The full-completed submission should not exceed 19 pages in total.

Ofgem will publish all the information contained within this Screening Submission.

Is the application for the Gas or Electricity NIC? If a Cross-Industry Project, please state 'Cross-Industry'.
Electricity NIC
Funding Licensee
Electricity North West
Project Partners including other Licensees
Smarter Grid Solutions (SGS), Fundamentals Limited, Schneider Electric (SE)
Project Title
QUEST

[1] https://www.ofgem.gov.uk/publications-and-updates/version-30-network-innovation-competition-governance-documents All capitalised terms used in this document have the meaning given to them in the respective NIC Governance Document.

Project Summary
To meet ambitious government decarbonisation targets our customers are increasingly required to become more environmentally friendly, leading to an increase in the uptake of Low Carbon Technologies (LCTs) such as heat pumps (HP), electric vehicles (EV) and low carbon generation. These changes in customer behaviour place even greater demands on existing distribution networks. To cater for the subsequent increase in demand and generation, DNOs have investigated and deployed techniques such as Active Network Management (ANM) and voltage optimisation. These techniques have been successful in helping DNOs to manage the network and have demonstrated benefits to customers, but they do have some limitations. This is because the techniques are deployed in isolation, are not currently co-ordinated, use worst case planning assumptions, and are reliant on a robust communications infrastructure. QUEST will seek to overcome these limitations. It will create an overarching control system by designing a holistic voltage control methodology to co-ordinate these techniques, optimising their use and facilitating the increased use of LCTs. This system will ensure the network is running at its most efficient, whilst minimising losses, thereby maximising the benefits to customers. We will engage with stakeholders to ensure that the methodology developed can be transferred to all DNOs and will be applicable to all customer types.

Estimated Start Date		**Estimated End Date**	
01 January 2021		31 April 2024	
Total Project Cost	£7m	**NIC Funding requested**	£6.3m
Technology Readiness Level (TRL) at start and end of project			6 and 8

What is the Problem that the Project seeks to address?

To facilitate the efficient connection and increased utilisation of LCTs, DNOs have introduced advanced network control techniques, including Active Network Management (ANM) and voltage optimisation. Whilst these techniques have proven successful in helping DNOs to manage the network, whilst maintaining statutory limits without the need for reinforcement, they do have limitations:

- They are often applied in isolation of one another and therefore do not operate in a co-ordinated manner.
- When active at the same time and on the same part of the network, it is possible that one technique could counteract another, resulting in reduced effectiveness and potentially failing to maintain operation within acceptable limits.
- They use worst-case planning assumptions, which build in large safety margins, resulting in sub-optimal operation below the theoretical maximum.
- They require a resilient communications infrastructure at all times and are set up to fail safe. In the event of a failure, to ensure that system constraints aren't breached, any voltage optimisation or ANM benefit would be significantly reduced or removed.

To overcome these limitations, it is necessary to investigate ways of integrating the various, isolated techniques for voltage control, creating a flexible and co-ordinated system which operates within the full range of availability and with much less reliance on communications.

QUEST will develop and introduce a distribution network-wide fully co-ordinated voltage control architecture, with appropriate balance between centralised and decentralised control hierarchy.

Through its co-ordinated design, QUEST will unlock greater overall capacity; further deferring the need for network reinforcement and facilitating faster, cheaper connections. It will allow DNOs greater control of equipment connected to the network, potentially bringing domestic infrastructure into the operation of an ANM scheme, where applicable. It will also deliver an inherently self-balancing network, further increasing the opportunity for demand-side markets and services.

What Method(s) will be used and why? Ie, what is being demonstrated or developed? Please describe in terms of the NIC eligibility criteria. (page 1/3)

The Method for QUEST will integrate discrete voltage control techniques into one overarching, co-ordinated and optimised system.

This will enable voltage optimisation for the whole distribution network; from the National Grid intake to the interface with the domestic customer. By viewing and controlling the network as a whole, QUEST will co-ordinate the often competing objectives of the various existing techniques to ensure optimised operation whilst maximising benefits for our customers.

In addition, the Method will allow demand and generation to automatically self-adjust in response to changing voltage requirements, creating the world's first inherently self-regulating distribution network.

QUEST will comprise the following four phases:

Phase 1 – System Design

Working with partners, we will design a holistic voltage control methodology, balancing outputs and adjusting voltages as appropriate. We will consult with stakeholders to ensure that the methodology is replicable and considers all appropriate use cases.

