Electricity/Gas 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). Please use the default font (Verdana size 10) in your submission. 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 10 pages in total. Ofgem will publish all the information contained within this Screening Submission.

Is the application for the Gas or Electricity NIC?	Gas NIC ☐	Electricity NIC ☒
Cross Industry Project	YES ☐ *If yes, please fill out Cross Industry Projects section*	NO ☒

Funding Licensee(s)
Western Power Distribution

Network Licensee Project Partners
None identified at ISP stage.

Funding Licensee area(s)
Western Power Distribution West Midlands

Project Title
Project Revise

Project Summary
The Licensee(s) must provide an approximate Project start and end date.
The electricity distribution network was originally designed to supply customer demand by transporting energy from large centralised facilities connected to the transmission network; however, in recent years the distribution network has seen an influx in the connection of Distributed Generation (DG). Latterly the advent of Low Carbon Technologies (LCTs) connecting to the distribution network has become prevalent, further adding to the demands and complexities of operating a distribution network. The connection of DG is predicted to double across the distribution network by 2030 and whilst current practices have been valid to this point, new and innovative Methods are required to prepare for this outcome. Project Revise aims to fulfil this requirement through the innovative use of new technologies and techniques to release network capacity; improve DG and LCT connectivity; and enable intelligent control of the system. Three technical Methods will be deployed to achieve this: – Compact Substation and smart deployment; – Enhanced Protection Schemes; and – Active Network Reconfiguration. Each Method will individually enable the transition towards a more flexible and accessible network and together support DNOs' transition to a Distribution System Operator (DSO). It is anticipated that the Project will be delivered over a four-year period.

Estimated Project funding			
The Licensee must provide an approximate figure of the total cost of the project and the NIC funding it is applying for.			
Total Cost of Project	£16.2m	**NIC funding requested**	£14.58m
Is the TRL of the Project at start date between 4 and 8?	YES ☒	NO ☐	

What is the Problem?

The Licensee must provide a narrative that explains the Problem(s) that the Project is seeking to address.

Historically the electricity distribution network was designed to transfer energy from large centralised sources on the transmission network to consumers at lower voltage levels. Over the last decade the connection of DG on the distribution network has increased dramatically with around 8.7GW of capacity currently connected across our four licence network areas. The latest forecasts indicate that DG is set to more than double across our network from 8.7GW to 19.5GW by 2030. This trend is supported by National Grid which predicts that non-visible distributed energy resources (i.e. connected within the boundary of the distribution network) will double from 17GW in 2016/17 to 34GW in 2025/2026 as detailed in their 2016 System Operability Framework.

To date the majority of DG and LCT connections have been successfully managed through utilising existing capacity on the network. However, the rapid increase in connections has meant that this capacity is becoming saturated in many areas resulting in the need for alternative connection solutions. The Problem is particularly acute on the 33kV network which has typically been the connection point for DG with a capacity greater than 5MW. In areas where capacity has been limited, traditional network reinforcement has been the only option to release sufficient capacity; however, it can be both cost and time prohibitive. Through previous innovation projects Active Network Management (ANM) schemes have been developed and are now the preferred solution to provide a timely connection in constrained areas, however they rely on the flexibility of the connecting customer which can sometimes result in periods of reduced output or disconnection due to external faults/outages on the network.

Typically the physical location of most new DG is remote from a substation. This normally results in a supply that is provided by connecting to a nearby overhead line or cable circuit. The cost effective connection solution for the customer in the short term is likely to manifest as a tee connection to that line; this is analogous to a t-junction which connects a small side road to a main road (the main road being the 33kV network and the side road being a generator connection). However, this type of arrangement does not provide any flexibility at the point of connection. For example, a fault or planned outage will result in all tee connected generators and network transformers on the affected section of network to be disconnected either temporarily or until the network has been reconfigured manually. This severely affects DG and LCT availability and results in increased costs to the customer.

A novel approach is required to vastly increase the utilisation of the existing 33kV network, provide additional flexibility and further facilitate the connection of DG and LCTs to meet the low carbon agenda. The novel approach will augment the offering that traditional reinforcement and ANM provide to enable the transition to DSO.

What Method(s) will be used?

The Licensee must describe the Method(s) that are being demonstrated or developed. It must also outline how the Method(s) could solve the Problem. The type of Method should be identified where possible eg technical, commercial etc.

