Review of Low Carbon Network Fund Proposals

Final Report to Ofgem and Expert Panel

Scottish Power Energy Networks

Flexible Networks for a Low Carbon Future

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II Report Context

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

This report has been prepared from Scottish Power Energy Networks (SPEN) Low Carbon Network Fund Tier 2 Submission of 18th August 2011 and the supporting information received by the Consultants from SPEN prior to their final presentations and clarifications to the Expert Panel and Ofgem on the 5th October 2011.

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

- It sets out any factual clarifications that may 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 submissions; and

- It highlights any concerns 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 may assume that the factual content of the submission pro-forma to be sound unless noted otherwise in this report. For clarity in producing this report and the associated documents the Consultants have avoided reproducing large parts of the submission verbatim, which stands on its own merits for the Expert Panel's 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 report and any associated documents are not intended to be read in isolation and should be reviewed alongside the pro-forma and compulsory appendices.

III Notice

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II External Circulation

Name	Role	Reason for Issue
Ofgem	Client	Final
Expert Panel	Stakeholder	Final

III References

Ref.	Details	Published by	Issue date
01	LCNF Governance Document Version 4	Ofgem	April 2011

IV Table of Contents

1. Summary

1.1 Project Description

Project summary	
Objectives	• The purpose of the Flexible Networks Project is to Trial a series of individual work packages and alternative technical solutions and determine their role in economically and rapidly increasing the network capacity to meet anticipated increase in demand and the need to connect low carbon generation.
Problem	• The traditional network reinforcement to meet the forecast increase in demand over time and the transition to the low carbon economy is costly, time consuming and disruptive for the consumer. • The network is built as a passive infrastructure with significant capacity headroom and the alternative technologies (both economic and technical) that are available to increase and release capacity is not sufficiently tested.
Solution	• This Project will trial a package of 12 independent technical and commercial solutions that allow the DNO to create additional headroom to defer further network investment until significant load growth materialises beyond that which is currently foreseeable.
Method	• Monitoring the network to understand the relationships between loads on the 11kV and LV networks, the use of improved operational and planning tools for network management and, as-appropriate, deployment of a set of intervention techniques, under a generic heading of “dynamic network control”. • This approach complements a number of other Tier 2 LCNF Projects.
Cost	• Total project cost is £6,424k with external funding of £174k. • LCNF Second Tier Funding request is £3,600k.

1.2 Evaluation Summary

This Project is a feasible development of a Method employing new techniques for avoiding, deferring or reducing network reinforcement requirements in order to meet new demands for connection of low carbon technologies. Good project management principles are in place with a detailed plan, risk register and good governance. The proposal includes detailed costings for each work package based on the proposed methodology and selected network Trial sites, and these appear to be comprehensive. Estimates of the financial benefits of roll-out are realistic based on future reinforcement plans and assumption that a capacity saving of 20% can be achieved using the proposed Method.

In our opinion the strength of this Project lies in its practicality and realism. Whilst it is not the most innovative of Projects, it does trial a set of applications which are designed to deliver carbon savings and customer benefits through more sophisticated monitoring, planning and control of the network. The proposal does not claim any specific quantity of carbon emissions reductions. More work is required in the next steps beyond the Project for roll-out to move from proof-of-concept and Trials, to full commercialisation of the solutions and transformation into Business As Usual. This is our key concern, beyond the Project and is a greater risk than the delivery through the Project of testing and demonstrating new Methods.

The Project offers incremental and modest changes that nonetheless offer real commercial value and could mitigate the need for new investment. The contribution from external funding is relatively low at 5%. However only 57% of the total Project cost is required from the LCNF Second Tier Fund as the Project can be part funded from the DPCR5 allowed revenues allocated for network reinforcement.

2. LCNF Criteria Evaluation

Acceleration of the development of a low carbon energy sector

- Potential carbon emissions reductions are not explicitly outlined in the proposal. The Project addresses a key element of the Low Carbon Transition Plan (LCTP): the creation of a GB Smart Grid. SPEN claim that it will build a knowledge base of solutions for increasing the capacity headroom on distribution networks and this seems reasonable. This will contribute to the learning that is required to meet targets set out in the UK government's LCTP. The solution will reduce the need to reinforce the network for a period of time, thereby enabling better optimised network design, reduced bottlenecks for consenting, procurement and installation of LCTs.
- The proposal indicates that the Method will facilitate higher volumes of low carbon generation and faster connection; facilitate the additional demand from the transition to electric vehicles (EVs) and heat pumps; and optimise the network to reduce losses through dynamic network control. The assumptions made behind these carbon emissions reductions are considered to be adequate in justifying their potential benefits.
- On receipt of further information the proposal is considered to have outlined how the Method roll-out across GB will deliver the Solution more quickly. It is anticipated that the Method is applicable to 30% of the cases where local network reinforcement is required.
- The Project is applicable across one third of GB DNO networks. This is based upon an assumption that network constraints will prevent 10% of future domestic LCT installations (solar PV, EV and heat pumps).

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

- This Project has the potential to increase the capacity of distribution networks by use of flexible networks, with the benefit of a lower cost than existing GB systems.
- The Base Case cost is realistic, based on the construction of new substations and circuit reinforcements at the St. Andrews, Whitchurch and Wrexham sites.
- Method Costs are an estimate of the costs associated with full implementation of the Flexible Networks solution
- The Project is expected to demonstrate the final benefit of the Flexible Networks approach compared with costs of conventional reinforcement at the scale of the Trial.
- The Method's potential for replication is demonstrated in terms of:
  - The potential deployment on up to one third of SP Energy Networks' reinforcement schemes;
  - The same level of deployment across GB networks as a whole; and
  - The cost savings of the Method in both DPCR5 and RIIO-ED1.

Level of impact on the operation of the distribution system

- The Future Network Project will evaluate the effectiveness of alternative network interventions in addressing network constraints and allowing the connection of renewable generation. The Project delivers a package of 12 individual interventions for assessment of cost and effectiveness compared with the traditional approach to Distribution network planning and operations. .
- The financial benefits of the Method are primarily attributable to the Distribution system and its customers.
- Customers will benefit through the faster connection of low carbon technologies such as PV and heat pumps.
- The solution includes measures to reduce customer demand through the installation of energy efficiency devices such as voltage regulators and low energy appliances that do not require a change in customer behaviour.
- The proposal identifies the external contribution of the Project partners. Key learning from their involvement is shared across the Project.

