Review of Low Carbon Network Fund proposals

Report to Expert Panel

Electricity North West

ENWT2002: Corridor Manchester Smart City

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: Corridor Manchester Smart City

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

Smart Cities

The Electricity North West project Corridor Manchester is to develop a fully integrated Distributed Energy Management System to integrate distributed generation and demand side into an actively managed network to optimise utilisation, including domestic generation, electric heating and electric vehicle infrastructure.

Problem

The challenge for smart grids is real time interaction between networks and customers' demand and generation. Managing this is a challenge for any new build, but achieving this interaction in existing urban environments is even more challenging. The benefits of moving to a low-carbon society risk being diluted or even negated by the costs of upgrading and operating networks. Network operators need to understand how to design and operate future networks to meet new requirements and to encourage customer actions. Traditional network modelling tools cannot cope with interactive networks, and techniques need to be developed to plan and operate smart networks, particularly low voltage networks.

Solution

The solution is to evolve the distribution network into a smart grid by: creating a test network for smart grid developments, installing network monitoring devices, implementing a Distributed Energy Management System (DEMS), using an aggregator to achieve demand side management, connecting and managing new electric heating loads and electric vehicle charging stations, dynamic HV distribution system automation, testing communication systems, developing smart network modelling tools and planning techniques, connecting domestic generation and prove voltage profile management using novel on-load tap changing distribution transformers, commercial framework for demand side response, sharing energy-efficiency best practice, demand side management, mitigate reinforcement requirements and reduce connection costs.

Method

Establish a future-proof permanent test network serving real customers where developments can be implemented and proved. A Distribution Energy Management System (DEMS) is essential to manage distributed energy resources, to implement demand side control, to reduce peak demand and manage efficiently the introduction of new loads in the Corridor. The demand side management will build upon previous ground-breaking demand side management work undertaken by Electricity North West during 2009/10. The value offered to participants in the demand side management trial will be derived from offsetting reinforcement costs. Power system modelling techniques will be developed that are capable of using smart metering data and additional system measurements. A range of communications technologies will be deployed in the Corridor for the necessary DEMS connectivity, and High Voltage and Low Voltage system monitoring and control. Four competing communication technologies will be evaluated for efficacy and economy. A comprehensive cyber security solution will be designed and deployed to maintain the integrity of network assets and all operational and customer data and systems.

Project

To overcome the challenge of engaging with customers and the demand side, Electricity North West has developed the Corridor consortium made up of four technology partners for the technology components of a smart grid; seven end-customer and infrastructure partners; and four energy supply chain partners. The CMSCP will lead the collaborative low-carbon effort in the Corridor Manchester and deliver a combined reduction in carbon dioxide of 52,000 tonnes by the Corridor Manchester partners. As the designated Low Carbon Laboratory, low-carbon initiatives developed under the Greater Manchester's Low Carbon Economic Area Status will be tried and tested in the Corridor before being rolled out across Greater Manchester.

Key Project Figures

Project

Funding requested:	**£8.8M**
Total Project value:	**£12.7M**
Direct Benefit:	**£1.19M**

Roll-out	**Proposal**	**Normalised (TNEI/PPA)**
Total Carbon Benefit (discounted):	**£0.13B**	**-**
Total Other Benefits (discounted):	**£0.44B**	**-**
Total Costs :	**£490M**	**-**
Net Benefit :	**£0.08B**	**-**
Carbon Saved (undiscounted):	**10.7 million tonnes**	**-**

TOTAL WITHOUT CONTINGENCY	11,675,000
Percentages of total cost	
Contingency	8.6%
IT	10.4%
Equipment	27.6%
Staff	52%
Internal	*20%*
Contractors	*32%*
Payments to consumers	3%
Decommissioning	0.5%
Other	5%

EXPLICIT PROJECT MANAGEMENT LABOUR	
Project Working Days	715
Labour Days	4598
Full Time Equivalents	6.4
Project Management	£2,165,000
Relative to Project Cost	17%

