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Planning Energy
for a Sustainable World

Ofgem LCNF Tier 2 Evaluations

Accelerating Renewable Connections (ARC)

Scottish Power Distribution

Final Report

Submitted to: Ofgem

Date: 2 November 2012

CONTENTS

Explanatory Note

This report, including the "traffic light" indicators that reflect issues of concern identified during the evaluation process, (other than Section 9) is based on:-

- the original full submissions that were received from the DNOs in August 2012;
- subsequent question responses through the formal written question process; and
- discussions held at meetings between the DNOs and the Expert Panel and/or PPA Energy.

In October 2012 the DNOs were given an opportunity to submit revised proposals. The traffic light indicators and the metrics shown in Sections 1 to 8 have not been changed to reflect any changes made by the DNOs in these revised submissions.

Section 9 of this report contains an addendum, which summarises changes made between the original and revised submissions, and the impact this has on the evaluation of the project against the criteria. Any significant changes to figures/metrics are noted in this addendum.

Project Summary

Full name:	Accelerating Renewable Connections	Short name:	ARC
		Total cost:	£10.314 million
DNO group:	Scottish Power Distribution (SPD)	LCNF funding request:	£8.752 million

The Problem(s): A frequent concern of Distributed Generation (DG) developers is that the current connection process is perceived to have prohibitive costs and long lead times. In 2011 more than 90% of connection offers in Scottish Power Distribution's (SPD) area were not accepted by customers. In some areas the network is approaching saturation as a result of renewable generation already connected. Transmission is also starting to be affected. The high volume of applications currently experienced can result in a piecemeal and sub-optimal approach to network development. Some stakeholders claim that networks are a barrier to connection.

The Method(s): The proposed method is to trial the following:

- Provide additional and more frequently updated network information to customers;
- Develop enhanced connections process, including a "viability study" option with a pre-application engagement process;
- Investigate and demonstrate the role of communities;
- Demonstrate commercial and technical solutions accelerating connections at exporting Grid Supply Points (GSPs);
- Investigate and trial new technical and commercial solutions for constrained connections;
- Identify the process and inform the business case for "smart enabling" of generation dominated areas;
- Define the process for identifying and implementing a "smart enabled" area; and
- Build on previous learning and avoid duplication.

The Trial(s): A trial is proposed based on part of SPD's area and including the following:

- Regular publication (web portal) of network information including "rule of thumb" views on cost effective DG connections;
- Viability studies with a pre-application engagement;
- Revised design policies, network visibility and planning tools;
- Design and implement network enablers - telecoms platform and Active Network Management (ANM) platform;
- Network connection trials:
    i. management of exporting distribution networks
    ii. active management of generation around constraints
    iii. community level connections
- Examine other aspects including organisational, behavioural and regulatory change; cost allocation approaches; and knowledge transfer.

The Solution(s): A new set of:

- Information provision and services to customers;
- Connection and planning policies, tools, approaches and guidelines;
- Focused ANM implementation including various network enablers;
- Support to community level connections; and
- Potential organisational, behavioural, regulatory and other changes.

all aimed enable accelerated renewable generation connection.

Key strengths and weaknesses Strengths:

against the criteria

- The project aims to facilitate the connection of low-carbon generation by removing barriers faced by generation developers wishing to connect to the distribution network.

- The project is highly relevant and current, given the short term ambition of the Scottish Government to achieve at least 500MW of local and community based renewable generation by 2020, coupled with challenges faced by Distributed Generation developers, which include prohibitively high connection costs and connection lead-times. These challenges are likely to be common across GB, and supported by feedback from developers at Ofgem's DG forum.

- SPD has identified a range of connection challenges to address using ANM techniques, which increases the likelihood that the learning will be relevant to other DNOs.

- The learning expected from this project is very relevant to the distribution system. It is likely that part or all of the learning will be valuable to all DNOs.

- New learning to be gained includes a holistic, rather than piecemeal, approach to ANM; new ANM control functions; the use of novel end-point devices; and the application of all of these to problems that have not been addressed with these techniques before.

- The project comprises a strong team – the partners are relevant to the project, with good experience and strong advantages. SPD has existing contractual relationships with two of the three partners.

Weaknesses:

- The extent to which some of the work is innovative is questionable. In particular, it seems difficult to justify why work package 1 should not be undertaken under Business As Usual (BAU).

- The benefit calculations appear not to include costs to all parties, which means they may be overstated. In particular, it appears that significant savings accrue to the Transmission Owner.

- The estimated capacity released is based on a set of Case Studies – it is not clear how much capacity might be released at each smart enabled GSP as a result of ARC.

- There are concerns around some major cost items, including DNO labour, work package 1 and an energy storage device. SPD is proposing to review SPD labour costs and remove the energy storage device from the project in their revised submission.

1 Summary of Assessment against Evaluation Criteria

Criteria	Overall Assessment	
(a) Low carbon and benefits		In seeking to remove barriers to generators wanting to connect to the distribution network, this project should facilitate the connection of low-carbon generation. It is likely that the claimed benefits, based on a set of case studies, are overstated. There are concerns with the calculation of savings across SPD's area. Similarly to the benefits, the capacity released figures are based on the size of the generation developments in each case study.
(b) Value for money		Financial benefits accrue to different stakeholders according to the type of problem being addressed. In the case of exporting GSPs, it appears that significant savings in transmission reinforcement accrue to the Transmission Owner. In other cases savings accrue to the DNO and generation developer; based on the case studies, these savings are more modest. The learning expected from this project is very relevant to the distribution system. There are concerns around some major cost items which seem difficult to justify. A key concern is the extent to which the work is innovative and novel, rather than work that should be conducted under Business As Usual (BAU). While the learning from Work Package 1 will undoubtedly be valuable to DNOs, it is difficult to justify this work package as innovative. Similar points could apply to elements of work package 2, such as reviewing internal design policies and developing planning tools. In order to improve on the assessment against this criterion, more justification would be required that elements of the work could not be undertaken as BAU. The extent to which SPD will revise their submission in terms of concerns on the risk profile of LCN Funding is not clear. SPD is proposing to review SPD labour costs and remove the energy storage device from the project in their revised submission.