The Compact Substation Method will design, develop and install a revolutionary compact 33kV substation that will replace tee network connections. The existing tee arrangement is currently the only practical option to connect generators with the alternative involving the construction of a new substation building at the point of connection. Establishing a new substation building would come at a substantial cost to the customer requiring a bespoke design that would contain switchgear, communications, batteries and back-up supplies, not dissimilar to what would be found at a main primary substation. The tee connection is no longer fit for purpose for the network of the future as it is inherently inflexible and does not facilitate the transition to remote network reconfiguration: an invaluable tool for the DSO to manage the network, DG and LCTs in an intelligent manner. The Compact Substation will be the first of its kind in the industry and will provide two fully configurable, remotely operated connections to the main network through what is known as a 'loop-in' arrangement, superseding the tee connection. The Compact Substation is a unique Solution that will contain three controllable circuit breakers and integrated smart communication and protection systems all within a single package. The substation equipment will be contained in a modular enclosure with all components tested and pre-commissioned so that it can be integrated on to the 33kV network in a matter of days, timescales that are unheard of in the industry. The implementation of this Method will provide a significant improvement to the security of supply and flexibility of the network by allowing network sectionalising both pre and post fault.

Method(s) continued

The substation will be designed with an appearance that is suitable for both rural and urban installations with a compact footprint reducing the requirement for new land acquisition. The Method will include identifying five strategic locations where the Compact Substation will be connected to maximise the utilisation of existing network assets and generate the most learning from the trial.

The Enhanced Protection Scheme Method will research and develop new protection philosophies, which are required to ensure that the network of the future is adequately protected. Existing protection schemes are designed based on a network running arrangement that is predominately static. The network of the future will be required to be reconfigured throughout the day to balance load, generation and utilisation at a local level. The rigidity in existing protection schemes will not be suitable for future scenarios where power flow and system impedances are changing on a regular basis due to network reconfiguration. A protection system checks certain parameters on the network almost instantaneously to determine if there is a fault on the system. If a fault is detected the protection will operate an asset to disconnect the faulted network from the rest of the system. Standard protection parameters are only able to assess one network condition and as we change the network configuration to best suit the needs of the system these standard parameters will not be suitable. The Solution to be trialled is the Enhanced Protection Scheme Method which will address these limitations with an intelligent system that responds in real-time to changes in the network. The Method will monitor various parameters such as system impedance (following network reconfiguration), circuit breaker positions and system fault level to inform the automatic calculation of new protection parameters. The potential of this Method will be more effectively harnessed through its integration with the equipment installed through the Compact Substation Method. The Enhanced Protection Scheme will be implemented at each Compact Substation location and an additional five independent locations to demonstrate its performance and benefits when integrated as a stand-alone Method.

The Active Network Reconfiguration Method will provide intelligent and autonomous reconfiguration of the network. The connection of DGs and LCTs to date has exhausted most of the available capacity on the network based on the most onerous network operating conditions that could occur. This Method will release additional capacity from the existing network by continuously calculating the optimal running arrangement. It will collate real-time information on various points of the network (such as voltage, current and power) and determine the optimal running arrangement for all network operating conditions. Part of the Method will also investigate and implement a robust cyber security system to ensure and maintain the integrity of the network. The trial area for the Method will cover the 33kV network from the selected Compact Substation and Enhanced Protection Scheme sites up to the source Bulk Supply Point (BSP) (the point where the 132kV network is transformed to supply at 33kV). Strategically selected manual switching points will also be upgraded to remotely controlled devices in the trial area to maximise the flexibility of the revised system. The Method will work together with the Compact Substation and Enhanced Protection Scheme Methods to form a pioneering new approach to network operation and management that is fit for the network of the future.

There will also be a key Research and Dissemination element in addition to the three technical Methods. This will include a detailed case study on the whole system costs of Solutions to DNOs, connecting customers and all network users. A report focusing on the learning outcomes and findings relating to the cyber security elements for the remote configuration of protection and system settings shall also be produced. Comprehensive studies will be completed to assess the capacity released from each Method and how connection offers, and potentially connection agreements, can be augmented.

