

Review of Low Carbon Network Fund proposals

Report to Expert Panel

Scottish Power (Manweb)

SPT2002: South Liverpool Smart Grid

8th October 2010

Report prepared by TNEI and Arthur D. Little
for project commissioned by Ofgem

Report Context

This report has been prepared for the Expert Panel with the aim of supporting them in their funding allocation decisions for the Low Carbon Network Fund.

Having reviewed the submission pro-forma and all of the supporting material, as well as answers to clarification questions we have put to the DNO, this report is intended to serve two purposes:

- it sets out any factual clarifications that we believe would be helpful to the expert panel when considering the submissions, based on information or data that is not immediately apparent or available in the pro-forma or Appendices A-E; and
- it highlights any concerns we have in any particular areas from, for example, either a technical, commercial or deliverability perspective, that the Expert Panel may wish to explore further with the DNO.

Consequently, the Expert Panel can assume that the factual content of the submission pro-forma to be sound unless noted otherwise in this report.

In writing the report we have avoided merely reproducing large parts of the submission, which stands on its own merits for the Expert Panels' consideration.

This report does not seek to assess the quality of this submission or rank it against any others. In particular, it does not provide any opinion as to whether the proposal should be funded. This is the role of the Expert Panel.

This report is not intended to be read in isolation and should be reviewed alongside the pro-forma and compulsory appendices.

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Project: South Liverpool Smart Grid

Description of Project (summarised from pro-forma Box 1)

Smart Cities

Scottish Power are proposing better monitoring and control of a network in Liverpool involving 54 High Voltage/Low Voltage substations, 8,000 properties, integration of Distributed Generation and storage, heat pumps, and Electric Vehicles. The focus is on the performance of the Low Voltage network.

Problem

In order for the UK to meet its challenging carbon reduction targets it is essential that the up-take goes beyond applications in rural locations and the more affluent sections of society, and becomes integrated into densely populated urban locations. This should encompass existing commercial and domestic properties and be adopted by consumers across a wide spectrum of society. This project will address technological and societal issues faced by the DNO during the retrofit of Smart Grid technology into an existing inner city network and the issues the UK is likely to face in the education and engagement of diverse urban communities.

Solution

The project is expected to facilitate the connection of innovative technology to reduce the areas carbon footprint through identifying: (1) The capacity of the existing urban network to accept low carbon technologies to support revised design policies, (2) The additional capacity available once a Smart Grid solution is adopted, (3) transparent policy that signals the requirement for a Smart solution and recommendations for cost effective selection, (4) the role of energy storage in an urban smart grid, (5) quantification of behavioural changes on electrical usage, (6) identification of potential demand response opportunities and their impacts.

Method

The proposed method will include Network Monitoring, Network Analysis, Refined Network Policy, Network Modelling, Community Engagement and Promotion of Low Carbon Technology.

Project

This project will involve a trial of 54 substations being equipped with advanced equipment to monitor the low voltage network in South Liverpool. The monitoring equipment will be connected to a GPRS communication channel that will transmit the Low Voltage network data to the existing Network Management Centre in Prenton.

The project will produce learning from the trial of a LV connected energy storage device that will be utilised for the retention and distribution of energy from local low carbon generators in a manner that relieves network stresses and can be utilised to increase the connection of future low carbon technology. The project will explore carbon benefits of the reduction of network losses via technical analysis and automation via Automatic Voltage Controllers (AVCs) linked to substantial generation schemes in the trial area.

As well as the technical developments in the area there will be a strong community engagement covering all 8,000 properties supplied by the proposed network.

Key Project Figures

Project

Funding requested: £2.90M

Total Project value: £3.58M

Direct Benefit: £0.0

Roll-out

Total Carbon Benefit (discounted):

Total Other Benefits (discounted):

Total Costs :

Net Benefit :

Carbon Saved (undiscounted):

Proposal

£4.5B

£0.2B

£1,500M

£3.2B

102 million tonnes (estimated)

TOTAL WITHOUT CONTINGENCY	3,192,500
Percentages of total cost	
Contingency	12.2%
IT	3.0%
Equipment	33.5%
Staff	43%
<i>Internal</i>	32%
<i>Contractors</i>	11%
Payments to consumers	0%
Decommissioning	3.1%
Other	16%

EXPLICIT PROJECT MANAGEMENT LABOUR	
Project Working Days	678
Labour Days	2645
Full Time Equivalent	3.9
Project Management	£1,062,000
Relative to Project Cost	29%