(c) Generates knowledge		The project involves procedural changes to the connections process but also includes consideration of "network enablers", i.e. Hardware including an Active Network Management (ANM) platform for managing distribution network constraints. The project spans the whole connection process, from initial discussions and application, to connection design and alternative connection solutions. It is building on learning from previous projects; some of the individual elements have been trialled in the UK before. The new learning comes from taking a holistic, rather than piecemeal, approach to ANM. It is considered that the learning gained from this project will be valuable to other DNOs.
(d) Partners and Funding		SPD's project partners are Community Energy Scotland (CES), Smarter Grid Solutions (SGS) and University of Strathclyde. Each of the project partners has some strong advantages and is an appropriate partner for this project. External funding is relatively small at around 3%. SGS is making the largest contribution, which is considered to be commensurate with the benefits to SGS from the project, which include demonstrating their technology. A competitive process was run for selecting SGS as a project partner. However, the outcome of the process is the selection of a partner with whom SPD has a working history and relationship. This process did not apply to CES and University of Strathclyde, who were selected directly for their relevance and experience.
(f) Relevance and timing		The project is highly relevant given the short term ambition of the Scottish Government to achieve at least 500MW of local and community based renewable generation by 2020. It is reasonable to claim that the problems being addressed are immediate. The broad challenges to DG developers facing prohibitively high connection costs and connection lead-times are likely to be common across GB. The extent to which the specific connection challenges identified are prevalent across GB is not clear, however. The learning from the information and connections process work packages is likely to be of interest to all DNOs. The project builds on learning from a number of other projects, which means that some individual elements do

		not appear to be new. The novelty of elements in Work Package 1 is questionable. The novelty of the ANM design and trials lies in the top-down ANM approach, and the challenges to which ANM is being applied.
(g) Methodology		The Project proposes to examine three areas of the connection process, i.e. Connection Application, Connection Design and Network Construction / Connection. It therefore takes an end-to-end approach to the overall connection process, which it addresses in six work packages. The project plans to involve National Grid in the development of novel ANM techniques to manage net-exporting GSP connections and to apply “Connect and Manage” principles at the distribution level; deploy ANM to address specific network constraint challenges identified in the case studies; and develop solutions involving balancing community generation with demand to facilitate community generation projects. Overall, the project seems to reasonably well thought out, although there are a number of references to using technologies or techniques that have been developed in other projects, without providing further information. There is an executive sponsor, whose role will include reviewing items every two weeks, including project finance, key risks and issues, and milestones. This will help to identify any cost and project over runs. It is considered reasonable to expect that there will not be any negative impacts on customers.
SDRC		Given the number of sub-work packages, it is difficult to cover all project outputs in the SDRCs. The ANM demonstrations, which are a key aspect of the project, have been captured by the SDRCs, although it is suggested that SDRC 9.4 could be extended to cover at least two demonstrations. There are two SDRCs relating to the community generation scheme element of the project, whereas there does not seem to be an SDRC specifically relating to the top-down ANM approach (WP3 Smart enabling the network), which is a key element of the new learning of the project. SDRC 9.8 is considered to be a good criterion for capturing the real outcome of the project, in attempting to capture an

		improvement in “connection experience”. SPD is proposing to revise their SDRC in their revised submission.

The “traffic light” system used in the table above gives an indication of PPA Energy’s assessment of the information provided by the DNO in support of the project in respect of its detail, alignment with the LCNF evaluation criteria, identification and management of project risks and other aspects for each of the criteria. This is not intended to suggest whether projects should be funded or not but to point out those areas which PPA Energy believes merit particular scrutiny or consideration. Thus:-

	• Seems to be generally in line with the objectives and requirements of the LCN Fund evaluation criteria, • Whilst there are some areas where additional information would be useful, that provided is generally comprehensive and provides no immediate cause for concern.
	• Some indication that the project is in line with the objectives and requirements of the LCN Fund evaluation criteria. However further scrutiny is required to ensure this, • There are some gaps in the information provided, • Further assurance is needed to confirm that the project is viable and that risks are appropriately managed.
	• Significantly more assurance is required that the project is in line with the objectives and requirements of the LCN Fund evaluation criteria, • There are some major gaps in the information provided, • Considerable scrutiny is needed to confirm that that the project is viable and that risks are appropriately managed, • Potential major risks to the viability of the project.

In the following evaluations against the criteria, if the project is addressing various problems and/or trialling several methods and solutions, separate analysis of metrics and sub-criteria will be provided, if appropriate, for relevant criteria.

2 Criterion (a) Low Carbon and Benefits

Criterion:	Accelerates the development of the low carbon energy sector and has the potential to deliver net financial benefits to future and/or existing consumers
Overall assessment:	In seeking to remove barriers to generators wanting to connect to the distribution network, this project should facilitate the connection of low-carbon generation, which will displace high carbon generation. Carbon savings have not been quantified, although it should be noted that this was not a requirement on DNOs. Benefits calculations are based on a set of case studies, which cover a range of connection challenges. It is likely that the Case Study benefits are overstated, as: • the BAU costs include costs to both the Transmission Owner (where transmission reinforcement would be required) and the developer; and • the Method costs in the Case Study examples do not appear to include the costs of ANM enablers (borne by the DNO) and constraint costs (borne by the developer). Savings have been estimated for the given set of case studies. SPD has estimated potential savings of £260.000 million if the ARC solution to exporting GSPs is rolled out to an appropriate number of GSPs in their area. There are some concerns with this calculation; in particular it is possible that the savings identified accrue to the Transmission Owner. Similarly to the benefits, the capacity released figures are based on the size of the generation developments in each case study. An indication is not given of the total capacity that could be released at each smart enabled GSP. Although SPD has used case studies as examples, they have identified a range of challenges to be addressed in the project. It is reasonable to expect that the project will deliver replicable learning, rather than a bespoke solution, with regards to the ANM connections.