Funding Commentary

The 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. OFTOs should indicate potential bid costs expenses

The estimated funding for Project Revise over the four-year duration is detailed below:

Project Management – Activities associated with the management of Project Revise including risk register, action log, coordination, weekly reporting, quality assurance etc.
£0.75m - £0.91m (6%)

Compact Substation (CS) Method – Design, develop, install and trial 5 no. CSs.
£3.56m – £4.35m (27%)

Enhanced Protection Schemes (EPS) Method – Research and develop new protection philosophies and implementation in the trial area.
£3.31m - £4.04m (25%)

Active Network Reconfiguration (ANR) Method – Design, develop and implement a novel system to intelligently control and reconfigure the 33kV network in the trial area.
£4.82m - £5.90m (36%)

Research and Dissemination – Perform research to investigate the application of methodologies and philosophies. Capture learning, benefits and outputs and disseminate with stakeholders through a number of different channels and media.
£0.82m - £1m (6%)

Total Estimated Project Cost: £13.26m - £16.21m

The project costs have been developed using a bottom up approach, using WPD's schedule rates, indicative supplier quotations and learning from previous innovation projects.
The estimated costs above cover the initial design, development, testing and installation of technologies associated with the deployment and trialling of the aforementioned Methods. A high volume of upfront work is required to trial these Methods on the 33kV network, however, much of this upfront work will not need to be repeated after the trial has concluded. For example, the Project will output a number of standard designs, specifications, policies and procedures that will facilitate a wider roll-out of the Methods as part of BAU. Hence the costs for BAU implementation compared with the trial costs are expected to reduce by a significant margin following completion of this Project.

Which Specific Requirements do the Project fulfil?(Please tick which of the Specific Requirements this Project fulfils)

	Electricity	**Gas**
A specific piece of new (ie unproven in GB) equipment (including control and/or communications systems and/or software)	☒	☐
A specific novel arrangement or application of existing electricity/gas transmission and/or distribution equipment (including control and communications systems software)	☒	☐
A specific novel operational practice directly related to the operation of the electricity/gas transmission and/or distribution systems	☒	☐
A specific novel commercial arrangement	☐	☐

How does the Project accelerate the development of a low carbon energy sector & have the potential to deliver net financial benefits to existing and/or future customers?
The Licensee must demonstrate that the Solution has the potential to accelerate the development of the low carbon energy sector in GB and/or deliver wider environmental benefits to GB customers. The Licensee must demonstrate the potential to deliver net financial benefits to existing and/or future customers.
The transition to a low carbon economy will require an increase in generation from a variety of renewable sources along with the development and connection of emerging LCTs on the distribution network. Project Revise will provide more granular control of the existing network assets to establish optimal running arrangements releasing latent capacity which can be made available for the connection of DG and LCTs. Currently the only method to release additional asset capacity is by reinforcing the network which is expensive, time consuming and does not align with the green objectives of government directives. Project Revise will also reassess generation connection methodologies to increase the availability for existing customers by providing additional flexibility in the network. A new standardised connection Solution will also provide new customers with the opportunity of accelerated connection times. In addition, the Methods will facilitate the necessary system flexibility outlined in The Clean Growth Strategy that will permit the changing flow of energy to and from emerging LCTs connected to the network. The main financial benefit to customers will be the ability to export additional energy back to the network when they would have otherwise been constrained: either due to restrictions borne of a static network or a network fault preventing the connection of DG. Using decentralised generators on the 33kV network will also result in lower system losses that will benefit the wider customer base. Furthermore, localised generation connected to an overall more flexible network will enhance the security of supply and network resilience for customers. Project Revise will mitigate the requirement for system reinforcement to accommodate additional demand and generation, providing an overall financial benefit that will be passed on to the end user through lower Distribution Use of System (DUoS) charges.

How will the Project deliver value for money for electricity/gas customers?

The Licensee must demonstrate that the Method(s) being used can derive benefits and resulting learning that can be attributed to or are applicable to the electricity/gas transmission and/or distribution systems.

Project Revise will develop a new standardised approach for the connection of DG and LCTs whilst trialling new innovative ways to operate the 33kV network. As all three of the Methods are scalable, the benefits and learning derived would be applicable to 33kV networks across the UK.

The development and demonstration of the three technical Methods will greatly increase the utilisation of the latent capacity in the distribution network meaning that network reinforcement expenditure can be avoided, or substantially reduced, whilst still maintaining the long-term reliability and efficiency of the network. The deployment costs of the three combined Methods shall be substantially lower than traditional 33kV system reinforcement costs whilst facilitating increased connectivity, security of supply and operational flexibility. Initial Method system studies show that the proposed Solutions will double the capacity released when compared with traditional solutions of the same financial scale.