		FUNDING PROPORTION OF TOTAL ITEM COSTS			
Key Items	**Total Cost**	**External**	**LCNF**	**DNO**	
				Compulsory	***Direct Benefit***
Labour	2,318,000	0%	100%	0%	0%
Equipment	3,217,000	12%	51%	0%	37%
Contractors	3,786,000	26%	74%	0%	0%
IT	1,215,000	20%	80%	0%	0%
IPR Costs	-	-	-	-	-
Travel & Expenses	61,000	3%	97%	0%	0%
Payments to users	390,000	0%	100%	0%	0%
Contingency	1,006,000	0%	100%	0%	0%
Decommissioning	57,000	0%	100%	0%	0%
Other	631,000	100%	0%	0%	0%
Total	12,681,000	18%	73%	0%	9%

Summary of independent analysis

General View:
The project is developing a smart grid network within an urban environment as a test ground for new network technologies, including extensive measurement, development of system modelling tools and techniques and engagement with major landlord groupings.

This project comes across well as a smart-grid pilot and testing environment to enable the transition to a low carbon network. It has a strong DNO focus with the wider benefits being dependent on the parallel projects that this is working alongside.

Significant Issues:
There are no significant issues with this project.

Specific Issues:
- The project has a complex team structure. Several of the collaborators could be classified partners; this would make the team tighter. However it is noted that all collaborators are partly funding their services.

- Service providers have offered to contribute 20% of costs of service and equipment. It is not clear how the equipment / services were originally costed and therefore the nature of contribution made

- It is difficult to see where all roles for collaborators are reflected in Gantt chart - especially those associated with engagement

- The organisation chart lists a number of collaborators under specific functions but it does not present clearly how these collaborators will interface with each other

- Details of links between risks to specific project timing and delivery are not apparent

- While a contingency is included, there is no breakdown and uncertainties in costing are not explicitly discussed

- Details of commercial arrangements are not discussed in detail (especially those between EnerNOC / npower and Electricity North West). It is therefore difficult to assess the arrangements being tested; though it is noted that Electricity North West has previously developed demand-side contractual arrangements is able to draw on this experience in the trial

- We note a significant proportion of the carbon benefits claimed are due to energy efficiency programmes, and question whether this is within the scope of the Low Carbon Network Fund. We also note that Electricity North West believe that these do fall within the scope of the LCNF and agree with the points they make, and merely raise the issue as a point of discussion for the Expert Panel.

- The proposed solution is the development of similar test networks in 65 other cities, limiting the overall size the benefits identified. This appears to be actually understating the overall benefits.

1. Accelerates the development of a low carbon energy sector

Summary:
The project is aligned with the need to understand how the demand side can participate in a low carbon future, particularly through aggregators.

It also tests the impact of increasing penetration of low carbon technologies, including electric vehicle charging, on network flows and measures to control these.

We note a significant proportion of the carbon benefits are due to energy efficiency programmes, and question whether this is within the scope of the Low Carbon Network Fund. We also note that Electricity North West believe that these do fall within the scope of the LCNF and we agree with the points they make, and merely raise the issue as a point of discussion for the Expert Panel.

