



Low Carbon Networks Fund Screening Submission Pro-forma

Notes on completion			
<p>Before completing this form, please refer to the LCN Fund Governance Document. Please use Verdana font 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 <u>9 pages</u> in total.</p> <p>Ofgem will publish all the information contained within the Screening submission.</p>			
DNO Group			
UK Power Networks			
Participant DNOs			
UK Power Networks (UKPN)			
DNO area			
Eastern Power Networks			
Project title			
Flexible Plug and Play Low Carbon Networks			
Project summary			
<p>Renewable energy is at the heart of the UK Low Carbon Transition plan. In the Renewable Energy Strategy, DECC sets an ambitious target for 30% of the UK's electricity to be generated from renewable energy sources by 2030. To achieve this target, electricity distribution networks need to facilitate the connection of renewable generation (RG), such as wind farms and biomass generators. However, the ability of the distribution network to accept further RG without substantial reinforcement is limited. This can make the connection of RG very expensive and financially unattractive to new developers, which in turn poses a significant risk to achieving the UK's renewable targets. This project aims to facilitate the connection of RG in three ways:</p> <p>(1) deploy modern Remote Terminal Units and communications based on open standards that will enable flexible management of network constraints; and</p> <p>(2) deploy and integrate several innovative technical solutions to accommodate higher levels of RG on the distribution network. The infrastructure being deployed will provide a DNO owned platform to deploy and trial innovative technologies based on open standards, reducing dependency on individual vendors and proprietary protocols, fostering innovation and competition.</p> <p>(3) develop an economic model that will identify the triggers for network reinforcement based on what can be achieved with existing infrastructure using the latest advances in Smart Grid technology. This model will incorporate and build on (but not duplicate) learning from LCNF projects being undertaken by other DNOs that are currently under way and will represent a significant learning opportunity for all GB DNOs.</p>			
Estimated Project funding			
<i>Please provide an approximate figure of the total cost of the project and the LCN funding you are applying for.</i>			
Total cost of Project	£9m	LCN funding requested	£7m

Problem

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

In order to achieve the UK's 2020 renewables target, electricity distribution networks need to facilitate RG connections. An area of 5,000km² between Cambridge and Peterborough, extending north-eastwards into Norfolk, has been chosen for this project and is mainly rural with clusters of population around small towns. Existing infrastructure consists of a small number of 132 kV grid supply points and an interconnected 33 kV network supplying 33/11 kV primary substations. The landscape is very flat and open making it a popular location for the development of wind farms. There are already 10 operational wind farms in the area with a total installed capacity of 100 MW. The ability of the network to accept further generation without substantial reinforcement is limited. So far the potential for wind generation including those already installed is around 260 MW. The sizes of projects vary from 1 MW to 18 MW. This makes the funding of any large-scale network reinforcement difficult as no one project could finance the investment required. In addition, the uncertainty regarding progression of these schemes makes large scale up front investment in the network risky. Moreover, piecemeal investment for each scheme in turn results in an uncoordinated and sub-optimal network to meet the needs of RG developers. Some specific issues that this project aims to resolve include:(a) Interconnected 33 kV networks give rise to power flows towards the lowest source impedance resulting in unbalanced flows and thermal overloads at certain pinch points whilst other circuits with spare capacity remain underutilised, particularly during N-1 outages; (b) Grid and Primary substation transformers reach their reverse power flow limits requiring RG to be constrained often due to protection limitations, which often become the limiting factor prior to breaching a transformer's thermal or tap change limits;(c) During periods of reverse power flow tap changers must maintain voltages within limits, which becomes more challenging with closed 33 kV rings between different Grid substations; (d) Remote Terminal Units and communications in the area are not Internet Protocol (IP)-enabled, which reduces the opportunity to test and make best use of innovative technologies, such as autonomous control, deployed on the network using open standards to facilitate increased RG units; (e) A model is required to help DNOs identify the triggers for network reinforcement based on what can technically and commercially be achieved with existing infrastructure using the latest advances in Smart Grid technology.

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.