Generates knowledge that can be shared amongst all DNOs

- The Future Network Project proposes a Method that is transferable to other DNOs and in an already constrained Trial area that is representative of other areas of the GB networks. The Project Method includes identifying the measures by which material improvements can best be demonstrated, developing an investment and roll-out plan over RIIO-ED1 and disseminating learning to the key stakeholders such as customers, stakeholders and other DNOs.
- The Project will focus on developing an enhanced network monitoring methodology based on actual network data and integrating improved DNO planning, operational tools and practices that are optimised for future low carbon networks such as trialling novel technology measures for improved performance of the network such as:
  - Dynamic thermal ratings of assets;
  - Voltage optimisation; and
  - Flexible network control.
- The Trial will design a communications strategy to deliver the knowledge and learning using appropriate media and channels.
- The learning and dissemination work-stream is tasked with ensuring that the right deliverables are made available to the right audience
- The DNO intends to conform to the default IPR requirements of the LCN Fund Governance v4.

Involvement of other partners and external funding

- This proposal includes four Project Partners – a manageable number within a project of this size. We have examined the credentials of these companies and their track records. We have discussed with SPEN their confidence in their partners.
- The Project will receive modest contributions from the University of Strathclyde, Nortech Management Limited and TNEI Services Limited.
- In addition to SPEN's in-house resources, the partners' skills and experience cover most of the requirements for the delivery of this Project, and SPEN will contract for additional goods and services as may be required. Three of the four partners have existing relationships with SPEN, which will help the negotiation process towards signing of contracts.
- The contribution of the partners to funding is 2.7% of total Project cost, and 4.8% of the Second Tier Funding Request.

Relevance and timing

- The Flexible Networks Project, if successful, will inform and address a wide range of technical and economic issues surrounding the connection of renewable generation and network constraints. The Project will build upon the learning from previous studies in the three network Trial areas and assess the interoperability of the technologies and Smart devices.
- The Project is designed to establish a set of robust, evidence-based technical and economic Trials and case studies. It will capture learning that can be fed through into future network business plans with the focus on RIIO-ED1 in the immediate future.
- The Whitchurch and St. Andrews trial sites are already constrained. This Project has an immediate value in deploying new techniques as an alternative to traditional reinforcement methods at these locations. This is recognised in the funding proposals whereby 40% of the total Project costs are funded from the revenues already allowed for in capital reinforcement schemes in the 2010-2015 price control.
- The Solution being deployed at Wrexham will immediately relieve the constraint on the Council's solar PV installation programme. The assessment of the Method will not be complete until 2014, although knowledge gained during 2012-2014 will be of use in the RIIO-ED1 process. Experience with the dynamic network control technology will be limited in view of the relatively short period of time it will have been in operation.

Demonstration of a robust methodology and that the Project is ready for implementation

- The project management principles are robust and the project office will be under the direct control of the DNO.
- The risk to the Project delivery that is associated with a lack of internal resources would normally be considered on the risk register

- Sufficient work has been completed to date, or will be completed before January 2012, in order that this Project may start on time.
- The methodology for developing and trialling solutions is clearly identified in the proposal.
- The impact on customers of this Project is relatively small. Any requirements for planned disconnection of supply can be managed by traditional methods. The energy efficiency module of the Project is straightforward, providing that the roles of BRE, SPEN as a Distributor, and the role of suppliers are clearly understood.

3. Detailed Assessment

3.1 Feasibility Assessment

Summary

- This Project is a feasible development of a Method employing new techniques for avoiding, deferring or reducing network reinforcement requirements in order to meet new demands for connection of low carbon technologies.
- It is proposed that the Project shall run according to good project management principles. SPEN and their Partners have a track record of expertise in their fields and SPEN are experienced in delivering major projects associated with network developments, design and operations.
- The uncertainty in delivery of benefits rests in the risk that the Trial sites are not representative of other GB networks. However, in view of the low capacity headroom in two of the three Trial sites where demand is increasing, there is opportunity to demonstrate savings from deploying alternative solutions.
- We note that more work is required in the next steps beyond the Project, where considerable work is required to move from proof-of-concept and Trials, to full commercialisation of the

3.1.1 Technical Assessment

Is the Project technically feasible?
• This Project develops and trials a range of interventions of different levels of potential benefit to avoid or defer network reinforcement. • Of the 20% additional headroom to be found, it is estimated that 9% may be released through application of flexible network control, 7% through applying dynamic ratings, 2% by use of voltage optimisation and 2% through energy efficiency. • All of these are feasible, and are relatively low-technology, low-risk solutions, other than the development of new software.

Is it safe?
• SPEN have advised that they are considering the specific safety requirements for installation of monitoring equipment on certain types of apparatus. • Otherwise SPEN identify no significant Health and Safety risks beyond those in Business As Usual in high-voltage network design and operations. We are confident that SPEN have the track record and competencies to manage safety in the Trial and to assess the safety requirements of the Method upon roll-out.

Is it innovative? If so, how?
• The proposed “cascade” monitoring process and integrated use of existing and newly-acquired data is new. Also, the flexible network control process being proposed is a novel technique not normally deployed in DNO Business As Usual (BAU). • The application of dynamic rating to other assets, in particular primary transformers, is being examined in the project and is not a business as usual technique. • We consider this Project to be innovative if defined as being new and beyond what is normal distribution business practice. • This Project neither depends upon nor contributes to the national Smart Metering roll-out programme. Future development programmes may deliver opportunities for Smart Metering data to be used in place of data acquired from current network monitoring proposals if the proposed Trials are successful, but the metering roll-out programme is insufficiently well established at present for use on this proposed LCNF Project.