1.1. The proposal is closely aligned to priorities outlined in the current Low Carbon Transition Plan	The project seeks to combine network solutions, including monitoring and control, and demand side response measures to allow the connection of low carbon technologies, including electric vehicles. The scheme involves testing a range of both technical and commercial options for load and network management. The project also aims at a coordinated energy efficiency drive to curtail the need for network reinforcement, bringing together a number of players within the community.
1.2. The calculations for carbon savings are robust (audit of calculations only)	The carbon calculations appear to be robust
1.3. The carbon benefits of the project are credible	Benefits are claimed for rolling the solution out over 65 other cities, with benefits claimed for the impact of 20 electric vehicle charging points per city, demand side management and demand reduction, via energy efficiency measures. We note that over 85% of the carbon savings comes from energy efficiency measures. It is not clear to us that this is aligned with the intentions of the DNO focused LCNF, with these benefits falling more naturally within the remit of suppliers, particularly under, for example, CERT. We note that the ENW believe that this does fall within the remit of a DNO as encouraging consumers to take an active role in controlling their energy usage in harmony with the wider distribution system is fundamental to their vision. We also note that the remits of suppliers versus DNOs will become blurred in a future low-carbon world. We agree with both of these points. We have no opinion as to the correct boundary definition of the LCN Fund and merely raise this as a point of discussion for the Expert Panel. The carbon savings are valued using DECC Traded Carbon Prices

1.4. Extrapolation for roll-out is both statistically and technically sound, reliable and/or verifiable.	The extrapolations for roll-out appear to be valid.
1.5. Total energy system consideration as well as for DNO	See the discussion above on carbon benefits. The overall rollout considers that similar energy efficiency actions could be delivered by players in other cities. This seems a reasonable assumption given the scale of the rolled-out networks
1.6. Assessment of Method's credibility	The Method trials a range of techniques relevant to inner city networks and the learnings should be replicable throughout the UK.
1.7. Significance of the Deliverable	New approaches to DSM will be trialled as part of the project, including interactions between DNOs and third-party aggregators. In addition, a number of different communication technologies will be evaluated efficacy and economy.
Re-estimation of carbon benefits on the basis of "correcting for erroneous assumptions" or re-baselining	

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

Summary: The solution does offer the potential for net benefits for existing and future customers, based on the carbon savings and avoided reinforcement costs. We note that the scale of these benefits is a function the solution being the development of similar test networks in 65 further cities.

2.1. The calculations for net benefits are robust	The calculations of net benefits appear to be robust.
2.2. The benefits claimed are credible	The only benefits claimed other than carbon, which is discussed above, is for avoided reinforcement costs, which is set at £600 million undiscounted.
2.3. The costs are credible	The costs assumed for the roll-out appear to be credible and are based on an assumption that each additional rollout would only be 60% of the cost of the project. Costs and Benefits have been inflated to 2015/16 prices.
Re-estimation of net benefits on the basis of "correcting for erroneous assumptions" or re-baselining	

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

Summary:
The project is focused on smart grid with active network management, flow control and monitoring, and development of management tools and modelling tools. It involves customer interaction but the "Low Carbon" elements will be a parallel almost independent activity run by the collaborators.

An important part of the project will be the development of new modelling tools for low voltage & medium voltage networks to cater for different loading patterns, unbalanced low voltage loads, high levels of distributed generation etc. These developments will also cater for smart grid control systems and techniques to do analysis in real-time or quasi real-time. They will be used for planning as well as the operational training of network operators on more dynamic networks.

The project includes the testing multiple possible communication methods and technologies to determine which are best suited to the urban environment. This will be based on a compact urban network, and the challenge of management of high volumes of data. This will require the development of new management systems and tools to manage the interactions at scale and in real-time.

Most of the provided direct impact is clearly DNO or network focused and is "Smart Grid" rather than explicitly LCN. There is one section looking at the interaction between end customers and the wider energy sector such as aggregators, suppliers and National Grid.

3.1. Directly contributes to the planning, development and operation of an efficient distribution system.	This project directly contributes to the planning and development of distribution systems.
3.2. The size of benefits that can be attributed to the Distribution System, taking into account the level of funding requested.	This project is quite interesting as it is a clear network based “Low Carbon Network” enabler pilot project, rather than a full demonstration of a Low Carbon Network as such. Therefore, while for the success of the Low Carbon element of this is dependent upon external parties, the success of the proof of concept from this project is dependent only on the network elements themselves. However, when combined with the customer activities, the overall project can be seen as being a low carbon network.

