



## Low Carbon Networks Fund Screening Submission Pro-forma

<b>Notes on completion</b>			
<p><b>Before completing this form, please refer to the LCN Fund Governance Document. Please use the default font (Verdana size 10) in your submission, the text entry areas are predetermined and should not be changed. Please ensure all content is contained within the boundaries of the text areas. The full-completed submission should not exceed 9 pages in total. Ofgem will publish all the information contained within the Screening submission.</b></p>			
<b>DNO Group</b>			
Scottish Power			
<b>Participant DNOs</b>			
SP Distribution, SP Manweb			
<b>DNO area</b>			
SP Distribution and SP Manweb			
<b>Project title</b>			
<b>Flexible Networks for a Low Carbon Future</b>			
<b>Project summary</b>			
<p><b>Problem:</b> In the transition to a low carbon economy the electrical network will increasingly become the energy vector for heat, transport and industry, which could double GB electricity consumption by 2050 (DECC Pathways). This challenge is exacerbated as this change is likely to be uncontrolled, potentially rapid, and localised. This is already starting to be experienced by DNOs with the adoption of photovoltaic installations. The limited forward visibility further complicates planning of long lead time network reinforcement projects. It will be necessary to be able to rapidly identify and then deploy solutions to avoid potential barriers to the connection of low carbon demand and generation, and critically to maximise the efficiency of the network.</p> <p><b>Solution:</b> The project will develop and demonstrate flexible solutions that can increase the capacity headroom of the network to defer or avoid the need for reinforcement. The project will examine a range of novel technologies that have not been used extensively nor integrated at scale by DNOs including; voltage optimisation, automatic network reconfiguration and dynamic asset rating. The project will initially focus on solutions that require minimal customer behaviour change, and on how the network can economically adapt to increases in customer demand.</p> <p><b>Benefits:</b> The project will be deployed to a scale that will exploit the different network characteristics and customer demographics of Scottish Power's distribution networks (covering parts of Scotland, England and Wales). The selected trial areas will be representative to ensure that the final solutions and associated learning is readily applicable to other DNOs. The project is readily deliverable with an achievable scope, and the need is imminent to inform the upcoming RIIO-D1 price review.</p>			
<b>Estimated Project funding</b>			
<i>Please provide an approximate figure of the total cost of the project and the LCN funding you are applying for.</i>			
<b>Total cost of Project</b>	£9m	<b>LCN funding requested</b>	£6m

### Problem

*Please provide a narrative which explains the Problem(s) which the Project is seeking to address.*

The Low Carbon Transition Plan cites the electrification of heat and transport as a key part of meeting our future emission targets. DECC pathways analysis projects this electrification process, as well as other increases for electricity and access to the network, as potentially resulting in a doubling of electricity demand by 2050. Network load related investment represents £1.5 billion across DPCR5, which is 11% of the baseline for network expenditure. The level of this investment will need to grow to accommodate increased demand associated with the electrification of heat and transport. It would therefore be of high societal value if more economic solutions were made available to DNOs to increase network capacity over the RIIO-D1 period.

Increasing network capacity is one of the main DNO challenges for various reasons:

- The electricity network can create a barrier to the uptake of low carbon technology when it does not have the capacity for it to be connected. Demand may increase faster than network reinforcement can take place, which could place at risk the integrity of the network or quality of supply to customers.
- Existing solutions for increasing network capacity can be time consuming and expensive to implement. Obtaining new substation sites and line or cable routes can be difficult due to land access and environmental issues.
- Solutions such as demand side management are reliant on customer participation and potentially making the electricity market more complex for customers and suppliers. This response may be less predictable, and may ultimately result in load related investment still being required if customers are unwilling to participate.
- A range of replicable solutions are needed that can be utilised on different network topologies with different customer bases. Any new technology requires to be rigorously trialled and analysed before it can be widely deployed due to the risk that it may create, should it fail to offer the anticipated network benefit.

This project will explore, develop, test and disseminate solutions that defer or avoid the need for new major network reinforcements. The novel techniques need integrated trialling at scale prior within a network environment prior to any credible business plan adoption. The core project objective is to enhance the network planning toolkit with lower cost, flexible and faster solutions for localised capacity enhancement to ensure the integrity of the distribution networks is maintained and do not become a barrier to the implementation of the Low Carbon Transition Plan.