How mature is the equipment?
• Automated intelligent switching equipment is relatively mature, but the packaged 11kV voltage regulators and reactive power compensation will be designed and prototyped. The engineering principles underlying these developments are very well established and the developments are relatively low-technology. • Dynamic line ratings are not BAU. There are other projects that are assessing the dynamic ratings of overhead lines, but this project will trial dynamic rating of other assets, in particular transformers which will contribute new knowledge to the industry. • The development of improved operational and planning tools will carry risks as with any change to software.

What is the technical impact on customers?
• This Method seeks to avoid, reduce or defer costs of reinforcement and the proposed interventions will allow design and operations of the network to make better use of existing assets, without reducing security of supply. • The proposed solution is of very little technical impact to the customers, other than the clear objective of reducing some customers’ demands through energy efficiency measures. • There may be some requirements for planned interruptions of supply to install monitoring equipment. SPEN have well established procedures for informing customers when interruptions are required.

What is the technical impact on normal operations?
• There is significant change to normal operations in deployment of the proposed Method. SPEN have included £110k in their proposal to finance the modification of the many policy and guidance documents which will be impacted by the incorporation of the new techniques for network design and operations. • The content of this Trial is relevant to the discussions on moving away from Engineering Recommendation (ER) P2/6 towards a more cost-effective approach to providing security of supply.

3.1.2 Assumptions

Assumption	Comment
Additional data regarding network loading and voltage can be acquired and put to good use in the proposed interventions.	The network monitoring is a relatively straightforward piece of work and is low risk. The development of improved software-based tools is simple in objective but there will be significantly more work required to move from the Trial to solutions which may be rolled out further.
The dynamic network control package will be developed and deployed to avoid network reinforcement.	The energy efficiency component of this Project will inform how network use can be eased by reducing demands from consumers. Quantifying the barriers to the customers' decision to invest will be valuable providing that the customers chosen are representative of those where the network constraints may lie upon roll-out. The two key risks within this part of the Method are: 1) the effectiveness of the technical solutions; and 2) the opportunities to deploy them where additional network capacity is required for new loads. These risks will be quantifiable from the results of the Trials.

3.1.3 Project Delivery Assessment

Is the Project plan robust?
• Yes. The Project management includes a detailed plan (including the critical path), a risk register, and governance structure. • Project partners, who have extensive track records in their chosen spheres of work, have been selected and have provided formal commitment to the Project. • In probing on the governance structure, we understand that the Steering Group members are already identified and will be chaired SPEN's Network Development Director.

Is the Project schedule credible?
• Yes, the development lead times appear prudent for the nature of tasks planned. Whilst outcomes from the Trials will be available during the work, there would be considerably more work to be done to move from the proof of concept and Trials within this work, to roll-out to deliver the benefits.

Are resources adequate?
• SPEN are experienced in putting teams together for major projects. • Suitable resources have already been identified and are available for mobilisation.

How do partners add value, how are they tied in to the Project, and is their contribution appropriate?
• Four Project Partners have been identified for this Project, a manageable number for a project of this scale. • Their buy-in to the Project is improved by their funding contribution of 2.7% of total Project costs (a relatively small contribution). • Three of the four partners have had previous contractual relationships with SP and the consultants agree that the move from formal commitment to the Project to contracts should be relatively straightforward. • Several of the partners are making time-in-kind contributions to the Project which effectively provides additional funding.

Is the customer/stakeholder communication plan appropriate?
• Yes. This Project has relatively little external impact. The customer-related work package (energy efficiency) is a small part of this Project, yielding only 2% of the 20% headroom targeted to be

achieved by the total Method.

Are successful delivery criteria appropriate?
• 40% weighting of the Successful Delivery Reward Criteria is toward the delivery of the Project to time and cost. • 45% is weighted towards the outputs from the three sites, by demonstrating that the objectives of overcoming network constraints have been achieved. • 15% of the reward is weighted to engagement, dissemination and adoption. This latter point is challenging in respect of the amount of work that will be required to move from proof of concept to BAU deployment. • The criteria largely satisfy the SMART criteria. We note that the adoption of the outcomes into the SPEN's core business to achieve 20% capacity headroom by the new Method is highly challenging, with the success of the proposals uncertain until the Trials have been completed.

Have key risks been identified and mitigated? Is contingency appropriate?
• The risk register shown in the proposal with 15 risks has been carefully prepared and includes both risk mitigation and contingency. • We note that there is no identified risk regarding availability of resources within this Project.

3.1.4 Assumptions

Assumption	Comment
SPEN and their partners have the capability to deliver this Project.	The plans for Project management include all of the key elements one would expect to see. The partners are of high repute in their fields of operation and have committed to the Project.
The Trial will be sufficiently representative for roll-out to achieve the identifiable benefits from the Method.	The key benefit is the delivery of 20% additional headroom by deploying techniques being Trialled. More work will be required to deliver the benefits through roll-out, although development work and testing, as included in this Project, are a relevant precursor to test the feasibility of the engineering solutions.

3.2 Commercial Assessment

Summary

- The Project verifies alternative Methods that offer smaller, faster and lower cost incremental increases in network capacity where major change or upgrade does not appear to be required.
- As such it offers incremental and modest changes that, in our opinion, nonetheless offer real commercial value and could mitigate the need for new investment.

3.2.1 Nature and Scale of Commercial Impact

Does the Project involve innovative commercial arrangements? If so, how?
• There is no fundamental change to the commercial arrangements.

How does the Project impact upon the customer (demand and generation)? What is the nature of this impact and does it endure beyond the Project?
• The Project speeds up connection in some areas and facilitates connection in areas that would otherwise require significant network upgrade. • The Methods, if proven successful, will mean lower costs for all customers connected to the network through reduced use-of-system charges and lower costs for those seeking a new connection in those cases where network reinforcement would traditionally have been required. • If successful, the Project will create an additional 20% network capacity at the Trial sites that will endure beyond the Project.

How does the Project impact upon the broader electricity and technology supply chains? What is the nature of this impact and does it endure beyond the Project?
• The impacts are modest facilitating up to 20% greater network use but making little change to the overall supply chain. It makes more efficient use of the current environment. It will continue beyond the life of the Project. However, future network upgrades will be required once the additional 20% capacity is used. • It should provide faster access to local renewable generation created via the Feed-in Tariff (FiT) programme.