This will include the design of the overarching, co-ordinated and optimised 'system of systems' and will examine a range of architecture options.

The technical capability and commercial appetite of our customers to respond to changes in voltage varies, therefore we will identify the different requirements and design the methodology to ensure it is fully applicable to all.

Phase 2 – Implementation

The core of the system will be the holistic voltage control methodology, implemented in software as part of the Network Management System (NMS).

What Method(s) will be used and why? (page 2/3)

This methodology will, via its integration with ANM, control both new and existing intelligent voltage control devices at substations and communicate via these devices to connected customers.

QUEST will:

- Upgrade existing, 'dumb' voltage control relays for new, intelligent devices and install communications equipment and local intelligence as required.
- Install and trial equipment on customers' networks as required to demonstrate the self-balancing component.
- Use offline modelling and bench-testing to allow assessment of a wider range of operating conditions and devices than would be possible on a live network.

Phase 3 – Trial

The trial phase will ensure the overarching system responds as designed during all seasonal load variations. During this phase the system will optimise voltage profiles across a defined section of the network; from the 132kV intake down to the domestic customer.

The loss of communications will be tested and the operational ability of the discrete systems and self-balancing component will be assessed and quantified.

Trial sites will be selected to ensure an overlap with existing intelligent voltage techniques on the network.

Along with outputs from the offline modelling, network measurements captured during the trials will be assessed to fully quantify the benefits of the holistic voltage control methodology.

Finally, throughout the trials QUEST will engage with customers, particularly those with voltage sensitive equipment, to understand how optimising voltage may affect their operations and to identify any special requirements. This will allow us to adapt the Method to incorporate the needs of these specific users.

What Method(s) will be used and why? (3/3)

Phase 4 –Transition to Business as Usual

The project will create all the necessary documentation, including a transition plan, to ensure the outputs can be deployed as Business as Usual (BaU) on our network. This will be made available to all interested stakeholders.

Funding Commentary (page 1/2) *Licensee must provide a commentary on the accuracy of its funding estimate. If the Project has phases, the Licensee must identify the approximate cost of each phase. If the NIC is being used as match funding, please state the other sources of funding.*

The project will run for 3 years with a total cost of approximately £7 million (including project management and contingency). These costs will be captured using a standardised costing methodology and will be formulated using learning from creating and costing previous demonstration projects. The costs will be developed in collaboration with project partners and will incorporate unit costs and market prices for commodity equipment, and where appropriate we will conduct competitive tenders.

The estimated costs for each phase of the project are as follows:

Phase 1 **System Design (25%)**

1A Develop use cases

1B Engage with stakeholders and customers

1C Design software solution

Funding Commentary (page 2/2)		
Phase 2	**Implementation (35%)**	
	2A	Upgrade equipment at substations
	2B	Deploy centralised software architecture
	2C	Deploy decentralised software architecture
	2D	Develop offline models and bench testing regime
Phase 3	**Trial (30%)**	
	3A	Evaluate and analyse the system performance
	3B	Refine holistic voltage control methodology
	3C	Undertake business case and carbon benefit analysis
Phase 4	**Transition to BaU (10%)**	
	4A	Produce BaU transition plan
	4B	Disseminate methodology and transition plan to stakeholders

Which specific requirements does the Project fulfill?		
Mark YES in the appropriate box(es)	**Electricity**	**Gas**
A specific piece of new (ie unproven in GB) equipment (including control and/or communications systems and/or software)	Yes	
A specific novel arrangement or application of existing electricity/gas transmission and/or distribution equipment (including control and communications systems software)	Yes	
A specific novel operational practice directly related to the operation of the electricity/gas transmission and/or distribution systems	Yes	
A specific novel commercial arrangement		

How does the Project accelerate the development of a low carbon energy sector and have the potential to deliver net financial benefits to existing and/or future customers in the relevant sector? (page 1/2)

QUEST will contribute towards the aims set out in the government's Carbon Plan, and the more recent Ofgem Decarbonisation Action Plan, to efficiently transform the power sector through system balancing and the facilitation of low carbon generation and demand.

Whole system balancing using existing innovation

QUEST will enable smarter, whole electricity system optimisation in a secure and affordable way by integrating existing assets and innovative technologies deployed on the distribution network. It will maximise the use and overall system efficiency of these innovations and facilitate increased use of low carbon generation on currently constrained networks. It will help to ensure the network is running at its most efficient at all times, whilst minimising network losses, providing improved value for money for customers.