Metrics (as quoted by the project):			
	Method 1 (Case study 1)	Method 2 (Case studies 2 and 3)	Method 3 (Case study 4)
Net financial benefit (£)[1]:	£16.000 million	£3.850 million	£0.620 million
Network capacity released (kW)[2]:	27,500 kW	24,700 kW	500 kW
Base case time to release capacity (months)[3]:	60	24	12
Method time to release capacity (months)[4]:	24	12	6
Potential for replication[5]:	Yes		

Sub-criteria	Assessment
Carbon claims (including	The references to carbon claims are at a high level, e.g. the full submission makes reference to the Low Carbon Transition Plan

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[1] The financial benefit of each method (at the trial scale) compared to the most efficient existing method; **Net financial benefit = Base case costs** (the lowest cost of delivering the Solution (on the scale outlined as part of the project) which has been proven on the GB Distribution Systems) **– Method costs** (the costs of replicating the method at the trial scale once it has been proven successful)

[2] The network capacity released by each method (the additional headroom released on the distribution system following implementation of the Method)

[3] The time it would take in months to deliver the capacity shown in "Network capacity released" under the Base Case

[4] The time it would take in months to deliver the capacity shown in "Network capacity released" using the replicated Method

[5] The estimated number of sites or % of the GB Distribution System where the method could be rolled out, up to 2040

quantitative, if provided)	and its aim to dramatically increase the amount of renewable electricity generation, and the Scottish Government target for at least 500 MW of local and community based renewable generation by 2020. Scottish Power Distribution (SPD) states that they are seeking to remove barriers to renewable generation deployment by improving access to the network, reducing the costs of connection and improving the interface with National Grid. There has been no real attempt to indicate the scale of the contribution of the project to meeting these targets. It is considered that addressing the barriers identified will facilitate the development of the low carbon energy sector by expediting renewable generation connections to the distribution network.
Quantitative analysis	No figures or quantitative analysis of the carbon benefits have been provided.
Robustness of financial benefits	SPD has illustrated the benefits of the project by describing seven case studies. In each case they state the costs of connection that would arise using current approaches (most of which would fall on the developer of the project and SP transmission) and then how these costs would be reduced if Active Network Management (ANM) and other techniques were used. The description of the mitigation that would be used in each of the seven cases was limited in the full submission. More information on the elements that make up the ANM solution was subsequently provided. However, the response does not describe what will be delivered and how this will bring about the claimed benefits. It is not clear how many further connections would be facilitated at each "smart enabled" Grid Supply Point (GSP), and what the associated costs would be. In these business case examples, the Business As Usual (BAU) cost is the cost of distribution, and transmission if appropriate, reinforcement. In Case study 1, it appears that the full cost of transmission reinforcement (£19 million) has been included in the BAU costs; some or all of these costs will be borne by the Transmission Owner. From discussions with SPD it is understood that the method costs do not include the costs (to the generator) of any constraints that result from the ANM solution, which may not arise should they choose a reinforcement (BAU) connection.

	SPD indicated that they thought the generator's lost revenue due to constraints would be low, although this has not been quantified. This would be an important consideration for generation developers. In addition, the method costs in the case studies do not appear to include the DNO share of the ANM costs; SPD claims that this cost would be born by the DNO. While this is a reasonable claim, it does mean that the financial benefits are likely to be overstated, as the DNO ANM enabler costs have not been taken into account. The cost savings for generation developers are claimed to be between 18-75%, based on the case studies. The broadness of this range was discussed with SPD, who stated it was difficult to narrow this down, or project the number of future connections that would require ANM and the associated savings. In addition to the financial benefits, SPD has indicated the reduction in connection time associated with the ANM solution, which is an additional and important benefit of the project. This benefit has not been quantified. SPD has estimated the potential benefits if the approach to exporting GSPs is implemented in their area. They have identified that there are 16 GSPs in their area that could benefit from the ARC solution. It is assumed that this number of GSPs has been multiplied by the £16.000 million saving associated with Case study 1, to reach £260 million for developers, DNOs and the Transmission Owner (TO). There are a number of issues with this calculation. The savings have not been identified for each of the stakeholders, and are based on extrapolating a saving from a case study, which is presumably situation specific and not necessarily suitable to be used to project future savings. Furthermore, it appears that the majority, if not all, of this saving is to the Transmission Owner, with little or no savings to the DNO or developer. In addition, other concerns remain, that the calculations may not include all costs (e.g. DNO ANM costs and constraint costs).
Capacity released (and how quickly)	The capacity released that SPD has quoted in the net benefits worksheet aligns with the case studies, i.e. the released capacity is the size of the generation connection that is facilitated by the ANM scheme. Whilst this is useful in indicating a possible range of sizes of generation developments that could be connected using this method, these are based on specific examples of projects, and this does not indicate the

	total capacity that could be released on a given part of network as a result of this project.
Replication (applicability of technology, dependence on specific network characteristics)	SPD has stated that the ARC project will develop network management tools and commercial arrangements that will facilitate the connection of renewable generators to the network and foresee that the work in the trial area will produce learning that can be used in other areas and in other DNOs, arguing that the project is not developing bespoke solutions. Although they have used project specific case studies to illustrate the method and potential benefits, the case studies cover a range of connection challenges, which increases the likelihood that the solution will be relevant to other DNOs. SPD indicated during discussions that work package 1.2, Publication of data, will involve significant changes to their systems. If implementation across GB depends on DNO specific systems and processes, this may impact the ease of rolling this out. The same concern could apply to other work packages, such as Work Package 2 Connection Design.

3 Criterion (b) Value for Money

Criterion:	Provides value for money to distribution customers
Overall assessment:	Financial benefits accrue to different stakeholders according to the type of problem being addressed. In the case of exporting GSPs, it appears that significant savings in transmission reinforcement accrue to the Transmission Owner. In other cases savings accrue to the DNO and generation developer; based on the case studies, these savings are more modest. The learning expected from this project is very relevant to the distribution system. A key concern with this project is the extent to which the work is innovative and novel, rather than work that should be conducted under BAU. While the learning from Work Package 1 will undoubtedly be valuable to DNOs, it is difficult to justify this work package as innovative. Similar points could apply to elements of work package 2, such as reviewing internal design policies and developing planning tools. In order to improve on the assessment against this criterion, more justification would be required that elements of the work could not be undertaken as BAU. There are concerns around some major cost items which seem difficult to justify: • Work package 1 – Empowering Customers • SPD labour costs - £3.850 million • Energy storage device SPD is proposing to review SPD labour costs and the use of the energy storage device is their revised submission.
Metrics (where available):	

Size of benefits to distribution system[6]	£260m benefits across DNO, TSO, developers due to Method 1, in SPD's area