Within current regulatory frameworks, where will financial benefits accrue within the supply chain (suppliers, DNOs, customers etc.)?
• The Project should deliver savings to generators connecting to the network and to the DNO in reducing the need for network upgrade to service new energy requirement such as Electric Vehicles.

• There are possible benefits in areas of new development. Development agencies will have access to greater capacity without the need for significant network reinforcement that is not needed for some time.

Are these commercial arrangements replicable across the GB distribution network on roll-out?
• They are applicable across the GB network in those areas that are highly loaded already and where additional demand may be anticipated.

3.2.2 Assumptions

Assumption	Comment
The savings (i.e. delivery of extra capacity) are delivered by flexible network capacity, dynamic rating, voltage optimisation and energy efficiency. The last, energy efficiency, contribute 2% each of the saving.	Will these modest savings of voltage optimisation and energy efficiency be achieved?

3.3 Wider Context Assessment

Summary

- The Project will develop a best-practice guide on management of system capacity to enable large-scale roll-out of low carbon technologies whilst optimising network investment and ensuring ER P2/6 compliance. This guide will be based on the philosophy of a high level assessment across the network, but more detailed monitoring and site-specific assessment of ratings as the network capacity headroom becomes depleted. It will incorporate learning on network characteristics and behaviour from Work Package WP 1.1 and 1.2 to enable beneficial changes to be made to network design practice.
- Other LCNF projects are underway within SPEN that will inform this Project.

To what extent will the Project overcome current obstacles to the future low carbon network?

- To meet the LCTP, more low carbon electricity generation will need to be connected to the grid and the grid will require enhancing to accommodate the anticipated increasing demand. The Trial describes how it will address the constraints by using a combination of technologies to defer or avoid traditional network reinforcement with the associated costs, delays and carbon.
- The Flexible Networks Project, if successful, delivers a cost-effective mechanism to connect renewable generation to the network alongside alternative technology enhancements.
- The Project will test that the costs of renewable generation connections and alternative solutions are lower than for traditional methods and provide more certainty in the business case.
- If successful, the model will address a number of obstacles to the low carbon network as it facilitates:
  - Higher volumes of low carbon generation and faster connections;
  - Additional demand from the transition to electric vehicles (EV) and heat pumps;
  - Improved monitoring and use of data to create higher resolution network knowledge to identify long-term and dynamic loading trends, and thus to target effective network reinforcement; and
  - Optimise the network to reduce losses and limit the need for network reinforcement.
- The Project identifies the importance of engaging with directly affected customers, both domestic and non-domestic, to raise awareness of the Project and demonstrate the positive and negative impacts and minimise any adverse impact. The Project will target I&C customers on a one-to-one basis and, through telephone surveys, test their attitude towards energy efficiency measures and willingness to be a part of the Project.

To what extent will the Project Trial new technologies that could have a major low carbon impact?

- The Flexible Networks Project facilitates the cost-effective connection of renewable generation to the existing network and offers alternative technology solutions to the traditional network reinforcement.

- The range of technologies is already identified by the Project and cost savings have been identified by the avoidance or deferral of traditional network reinforcement.
- The Flexible Networks Project includes targeted monitoring and measurement at key points on the network to identify long-term trends and effectively target any network reinforcement at the pinch points.
- The development of targeted network monitoring integrated with control room tools will enable novel technology such as flexible control and dynamic ratings to improve the performance of the network and reduce customer risk.

To what extent will the Project demonstrate new system approaches that could have widespread application?

- The Flexible Networks Project identifies and Trials:
  - New systems for the operational network control room that will enable the introduction of novel technology and network performance feedback and working practices, which improve the performance of the network;
  - New network planning tools based on more detailed modelling of the network constraints; and
  - Improved tools to understand and predict capacity growth with low carbon technology connections.
- The proposal identifies that the systems approaches provide solutions to areas of common interest to all the DNOs.

3.4 Carbon Emissions Reduction Assessment

Summary

- The Project will generate a knowledge base of potential solutions that addresses the capacity headroom on distributed networks. Whilst network reinforcement may still be required in some cases, the Solution will buy time to better optimise network design, reduce bottlenecks for consenting, procurement and installation.
- SPEN estimates that 10% of future installations will face network constraints, resulting in a potential delay of three to four years for these customers. SPEN estimate that the Method will be applicable to overcome one third of these constraints.
- The proposal and supplementary information provided by the DNO indicate that this will lead to an increase in facilitated LCT uptake. They will benefit from faster connections due to greater network headroom. This should help the transition to a low carbon economy to take place more smoothly and with greater adaptability (of the network) in managing this change.

3.4.1 Nature and Scale of Carbon Emissions Reduction

Does the Project align with the Low Carbon Transition Plan? If so, how?
• The LCTP anticipates the growth in installations of LCTs over the next two decades. The Project claims that it will enable a greater understanding of DNO networks thereby leading to more effective network planning in the short and long term. The proposal also states that these will create localised capacity issues for the network. • This Project intends to provide further insight into what and, importantly, when network upgrades are required. Through this understanding, network upgrades can be delayed or avoided allowing more LCTs to be connected to DNO networks at greater speed and reduced cost. • We believe that these are credible assumptions and that the Method will facilitate a greater uptake of LCTs.

What is the nature of claimed carbon emissions reductions and what is the balance between the technological and behavioural change?
• The proposal places carbon benefits in a wider context with the primary Method being the facilitation of LCT uptake. Project learning and stakeholder engagement is also anticipated to lead to an avoidance of asset upgrades and improved network efficiencies. Supplementary information provided to us by the DNO adds further support that this Project is complementary to other Tier 1 and Tier 2 projects.

