

NIA Project Registration and PEA Document

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Jan 2022

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NPG_NIA_039

Project Registration

Project Title

Community DSO

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NPG_NIA_039

Project Licensee(s)

Northern Powergrid

Project Start

January 2022

Project Duration

1 year and 0 months

Nominated Project Contact(s)

Chris Goodhand

Project Budget

£170,000.00

Summary

Smart local energy systems are one approach to future energy systems architectures.

A fractal approach, using a limited set of configurable local energy archetypes has been proposed.

This project aims to understand , and to provide initial estimates of the magnitude of, the technical, social and economic issues that are important in determining whether this approach is a viable future option and to identify barriers to implementation.

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Problem Being Solved

Energy generation and demand management is becoming increasingly decentralised, and the importance of communities in facilitating this transition has been recognised and promoted by the EU with policy supporting 'citizen energy communities'. One type of decentralisation is the formation of Smart Local Energy Systems (SLES). These could play a very important role in the future energy system with many schemes and approaches already in development. However, there are several challenges associated with the extensive use of SLES if they are to develop in a way which ensures network constraints and needs of the DNO are met whilst delivering a fair distribution of both the costs and benefits of SLES to customers:

- Each SLES design performs differently, potentially uniquely, in economy, technical effectiveness, and in how it impacts the broader network. Connection approaches are not consistent. Designs and impact studies must be constantly repeated. This is inefficient and costly for customers and leads to sub-optimal systems.
- Local management, individually and in combination, may lead to significant increased complexity and a sub-optimal system at a larger scale. This reduces network stability and reliability and raises network costs.

- Communities can find it challenging to deliver local energy schemes due to their complexity and lack of standardisation. This may discourage take-up of low carbon technologies slowing net zero delivery and can result in missed opportunities.
- First adopters in SLES often preferentially consume system and benefit resources by, for example, shifting fixed costs to others. This may unfairly reduce the ability of later adopters (who may be fuel poor or more vulnerable) to participate.

A more structured approach to decentralisation incorporating SLES and enabling DNOs to better work with communities in facilitating SLES and DSO functionality to the benefit of communities and networks could be beneficial. To demonstrate the viability of this, research is required to address a number of gaps in current knowledge:

- There are many technical solutions and enablers to deliver SLES, but the lack of standardised approaches, and the complexity of the landscape is a hindrance to the efficient delivery of projects which work for customers and networks.
- There are a range of innovative commercial models being exploited for SLES, but it is not clear how these may evolve, or operate in the context of a scheme to deliver benefits to both the DNO and community delivering a DSO function. In general, SLES models up to now have either focussed on the community or the system / network, and not to provide a common approach.
- Community led energy schemes are in their infancy, and the long-term market potential is uncertain. Whilst the level of deployment is potentially significant, it is not clear how this roll out will evolve, and the types of SLES schemes and delivery mechanisms which will be deployed.
- The commercial benefits and business case for a community-led DSO approach have not been established. It is clear that a range of values can be accessed, but there is a lack of evidence on how these can be used to enable the delivery of SLES schemes in a way which provides value to both customers and the network, or how the DNO fits into the value chain in a community-DSO led approach.

The aim of this project is to conduct in-depth research to explore and establish the types of approaches which could facilitate a community DSO model, and the future potential and benefits this can provide. This will provide the foundation for future technical development and trials of approaches that can lead to a market ready solution.

Method(s)

It could be possible for DNOs to more actively enable and support customers to develop their own effective SLES solutions, with communities providing services to the DSO. In doing this, DNOs should be technology agnostic but provide easy-to-use common frameworks and design approaches to ensure that any SLES, or combination of independent implementations, is economically efficient, effective, and manageable across the whole system, whilst providing a good solution for the DNO. This should also support a level playing-field allowing a fair net-zero transition for all customers. This approach responds to many strands of UK policy set out in the UK Energy White Paper and 10-point plan aimed at delivering low carbon energy with smart local systems.

The method that this NIA project seeks to promote is the adoption of a DSO-like role by physically connected local energy communities, to enable and empower those communities to manage their own energy resources. One of the foundations of this method is the designation of an existing distribution network as having a hierarchical cellular structure. Individual LV feeders or secondary networks will comprise a single cell, and local actors within that physical cell can opt to use their DERs to act as a community DSO. DNOs will have responsibility for managing multiple cells (e.g., the aggregated behaviour of multiple secondary networks or HV feeders).

However, the technology readiness levels for this method is currently too low to proceed immediately to physical trials. Therefore, this NIA will carry out desktop research and analysis to help progress the concept and increase the technology readiness level. This research will:

- Define a range of SLES solutions and typologies representing a broad part of the community energy market, replicable across the majority of the UK.
- Identify possible solutions for delivering LES schemes and a hierarchical cellular control structure looking at existing innovation and schemes / trials across the UK and Europe.
- Explore overarching technical and commercial architectures which could be tested in a trial.
- Assess the market potential for roll-out of the method, and appraise its value.
- Produce a business case for further research and innovation activity.

Five work packages are planned:

WP1 - Technical enablers: We will identify the technological enablers required to make the Community DSO concept viable and engage with prospective suppliers to identify what technology readiness levels are and whether there are any critical technological gaps.

WP2 - Commercial models: We will investigate possible commercial models which could be used to incentivise and create value from the Community DSO concept. This will include interactions with network charging and access, flexibility services, and the commercial relationship between the incumbent DNO and the community DSO.

WP3 - Market potential: We will research the prospective market for the Community DSO, including both (i) the possible pool of trial participants in NPG and UKPN's licence area and (ii) the longer-term prospects for adoption. This will include some focused engagement with relevant community groups, with a view to developing trials in a future stage of research.