Sub-criteria	**Assessment**
Proportion of benefits attributable to distribution system (as opposed to elsewhere on supply chain)	The main benefits claimed for this project are reducing the costs of connecting renewable generation (which usually result in lower connection charges to be paid by the developer of the generation), postponing reinforcement of the network and increasing the speed with which connections can be made. Thus some of the benefits should be expected to accrue to the direct customers of the network and the network itself - and thus indirectly to the wider community by an increased and speedier penetration of low carbon generation. Case Study 1 includes costs of transmission reinforcement in the assessment of costs and benefits. In discussions with SPD it was queried to whom savings in transmission reinforcement would accrue; SPD indicated that they would accrue to SP Transmission (i.e. in general the relevant Transmission Owner). While transmission costs are socialised across all GB consumers, these savings are not passed on directly to the customers of the DNO should the method be implemented.
How learning relates to the distribution system	The vast majority of the activities to be undertaken in this project are directly related to the distribution system. The trial is taking place in a constrained generation area on the distribution network, addressing a variety of connection challenges at various distribution voltages and to various types and sizes of DG scheme. Therefore the learning that emerges should be directly applicable. The issue that is less clear is the extent to which the proposed initiatives are "business as usual" and should be undertaken by the DNO as part of the day-to-day development of the business. However it is also recognised that completing the development of systematic enduring processes to deal with changed circumstances is potentially resource intensive and expensive

[6] Size of benefits attributable or applicable to the Distribution System versus elsewhere

	and perhaps the incentive of the LCNF is needed to "kick start" the activity. This is discussed further under Criterion (c), Section 4.
Approach to ensuring best value for money in delivering projects	SPD states that they have identified their partners for this project through a competitive process. This is discussed further under Criterion (d). Additionally they indicate that they have not included any end device technology providers as partners. They believe that value for money will best be achieved by contracting through a competitive tendering process, or through existing framework contracts, for products and services through the duration of the project when required. Costs have been based on indicative costs from tenders and/or experience from previous LCNF, IFI and BAU projects. However, there is a degree of uncertainty in the costs, particularly in the case of the storage device (discussed further in sub-criteria below). A key concern with this project is the extent to which the work is innovative and novel, rather than work that should be conducted under BAU. Concerning Work Package 1, SPD claims that there are novel elements (e.g. hosting multi-party discussions, and providing more detailed network information) and that there is currently no clear business case for DNOs to undertake this work. It could be argued, however, that the elements of this work package are the next logical steps the DNO should be taking in information provision in response to customer concerns. While the learning from Work Package 1 will undoubtedly be valuable to DNOs, it is difficult to justify this work package as innovative. Similar points could apply to work package 2, such as reviewing internal design policies and developing planning tools. SPD has argued that work packages 3 and 4, developing smart enabled networks and trialling ANM connections, require LCN Funding as there is uncertainty and risk in the proposed ANM approach, which requires testing and development. These work packages involve trialling a "top-down" ANM approach, with novel control functions and end devices. SPD claims that funding would not be available for this activity under the normal price control, as it may be regarded as speculative and would be challenging to justify without experience. Regarding work package 4.2 (ANM for constraints), SPD believes that without LCN Funding it is likely that each generation developer would pursue their own agenda, which may not

	result in the optimal solution. It is considered that there is a stronger case for LCN Funding for these elements of the work. However, it should be noted that the approach of revising the connection process end-to-end is a strength of the project, and there are links between the work packages. The extent to which SPD will revise their submission in terms of concerns on the risk profile of LCN Funding is not clear.
Identify and review major cost items, examine justification for relevant costs, assess choice of discount rates	Work Package (WP) 1 is called Empowering Customers and delivers forums, provision of network data and introduces a viability study. This work package includes Stakeholder forums (WP1.1) and delivers 16 stakeholder workshops, customer information packs and customer surveys – the cost seems expensive for the deliverables. A major cost item is £2.031 million of non-labour costs associated with community level connections (WP4.3), a significant portion of which is for a 100kW/200kWh energy storage device (including equipment, system integration and contractors to assist with installation, design and operation). The type of storage technology has not been specified; SPD does not want to commit themselves to a specific technology yet, which seems reasonable. However, this raises the question of how the costs are derived. In discussions with SPD they indicated that they tendered for an energy storage device, which has formed the basis for the cost estimate; they acknowledged that there is uncertainty in this cost. In terms of power capacity costs this seems high, but the energy requirements may be driving the costs. The driver for the size of the energy storage device has been queried; the requirement will be based on the size of community scheme and relevant network constraints. More assurance would be useful on the energy requirements of the storage device, as this could be driving the costs. SPD is proposing to remove the energy storage device from the project in their revised submission. SPD labour costs associated with this project are £3.850 million. The associated number of person days is considered to be a large amount of resource, which appears to be difficult to justify. SPD notes, however, that there are advantages to using internal staff, in terms of keeping skills and learning within the DNO. The charge rate includes an undisclosed overhead rate, which may well recover costs in excess of those directly applicable to the project. SPD is proposing to review labour costs in their revised submission.

	Average day-rates for partners appear to be reasonable. 4.2% of the total cost has been allocated to contingency cover. A 2% interest rate is used in the project cost calculation. These both seem reasonable.

4 Criterion (c) Generates Knowledge

Criterion:	Generates knowledge that can be shared amongst all DNOs
Overall assessment:	The project involves procedural changes to the connections process but also includes consideration of "network enablers", i.e. hardware including an Active Network Management platform for managing distribution network constraints. The project spans the whole connection process, from initial discussions and application, to connection design and alternative connection solutions. It is building on learning from previous projects; some of the individual elements have been trialled in the UK before. The new learning comes from taking a holistic, rather than piecemeal, approach to ANM. It is considered that the learning gained from this project will be valuable to other DNOs.
Metrics (where available):	
Conforming to default IPR arrangements:	Yes

Sub-criteria	**Assessment**
Potential for new/incremental learning to be generated by the project	The learning outcomes include network management tools and commercial arrangements to accelerate Distributed Generation connections. SPD states that the project will demonstrate a series of small and low risk steps rather than large and high risk steps – this links to the discussion on BAU in Criterion (b). "Process maps" are one of the key learning outcomes, including: decision making process for top-down versus incremental investment in "network enablers"; information flows to customers to allow them to assess options and costs; process for interfacing with NG regarding exporting Grid Supply Points (GSPs); identification of trigger points for anticipatory investment for DG connections. Another key learning outcome is recommendations for a new incentive mechanism for DNOs to proactively invest to enable DG connections (i.e. a replacement of the current DG Incentive