Nature of emissions reductions

	Type of reduction
Facilitate LCT uptake more quickly & lower cost	xxx
Avoidance of asset upgrades	x
Network efficiency	x
Efficiency of use	x

xxx - Main focus
x - Secondary focus

What is the size of claimed carbon emissions reductions?
• The proposal does not quantify carbon emissions reductions that will result as a direct benefit of the Method, during the Trial or on roll-out. Supplementary information provided by the DNO states that the Trial will, at Wrexham, allow 1,559 additional properties to connect domestic PV installations equating to 1,380 tonnes of carbon emissions reductions per annum. On roll-out, the supplementary information states that carbon abatement from facilitated PV installations could equate to 0.3 million tonnes of CO_2 per annum by 2020, as well as a further 0.2 million tonnes of CO_2 per annum by 2020 due to facilitated heat pump and EV installations. • These estimates are based upon assumptions of approximately one million new heat pump installations and over two million new EVs in GB by 2022 and 2020 respectively. • In our opinion the claimed carbon benefits are reliant on LCT uptake. Ultimately the level of uptake is outside the control of the DNO.

Roll-Out at Scale

tonnes CO_2		Base case emissions	Method emissions	Net carbon emissions reduction
Trial / Method	Facilitated PV uptake	0	-500,000	500,000
	Facilitated HP & EV uptake	0	-700,000	700,000
	Total	**0**	**-1,200,000**	**1,200,000**

Note: These carbon savings are between 2014 and 2020.

When will the carbon emissions reduction occur?
• The proposal does not state when savings will be made. It states that it will "reduce bottlenecks for consenting, procurement and installation of LCTs which can have timescales of four years or more", thus enabling carbon emissions reductions to occur „sooner'. We consider this to be reasonable. • Supplementary information provided by the DNO states that carbon benefits will be accrued both during the Trial and on roll-out from 2014.

3.4.2 Carbon Emissions Reduction Assessment

How comprehensive are the carbon emissions reduction estimates?
• Carbon emissions reductions estimates have not been comprehensively explained within the proposal. The wider benefits referred to are reasonable. • Supplementary information provided by the DNO outlines the basis of carbon emissions reductions and quantifies benefits resulting from facilitated solar PV, EV and heap pump installations. These are based on an assumption that 10% of customers are delayed in connecting LCTs and that the Method will be applicable to one third of these customers. We believe these assumptions are simplistic as they do not take account of changes in LCT, grid or network efficiency improvements over time.

Are carbon emissions reduction estimates additional to business as usual?
• Incremental carbon reductions can be anticipated as the Project will enable other projects (Tier 1 and Tier 2) as well as general asset upgrades to be completed faster and the savings delivered sooner. It will also enable additional LCTs to be connected to DNO networks and at a faster rate. We believe these benefits to be additional to business as usual.

Are carbon emissions reduction estimates realistic?
• We expect the carbon emissions reductions figures to be achievable based upon roll-out of the Method across all GB networks. This is subject to estimated demand for LCTs remaining as anticipated in the proposal and that the Method is applicable to one third of customers that face connection issues.

3.4.3 Assumptions

Assumption	Comment
Knowledge from the Project is transferrable.	The Project will lead to greater learning which may or may not facilitate network efficiencies.
LCTs being connected up to 12 months sooner compared to the four-year Base Case, which was taken from an example in St. Andrews.	This may not be representative across all GB DNO networks.
10% of customers will face delays in connecting LCTs.	No reference was provided for this factor. In our opinion this appears conservative.
The Method is applicable to one third of customers that face connection issues.	This is subject to the Method being successful in resolving connection issues. It is anticipated that this ratio will be tested further during the Trial.

LCT carbon emissions benefits remain constant over time.	Carbon emissions reductions do not appear to have taken account of grid carbon intensity reducing over time. This may result in claimed carbon benefits being overstated.

3.5 Project Costs and Cost Benefits Assessments

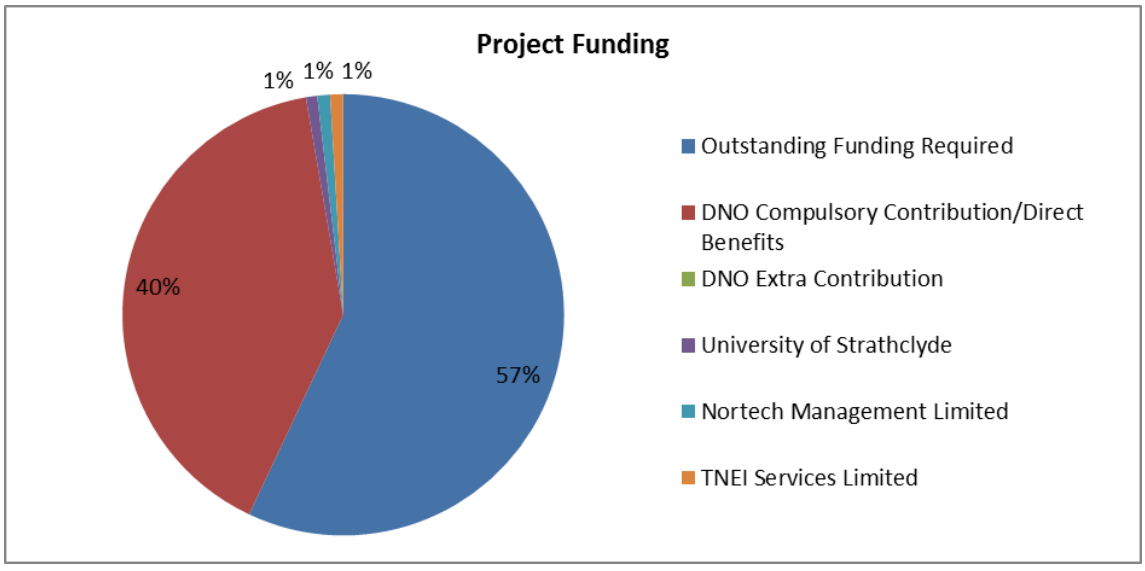
Summary

- The proposal includes detailed costings for each work package based on the proposed methodology and selected network Trial sites, and these appear to be comprehensive.
- The overall Project budget appears to be realistic in light of the Project's scope and objectives.
- The Flexible Networks approach could result in a benefit of £20-£36m arising from deployment on up to one third of SP Energy Networks' reinforcement schemes over DPCR5, which increases by a factor of 10 if applied to GB as a whole.
- The key assumption is the achievement of a 20% capacity saving by use of the flexible networks approach, particularly Dynamic Asset Ratings and Flexible Network Control.
- It is also assumed that a much lower level of substation monitoring will be required on roll-out than tested in the Trial.