Key Items	Total Cost	FUNDING PROPORTION OF TOTAL ITEM COSTS			
		External	LCNF	DNO	
				Compulsory	Extra
Labour	1,035,000	0%	90%	10%	0%
Equipment	1,070,000	4%	86%	10%	0%
Contractors	347,000	0%	90%	10%	0%
IT	96,000	0%	90%	10%	0%
IPR Costs	-	-	-	-	-
Travel & Expenses	44,000	0%	90%	10%	0%
Payments to users	-	-	-	-	-
Contingency	390,000	0%	90%	10%	0%
Decommissioning	100,000	0%	90%	10%	0%
Other	500,500	40%	54%	6%	0%
Total	3,582,500	7%	84%	9%	0%

Summary of independent analysis

General View:

The project focuses on network-side technologies it also seeks to encourage increased penetration of low carbon technologies, including electric vehicles and encourage demand side measures via community information dissemination and engagement within the trial's catchment area.

There is concern as to whether this project has been sufficiently developed to result in a project that can be started quickly and deliver robust results. The proposed outputs are difficult to determine given the uncertainty around the overall project team and tasks.

Significant Issues:

- There are some significant gaps in the collaborators involved. In particular, partners to deliver the PV, CHP etc projects are not listed.
- Energy suppliers will also play an important role to interface customers and they are not included in the proposal

Specific Issues:

- Based on 55 person days contribution, ESRI could be in a position to develop IPR to provide similar solutions to other DNOs; this could be a significant benefit in relation to funds (in kind) provided.
- Project still seeking external funding; it is not clear on impact to project if not secured. The importance of further external funding not detailed.
- There are a number of risks that could affect the project plan (and project start-up), namely: they are still actively recruiting a project manager, while a contract is in place with ESRI, only letters of intent are provided for other partners, there are a number of further partners/collaborators who may need to join the team
- The project involves extensive engagement with customers and communities. However there is little discussion of involvement of, or commercial arrangements with, suppliers who play a key role in customer interface
- Both community engagement and the inclusion of smart grid elements have been listed as risks though it is not clear how these are essential to the project and which carries more weight.
- 62% of the carbon savings claimed is the result of community engagement. We question whether this level community engagement to encourage demand-side measures is within the scope of the Low Carbon Network Fund.
- We cannot verify that the carbon savings or net benefit calculations are robust as there is insufficient information in Appendix E to reproduce them independently.

1. Accelerates the development of a low carbon energy sector

Summary:

The scheme itself focuses on network-side technologies, but seeks to encourage increased penetration of low carbon technologies, including electric vehicles, within the trial's catchment area to allow

Demand side measures are encouraged via community information dissemination and engagement rather than by direct measures, such as smart meters.

62% of the carbon savings claimed is the result of community engagement. We question whether this level community engagement to encourage demand-side measures is within the scope of the Low Carbon Network Fund.

We cannot verify that the carbon savings calculations are robust as there is insufficient information in Appendix E to reproduce them independently.

<p>1.1. The proposal is closely aligned to priorities outlined in the current Low Carbon Transition Plan</p>	<p>The project seeks to trial a number of network technologies</p> <p>In addition, it seeks to encourage the concentration of low carbon generation heating technologies and electric vehicle trials within the projects geographic area to allow trials of the network solutions in the face of intermittent renewable generation and increased pressures due to EV charging.</p> <p>The scheme includes trialling of storage technology to manage the variability of renewable energy generation and the loading of the network during peak times due to electric vehicles.</p> <p>The focus on demand-side measures is through community engagement – influencing customer behaviour through information dissemination rather than through direct means, for example by smart meters.</p>
<p>1.2. The calculations for carbon savings are robust (audit of calculations only)</p>	<p>We cannot verify that the calculations are robust as there is insufficient information in Appendix E to reproduce them independently, and we have not seen the original underlying spreadsheets.</p>
<p>1.3. The carbon benefits of the project are credible</p>	<p>The carbon savings appear credible.</p> <p>We note that 62% of the carbon benefit value (undiscounted) is attributed to customer engagement. This is assumed as a result of Scottish Power's community engagement the project will deliver a 2.5% reduction in customers' load, an additional 40kWp of PV, 1% of new load being used during the 4 lowest carbon intensity periods rather than during the 4 highest.</p> <p>The expected savings from the project are then extrapolated nationwide as discussed below. We question whether this level community engagement to encourage demand-side measures is within the scope of the Low Carbon Network Fund.</p>