	Mechanism). These learning outcomes would all seem to be valuable learning for DNOs, and beneficial to developers of DG. In terms of the new learning in this project compared with previous projects, SPD states that their previous project, Flexible Networks, focuses on the demand-side of network challenges (e.g. Electric Vehicles and heat pumps), with little emphasis on generation. Although ANM solutions have been trialled in a number of other projects, the novel approach of this project is in not treating the connections in isolation; instead a more holistic approach is taken. In addition, SPD claims that the ANM control functions that will be used in this project have not been tried in the UK. It is considered that the development and demonstration of this holistic ANM approach will be valuable learning. The proposed TSO (Transmission System Operator)-DNO link has been implemented internationally, and in the UK (WPD toolkit). SPD claims that the new learning from this project will be in using this link with ANM to address the challenge of exporting GSPs. This challenge (exporting GSPs) has been identified as needing to be addressed due to the long-lead times, as well as significant costs, associated with transmission reinforcement. A significant portion of the project budget is for Electrical Energy Storage. This will be used to demonstrate maximising generation output as part of an innovative connection option for the community schemes. It is not clear what new learning this project will generate on the use of storage that other projects are not addressing; this may require further discussion.
Applicability of learning to other DNOs	SPD notes the importance of learning from other DNOs and previous LCNF projects, as well as exporting learning to other DNOs. There is reference to using the Power Networks Demonstration Centre (PNDC) at the University of Strathclyde that will provide a focal point for learning dissemination. It is reasonable to claim that developing and testing solutions to DG connection challenges is applicable to all DNOs; Ofgem's DG forums have highlighted many concerns of, and challenges faced by, DG developers, of which some of the problems being addressed here feature. The learning from work packages 1 and 2 (Empowering Customers and Connection Design respectively), in particular, should be relevant to all DNOs, although to implement the learning may be dependent on DNO specific processes and

	systems. SPD claims that the trial area is representative of GB networks, customer demographics and demand for generation capacity. The learning associated with the ANM trials might be more relevant to Scottish than England and Wales DNOs, due to the volume of connection applications expected in that area. However, as the case studies identify a range of connection challenges, this increases the likelihood that these challenges are being faced elsewhere. The scale of the problem being addressed has been indicated for SPD's area, but not across GB. The project will produce learning on all aspects of the connection process, from initial discussions and application, through to connection designs and alternative connection solutions to traditional methods. This learning should be valuable to other DNOs, as there are challenges and concerns from DG developers in many aspects of the connection process.
Proposed IP management and any deviations from default IP principles	SPD does not propose to deviate from the default IP arrangements. Any IPR development associated with ANM during the project will be funded by SGS.
Credibility of proposed methodology for capturing learning from the trial and plans for disseminating	There is a work package dedicated to knowledge transfer (WP6); the focus of the work package is on knowledge into the project. It also covers disseminating the learning from the project (WP6.2). The transfer of knowledge into the project is important for a project of this nature, where there is a considerable amount of building on learning from previous projects. This is discussed more under Criterion (g), project risks. In terms of exporting knowledge, dissemination will take place via practical demonstrations at the Power Networks Demonstration Centre (PNDC), which is being developed by University of Strathclyde, Scottish Power and SSE; academic papers; the use of data in PhD projects (which are already underway); updating the SP website; and LCNF and other industry conferences. These seem to be standard and reasonable approaches, although the use of the PNDC will be novel. SPD plans to host events for DNOs at the PNDC to

	demonstrate the outcomes of the project. SPD has also considered internal knowledge dissemination, proposing activities such as training staff at the PNDC and an annual internal technology conference. "Project champions" will be identified from each business area to act as internal ambassadors of the project (e.g. give updates at monthly team meetings and presentations about the project). Overall the knowledge dissemination method seems sound.

5 Criterion (d) Partners and Funding

Criterion:	Involvement of other partners and external funding		
Overall assessment:	SPD's project partners are Community Energy Scotland (CES), Smarter Grid Solutions (SGS) and University of Strathclyde. Each of the project partners has some strong advantages and is an appropriate partner for this project. The level of contractual commitment between SPD and CES is not clear. External funding is relatively small at around 3%. SGS is making the largest contribution, which is considered to be commensurate with the benefits to SGS from the project, which include demonstrating their technology. A competitive process was run for selecting SGS as a project partner. The process SPD has been through is a useful approach to adopt, but does not suggest a willingness to become involved with a wider pool of partners than the DNO is generally associated with. This process did not apply to CES and University of Strathclyde, who were selected directly for their relevance and experience.		
Metrics (where available):			
Total cost of project (£):	£10.314 million	LCNF support (£):	£8.752 million
Costs met by DNO (£):	£0.992 million	Costs met by others (£):	£0.321 million
LCNF support (% of total cost):	84.9%	Costs met by DNO (% of total cost):	9.7%
Costs met by others (% of total cost):	3.1%	Number of consortium members:	4 Project partners (including SPD)

Sub-criteria	**Assessment**
Appropriateness of collaborators (including	SPD's project partners are Community Energy Scotland (CES), Smarter Grid Solutions (SGS) and University of Strathclyde. SPD claims that the number of partners strikes a good balance between