3.5.1 Project Costs

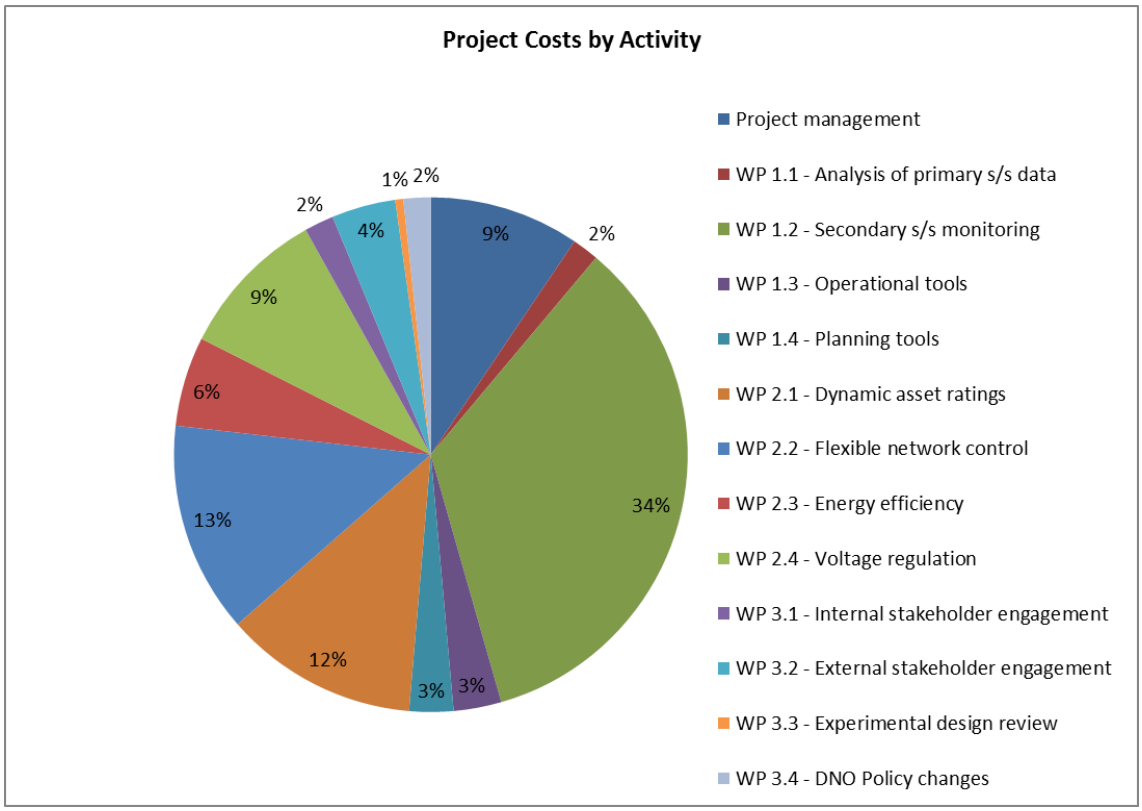
Project Funding

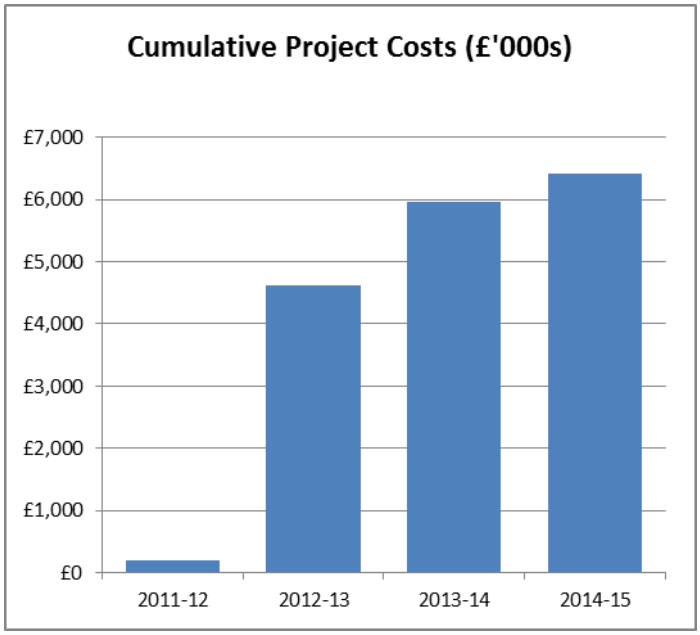
		Total
Project Participants Contribution (£'000s)	University of Strathclyde	£53
	Nortech Management Limited	£60
	TNEI Services Limited	£61
	DNO Extra Contribution	£0
	DNO Compulsory Contribution/Direct Benefits	£2,588
	Outstanding Funding Required	**£3,663**
	Total Project Costs	**£6,424**