	<p>We also note that displaced carbon density of electricity is based on 2010 data from Elexon (0.5406 kgCO₂/kWh) rather than DECC/Defra figures (0.4795 for 2010)</p> <p>We note that the carbon calculations are adjusted for the carbon embedded in the various solutions.</p> <p>The carbon saving are valued using DECC's Traded Carbon Prices.</p>
1.4. Extrapolation for roll-out is both statistically and technically sound, reliable and/or verifiable.	These benefits are extrapolated across the country on the basis of a ratio of customers within the project and 27 million customers across GB. (see response to question SP032)
1.5. Total energy system consideration as well as for DNO	Beyond the assumptions on community engagement measures to encourage demand response there are no other specific assumptions on behalf of other industry players.
1.6. Assessment of Method's credibility	<p>The method appears credible.</p> <p>Active monitoring and management of the network, and the use of storage, should allow the connection of greater quantities of intermittent and renewable generation, as well as facilitate electric vehicle charging, saving carbon and avoiding network reinforcement.</p>
1.7. Significance of the Deliverable	<p>The project targets network-side solutions which should be replicable within DNOs across GB.</p> <p>It brings together the use of storage technologies and active network management under one trial.</p>
<i>Re-estimation of carbon benefits on the basis of "correcting for erroneous assumptions" or re-baselining</i>	

2. Has the potential to deliver net benefits to existing and/or future customers

Summary:

The solution delivers net benefits to existing and future customers, with significant carbon savings (as discussed above) and additional savings from avoided network reinforcement costs and the deferral of peak generation investment.

We cannot verify that the net benefit calculations are robust as there is insufficient information in Appendix E to reproduce them independently

<p>2.1. The calculations for net benefits are robust</p>	<p>We cannot verify that the net benefit calculations are robust as there is insufficient information in Appendix E to reproduce them independently.</p>
<p>2.2. The benefits claimed are credible</p>	<p>The benefits appear credible, subject to lack of detailed inspection.</p> <p>The assumptions on which they are based appear to be reasonably estimated.</p>
<p>2.3. The costs are credible</p>	<p>The costs appear to be credible, subject to lack of detailed inspection.</p> <p>The costs of roll-out are based on the cost of the project, with provision for cost reductions as the supply chain develops. The cost reductions are up to 30% over 10 years and 40% over 20 years.</p> <p>No inflation has been applied to costs or benefits.</p>
<p><i>Re-estimation of net benefits on the basis of “correcting for erroneous assumptions” or re-baselining</i></p>	

3. Has a Direct Impact on the operation of the distribution system

Summary:

The project will provide network loading and voltage profiles to feed into the network planning process. This will result in revisions of connection policies, potential reduction in losses from improved understanding of Low Voltage network operation, and improved understanding of reverse power flows.

The knowledge of closed-ring behaviour can be transferred to some other urban networks in the UK however it is not applicable to open-ring (radial) systems.

The project includes elements of network monitoring and model refinement with some Automatic Voltage Control and storage trials which will have a direct impact.

<p>3.1. Directly contributes to the planning, development and operation of an efficient distribution system.</p>	<p>The project outputs may not strongly influence design decisions because it is only monitoring and possible improved modelling. This is not looking like a clear step-change in behaviour.</p> <p>The value of the storage element in the project is not clear and appears like a novelty item rather than core component to the project.</p> <p>It is not clear from the proposal on what the trials are and why they are important.</p> <p>Project is only monitoring and so will not strongly influence other DNO network planning. Same point as previous. Essentially, the link between the emphasis on community engagement and network operation and development is not obvious.</p>
<p>3.2. The size of benefits that can be attributed to the Distribution System, taking into account the level of funding requested.</p>	<p>No clear boundary identification between the DNO and wider benefits from this project.</p> <p>The level of activity on the network itself appears quite limited and most of the work seems focused on customer engagement and as such is more of a supplier led project.</p>

4. Generates new knowledge that can be shared amongst all DNOs

Summary:

The project is based around the monitoring of networks and refinement of network simulation models. The knowledge dissemination is via annual reporting and presentations.

The learnings section seems to be inconsistent with the project descriptions, storage appears as a major element and yet not described adequately elsewhere. Mention has been made of "possibility" of influencing customer behaviour but no evidence of methods or measurement of this.

Learning Chain Summary:

The project will generate Data and Information. It is unclear how much analysis will be undertaken and so limited Knowledge generated. No significant learning is envisaged as no real network management change tested as part of this project.