experience, expertise and robustness of commitments)	having enough relevant industrial input and not leading to programme delivery issues due to complex management and contractual negotiations. This statement seems reasonable. Each of the project partners has some strong advantages and is an appropriate partner for this project. CES brings experience working with communities and will provide the link to community generation projects; SGS provides ANM and is currently playing a role in several other DNO projects; Strathclyde will provide academic expertise, and has an international reputation. The external involvement is relatively small and it is believed that there are close links between the University of Strathclyde and Smarter Grid Solutions. While this provides advantages in terms of running the project, it does restrict the partner pool.
Level of external funding (presented on a comparable basis with other Projects)	Some external funding has been obtained but a relatively small amount of around £321,300 or about 3% of the estimated total costs of the project. This is broken down across the partners as follows: £38,900 from CES; £32,400 from University of Strathclyde and £250,000 from SGS. The contributions are benefits in kind, such as a CES team member being dedicated to the project, SGS providing project management resource, a test environment and development of analysis tools, and Strathclyde providing academic resources. There is a total budget for contractors in the project of £2.494 million. It is not clear how this will be split between the identified partners and services to be procured from other parties during the project. SPD has existing contractual relationships with the University of Strathclyde and a collaboration agreement and working history with SGS; these agreements will be updated for this project. While CES has expressed enthusiasm for the project, the level of contractual commitment between SPD and CES is not clear.
Effectiveness of process for seeking and identifying new project partners and ideas	SPD claims to have carried out a competitive process to identify partners for this project. This is described in an appendix. They approached 200 organisations, received 40 responses and short-listed 8 of these resulting in the selection of Smarter Grid Solutions (SGS). The short-list criteria included relevance to the project aim; tangibility of the proposal; uniqueness and novelty; and level of development and approach to partnership. Discussions were held with the short-listed parties and SGS

	emerged as the preferred organisation in terms of shared objectives and willingness to contribute to the project. SPD believes that this process has been open and extensive, and states that they received responses from a wide range of organisations. However, the outcome of the process is the selection of a partner with whom SPD has a working history and relationship. When challenged on this, SPD discussed the balance of risk, in terms of working with an organisation they have not worked with before. They also claim that an additional benefit of the process has been the identification of organisations that may get involved with the project when services are procured. The process SPD has been through is a useful approach to adopt, but does not suggest a willingness to become involved with a wider pool of partners than the DNO is generally associated with. This process did not apply to CES and University of Strathclyde, who were selected directly for their relevance and experience.

6 Criterion (f) Relevance and Timing

Criterion:	Relevance and timing		
Overall assessment:	The project is highly relevant given the short term ambition of the Scottish Government to achieve at least 500 MW of local and community based renewable generation by 2020. SPD states that the project addresses a very immediate problem of facilitating DG connections, which is a reasonable claim. The broad challenges to DG developers facing prohibitively high connection costs and connection lead-times are likely to be common across GB. The extent to which the specific connection challenges identified are prevalent across GB is not clear. The learning from the information and connections process work packages are likely to be of interest to all DNOs. The project builds on learning from a number of other projects, which means that some individual elements do not appear to be new. The novelty of elements in Work Package 1 is questionable. The novelty of the ANM design and trials lies in the top-down ANM approach, and the challenges to which ANM is being applied. The focus of the project is in removing DNO-specific barriers to DG developers. Given the various government incentives, it is reasonable to assume a sustained or increased level of DG connections.		
Metrics (where available):			
Start date:	January 2013	Elapsed time of project:	4 years

Sub-criteria	**Assessment**
Significance in the project in: (a) overcoming current obstacles to a low carbon future	The connection application process is perceived by developers as having long lead times and prohibitive costs. ARC aims to address these problems, so that the network is not a barrier to the uptake of Low Carbon Technologies. SPD has provided a good indication of the scale of problem in their network, e.g. that the volume of generation connection applications has increased by 700% in SPD since 2009; in 2011 over 90% of connection offers were not accepted for variety of reasons,

	including time to connect and costs. SPD estimates that, of the number of connection offers not accepted, at least one third of these could be reduced due to the methods proposed in this project. SPD also makes a reasonable case for the problems getting worse, as distribution networks become "saturated" with renewable generation, and future connections will require more significant works, increasingly impacting on the transmission network and increasing costs and lead-times to developers. SPD has identified current challenges for DG connections more specifically, which include: • connections that would give rise to exporting Grid Supply Points (GSP) or constrained transmission / distribution can result in significant project delays and connection costs; • community schemes cannot currently be facilitated by managing generation output with local demand or storage; • complex inter-tripping arrangements can limit access; and • distribution constraints can result in expensive reinforcement. The extent to which these problems are more prevalent in Scotland compared with the rest of GB is not clear. Other problems, as highlighted through stakeholder engagement events include: • lack of access to detailed information, which limits the ability of developers to make decisions on where to connect, as well as understanding the costs involved in their connection; • lack of transparency in costs and processes; • lack of investment in network ahead of need; and • time of connection work (planning) and costs (reinforcement). SPD has also highlighted that this project will address

	problems that are internal to the DNO, such as resources required to deal with an increasing number of speculative applications and the limited experience of proven alternatives for connection. It is likely that these and the issues above are common concerns to DG developers and DNOs across GB. It is deemed that all of these are genuine issues currently faced by DG developers. These align with issues raised in Ofgem's DG forums.
(b) trialling new technologies that could have a major low carbon impact	DNOs, in response to Ofgem and following the DG Forums, indicated measures they are undertaking to address the challenges developers are facing in DG connections. Measures that DNOs are already planning to take forward include holding "surgeries" for developers (drop-in sessions for anyone to hold discussions with the DNO), heat maps (ENW currently has on their website 33kV fault level maps and 33kV thermal capacity maps, with a traffic light system); a DG "website portal" and hosting stakeholder events (SSE); and a "budget quotes calculator" (UKPN). When queried on the novel elements of WP1, Empowering Customers, SPD claims that these are multi-party stake holder workshops (WP1.1); an increased level of granularity of detail in information provided (WP1.2); and the opportunity for developers to discuss novel connection arrangements with the DNO (WP1.3). While these may be novel, they could also be seen as logical next steps that the DNO should undertake as BAU. This is discussed further under Criterion (b). In Work Package 2 (Enhanced connection process) there are references to "smart interventions, new tools and developer options", "novel estimation techniques" and "new tools for connections planners". It is suggested that these will be applied learning from other projects; little or no information on these new techniques is provided. In terms of the ANM development and trials, the new approach of the project is in the "top-down" rather than piecemeal ANM solution, and the problems to which the ANM solutions are being applied (e.g. exporting GSPs). SGS claims that the software element of the ANM platform will trial control functions that have not been tried in the UK before. Overall, it appears that individual elements (sub-tasks in work packages) are not new, in fact many are building on learning from other projects. It is considered, however, that there is