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

Summary:
The project is relatively focused on smart network rather than broader Low Carbon Networks, and as such the knowledge is be more specific to the network itself. There appear to be a high level of discrete information releases across the project, these range from data, project updates, analysis, and white papers.

New DNO specific communication schemes for Smart Networks will be transferrable as will the new modelling tools, specifications and performance requirements. The Energy Management system will have transferrable learnings. Knowledge generated will be managed by one of the collaborators (Joule Centre).

Dissemination appears in terms of a website with data and project notice board, public events, seminars and conferences for both general public and industry. Formal outputs will include technical reports for appropriate interested bodies from public sector through to DNOs. Various academic and other research links will also be formed.

The project program shows a good frequency of website updates, 6 monthly DNO forums, quarterly white papers, and participation with annual industry conferences.

Learning Chain Summary:
The project will be gathering network data which will be summarised into information. Knowledge from the review of this information will be generated through the development of modelling tools and new procedures. Learning will be in terms of real implementation by the DNO and the corresponding measurement of outcomes.

There is the potential for good DNO specific learnings both in general and within the appropriate DNO teams.

4.1. Robust methodology to capture the results from the Project	Learning will be managed via the Joule Centre on behalf of the consortia. The definition of key focus areas could be better. Box 17 is predominantly discussion rather than clear definition of the new knowledge being sought and its measurability. Further detail has been provided in response to question ENWL009 which provides the required information.
4.2. Applicability of the new learning to the other DNOs.	Learning should be readily transferrable to other DNO urban networks
4.3. Effective plans to disseminate learning from the Project	The proposed dissemination is very broad and all encompassing, but is probably appropriate for a 3-4 year project. It will need a clear dissemination plan to ensure that the information is staged and appropriate across the project and not an end-game rush. The dissemination plan appears to be planned to be developed during Jan 2011.

4.4. Knowledge generated is novel including innovative plans, tools and techniques which will be shared openly and easily with DNOs.	The success of the knowledge capture will be dependent on how integrated the Joule centre will be within the project. DNO clarification indicates that the Joule Centre staff will be integrated well within the project team.
4.5. Effective treatment of IPR. (Where a DNO wishes to deviate from the default requirement for IPR)	Box 19 confirms default provisions but then goes on to mention new foreground IPR. Not clear if this new foreground will definitely be under default conditions or not.

5. Involvement of other partners and external funding

Summary:
Key parties involved in the project are summarised below.

	Equipment providers /software providers	*Comms. providers*	*Energy retailer*	*Project managers/ consultants/ advisors*	*Public sector players*	*Other*
Collaborators	GE Digital Energy BPL Global	Alcatel-Lucent, Arqiva	RWE npower	SAIC Electralink	Corridor Manchester, Manchester City Council , University of Manchester, Manchester Metropolitan University Central Manchester University Hospitals NHS Foundation Trust	National Grid EnerNOC Joule Centre Manchester Science Park, Bruntwood
Partners					Association of Greater Manchester Authorities	
Others mentioned						

Collaborators
All Collaborators are under different ownership to Electricity North West. They all appear to have commercial dependence / exposure on the success of the project to varying degrees:
- While the equipment/software/communications collaborators appear to function as key suppliers to the project, they are also actively involved in driving specific aspects of the trials.
- The role of a energy supplier in the project is important, it is not clear how important this project is to npower from a commercial perspective. Also the contribution from npower to the project appears small
- The level of effort committed by the Joule Centre was unclear from the proposal
(Clarification has provided further detail on the contribution by the Joule Centre)

The project consists of a large team (note: additional collaborators are listed in optional appendices), though the key skills required are present. Key points to consider:
- It is not clear what explicit UK utility experience is held by the "program manager", specifically with reference to the comment in the proposal: “Benefits of SAIC include insight of working with a DNO, developing their Smart Grid Practice, and ...demonstrate credentials to GB utility industry”.
(Clarification questions responded with case examples of strong track record in USA based projects and “working with a UK oil company over the last 7 years to develop intelligent smart systems for its offshore field operations.)

