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

Jun 2026

Project Reference Number

NIA_SPEN_0138

Project Registration

Project Title

MeshVolt

Project Reference Number

NIA_SPEN_0138

Project Licensee(s)

SP Energy Networks Distribution

Project Start

June 2026

Project Duration

0 years and 7 months

Nominated Project Contact(s)

Anna Muir & Parham Momeni

Project Budget

£235,000.00

Summary

In SP Manweb (SPM), we have highly interconnected and meshed networks in which control systems have to act with a greater understanding on grouped network impact and be adaptable to network topology changes which can completely alter the system behaviour. This network topology provides an excellent proving ground for coordinated voltage control across interconnected groups and under varying operating scenarios and an opportunity to improve understanding of voltage control within an interconnected system.

This discovery project will demonstrate functionality of dynamic voltage control capability across a group of primary substations in a meshed network. It will explore network behaviour, monitoring and coordinated control requirements, and consider interactions with existing technologies. The outputs will provide evidence and learning to improve understanding of DVC in meshed networks and inform future approaches across SPEN and GB networks.

Third Party Collaborators

Fundamentals

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

Changing network conditions require DSOs to adopt more advanced operational capabilities – development of Dynamic Voltage Control (DVC) capability is increasingly important to support system operations. Examples of recent changes and trends contributing

to the need for more dynamic control of voltage include the rapid growth of EVs, heat pumps and rooftop PV; enhanced visibility from smart meters and LV monitoring; and increased understanding of real and reactive power flows across the transmission-distribution boundary. Dynamic Voltage Control in SP Manweb (SPM) faces complex challenges due to the interconnected topology of the network as well as long radial networks in rural areas. It is therefore critical to manage power flow constraints that may introduce complex circulating currents in meshed networks or be exacerbated by long LV feeders in rural networks.

Method(s)

The Project will deploy a combination of technical and operational Methods to develop, demonstrate and inform the future design of Dynamic Voltage Control (DVC) capability within a highly meshed distribution network.

The primary technical method involves the installation and configuration of coordinated voltage control (including enhanced AVC functionality) across a group of trial sites within SP Manweb (SPM). This trial will be used to inform optimised voltage management approaches based on network conditions and topology.

The project will trial and assess available technologies to support future development of a scalable and robust Dynamic Voltage Control system with the aim of optimising performance for meshed networks and enabling integration with services and supporting more adaptive and resilient network operation. These enhancements are expected to enable optimised voltage control across interconnected circuits, improving system stability and supporting future system needs.

Scope

The scope of the project is broken down into four work packages:

- WP1 Project Specification & Network Assessment: This work package will undertake network assessment and site selection for trial locations
- WP2 DVC-Ready Sites: Installation and commissioning of equipment for grouped sites within the SPM network
- WP3 Network Demonstrations: Demonstration of Dynamic Voltage Control through a series of trials across the group
- WP4 Advanced Monitoring & Future Capability: The project will produce a report which will identify gaps (e.g. transformer monitoring / network voltage optimisation) and improvement opportunities and will propose recommendations to ensure future solutions deliver maximum improved reliability, efficiency, and readiness for evolving requirements

Objective(s)

The objectives of the Project are to generate evidence and learning to support future decision-making on deployment of DVC capability across SPEN and GB networks:

1. Demonstrate the operation of Dynamic Voltage Control in a highly meshed distribution network
2. Assess network behaviour under a range of operational scenarios and make recommendations to support future system performance
3. Identify requirements for enhanced monitoring, control systems, and asset management associated with coordinated voltage control across interconnected network assets to support future DVC development
4. Document findings and learning to support future development of DVC capability across SPEN and GB networks

Consumer Vulnerability Impact Assessment

Improved voltage control will enhance network reliability and quality of supply, reducing the risk of disruptions for vulnerable customers who may be more dependent on a secure electricity supply.

No adverse or disproportionate impacts on vulnerable customer groups have been identified, and benefits will be shared across the customer base.

Success Criteria

The project will be deemed successful if it delivers:

- Installation and commissioning of coordinated voltage control configurations across the selected trial sites, and completion of

planned network trials within a meshed network

- Identification of key technical and operational considerations for coordinated voltage control, including monitoring, control, and asset management aspects and areas requiring further investigation
- A framework for scalable deployment, and recommendations and learning to inform wider SPEN and GB network rollout

Project Partners and External Funding

Fundamentals Ltd

Potential for New Learning

The Project will generate evidence on how DVC performs within complex meshed networks (where limited evidence currently exists in GB) and will provide evidence on DVC behaviour under reverse power flows. It will establish the requirements for coordinated voltage control across sites, while considering asset health implications and monitoring needs associated with tap operations. The Project will also produce replicable evidenced learnings and rollout considerations to support future GB wide DVC developments.