	value in building on learning from existing projects, and in particular in addressing connection challenges from end-to-end. The DNO is considered well placed to undertake this end-to-end review and development.
(c) demonstrating new system approaches that could have widespread application	The trials involve "smart enabling" three GSPs, and investigating the benefits of top-down rather than incremental application of ANM. The ANM will be applied at different voltage levels, and to a variety of connection challenges. The project focuses not only on network connections, but on all elements of the connection process. The application of the learning to DNOs across GB has been discussed above.
Applicability of the project to future business plans, regardless of uptake of Low Carbon Technologies (LCTs)	The project focus is on Distributed Generation connections, and it is reasonable to assume that many of these will be renewable. The likelihood of sustained or increasing connection applications is high, driven by incentives such as the Feed-in Tariff (FIT) scheme and Renewable Obligations Certificates (ROCs), or the FIT with Contracts for Difference (FIT-CFD) to be introduced by Electricity Market Reform proposals, to facilitate the UK in meeting the 2020 targets. The project is not technology specific, so will encompass all generation technologies. It is reasonable to assume that the need for this project is robust to a range of future scenarios.

7 Criterion (g) Methodology

Criterion:	Demonstration of a robust methodology and that the project is ready to implement
Overall assessment:	The Project proposes to examine three areas of the connection process, i.e. Connection Application, Connection Design and Network Construction/Connection. It therefore takes an end-to-end approach to the overall connection process, which it addresses in six work packages. The project plans to involve National Grid in the development of novel ANM techniques to manage net-exporting GSP connections and to apply "Connect and Manage" principles at the distribution level; deploy ANM to address specific network constraint challenges identified in the case studies; and develop solutions involving balancing community generation with demand to facilitate community generation projects. Overall, the project seems to be reasonably well thought out, although there are a number of references to using technologies or techniques that have been developed in other projects, without providing further information. There is an executive sponsor, whose role will include reviewing items every two weeks, such as project finance, key risks and issues, and milestones. This will help to identify any cost and project over runs. It is considered reasonable to expect that there will not be any negative impacts on customers.

Metrics (where available):			
Requested level of protection against cost over runs (default 5%) (%):	0	Requested level of protection against direct benefits (default 50%) (%):	0

Sub-criteria	Assessment
Feasibility of project proposal	Although there are elements of Work Package 1 (Empowering Customers) that involve external parties, such as the stakeholder forums and viability studies, it is not considered

	that SPD will face challenges in achieving participation from customers and other relevant stakeholders, as developers are very engaged in this area. Work Package 2 (Connection Design) largely concerns internal resources and processes and similarly with Work packages 3 (Network Enablers), although this also involves the SGS ANM platform. The elements of SGS's ANM technology appear to be readily available products, although new control functions will be trialled in this project. Work Package 4 (Connection Trials) requires DG developers to choose an ANM connection over a BAU connection. The Case Study connections are not committed to taking part in the trial. SPD has identified current connection applications that are facing the same challenges, and is confident that relevant connections will come through during the trial period. As part of the ANM connection, developers would be expected to pay for the incremental costs associated with the ANM solution. SPD states that these costs will be determined on a case by case basis, but has estimated the cost of the communications link, which they expect to the most prevalent solution; the estimated cost seems reasonable relative to likely connection costs. SPD notes the incremental ANM costs are significantly lower than traditional reinforcement costs, and has considered the possibility that developers are unwilling to trial the alternative connection in their risk register (appendices). As noted previously, the project plans to draw upon and build on learning from previous LCNF/IFI projects. The challenges associated with acquiring this learning is discussed below, under "risks". SPD has a good working relationship with the University of Strathclyde, a working history with SGS, and existing contractual relationships in place with both of these parties. This should facilitate project readiness.
All risks, including customer impact, exceeding forecast costs and missing delivery date	The discussion on customer impacts focuses on how SPD will engage with DG developers, e.g. creating a Generator Information Pack and having a dedicated ARC connections contact. Developers will have the opportunity to take part in elements of ARC, such as engaging with SPD to explore connection options prior to submitting an application, and offering DG applicants in the trial area the option of an

	alternative ANM connection, if appropriate. SPD does not anticipate that there will be an impact on supply to domestic customers. A contingency budget of £432,000 has been included in the project cost, which is around 4.2% of the total costs. There is an executive sponsor, whose role will include reviewing items every two weeks, including project finance, key risks and issues, and milestones. This will help to identify any cost and project over runs. A risk register has been provided in the appendices. This is not very detailed, although key risks have been identified (e.g. developers not coming forwards, communication issues with the ANM scheme, failure to establish processes with National Grid (NG) on exporting GSPs). The project aims to build on and use learning from previous projects, which raises questions around the confidence SPD has in obtaining sufficient information and handover to implement this learning. SPD has a specific Work Package (WP6.1) on knowledge import, which focuses on engaging with other DNOS to capture such learning, and has already engaged with SSE to arrange workshops to share practical elements of their experience with technology deployment. SPD noted in discussions that the nature of LCNF projects is to share learning with DNOs, and they do not anticipate barriers in this area. With a dedicated Work Package in place, this seems to be well thought through.
Whether items within project budget provide value for money	See Criterion (b), and in particular sub-criteria "Identify and review major cost items".
Project methodology (including depth and robustness of project management plan)	In terms of project management and governance, a number of bodies will be established. A Project Steering Board has been identified, which is a mix of SPD personnel and project partners. It is considered beneficial to have project partners on the Steering Board. A Governance Board, which will meet bi-monthly, will have organisational authority. The project will have an Executive Sponsor who will review key elements every two weeks (e.g. milestones progress, risks and issues,

	financial reporting). The project is arranged into a six work packages, which will deliver eight methods. SPD has provided a mapping of the methods to the work packages. The work packages have been sub-divided into a number of sub-work packages. In an appendix, each sub-work package is presented in terms of activities, specific learning, reference to other projects, benefits during the next price control period (ED1), costs excluding resources, and estimated person-days. Each work package has been described in the full submission. Overall, the project seems to reasonably well thought out, although there are a number of references to using technologies or techniques that have been developed in other projects, without providing further information. For example, Work Package 2 focuses on design, network visibility and planning tools. Reference is made to the tools being suitable for the analysis of “smart interventions”, however it is unclear what range of techniques this includes.
Appropriateness of Successful Delivery Award Criteria (SDRC)	See Section 8 below.