- For BPL Global - this is an initial deployment to be achieved by a DNO. While the general track-record is obvious, specific experience of working with other energy partners in the team is not clear.
- It is noted that the project was unable to secure (a cost-effective) collaborator for network storage devices and so the decision was made to drop this from the project.

Partners
The project has strong local/regional support from public organisations.

Also while Electricity North West is working with each partner individually, the project is using Corridor Manchester, as the "single collective voice representing the Corridor"; this appears to be an effective approach to manage a large team on specific issues.

Nevertheless the project has a complex team structure. Several of the collaborators could be classified partners; this would make the team tighter. However it is noted that all collaborators are partly funding their services.

External Funding
Service providers have offered to contribute 20% of costs of service and equipment. It is not clear how the equipment / services were originally costed and therefore the nature of contribution actually being made.

Several external collaborators benefit by gaining insight and credentials in Smart Grid. They have contributed 20% of their costs. The exception is Arqiva, which is contributing 74% of total costs - this is reasonable given the value of being able to report on performance.

Additional funding has not been sought and the project is not dependent on further sources of funding.

6. Relevance and timing

Summary:
Timing of this ties in well with smart metering roll-outs and a broader parallel project on energy efficiency and potential DG and scale-up in the area. One of the focuses is on the development of modelling tools and techniques that will be important to address LCN/SmartGrid issues.

The project will focus on flexibility and adaptability, importantly, avoiding single source solutions or risk of vendor lock-in, which will allow for future technology change

Developments describe a set of enabling network changes to allow others to exploit and deliver LCN benefits. A key project objective appears to be ensuring that network barriers are removed

The proposal stated that learning from this and other LCN projects will feed into ENW DPCR6 submissions. System modelling techniques for smart grids are seen as essential.

The project program is well defined and appears realistic. The project is phased to ensure early learning feeds into the main project delivery. Box 13 and response to ENWT034 provide additional detail

6.1. The timing of the project is appropriate	The only concern is that while it is appreciated that such developments take time, the outputs are reasonably far out in time for what is a relatively small project. Simulation tool developments can have a moderately long development lead time and as such starting early is essential.
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.	More detail on how the project outputs will be used would be useful in this section
6.3. Focus on developments associated with a move to a low carbon economy that are more likely to happen.	The project has a good focus on appropriate developments, in particular allowing for flexibility and adaptability to allow for future technology change
6.4. Time to tangible results	Box 24 could be improved particularly based on the project program and information in box 13. Additional good detail has been provided in response to ENWT034.

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

Summary:
A detailed project plan has been provided which includes start-up activities and outlines key interdependences. It has a strong team with significant international expertise (especially technical and dissemination partners) have been engaged as collaborators. Agreements with collaborators have been set out under Memorandum of Understanding.

Corridor Manchester will be used as a single contracting body as well as individual agreements with Electricity North West and collaborators/partners

The project is using low technology risk, this is essentially existing technology but in a new application. Risk procedures and processes in place, risk register in place and mitigation and contingency have been applied. Provision of contingency (£1m) to cover additional costs and high level risks are identified.

The project has no direct interface with individual consumers but instead involves are lower number of larger customers/partners to act as an intermediary.

The installation of equipment is intrusive and will require system outages

The project will test a number of different commercial arrangements: The project uses the partner EnerNOC to play role of incentivising customers to vary usage of network. npower is looking to work with Electricity North West and stakeholders to develop an understanding of new commercial arrangements.