WP4 - Appraising value for community: We will undertake some modelling to identify the possible value that could be created from Community DSO by unlocking flexibility on the HV and LV networks. This will incorporate justified assumptions about the nature of the flexibility that could be accessed and will help to determine a credible upper bound on the level of benefits that could be created for different archetypes.

WP5 - Business case: We will prepare the business case for further development of the concept, following the conclusion of the preceding four work packages. This will include a more extensive cost benefit analysis (drawing on the outputs of WP4 in particular). This business case will inform NPG's decisions about how to progress the concept further.

Scope

Scope includes technical, social and economic issues associated with the potential implementation of smart local energy systems. This includes the identification of potential barriers to implementation and the quantification of potential for benefits of such systems.

Objective(s)

The overarching objective of this project is to identify and demonstrate at a theoretical level that there are community SLES solutions that could help deliver an optimised energy system and accelerate decarbonisation whilst providing local community benefit. Specifically for this NIA research project, the objectives are to:

- Understand the types of technical solutions and architectures which could enable a Community DSO Model, exploring existing offerings (we are aware that many of the components may already exist, but they are not in a structure which can currently deliver the solution), innovators and organisations operating in this field, and gap analysis where further innovation and technical development may be required.
- Identify the potential market size for SLES solutions, and therefore the role that the Community DSO model could have in helping to transform the energy system.
- Engage with communities to assess whether there are communities that would participate in a Community DSO trial as part of a future innovation project.
- Identify potential commercial structures for delivery of Community DSO SLES, the values (economic and broader) which can be obtained, and whether there are viable economic solutions which can deliver a cost benefit to consumers and networks.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

N/A - although a key aspect of the work is to ensure that all sectors of society and the customer base can beneficially participate in the energy system changes.

Success Criteria

The project will be judged against the following outcomes:

1. Production of an outline architecture for delivery of community DSO, identifying the potential technical solutions, technology providers, and technology development needs, alongside potential commercial models.
2. Assessment of the replicability in terms of potential market size across NPG's licence area, and more broadly across GB, of a community DSO approach.

3. Demonstrating whether there is a business case for Community DSO based on a CBA analysis.

Project Partners and External Funding

None. UKPN are an interested party in the project outputs.

Potential for New Learning

The outputs from this research will provide new methods and structures for SLES involving communities and networks which is highly replicable (across the whole UK). The reporting will provide a solid evidence base for the further development of the concept in the form of later trials, ultimately leading to a market ready solution. no such comprehensive and holistic study of SLES, and particularly the "fractal" approach proposed has yet been undertaken. All learning will be provided in the project outputs for all DNOs to benefit from – the intention of this project is to inform further work which will help all relevant stakeholders support acceleration of the low carbon transition.

Scale of Project

Desktop

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

Yorkshire and the North East, although applicable to all GB distribution areas.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£170,000

Project Eligibility Assessment Part 1

There are slightly differing requirements for RII0-1 and RII0-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RII0-2 / RII0-1).

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 RII0-2 projects only)

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

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

The project proposes a new approach to DSO and community energy. This would provide an additional, as yet untested, option for system development.

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

The project specifically aims to ensure that the needs of all customers, particularly those often excluded from the benefits of the energy system transition, are considered and understood.

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 (RII0-1 projects only)

The implementation of smart local energy systems is still unproven and the project aims to provide improved quantification of benefits and to prove, or otherwise, the business case for further work in this area.

An outline assessment indicates that the potential savings following a full roll-out and solution of the problem are large:

Please provide a calculation of the expected benefits the Solution

With savings of 10-25% on each implementation, this project would help individual Community DSO projects to save upwards of £50,000 per year period assuming (approximately 5000 customers saving £100 or more per year each). More importantly, the project will design and demonstrate methods which can be implemented by other local communities investing in future community energy schemes across the UK energy system. Combined systems savings have the potential to reach £8bn.

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

The method is replicable across the whole of the GB network.

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

These are currently unknown and the project aims to resolve technical requirements and therefore costs.

Requirement 3 / 1

Involve Research, Development or Demonstration

A RII0-1 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

Learning will be made available through the usual dissemination channels and in the form of analytical reports. Networks will be able to use this to inform their own network development plans and DSO transitions in line with the needs of their stakeholders.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

The project contributes directly to cost reduction for customers, to network resilience improvement and to carbon reduction.

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.

Smart local energy network systems of this type have not been implemented in any other GB DNO or, as far as the literature is concerned, elsewhere. Other DSO implementations do not use the fractal/cellular philosophy being investigated here.

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 combination of technology, control and social acceptance of a cellular/fractal based approach has not been investigated previously as the appropriate technological conditions have not been in place. Further the need for large-scale, wide area understanding of how local energy systems, and other DSO type approaches, interact has not been an issue of interest due to the low level of implementation of such systems to date in the field.

Relevant Foreground IPR

All project IP is self contained, no background IP is required to use the project outputs. The form of the IP is in analysis and understanding of a specific approach to local energy/DSO.

Data Access Details

No large scale data sets will be produced by this project.

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

The project is low TRL with a uncertain business case and an even greater uncertainty, at this stage, as to whether this is ultimately viable as a network development option. Even in the event of a sucessful project any benefit is like to be directly to the customer.

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 is designed to assess and quantify benefit and risk for an as yet unproved approach to local energy/DSO. Technically it is not clear whether current equipment canb deliver what is needed nor what configurations of the same are required. Costs and benefits, assuming a sucessful outcome, are not known. Significant further work is also likely to be required to bring this to market.

This project has been approved by a senior member of staff

☒ Yes