Accelerates the low carbon energy sector (page 2/2)

Facilitating use of low carbon generation and technologies

QUEST will support the government's aims to decarbonise the heating and transport industries by releasing network capacity to facilitate the connection of LCTs such as HPs and EVs. This aim seems more urgent now than ever before, after the recent acceleration of the ban on the sale of internal combustion engine vehicles, with the government citing an urgency to cut carbon emissions further to reach their target of net-zero carbon emissions for GB by 2050.

Greater Manchester Combined Authority (GMCA) is even more ambitious, with a decarbonisation target of 2038. In their Spatial Framework, GMCA have specified the requirement that all new building developments will be net-zero carbon from 2028, by utilising on-site generation and greater energy efficiency. They have also outlined plans for investment in low carbon energy.

In addition to this, the Carbon Plan outlines the government's prediction that we will need more than 100GW of low carbon generation by 2050 to support growing electricity demand, and the Decarbonisation Action Plan emphasises the need for investment in network infrastructure to accommodate this necessary increase. QUEST will help to achieve this goal by maximising the use of existing low carbon generation and allowing network operators to provide faster, cheaper connections to their customers, facilitating further uptake.

Customer benefits

QUEST will maximise the overall efficiency of existing innovative technologies on the network, enable the more efficient running of our network at any point in time, and minimise network losses. Taking steps to facilitate a self-balancing, low carbon network now will help to avoid higher costs to our customers in the future. QUEST will achieve this through a reduction in the need for traditional reinforcement associated with customer connections, whilst helping to achieve the government's carbon targets by releasing capacity for the connection of LCTs.

How will the Project deliver value for money for electricity and/or gas customers?
Previous voltage optimisation projects such as CLASS, Smart Street and ANM have each demonstrated benefits to customers. QUEST will enhance these benefits further by co-ordinating and optimising the use of these existing techniques. QUEST will optimise voltages across the entire distribution network in a co-ordinated manner. It will also facilitate active management of voltages across the interface with the Transmission network, enabling optimisation between the two systems. This will further improve overall system efficiency, leading to greater reductions in energy consumption, and will have the secondary effect of a further reduction in system losses. The reduction in energy consumption will create additional capacity without the need for reinforcement, allowing faster and cheaper connection of LCTs. QUEST will also maximise the use of low carbon generation by ensuring that network conditions are optimised. By reducing the barriers to connection and adding incremental capacity for new LCTs, QUEST could increase the number of participants in the energy services market. This will increase competition and help to ensure the best value for money for customers is achieved when procuring these services. The Method will be made available to all DNOs to allow for these benefits to be passed on to all customers across GB. We will apply best practice project management techniques to ensure timely and cost effective delivery of project outcomes. Regular project steering group meetings including risk and mitigation reviews will be conducted. In addition to members of the project team and project partners, this group will include oversight by a project director and federated management accountant from the finance directorate for driving delivery to budget. Competitive procurement processes will be used to select Project Partners and suppliers, which will ensure value for money.

How will the Project generate knowledge that can be shared amongst all relevant Network Licensees?
QUEST will create a new integrated system to co-ordinate existing and future services provided by the DNO/DSO. It will ensure that the distribution network operates as efficiently and reliably as possible, as increasing demands are placed on it by customers and other users. QUEST will deliver a new overarching voltage control system which can manage the DNO network at all levels, and which has the potential to be extended in the future to include the transmission system. This will extend the optimisation of network voltage from National Grid intake points through to domestic customers. QUEST will develop and demonstrate a holistic voltage control and optimisation standard that could be adopted by all DNOs and DSOs. To ensure transferability, the project will consult with all electricity network licensees when developing the new control methodologies and standards to ensure that they are applicable across GB. This consultation could involve the formation of a steering group with appropriate participants, which could meet regularly during the course of the project. A designated knowledge and dissemination work stream will work in collaboration with Project Partners to capture all the learning and promote simple, targeted and pragmatic dissemination activities. This approach allows access to a broad range of skilled personnel and other resources to deliver learning cost effectively and document any additional learning experienced around the periphery of Project delivery. We will use communication channels which support direct feedback from our audiences, including one-to-one sessions with other network licensees, to enable Project responsiveness and further incremental learning.