7.1. Detailed Project plan, with responsibilities clearly established and inter-dependencies identified.	The timings in the detailed plan look credible. It is difficult to see where all roles for collaborators are reflected in Gantt chart - especially those associated with engagement. For instance npower will "work with consumers to look at developing ways to work with commercial land-lords to better engage their tenants in energy efficiency and low-carbon". Similarly activities related to Distributed Energy Management do not discuss activities required for customer engagement. Other collaborators (e.g. BPL, EnerNOC, npower, Arqiva, Electralink and National Grid are also not listed in the organogram. The organisation chart lists a number of collaborators under specific functions but it does not present clearly how these collaborators will interface with each other. *(DNO clarification: The key role is SAIC as the System Integrator and Program Manager; they bring multiple skill sets together and improve recognition of responsibilities and accountabilities in project organisation)* Interdependencies to activities outside the direct control of the project (e.g. in Corridor Manchester) are not listed.
7.2. Resources to deliver the Project are of a sufficient size and quality to be reasonably expected to ensure its delivery.	The resources to deliver the project are significant players with strong track records; Parties to support engagement do not receive as much attention as communications, software and equipment providers. Risk register mentions "*there is a risk that a key equipment supplier business fails particularly newer high technology companies".* It is not clear whether this is a generic risk or whether there are specific companies that are being

	considered.
7.3. Demonstration that the Project can be started in a timely manner.	The detailed plan for Q4 2009 illustrates efforts in place to prepare for timely start-up. Extensive dialogue with suppliers suggests that the project appears ready to go. Memorandum of understanding specifying scope have been signed, but detailed contractual arrangements not in place.
7.4. Risks to costs and benefits of the Project have been reasonably estimated.	The risk assessments identifies a number of generic issues such as: - risks of smaller business providers failing - risk that poor project management can cause cost overruns Further details on risks to timing are not apparent. While a contingency is included, there is no breakdown and uncertainties in costing are not explicitly discussed. Direct benefits are equipment to the value of £1,186,500. Uncertainty associated with these estimates is included within contingencies but not discussed in detail.
7.5. Assessment of proposed cost overrun percentage (if non-default?)	No protection sought
7.6. Assessment of Direct Benefit protection (if non-default?)	Default protection sought (direct benefits for the project are quoted as £ 1,186,500) There is no discussion of the circumstances when this would be used.
7.7. Identification of appropriate risk mitigation processes	Risk procedures and processes in place, risk register in place and mitigation and contingency have been applied. The Project management side is being managed by a third party rather than directly by the DNO. Generally high level risks have been listed but they have specifically highlighted the risk that equipment failure could lead to loss of supply to customers.
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. When combined with the new modelling tools, operational techniques and active management 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 installation of equipment is intrusive and will require system outages. A move from passive to active control of the network will be undertaken.

7.10. Customer Impact and change required have been correctly identified	The project has no direct interface with individual consumers but instead involves larger customers/partners as an intermediary. The proposal is to influence demand via commercial means and energy efficiency measures whilst actively managing the network
7.11. Technology Viability	This project has low technology risk. The scheme uses existing technology but in a new application. The project proposes generally utilises new monitoring equipment, combined with automated control of HV switchgear (retrofit) and new on load tap changing transformers all connected to central management platform (DEMS) via a range of communications systems combining UHF radio and fibre-optic cables The project includes the trial of different communications type hence there is little risk of communications failure. Technically there are no significant risks as interfaces are limited, control is on the DNO network only and multiple communication systems are being trialled.
7.12.Successful Delivery Criteria	Good breakdown of success criteria have been provided that match well against the key project work areas. Dates as well as volumes so incentivised delivery. Revised successful delivery criteria align with project milestones and timescales provided.
7.13. Contractual proposals	Details of commercial arrangements are not discussed in detail (especially those between EnerNOC / npower and Electricity North West). It is therefore difficult to assess the arrangements being tested. *(DNO Clarification: a purpose of the trial is to enable the development of effective commercial arrangements."; ENW have previously developed Demand Side contractual arrangements and are planning to use this learning within the project)*
7.14 Derogations and exemptions	