An IP-enabled platform of modern RTUs and communications will be deployed to over 7 grid and 20 primary substations in the trial area. This will form the basis for trials of innovative technology to enable increased RG connections. The IP-enabled platform will allow technology trials to be targeted at the specific needs of the new RG connections, with trial locations being specified as the project progresses. This will facilitate communication to IP-enabled network equipment, including 3rd party control solutions, and reduce dependence of the trial on the existing network management system. Technologies that will be deployed include: (1) Phase-shifting transformers (or equivalent technology), voltage source converters and dynamic line ratings (supported by weather stations) to facilitate power flow management across an interconnected 33 kV network;(2) Changes to protection systems, inter-tripping or generator constraint management, to reduce the generation at risk periods when reverse power flow limits to 132 kV are met; (3) Co-ordinated voltage control of transformers and RG units operating in voltage control mode on closed 33kV rings

Method(s) continued

(4) Use of Storage to support network management and excesses of intermittent wind generation; (5) Active Network Management solutions that coordinate the integration and control of solutions (1)-(4) both in a centralised and de-centralised way. The platform delivered in this project will be vendor agnostic and make use of recent developments in substation communication protocols such as IEC 61850. Secure open standards based communications, both within and between substations, will be a key feature of the project. This will facilitate trials of various technologies to enable RG connections from multiple vendors, which will be integrated with the platform. In parallel with the deployment of the above platform and trial technologies, an economic model will be developed which will determine the triggers for reinforcing future low carbon networks. This model will incorporate lessons learned from the Central Networks 'Low Carbon Hub' project and the UK Power Networks 'Low Carbon London' project (mainly in the commercial rules or 'Principles of Access' that will define how multiple RGs access a constrained network). This model will consider a variety of technical, financial and environmental (e.g. CO2 emissions) factors to determine when network reinforcement should occur to best facilitate RG connections and to support DNOs in the optimisation of their investment and RG connection plans. Through this project we will also actively engage with key stakeholders (e.g. RG developers and local authorities) in order to better understand the likelihood of developments and the beneficial social impact of those developments.

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 £9 million cost of the project is spread over two phases – the first phase is concerned with the deployment of IP-enabled substation platform technology and the second with the trial of specific innovative technical solutions to connect new RG units. Throughout these phases, the model to consider triggers for network reinforcement will be created, continually refined and developed. The first phase has an approximate cost of £7 million over an 18 month time scale and the second £2 million over one year. Costs include a 20% contingency which we feel is appropriate given the nature and scale of the project and the uncertainties associated with RG connections. We do not anticipate applying for funding for cost overruns during this project. At the Initial Screening Stage we have around a 75% confidence in our cost forecasts, which we will continue to refine prior to Full Submission. We are currently exploring additional funding avenues. UKPN truly believes in the importance and relevance of this project to supporting the UK Low Carbon Transition plan and the UK Renewable Energy Strategy and is committed to contribute £2m to this project, therefore requesting £7m from the LCNF.

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)	★
A novel arrangement or application of existing Distribution System equipment (including control and communications systems software)	★
A novel operational practice directly related to the operation of the Distribution System	★
A novel commercial arrangement	★

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 nature of the project places it at the heart of the Low Carbon Transition Plan to achieve a UK target of 30% of all electricity generation from renewable sources by 2020. This project aims to identify the DNO platform technologies that can better facilitate the connection of RG units through the deployment of innovative technical solutions. These technical solutions and the accompanying analysis model being developed to identify triggers for network reinforcement will allow the most cost and carbon effective way of connecting RG to be identified. This will provide significant learning to GB DNOs and to the wider power industry. The resolution of some of the uncertainty regarding options to enable increased RG connections in the project area will provide a repeatable formula to assess other parts of the GB distribution networks that are experiencing many connection applications for new RG developments.

This project aims to deliver the tangible connection of up to 160 MW of new RG units in the East of England region. The open standards approach being adopted means the technology could be easily deployed to other locations in GB.

This project will also uniquely explore an open standards based platform that will foster innovation and competition. Vendors will be able to trial their technology in an open, yet highly secured, real-world environment, the like of which has not existed elsewhere in GB.

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 will trial innovative technical solutions, described in "Method(s)", that will allow RG developers to connect to the distribution network in a cost effective way, which would otherwise require extensive investment in network reinforcement. In some cases the use of a constraint management solution compared with a traditional connection could reduce the cost of connection by 80%.

Financial benefits to RG developers will also be accrued due to earlier connections, ahead of connection dates that previously would have been based on future network reinforcements.

The IP-based open platform will create competition and encourage innovation amongst network management solution developers. UK Power Networks anticipate this providing an opportunity to assess and offer a greater range of connection solutions due to greater flexibility and visibility in the trial network.

The economic model to identify triggers for reinforcement will ensure that RG developers will always be offered the most cost and carbon effective connection solutions.

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.