### Method(s)

*Please describe the Method(s) which are being trialled. Please outline how the Method(s) could solve the Problem. The type of Method should be identified where possible e.g. technical or commercial.*

The method as follows is to establish a set of robust evidence based technical and economic trials and case studies that can be fed through into RIIO-D1 business plans.

**Understanding the problem** - Detailed analysis of the project locations which are representative of the GB 11kV and LV networks including load profiles and future network challenges. This will involve the development of tools and network monitoring techniques to identify area hot spots to refine knowledge and define operational margins of stressed assets.

We will aim to work with energy suppliers to deploy energy efficiency measures as part of their CERT/CESP obligations in a focussed manner to benefit the network loading and build on the analysis undertaken as part of the energy suppliers' EDRP work. Customer engagement and focus groups will be used to determine the customers' appetite for participation and what particular solutions are most likely to be effective if installed in the customer's property.

**Method(s) continued**

**Demonstrate components and develop case studies** - Full cognisance will be taken of other LCNF projects in order that the case studies are innovative and will generate new valuable learning. The identified technologies will first be installed at the Power Network Demonstration Centre in Cumbernauld to assess their effectiveness in advance of installation on the network. Potential solutions will be matched to the selected trial networks with sound experimental design to ensure maximum repeatability across GB.

**Deploy solutions** - The new solutions will be deployed on the network with a target of increasing the network capacity by up to 20%. The approach will be to examine these technologies on two separate areas of the 11kV and LV network to examine the impact that they have on different network characteristics and with different customer bases.

**Analysis of impact** - The technologies will be analysed in a controlled manner in order to quantify the learning and benefits of each one for future deployment, including a full cost benefit analysis. The implications on the existing network and how network demand characteristics affect asset lifetime and customer power quality need to be understood. The output from other LCNF projects as they become available will be used to better characterise time profiles of network loading so gaining a better understanding of network issues such as network losses.

**Dissemination of learning** - Dissemination will be designed to allow other DNOs to readily apply the new techniques throughout the project. This will progress throughout the project and range from internal and external outcome reporting through to site visits, roadshows, team rotation and data sharing. A web portal will be set up to provide access to information on the project with the potential for live data feeds.

**Funding commentary**

*Provide a commentary on the accuracy of your funding estimate. If the Project has phases, please identify the approximate cost of each phase*

The funding estimate is based on experience from previous projects and preliminary enquiries with technology providers. The final value will depend on the exact sites which are selected (which will be completed before the full submission) and further discussions with technology providers. It is anticipated that the funding requirements will be approximately:

- Understanding the problem- £600k: months 0-12
- Develop case studies- £800k: months 6-18
- Deploy solutions- £4,000k: months 18-36
- Analysis of Impact- £300k: months 18-42
- Dissemination of learning- £300k: ongoing

It is expected that most of the technology will be sourced through a procurement process which may also change the funding estimate.

**Specific Requirements** (please tick which of the specific requirements this project fulfils)

A specific piece of new (i.e. unproven in GB) equipment (including control and communications systems and software) that has a Direct Impact on the Distribution System)	<input checked="" type="checkbox"/>
A novel arrangement or application of existing Distribution System equipment (including control and communications systems software)	<input checked="" type="checkbox"/>
A novel operational practice directly related to the operation of the Distribution System	<input checked="" type="checkbox"/>
A novel commercial arrangement	<input type="checkbox"/>

**Accelerates the development of a low carbon energy sector**

*The DNO must demonstrate that the Solution makes a contribution to the Low Carbon Transition Plan.*

The connection of low carbon technologies such as micro generation, heat pumps and an uptake of electric vehicles in the quantities required to meet the UK Low Carbon Transition Plan are likely to exceed the capacity of the existing 11kV and LV distribution networks.

Much of the envisaged low carbon demand growth could be uncoordinated development. There are no formal or legal requirements for the DNO to be notified either in advance, or after the event, about the connection of new demands to existing connections. Some of these demand growths driven by external subsidies such as the Renewable Heat Incentive or rising energy costs have the potential to be rapid and localised, thereby exacerbating network stresses. More detailed forecasting and customer analysis will be required to anticipate growth such that network constraints can be avoided and the network is not a barrier to achieving the transition to a low carbon economy.