4.1. Robust methodology to capture the results from the Project	<p>The learnings section seems to be inconsistent with the project activity descriptions in box 1 and box 2.</p> <p>Only learning goal consistent with trials appears to be the "reconsideration of connection policies"</p> <p>Storage appears as a major element and yet not described adequately elsewhere in the proposal</p>
4.2. Applicability of the new learning to the other DNOs.	<p>Limited applicability of most learnings to other DNOs given the stated learnings are not strongly related to trials undertaken.</p> <p>The network environment is atypical of most UK DNO networks.</p>
4.3. Effective plans to disseminate learning from the Project	<p>Not clear how much of the information will be made available.</p> <p>Dissemination focused on DNOs, SP staff, local community and partners. Reporting is annual only.</p>
4.4. Knowledge generated is novel including innovative plans, tools and techniques which will be shared openly and easily with DNOs.	<p>Key learning of benefits of interconnected networks being proven opening way for future DNO automation schemes and network design changes – the mention of this in Box 17 & 18 is the first time mentioned in the proposal.</p>
4.5. Effective treatment of IPR. (Where a DNO wishes to deviate from the default requirement for IPR)	<p>Default conditions. Unlikely to be any significant IPR generation from the project as stands.</p>

5. Involvement of other partners and external funding

Summary:

Key parties involved in the project are summarised below. Organisations with an asterisk represent organisations which could have been categorised as collaborators

	<i>Equipment providers</i>	<i>Comms. providers</i>	<i>Energy retailers</i>	<i>Academic organisations</i>	<i>Project managers/ consultants/ advisors</i>	<i>Public sector players</i>
Collaborators	ESRI (UK) Ltd					
Partners						Plus Dane Group Liverpool City Council The Mersey Partnership
Others mentioned						

Collaborators

The collaborator is under different ownership to Scottish Power Manweb and they have a stake in success of the project. ESRI, the key collaborator has a strong track record and works internationally. Based on 55 person days of contribution, ESRI could be in a position to develop IPR to provide similar solutions to other DNOs; this could be a significant benefit in relation to funds (in kind) provided.

Benefit in kind /funding has been identified for ESRI but not for other partners.

There are some significant gaps in the collaborators involved. There is one organisation providing IT and support, further organisations allowing testing of equipment, supporting dissemination of information. The management of security of customer data is not listed.

In response to queries on one of these gaps (dissemination, analysis, engagement), it was stated: “*Scottish Power Manweb have in PDG a proven partner with specialist knowledge in engaging with communities in innovative schemes. Scottish Power Manweb will also be looking to additional partners to aid the delivery of the engagement scheme, including web developers, local academia, the Education Authority and Energy Retailers. It is likely that Scottish Power Manweb will engage the services of an external body with a proven background in project analysis.*”

Partners

Dane Group appears to be important for community engagement in trial; it is not clear on rationale to categorise as partners rather than collaborators.

The project mentions that the “smart grid will receive the following elements: domestic PV schemes, Schools PV schemes, Commercial PV schemes, domestic CHP trials, Electric Vehicle trials.....”. Partners to deliver these activities are not listed. In response to queries on this point, it is noted: “*TMP will provide Scottish Power Manweb with a platform to meet with academic experts, industry leaders, technology providers that wish to be involved, have similar aspirations and projects that could potentially link with the project*”

Energy suppliers will also play an important role to interface customers; they are not included in the proposal

External Funding

SPM further effort has been identified the need to seek additional funding from collaborators during the course of the project. It is not clear regarding the impact of not securing this funding

6. Relevance and timing

Summary:

The proposed network monitoring is appropriate and relevant, although there is no clear firm low carbon technology or demand side management involved in this project, or with parallel projects. Additional mobilisation still required to create these demands/effects. Therefore learnings may not result in low carbon technology related network behaviour change learnings within the project duration.

The project has a very simple project setup and deployment so measurements can be in place relatively quickly.

<p>6.1. The timing of the project is appropriate</p>	<p>There is a risk that the learnings from this project may not result in low carbon technology related network behaviour change as the development of low carbon technology within this selected network area is not developed within the LCNF project timescales.</p>
<p>6.2. Use of solution as part of their future business planning and how it would impact on its business plan submissions in future price control reviews, including DPCR6.</p>	<p>Some of the outcomes include refinement of existing policy which may result in less reinforcement required, but no significant step-change behaviours will be tested as part of this project</p>
<p>6.3. Focus on developments associated with a move to a low carbon economy that are more likely to happen.</p>	<p>This project will provide monitoring and possibly policy change on the basis of improved evidence, however no firm actions to be tested to enable additional generation to be connected beyond existing uncontrolled limits.</p>
<p>6.4. Time to tangible results</p>	<p>Very simple project setup and deployment so measurements in place relatively quickly.</p>

7. Demonstration of a robust methodology and that the Project is ready to implement

Summary:

The plan is detailed with Interdependencies identified including links to other external projects. A high level organisation chart is provided. Size and quality of resources is presented clearly for ESRI; for other partners high level descriptions are provided.