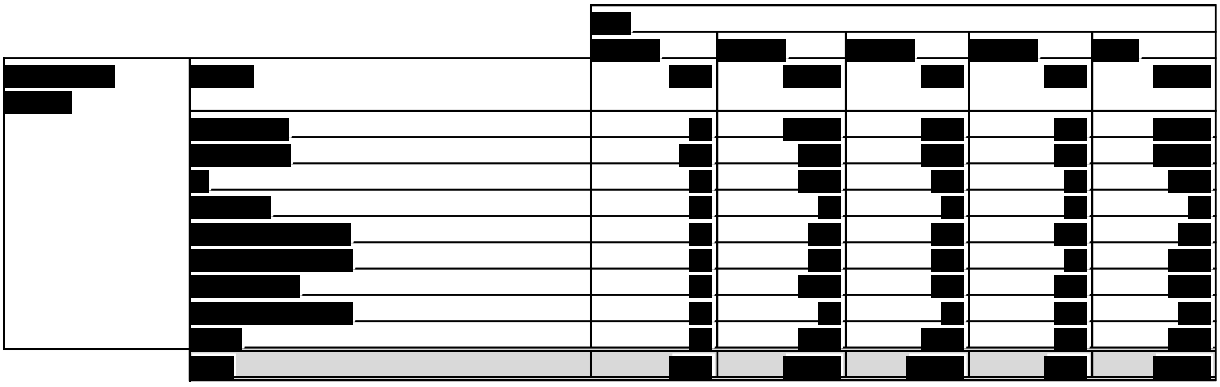
Project Costs by Activity and Year

		Year				
		2011-12	2012-13	2013-14	2014-15	Total
Costs of activities (£'000s)	Project management	£141	£248	£151	£68	£607
	WP 1.1 - Analysis of primary s/s data	£22	£86	£0	£0	£108
	WP 1.2 - Secondary s/s monitoring	£30	£2,125	£11	£47	£2,212
	WP 1.3 - Operational tools	£6	£182	£6	£0	£193
	WP 1.4 - Planning tools	£0	£178	£0	£0	£178
	WP 2.1 - Dynamic asset ratings	£0	£535	£234	£14	£783
	WP 2.2 - Flexible network control	£0	£633	£170	£48	£851
	WP 2.3 - Energy efficiency	£0	£181	£181	£0	£362
	WP 2.4 - Voltage regulation	£0	£138	£410	£60	£608
	WP 3.1 - Internal stakeholder engagement	£0	£30	£48	£42	£119
	WP 3.2 - External stakeholder engagement	£0	£79	£95	£84	£258
	WP 3.3 - Experimental design review	£0	£13	£13	£7	£33
	WP 3.4 - DNO Policy changes	£0	£0	£11	£99	£110
	Total	**£197**	**£4,429**	**£1,329**	**£468**	**£6,424**
	Cumulative total	**£197**	**£4,627**	**£5,956**	**£6,424**	**£6,424**





Project Costs by Type and Year



Direct Benefits

Are the Direct Benefits of the Project realistic?
• SP Energy Networks is providing funding to this Project in the form of direct benefits which will be achieved by utilising part of the funding allowance for reinforcement works in St. Andrews in DPCR5. It is understood that this approach has been agreed with Ofgem. This Direct Benefits contribution amounts to £2,588k, 40% of the total Project costs.

3.5.2 Project Costs Assessment

How comprehensive are the Project costs?
• The proposal includes detailed costings for each work package based on the proposed methodology and selected network Trial sites, and these appear to be comprehensive. • Work packages (WPs) and costs by type are also well described in the Project proposal.

Are the Project costs realistic?
• The overall Project budget appears to be realistic in light of the Project's scope and objectives. • WP 1.2 „Improved secondary substation data monitoring' at a cost of £2,212k (34% of total) is the largest area of spend. Monitoring equipment costs are based on a cascade approach to substation monitoring from primary to LV and across adjacent feeders. • This will involve the development of Smart monitors that can pre-process incoming data before transmission to a communications hub. A total of 185 such devices will be installed across the three Trial sites. • A risk register has been developed for the Project and used to provide an indication of the level of cost contingency that will be required for each WP, broken down by cost type. Equipment costs were allocated a higher level of contingency due to possible price variations in raw materials and manufacturing, an increased level of contingency was also attached to contractor costs which may be subject to change. • Contractual negotiations are scheduled to be complete by the end of March 2012.

Does the Project provide value for money?
• The Project offers a tangible benefit based on increasing network headroom in a faster and more cost-effective manner compared to traditional reinforcement. Real problems with network capacity will be tackled at the three Trial sites. • Overall the Project is focused on practical results and appears to provide value for money.

Is the Project feasible within the budget?
• The Project appears to be feasible within the total budget, which includes a contingency.

3.5.3 Assumptions

Assumption	Comment
Substation monitoring equipment and installation costs fall within budget (@£7,250 per unit).	SPEN has experience with similar monitoring equipment.

Target increases in headroom can be achieved through proposed interventions, particularly „Flexible network control' and „Dynamic ratings'.	It may prove more expensive to release target headroom than expected.
Fund of £100k for payments to users will be sufficient to encourage uptake of energy efficiency equipment.	May be difficult to differentiate between impact of this Project and other schemes such as the Carbon Trust. Typically the adoption of such technologies involves long lead times.

3.5.4 Cost Benefits Assessment

Financial Benefits

- The Project sets a target to create a saving of network capacity of 20% across the three Trial sites. This will defer further network investment for at least 10 years, and potentially longer, so reducing the charges to customers.
- Customers will also benefit through the faster connection of low carbon technologies such as PV and heat pumps.
- The Solution includes measures to reduce customer demand through the installation of energy efficiency devices such as voltage regulators and low energy appliances that do not require a change in customer behaviour.
- Development of new substation monitoring equipment for sale to other DNOs.

Non-Financial Benefits

- Non-financial benefits include reduced supply interruptions and reduced disruption due to construction work to lay cables.
- Tools and processes will be developed for future network planning and operations which could benefit other DNOs.

Method Costs

	Description	
Method Costs (£m)	Substation Monitoring	£0.6
	Dynamic Asset Rating	£0.4
	Dynamic Network Control	£0.8
	Energy Efficiency	£0.1
	Voltage Regulation	£0.3
	Stakeholder engagement	£0.1
	Total	**£2.4**

Are the unit Method costs calculated on an appropriate basis and are the unit Method costs realistic?

- Method costs are an estimate of the costs associated with full implementation of the Flexible Networks solution across the St Andrews, Whitchurch and Wrexham sites. Costs are based on Project costs, excluding or scaling back elements as appropriate. For example, the development of planning tools would not be required and a lower level (25%) of substation monitoring is envisaged.
- Four network interventions are to be tested in the Trial namely Flexible Network Control, Dynamic Ratings, Voltage Optimisation and Energy Efficiency; the first two of which are expected to account for 9% and 7% respectively, of the target 20% increase in headroom. The Trial is expected to demonstrate the actual increases in capacity that can be achieved which can then be used to optimise the deployment of these interventions. Method cost is based on the same balance of interventions as tested in the Trial.
- SP Energy Networks believes that, should the Project successfully achieve a saving of 20% in network capacity, these solutions could be deployed on up to one third of its reinforcement schemes. The same level of deployment is then assumed across GB.
- Numbers are presented for DPCR5 period and RIIO-ED1.