Challenges with installation, supply chain delays, obtaining land rights, planning permission and delays when laying cables can result in lengthy reinforcement times, potentially creating a barrier to the uptake of low carbon technology.

A variety of solutions to increase the declared capacity of existing networks will be developed using solutions that are faster to deploy and at a lower cost. These solutions although not new technologies are unproven in a distribution network context and as such, need to be adequately trialled in real environments to verify their cost effectiveness and feasibility prior to adoption into RII0-D1 business plans.

**Deliver net financial benefits to existing and/or future customers**

*The DNO must demonstrate that the Method(s) they are trialling has the potential to deliver the Solution at a lower cost than alternative methods.*

This project proposes the trialling of a range of solutions that can be deployed faster and at lower cost than traditional reinforcement, thereby providing a technically and economically advantageous network solution. Alternative solutions that provide 10% to 20% headroom could avoid traditional reinforcement altogether, whereas those that provide 5% to 10% may defer reinforcement and provide more time to understand network reinforcement priorities and plan an efficient network investment programme.

There is a potential opportunity for reducing customer power demand (via voltage dependant loads) without requiring behaviour change if the trial demonstrates the value of DNO based voltage optimisation. Should this prove feasible, then customers may also see a reduction in their electricity consumption as well as reduced network costs.

Customers will also benefit through the faster deployment of solutions on the network that allow them to connect low carbon technology such as electric vehicles and heat pumps without the levels of constraint that may otherwise be expected. This will reduce possible inconvenience to customers. We plan to engage with customers in the trial areas to explore and document their preferences for the different approaches DNOs could take when accommodating large volumes of low carbon technologies.

The project will be undertaken in a controlled manner such that the outcomes can be quantified and learning can be shared with other DNOs to offer a solution which can be readily deployed across GB for other customers to benefit. This approach will ensure that solutions are developed that benefit the widest possible range of customers.

### Has a Direct Impact on the operation of the distribution network

*A Second Tier Project must demonstrate that the Method(s) being trialled will have a Direct Impact (as defined in v.4 of the Governance Document) on the operation of a DNO's Distribution System.*

This project will be trialling a new arrangement of existing equipment, new network analysis tools and novel operational practices directly onto the distribution network. A range of technologies have already been identified that can provide material cost savings in terms of either reinforcement avoidance or reinforcement deferral. They can either release sufficient thermal capacity on the existing network, or enable the network to be run at a tighter margin over limited and critical periods of peak demand.

Some of the technology groups identified at this stage are listed below, but this is not exhaustive and will be subject to modification as the project progresses:

- Through trialling extensive voltage optimisation, the project will provide a better understanding of the voltage dependency of load, which has not been examined extensively in Great Britain. This trial will also examine different methods of undertaking voltage optimisation on the 11kV and LV networks.
- The deployment of automatic network reconfiguration is a continuation of IFI funded research we have been undertaking with the University of Strathclyde. This will examine how the network can automatically reconfigure itself to shift load to different parts of the network to optimise its operation.
- The dynamic rating of critical assets will be investigated, including how to dynamically rate a combined circuit which includes different types of asset. This will build and develop the outputs of our previous IFI and Tier 1 projects.
- Examining and correcting phase imbalance as this can create significant losses on the low voltage network and voltage constrain the network capacity. Recent developments in technology have created a possible solution to this issue.

### Generate knowledge that can be shared amongst all network operators

*The DNO must explain the learning which it expects the Method(s) it is trialling to deliver. The DNO must demonstrate that it has a robust methodology in place to capture the learning from the Trial(s).*

**How will the knowledge be generated and disseminated?** The novel technologies will be deployed and examined in a controlled manner in order to quantify and document the benefits that they offer. This will be carried out by the University of Strathclyde to provide independent and academic rigour to the process. A wide range of dissemination activities are planned including visits to the Power Network Demonstration Centre, web site and seminars.

**What will the knowledge comprise?** The project will develop:

- A variety of new standard solutions for optimising network capacity.
- A series of case studies for other DNOs on the deployment of the technology being deployed in this project across Great Britain.
- Documented understanding of customer appetite for being involved in such a project and how we should engage with customers in the future.
- Demonstration of new technologies in a distribution network setting which will build confidence in the methods and techniques being applied.
- Updated design guidelines relating to P2/6 and other relevant ETRs.
- Detailed characterisation of the voltage dependency of load as part of an extensive trial with a variety of customers and loads.
- Quantified recommendations on how energy efficiency measures can be used by customers in a coordinated approach with Energy Suppliers for network benefit.
- An assessment of the impact of these technologies on the condition of the existing assets as part of an on-going monitoring activity.