Use of proven technology, process of recruiting a project manager and working with proven (and where appropriate) local partners are elements presented to ensure the project can start in timely manner

Contingency included with breakdown by labour, equipment, contractors, IT and other contingencies and risks to costs and benefits have been identified.

The project is designed to make use of existing DNO software platforms rather than implement bespoke new ones and thus limits the risk of a large scale software development project.

The scheme does not have any direct involvement with customers; but is intended to provide information on customer demand. Both community engagement and the inclusion of smart grid elements have been listed as risks though it is hard to see how these are essential to the project.

<p>7.1. Detailed Project plan, with responsibilities clearly established and inter-dependencies identified.</p>	<p>The project plan looks realistic with key linkages made. Given the small number of organisations involved, delivery of the plan should be straightforward.</p>
<p>7.2. Resources to deliver the Project are of a sufficient size and quality to be reasonably expected to ensure its delivery.</p>	<p>Responsibilities for specific activities are not clearly articulated and there is insufficient detail in the organogram</p> <p>While credentials of ESRI are provided, details on resources by other partners are not available.</p>
<p>7.3. Demonstration that the Project can be started in a timely manner.</p>	<p>There are a number of risks that could affect the project plan (and project start-up):</p> <ul style="list-style-type: none"> - they are still actively recruiting a project manager; - while a contract is in place with ESRI, letters of intent are provided by other partners (this is less of an issue given past relationships); - there are a number of further partners/collaborators who may need to join the team.
<p>7.4. Risks to costs and benefits of the Project have been reasonably estimated.</p>	<p>Risks of delays by third parties to the schedule have been identified but not assessed in detail. If this risk materialises, the project has stated it will use time caused by delays to validate existing network performance</p> <p>Circumstances under which the DNO would apply to Ofgem to request extra funding to cover cost overruns are not specified. Programme management arrangements include processes to provide Ofgem an early warning of unmitigated risks such as cost over-runs</p>

7.5. Assessment of proposed cost overrun percentage (if non-default?)	The default level is being requested
7.6. Assessment of Direct Benefit protection (if non-default?)	No direct benefits have been identified in the proposal
7.7. Identification of appropriate risk mitigation processes	<p>Risk procedures and processes in place, risk register in place and mitigation and contingency applied.</p> <p>Three high level risks have been listed. As neither community engagement or the inclusion of smart grid elements is essential to the project these risks would not be deemed high.</p> <p>The only technical risk mentioned is the use of storage on the system and these are primarily associated with health and safety though issues may exist with operation.</p>
7.8. Direct Impact on Distribution Networks on roll-out has been correctly identified	Increased monitoring will lead to increase visibility of the network conditions in real time and when combined with both the new modelling tools and techniques and lessons learned from both storage and voltage control will have an impact on the planning, design, operation and maintenance of the network.
7.9. Immediate Project impacts on the proposer's network have been correctly identified	The scheme is predominantly monitoring with limited scope for network storage and loss reduction through voltage control
7.10. Customer Impact and change required have been correctly identified	<p>The scheme does not have any direct involvement with customers; but is intended to provide information on customer demand.</p> <p>Though not explicitly stated there may be a risk to security of supply during installation of monitoring equipment</p>
7.11. Technology Viability	<p>Relatively low risk.</p> <p>The proposal primarily involves the inclusion of substantial monitoring on the Low Voltage network (54 substations) but includes voltage control for the 6.6kV network (for loss reduction only) and a limited amount (150kWh) of network storage. The data collected will provide greater knowledge of the network with reference to capacity and utilization allowing network models to be developed.</p> <p>The project is designed to make use of existing DNO software platforms rather than implement bespoke new ones and thus limits the risk of a large scale software development project.</p> <p>A significant amount of data must still be transmitted over a GPRS network in</p>

	<p>order to provide the necessary results. However there is no evidence that the data is to be used to allow 'real time' control.</p>
<p>7.12.Successful Delivery Criteria</p>	<p>The proposed criteria line up well against the project activities.</p> <p>Revised successful delivery criteria align with project milestones and timescales provided.</p>
<p>7.13. Contractual proposals</p>	<p>The project involves extensive engagement with customers and communities. However there is little discussion of involvement (or commercial arrangements with) of suppliers who play a key role in customer interface.</p>
<p>7.14 Derogations and exemptions</p>	<p>None are deemed to be required. Have CI & CML (Customer Interruptions & Customer Minutes Lost) impacts been considered during the installation of the metering?</p>