Answering Yes or No, does the Project conform to the default Intellectual Property Rights (IPR) arrangements set out in the NIC Governance Document? *If answer is NO, the Licensee must demonstrate how learning will be disseminated to other relevant Licensees and how value for money will be ensured. The Licensee must also outline the proposed alternative arrangements and justify why the arrangements are more suitable than the default IPR arrangements.*
Yes

How does the project demonstrate it is innovative (ie not business as usual) and has an unproven business case, that the innovation risk warrants a limited Development or Demonstration Project to demonstrate its effectiveness?
Until now, innovation has been focussed on producing significant learning on how techniques such as ANM, voltage optimisation and flexible services operate individually to solve specific constraints on the network or to provide benefits to customers. However, as these techniques act independently, it is timely to turn our attention to the challenge of their co-ordination. There is no current learning on how they can be operated in a co-ordinated manner and extended across the whole distribution network, which would maximise their benefits to customers. QUEST will aim to develop this learning. Currently, there is uncertainty as to how the control mechanisms will facilitate seemingly opposing outcomes such as maximising generation and reducing energy consumption. There is also uncertainty as to whether customers' equipment can respond in a positive way to help facilitate these services. The architecture of the overarching system, including knowledge about which elements can be decentralised, is unknown, and deploying such a system could lead to unforeseen issues with maintaining statutory limits, unnecessary curtailing of customers' supplies, or unintentional overloading of DNO assets. Therefore, a limited trial in controlled circumstances, such as a NIC project, is required to understand what a co-ordinated system looks like, how existing deployments can be integrated, and to quantify the additional benefits to GB customers.

How were Project Partners, external resources/funding identified, and what are their respective roles in the Project? Please evidence how Partners were identified and selected, including the process and rationale that has been followed. *The Licensee should provide details of any Project Partners who will be actively involved in the Project and are prepared to devote time, resources and/or funding to the Project. If the Licensee has not identified any specific Project Partners, it should provide details of the type of Project Partners it wishes to attract to the Project.*
Electricity North West is replacing it's bespoke NMS with an off-the-shelf NMS produced by Schneider Electric (SE). As the overarching system is expected to form part of the NMS, we will be partnering with SE to assist with specification, design, development and, if appropriate, implementation. We will partner with Smarter Grid Solutions (SGS), who have valuable knowledge regarding the operation of software systems such as ANM, to help define the architecture and use cases and to participate in trials. We will also partner with Fundamentals, who have experience in voltage control which will assist with design of the control methodologies and customer interface. We are actively seeking to partner with National Grid ESO to explore the expected benefits of QUEST for the transmission system, including real-time visibility of our network and dynamic adjustment of interface voltage parameters, for both steady state and emergency conditions. QUEST will require support from a suitably qualified technical consultancy to carry out modelling to inform design of the control methodologies, inform trial design and analyse data to calculate the benefits, and update the business case and carbon assessment. We intend to issue a tender for this work and secure partners before the FSP deadline. We are exploring collaboration with customers, including a possible commercial or generator partner, to discuss the feasibility of applying voltage control devices to their equipment to allow self-balancing within set parameters. We will also undertake research to understand the effects of voltage optimisation for customers with sensitive equipment.

Would the Project require any derogations or exemptions to current regulatory arrangements? *If YES, please provide details of the required changes.*
No – we do not anticipate any derogations.

How will the Project activities impact customers? *The Licensee should outline any planned interaction with customers or customers' premises as part of the Project, and any other direct customer impact (eg amended charging arrangements, supply interruptions).*
Owing to the nature of the work required for QUEST, there are no anticipated planned interruptions to customer supplies. As we anticipate being able to interact with customers in real-time, we will work with generators and large demand customers to test and calibrate their appetite for voltage driven, self-managed connections and explore whether their responding to changes in voltage is a viable and attractive control method. As networks are increasingly operated within the full range of what is allowable, we will engage with customers to investigate the effects of further optimisations, particularly those with voltage sensitive equipment, and provide advice on how changes could be made to improve their service.

This question is for Cross-Industry Projects only. What funding is being requested from each NIC? Please include justification for the funding split.
N/A

Are there any further details the Licensee considers would support its submission?
Many of the network innovation challenges facing the electricity industry share common traits, and it is expected that there is convergence around a number of key innovation themes. Convergence will produce innovation project ideas which are similar conceptually but which have important differences in objectives, techniques and outcomes. To this end we will continue to work closely with other Network Operators to identify, understand, and - where there is value in terms of learning, cost efficiency and removal of unnecessary duplication - to incorporate collaboration between projects. We have already held discussions with WPD regarding possible collaboration between their ENABLE project and QUEST. In the full submission we will provide detail on how we intend for themed projects to learn from each other to produce better outcomes for GB customers.

Contact Information (Cross-Industry Projects can provide two contacts)

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