At present, the UK Power Networks' network management system is based on direct communications links to RTUs in substations and limited ability exists to interface via open standards and a flexible communications system. The trial will apply IEC 61850 standards within substations and IP-based communications between substations. This will enable de-centralised network management solutions which could provide operational benefits to DNOs and financial benefits to RG developers.

Power flows and voltage levels are not currently actively managed, nor are dynamic line ratings deployed across the network area. This project will address this issues.

The project will seek to deploy the first use of phase-shifting transformers (or equivalent technologies) at 33 kV to increase utilisation by managing the control of power flows. The project will seek to perform autonomous coordination of multiple devices capable of actively managing voltage on the 33 kV network. These devices either normally operate in isolation, or are configured at the deployment stage to act in a complementary fashion for certain scenarios without online coordination.

RG units will be directly controlled and integrated within the operation of the trial network through the regulation of real and reactive power. This is not typically performed on distribution networks.

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).

This project will answer a number of key questions and will provide invaluable knowledge that can be directly used by all DNOs. As an example, the following are some of the questions that this project will address:

Can recent developments in IP open standards provide a platform to integrate multiple technologies from multiple vendors to enable RG connections?

Can DNOs implement a Smart Grid platform across substations based on open standards that facilitate the safe and secure adoption and inter-operation of different Smart Grid vendor technologies to enable new RG connections and manage network constraints?

How can the triggers for reinforcing the network to connect RG be identified based on the use of multiple technical solutions and financial and environmental factors, to overcome barriers to new RG connections?

How can new solutions deployed to substations be flexibly adopted within short time scales and incorporated within a deployed Active Network Management scheme?

Technical papers, reports, workshops and conferences will be used to share generated knowledge with all DNOs.

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.

UKPN does not wish to deviate from 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.

UKPN would not develop this project as business as usual for the following reasons:

- 1) The project trials several innovative technical solutions that have not previously been integrated, the combined performance of which is therefore uncertain;
- 2) In particular, the application of an IP based open standards platform is a potentially beneficial development but it is not possible to quantify those benefits at this stage;
- 3) While the project is expected to deliver valuable learning for the future development of active networks and RIIO ED1 business plan submissions, the solution is not expected to reach sufficient maturity to permit universal adoption during DPCR5;
- 4) The investment required in the distribution assets to be used in this project did not form part of our DPCR5 business plan submission and will not materially impact LI (or HI) outputs during DPCR5;
- 5) The philosophy of 'flexible plug and play' networks, which aims to deliver a more efficient and economic basis for the connection of RG, is a departure from the current piecemeal approach to connection of RG and therefore requires different commercial arrangements to those currently applied to determining connection charges;
- 6) Moving from a centralised to a decentralised approach to network control potentially delivers many benefits but carries significant risks which need to be evaluated through this project before being rolled out at scale;
- 7) The project will develop technologies to a higher maturity level (TLR) than research and development; the solution is not therefore R&D but a deployment of proven, but not previously integrated, technologies.

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.

Smarter Grid Solutions: Provision of ANM platform and communications interfaces and Provision of ANM software applications ANM

Cambridge University: Development of an economic model that will identify the triggers for network reinforcement

Silver Springs and Cable and Wireless: Provision of IP based communication network within the trial area

GL Garrad Hassan: Stakeholder Engagement

GE and Telvent: Distribution Management System provider

Initial conversations have been taken place with the following technology providers: Alstom, ABB, Siemens and Fundamentals.

Derogations or exemptions

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

As part of our development of this proposal we have identified two possible regulatory framework issues.

Firstly, as we will be installing the infrastructure to facilitate the connection of renewable generation our initial view is that this could lead us to be non compliant with our connection charging methodology and associated statement. Consequently, we may need to seek a derogation from our obligations under Standard Licence Condition 14 i.e. charging in accordance with Connection Charging Statement.

The second area is the interaction of the Distributed Generation Incentive scheme with this proposal. Our initial thinking is that some of the aspects of the incentive should be suspended within the defined zone of operation. We will set out in more detail our proposals for both of these issues as part of our final submission.

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).

The provision of an interface to the RG control systems at each RG substation will be required. This will make use of off-the-shelf components and the learning that UK Power Networks has gained from the 'Low Carbon London' project.

The RG developers will receive new connection agreements, these will also make use of the learning that UK Power Networks has gained from the 'Low Carbon London' project.

Also, RG developers will benefit from more viable connection charges and will have the important assurance that provisional connection charges are less likely to be impacted by 'interactive' developments or 'races' between RG developers for available network capacity.

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

A map of the trial areas showing existing and projected generation is available on request.

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