Scale of Project

The scale of the project will include a group of five primary sites in SP Manweb with recommendations and learnings applicable across SPEN licence areas and wider GB networks.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

The Project will take place within SPEN's licensed distribution network areas, specifically focusing on SP Manweb region. The initial trial will involve a group of five trial sites in SP Manweb.

Revenue Allowed for the RIIO Settlement

0

Indicative Total NIA Project Expenditure

Total expected NIA expenditure over the project lifetime is around £235k.

Project Eligibility Assessment Part 1

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

The scope of this project supports DSOs in meeting future network requirements for proactive, coordinated voltage management under high DER/LCT uptake with a particular focused on interconnected networks. Provides a technical solution to increasing voltage volatility by enabling dynamic voltage control across complex meshed networks caused by EVs, heat pumps, rooftop PVs and increasing reactive power challenges. It creates the opportunity to enable increased hosting capacity for DER and LCTs, reducing curtailment and enabling more efficient decarbonisation outcomes for consumers. It provides a replicable DVC approach and shared learnings relevant across GB, supporting wider decarbonisation objectives.

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

n/a

Please provide a calculation and/or description of the expected benefits of the solution

This project has clear potential to deliver net benefits to consumers of the electricity distribution system by improving network efficiency, enhanced asset utilisation, and facilitated integration of low carbon technologies.

As this is a trial and demonstration project, benefits will initially be evidenced qualitatively and through measured performance improvements. These outputs will inform a more detailed and quantified cost-benefit analysis to support future large-scale deployment in RIIO-ED3.

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

The Method is expected to be applicable to a significant proportion of GB primary substations with a particular focus on interconnected groups. While focused on meshed network, the learnings will be applicable for networks with interconnection including open points (particularly with increased prevalence of soft open points). Furthermore, recommendations from the project around impact on transformer health and interactions with other voltage management technologies and use cases will be beneficial to DNOs across GB. Voltage challenges are increasing across GB so learnings ahead of future network planning cycles will be transferable.

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

The costs of rolling the method out across GB will be established through the project.

Requirement 3 / 1

Involve Research, Development or Demonstration

Projects 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

Involve Research, Development or Demonstration - Please select all that apply

☐ 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 Project will generate new learning on how DVC performs within complex meshed HV networks and will provide evidence on DVC behaviour across multiple use cases. It will establish the requirements for coordinated voltage control across primary substations, while assessing the asset health implications and monitoring needs arising from increased tap operations and considering interaction with other voltage management technologies. The Project will also produce replicable rollout considerations to support future GB wide adoption of DVC. This learning will be applicable to all GB DNOs and will inform their DVC deployment strategies as networks prepare for future price controls.

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. Networks must explicitly mention similar projects that they have considered and how these differ.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

This project will build upon learnings from previous projects in this space to avoid duplication but will specifically focus on the practical challenges of operating DVC in a meshed primary network environment (considered synchronicity of AVC control for DVC across a group of sites) and will also consider impact on transformer operations and provide recommendations for enhanced monitoring and predictive maintenance as a result of voltage control alongside practical considerations of interactions with other voltage control technologies and against different use cases.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

This project will build on and complement learnings from existing GB DNO projects focused on voltage control - including but not limited to SP ENW's CLASS and QUEST, NPG's BEET and SPEN's LV Engine but delivers new knowledge at a different TRL and for a different network topology with high levels of interconnection across additional use cases. The scope is fully aligned with DVC strategy development and focuses explicitly on gaps not addressed to date in order to develop capability and inform planning ahead of future price control periods.

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

DVC has not yet been widely demonstrated within an interconnected, meshed 33/11kV network. It involves discovery work to consider novel combinations of voltage control technologies interacting with other voltage management technologies and DER penetration. It introduces new operational practices requiring coordinated control across grouped substations under varying topology states.

Relevant Foreground IPR

In accordance with the default Network Innovation Allowance Intellectual Property Rights arrangements, learning from the Project will be disseminated to Network Licensees, while proprietary software components, algorithms, data models, and commercially sensitive implementation details developed by project partners will be protected.

SP Energy Networks will receive the appropriate rights to use the Project outputs for network planning and operational purposes in line with the NIA Governance Document.

Data Access Details

The SP Energy Networks Data Access policy can be found here.

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

A number of operational, technical and asset health uncertainties must be resolved before adopting DVC at scale as BaU, and this will be informed through the outputs and recommendations from this initial discovery phase. Requires controlled trials and demonstration to reduce risks prior to fullIscale deployment.

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

Outcomes will inform the business strategy for wider DVC deployment. The project will inform on the technical and operational risks (e.g., unintended voltage interactions, circulating current effects, transformer wear) and commercial risks exist due to uncertain integration requirements and monitoring needs.

This project has been approved by a senior member of staff

☑ Yes