**Please tick if the project conforms to the default IPR arrangements set out in the LCN Fund Governance Document?**

*If the DNO wishes to deviate from the default requirement for IPR then it must demonstrate how the learning will be disseminated to other DNOs.*

IPR arrangements have not yet been finalised, however it is anticipated that this project will confirm with the default IPR arrangements set out in the LCN Fund Governance Document.

**Focus on Methods that are at the trialling stage**

*Demonstrate why you have not previously used this Solution (including where the Solution involves commercial arrangements) and why LCN funding is required to undertake it. This must include why you would not run the trial as part of your normal course of business and why the Solution is not R&D.*

The project will examine a range of new technologies, design tools and operational practices that have not had extensive operation on the distribution network, nor fully integrated within DNO operational activities. These will include but not limited to; voltage optimisation, dynamic asset rating of transformers, OHLs and cables, automatic network reconfiguration to balance load. The project will also seek to transfer knowledge and experiences from the energy management sector about technologies and techniques that can be applied by a DNO for 11kV and LV capacity management.

In general, the existing methods to provide increased system capacity would be traditional investment such as the construction of a new substation and associated network. DNOs have sought alternatives to traditional reinforcement but solutions such as DSM can prove to be unpredictable, and technical solutions have not been extensively demonstrated to quantify and provide confidence in the benefits they create, which is what this project is addressing.

The business case for using these unproven alternatives to network reinforcement needs to be developed. First the practical, technical and economic case needs to be trialled to determine the appropriate circumstances for deployment in order to prove the feasibility and benefit of the proposed solutions. Then if positive, these need to be tested against the business case of a DNO to ensure that it meets the wider business requirements. The technologies also need to be integrated into existing DNO operational end-to-end activities at scale to make them into mainstream solutions.

**This is the primary reason why the trial requires second tier funding.**

**Project Partners and external resourcing/funding**

*The DNO 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 DNO has not identified any specific Project Partners, it should provide details of the type of Project Partners it wishes to attract to the Project.*

University of Strathclyde are a key partner in the project and have provided assistance to develop this project and methodology. As part of their commitment as a partner they are providing resources to assist with the development of this project to ensure a rigorous academic methodology is followed, and that the optimal technologies are deployed on the network.

To date we have had a number of discussions with various community groups, local councils and social landlords with regard to this proposed project. We are in the process of finalising the optimal sites for this project in collaboration with these groups in order to maximise the learning and benefits to customers.

We have also discussed the proposal to link in CERT obligations with Scottish Power Energy Retail and will be contacting other suppliers in due course to identify their appetite to participate in this project.

**Derogations or exemptions**

*The DNO should outline if they consider that the Project will require any derogations, exemptions or changes to the regulatory arrangements.*

It is not anticipated that this project will require any derogations, exemptions or changes to the regulatory arrangements.

In the event that we anticipate one of these to be required, we will contact Ofgem at the earliest opportunity.

**Customer impact**

*The DNO should outline any planned interaction with Customers or Customer's premises as part of the Project, and any other direct customer impact (such as amended contractual or charging arrangements, or supply interruptions).*

As a result of the installation of equipment, the project may incur Customer Interruptions and Minutes Lost. In line with the LCN Fund guidance we will ensure that appropriate plans are in place for Ofgem approval.

It is intended to hold focus groups with customers to understand how this project could impact them and to determine their enthusiasm for hosting technologies to fulfil the aims of this project.

Through working with energy suppliers, the project may interact with customers through the suppliers undertaking works as part of CERT/CESP. This interaction with the customer will be undertaken by the supplier using their existing strategies.

A detailed engagement strategy will be developed as part of the full submission for this work.

**Please use the following section to add any further detail you feel may support your submission.**

We recognise that the project has a good fit with other LCNF and IFI projects. In some cases we will be using the outputs from these projects as component parts of this LCNF Tier 2 project. Other projects will provide complementary outputs which will be required by DNOs in the future alongside the outputs from this project. We will be seeking to collaborate with other DNOs to share this learning in order to avoid unnecessary duplication.



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