8 Successful Delivery Reward Criteria

Criterion:	Appropriateness of the SDRC definitions and timing and adequacy of links to key project milestones.
Overall assessment:	Given the number of sub-work packages, it is difficult to cover all project outputs in the SDRCs. The ANM demonstrations, which are a key aspect of the project, have been captured by the SDRC, although it is suggested that SDRCs could be extended to cover at least two demonstrations. There are two SDRCs relating to the community generation scheme element of the project, whereas there does not seem to be an SDRC specifically relating to the top-down ANM approach (WP3 Smart enabling the network), which is a key element of the new learning of the project. SDRC 9.8 is considered to be a good criterion for capturing the real outcome of the project, in attempting to capture an improvement in “connection experience”. SPD is proposing to revise their SDRC in their revised submission.
Review:	The first two delivery reward criteria are based on the project being completed on budget and in time. While these are sound principles and necessary aims, these Successful Delivery Reward Criteria are not considered to be sufficient as they stand. For example, SDRC 9.1 on project budget, there is no assurance that the project will have delivered any useful output. SDRC 9.4 relates to demonstrating an alternative solution to either case studies 2, 3 or 4. In discussions SPD indicated that they are confident they will be able to demonstrate solutions to at least three of their case studies. Given that they are committed to demonstrating a case study 1 example in SDRC 9.3, it is suggested that this criterion could be extended to demonstrating at least two of the case studies 2, 3 or 4. There are two SDRCs relating to the community generation scheme element of the project, SDRC 9.5 and 9.6, whereas there does not seem to be an SDRC specifically relating to the top-down ANM approach (WP3 Smart enabling the network), which is a key element of the “new” learning of the project. SDRC 9.7 relates to knowledge dissemination and learning. It is suggested that the evidence, and in particular the project learning to be shared, could be more detailed. The aim of the project is to facilitate DG in terms of lower connection costs and faster connection times, as well as

	addressing all aspects of the connection process. SDRC 9.8 is considered to be a good criterion for capturing the real outcome of the project, in attempting to capture an improvement in "connection experience". However, the SDRC evidence does not specify that the survey should demonstrate an improvement. The outputs associated with work package 1 do not appear to be explicitly covered in any of the evidence proposed for the SDRCs. SPD is proposing to revise their SDRC in their revised submission.

9 Addendum: Changes made in resubmission

9.1 Summary of Changes

SPD submitted a revised full submission in mid-October 2012 following meetings and discussions with the Expert Panel and PPA Energy, and after receiving and responding to written questions.

The key changes that SPD has made to their submission are:

- The removal of the Energy Storage device from the scope of the project;
- Reviewing and reducing SPD resource costs; and
- Revisions to the SDRC.

The edits in the revised submission relate solely to these changes. Each area is discussed in more detail below.

Overall the LCN funding request has reduced by £1.331 million, from £8.752 million to £7.421 million. The total project costs have reduced by £1.530 million, from £10.314 million to £8.784 million. The changes are summarised for a number of categories:

- SPD Labour: £570,000 reduction
- Equipment: £650,000 reduction
- Contractors: £150,000 reduction
- IT: £50,000 reduction
- Contingency: £110,000 reduction

9.1.1 <u>Electrical Energy Storage (EES) device</u>

During the evaluation process there were discussions on the additional learning from the proposed Energy Storage device, given the significant costs involved. The concerns were that the EES device would not provide additional learning on storage devices, compared with other LCNF projects. In their revised full submission, SPD has removed this element of the community energy work package from the project. The costs of the relevant work package have been reduced. The community energy work package will still undertake other activities that were originally proposed; these activities are a core part of the project and expected learning.

9.1.2 SPD resources

SPD has reviewed their internal resource levels associated with the project, as well as the grading of staff allocated to the project. As a result of this review, the number of SPD person-days has been reduced, and the internal labour costs have reduced accordingly from £3.850 million to £3.280 million. A small portion of the labour cost reductions is associated with removal of the storage device activity from the project. The average day-rate for SPD internal resources has reduced, which is likely to be driven by the review of staff grading.

9.1.3 Successful Delivery Reward Criteria (SDRC)

A number of issues were raised with the SDRC in Section 8 of this report. SPD has revised their SDRC in response to this report, and appear to have incorporated all of the suggestions made. These include small clarifications, increasing the number of connections to be demonstrated, and including a criterion on the top-down ANM approach.

9.2 Impact on LCN Funding Application

The impacts of the changes made by SPD to their submission are considered for each evaluation criterion.

9.2.1 Criterion (a) Low Carbon and Benefits

The revised submission is not considered to impact on the evaluation against this criterion.

9.2.2 Criterion (b) Value for Money

The key concerns in value for money were around the extent to which Work Package 1 would be considered Business As Usual (BAU), as well as three key cost items; Work Package 1, SPD labour costs and the energy storage device. In their revised submission, SPD has reduced their internal resources and removed the energy storage device from the project, resulting in reduced costs associated with Work Package 4.3 of £1.056 million. In addition, SPD appears to have reduced the cost of WP1. Overall the LCN funding request has reduced by £1.331 million, from £8.752 million to £7.421 million. These changes improve the evaluation of ARC against this criterion. BAU concerns around WP1 remain.

9.2.3 Criterion (c) Generates Knowledge

It is considered that SPD sufficiently demonstrated the potential for generating new knowledge that can be shared with all DNOs in their original full submission.

9.2.4 Criterion (d) Partners and Funding

The revised submission is not considered to impact on the evaluation against this criterion.

9.2.5 Criterion (f) Relevance and Timing

It is considered that SPD sufficiently demonstrated the relevance and timing of ARC in their original full submission.

9.2.6 Criterion (g) Methodology

It is considered that SPD sufficiently demonstrated a robust methodology and that the project is ready to implement in their original full submission.

9.2.7 Successful Delivery Reward Criteria (SDRC)

While the original SDRC covered most of the key aspects of the project, there were a number of suggestions made to the SDRC in Section 8 of this report. SPD has taken account of all suggestions, and incorporated relevant changes into their SDRC. Changes include extending the coverage of SDRC 9.4 to delivering at least two connections, and including an SDRC on top-down ANM deployment. It is considered that these revisions improve the appropriateness of the SDRC.