The Project will also demonstrate how system losses will be reduced through higher utilisation of existing assets and greater access for DG to export on to the network. The benefits from the Project will be accrued by all electricity users and will return considerable value to all electricity customers whilst minimising disruption and taking a flexible approach to meet future needs.

The delivery of the three technical Methods will also provide a major stepping stone towards the transition to DSO by capturing the learning generated from operating a network that is able to be intelligently controlled.

How will the Project generate knowledge that can be shared amongst all relevant Network Licensees?

The Licensee must explain the learning that it expects the Method(s) to deliver, and how it will be shared. The Licensee must demonstrate that it has a robust methodology in place to capture the learning and how the learning is disseminated.

At present all DNOs utilise a static operational network methodology, whereby the 'normal' network status is maintained irrespective of the conditions apparent on that network. 'Abnormal' operation is predominantly reserved for post-fault and planned outage conditions. A Solution to enable dynamic and automated network reconfiguration will provide key learning that will be shared amongst all network licensees, specifically:

- Functional specifications for the proposed technologies and control methodologies;
- Standard designs for the technology elements within the three Methods to ensure other network licensees can integrate the Solutions in to their Business As Usual (BAU) activities;
- Policies, practices and procedures for the integration of an Active Network Reinforcement scheme;
- Policies, practices and procedures for the integration of a Compact Substation in a new or existing network;
- Policies, practices and procedures for the application of Enhanced Protection Scheme;
- Provision of application and connection hierarchy of Solutions to provide guidance and instruction on the appropriate implementation of the Methods.

The learning will be captured and disseminated using the same robust methodology already employed on existing projects as part of WPD's Future Networks' programme of work.

Does the Project conform to the default IPR arrangements set out in	YES	NO

the NIC Governance Document?	☒	☐

By selecting NO, the Licensee wishes to deviate from the default requirements for IPR. If this is the case, it must demonstrate how the 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 arrangements.

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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?

Demonstrate why the Licensee has not previously used this Method (including where the Solution involves commercial arrangements) and why NIC funding is required to undertake it. This must include why the Licensee would not run the Project as part of its business as usual and why the Solution is not Research.

Project Revise will deploy three technical methods that will use a combination of technologies to enable the autonomous reconfiguration of the 33kV distribution network. This revolutionary application of these technologies has never previously been trialled on the UK distribution network. Each of the Methods will provide innovative solutions to the challenges facing the DNOs in their transition to the DSO model. These challenges are driven by the significant numbers of DG and LCTs connecting to the sub-transmission network in the coming years. The solutions will also enable the DNO to unlock capacity in the existing network, extract more energy from low carbon sources and reduce customer costs.

The Compact Substation Method will increase connection flexibility to the 33kV network. It will provide a remotely configurable, pre-packaged, pre-commissioned, standardised connection Solution that is a first of its kind. The benefits of which will be quantified through trials on a live, operational network. This Method has the potential to become the minimum scheme for future connections.

The Enhanced Protection Schemes Method will pilot an adaptive protection scheme and supporting smart communications system. The novel scheme will dynamically optimise the protection parameters based on real-time system measurements. The Method will provide protection that is suitable for the future network which will operate in a multitude of different scenarios and configurations that have not previously been considered.

The Active Network Reconfiguration Method will deliver a fundamental change in how the 33kV network is controlled and operated. The Method will trial an autonomous system that is capable of determining the optimal running arrangement in real-time and reconfiguration of the network accordingly. This will become a prerequisite for realisation of an intelligent distribution system.

How were project Partners, external resourcing/funding identified, and what are

their roles?
The Licensee must provide evidence of how Project Partners were identified and selected, including details of the process that has been followed, and the rationale for selecting partners and ideas for the Project. *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.*
None identified as yet at the ISP stage.
Will the Project require any derogations or exemptions?
The Licensee should outline if it considers that the Project will require any derogations, exemptions, or changes to the regulatory arrangements.
No derogations or exemptions have been identified at the ISP stage.
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 (such as amended contractual or charging arrangements, or supply interruptions).
We do not foresee any specific customer impacts at this stage. Construction outages will be managed through the existing outage management processes.
What funding is being requested from each NIC? (Cross Industry Projects only)
The Licensee must outline funding that is being requested from the Electricity and the Gas NICs and include a justification for the funding split.
Click or tap here to enter text.
Are there any further details the Licensee feel may support its submission?

Click or tap here to enter text.

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Job Title

Innovation and Low Carbon Networks