Base Costs

	Description		Comment
Base Case Costs (£m)	St Andrews - construction of new substation and associated works.	£6.2	Includes two 33/11kV transformers, associated switchgear and cable work)
	Whitchurch - construction of new substation and associated works	£3.1	Includes one 33/11kV transformer, associated switchgear and cable work)
	Construction of multiple new secondary substations and circuit reinforcement	£1.2	
	Total	**£10.5**	

Are the unit base case costs calculated on an appropriate basis and realistic?
• Base Case costs are summarised above and appear to be realistic, based on the construction of new substations and circuit reinforcements at the Trial sites.

Summary of Net Benefits of Roll-out

		Base Cost	Method Cost	Net benefit
Trial / Method	St Andrews, Whitchurch and Wrexham sites	£10.5m	£2.4m	£8.1m
	SP network areas over DPCR5	n/a	n/a	£20-36m
	GB over DPCR5	£1.5bn	£1.1-1.3bn	£225-400m
	GB over RIIO-D1	£3-5bn	£2.6-4.3bn	£400-670m

Are the forecast benefits of roll-out realistic?
• Estimates of the financial benefits of roll-out appear to be realistic based on future reinforcement plans and assumption that a capacity saving of 20% can be achieved using the Flexible Networks approach. • Further assumptions made are highlighted below.

3.5.5 Assumptions

Assumption	Comment
Roll-out will require a much lower level of monitoring than used in Project itself.	25% level assumed compared to Trial may be too low.
Capacity saving of 20% can be achieved.	The Project team are confident that this is achievable.
All four network interventions will be implemented.	The Trial is likely to refine deployment of potential interventions, which is likely to modify the estimate of Method cost.
Solutions can be applied to one third of SP Energy Networks reinforcement schemes.	SP Energy Networks appears to have done careful analysis here but will not be known with certainty until the end of the Project.
Solutions will be deployed in one third of GB distribution network reinforcement schemes.	Estimate of potential level of technical deployment across GB will need to be assessed at the end of the Project. Actual deployment will depend of adoption by other DNOs.

3.6 New Learning Potential

Summary

- SPEN has defined a number of key learning areas and highlights that there are significant additional learning opportunities that will be supported by the Project partners.
- The proposal highlights the responsibilities of the Project Partners in the knowledge sharing process and describes a programme to disseminate the knowledge to the DNOs, other stakeholders and to the wider end-user community through a number of communications channels and media. In the opinion of the consultants the risk of ineffective learning and knowledge dissemination is low.
- The Project intends to inform all affected customers of the impacts of the Project and will engage directly with the larger I&C customers to understand their motivations and attitude to energy efficiency.

3.6.1 New Learning Assessment

What is the potential for new learning?
• The learning outcomes and benefits are separated into two categories: the first is the development of innovative and alternative technology solutions for the network planners; the second is the development of improved network control tools using the enhanced network monitoring to facilitate dynamic ratings and flexible network control. • The learning outcomes are described within the Project and we consider that these will be effective. • The Project identifies that there is an opportunity to work with I&C customers to understand the relationship between energy efficiency and overall demand reduction and the attitudes towards energy efficiency. • SPEN recognises that there are partial learning outcomes in the event that the Trial is not completely successful.

What are the plans for disseminating such learning?
• Our view is that the Trial has a clear and comprehensive strategy for collecting the learning from the defined areas, undertaking the analysis and disseminating knowledge to the DNOs and other stakeholders and government, including the recognition that learning from partially successful Trials is valuable. • The Flexible Networks Project has a clear and comprehensive strategy for disseminating knowledge to the DNOs and other stakeholders and government. • The Project team will have a key role in assisting with the academic elements of the Project and

publishing the findings from an academic perspective. Other Partners' roles are defined and will undertake dissemination.

What is the IP management strategy and does it deviate from the default IPR conditions? If so, how?
• The Default conditions will apply for IPR.

Are the IP benefits to partners adequately reflected in the proposal?
• The Partners' proposed funding contribution is 5% of the Second Tier Funding Request of £3,600k. • Each of the three Project Partners and the Project Supporter contributes expertise to the Trial and will share in the learning and benefits from the deployment of the Method.

3.6.2 Assumptions

Assumption	Comment
Project Partners are engaged and disseminate the knowledge to DNOs	A clear, relevant message and appropriate communications channel is critical to the knowledge transfer across the DNOs and other stakeholders, which will require careful management
Dissemination of the knowledge is effective and the Method is adopted within SPEN	The internal knowledge transfer and adoption of the successful Method is a key learning area for SPEN

3.7 Risk Assessment

Summary

- The technical interventions are predominantly well understood with some novel features and overall are considered by the consultants to be low risk and feasible. The Project identifies a mitigated risk that the new approach would not be adopted within SPEN.
- The five key Project risks identified by SPEN are detailed in the Project Risk table and are considered by the consultants to be relevant and partially mitigated by the actions within the Risk Register.
- Two risks are also identified by the consultants and are set out in the table called Further Risks. Insufficient take-up of low carbon technologies represents a risk to the Project as does the risk that the Trial network is not sufficiently representative of the GB network and therefore roll out is constrained.

SPEN Flexible Networks				
PROJECT RISK				
Index	**Type**	**Risk**	**Mitigation Plan**	**Contingency**
1	Project	Failure of internal user to adopt new tools and processes.	Yes	Yes
2	Project	Once the network models are created, failure to adopt an updating strategy will devalue the Trial and subsequent roll-out.	Yes	Yes
3	Project	It may not be possible to achieve the expected energy efficiency savings or there may be a lack of customer uptake.	Yes	Yes
4	Project	Customers may suffer supply interruptions during installation of monitoring equipment.	Yes	Yes
5	Project	Potential data privacy issues for customers due to the extensive programme of monitoring to be deployed.	Yes	Yes

SPEN Flexible Networks				
FURTHER RISK				
Index	**Type**	**Risk**	**Mitigated Plan**	**Contingency**
1	Project	Networks not representative of sufficient networks within GB.	No	No
3	Project and roll-out	Inability to collect the data to monitor the network	No	No