Review of Low Carbon Network Fund Proposals
Final Report to Ofgem and Expert Panel

Eastern Power Networks (EPN), UK Power Networks
Flexible Plug and Play Low Carbon networks

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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 UK Power Networks (UKPN) Low Carbon Network Fund Tier 2 Submission of 18th August 2011 and the supporting information received by the Consultants from UKPN prior to their final presentations and clarifications to the Expert Panel and Ofgem on the 3rd 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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IV 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 Plug and Play (FPP) Low Carbon Networks Project is to demonstrate how, through the innovative integration of technological and commercial solutions, the cost-effective connection of renewable generation to a distribution network can be achieved. • The FPP technical innovation focuses on the development of a vendor-agnostic, open standards platform to enable end-to-end communication between distributed Smart network technologies and generation.
Problem	• Where multiple developments are under construction, the Long Term Development Statement (LTDS) cannot provide a reliable indication of the timing and connection of generation, and therefore at what stage the network reinforcement needs to be undertaken. • The connection costs cannot be predicted and the piecemeal approach has the potential to deliver a sub-optimal network reinforcement solution.
Solution	• The Solution is to deliver significant headroom on the 33kV networks using the FPP Method, thus enabling speedier connections of renewable generation at lower cost.
Method	• The FPP Project will Trial the use of the IEC61850 open standards to facilitate the adoption of Smart devices, peer-to-peer communications internet protocol (IP) and interoperability to facilitate the deployment of new technologies and, therefore, offer alternative connection solutions thus maximising the contribution from renewable generation. • The FPP Project will also explore the innovative commercial arrangements that will enable an adoption of an Active Network Management (ANM) approach, with new contractual arrangements that will form the basis for trialling new technical solutions and grouping the generators at the planning stage.
Cost	• Total project cost is £9,889k with external funding of £989k. • LCNF Second Tier Funding request is £6,780k.

1.2 Evaluation Summary

The Project will demonstrate how an open standards platform will enable the progressive and flexible addition of new Smart devices and applications. These applications will directly address existing or anticipated constraints and operational limitations of (primarily) the 33kV network in order to accelerate and lower the cost of the connection of Low Carbon Technologies (LCTs) in a constrained or distributed generation (DG) dominated network. In our view there is merit in Trialling the devices and applications, some of which are new and achieving their integration on the existing network and those being planned for the future.

The Method is feasible and can be effectively developed, tested and demonstrated on the trial network. There are some significant technology and resource risks to be managed. There is a comprehensive project plan for this proposal and careful thought has been given to project resourcing, governance and risk management. The Project planning is proportionate to a project of this scale and risk.

The benefits of this Project will accrue primarily to the generators. It is equally applicable to other DNOs on those parts of the network where renewable generation requires connection and the local configuration is suitable for the use of this Method. The overall Project budget appears to be comprehensive and realistic in light of the Project's scope and objectives although the experimental nature of the Project is reflected in high costs of equipment in customer premises and substations.

The Project claims that 242 thousand tonnes of CO_2e emission may be saved by 2020. On roll out it is estimated that the Project will lead to a further carbon emissions reduction of 4.8 Mt CO_2e. This is subject to further phases of work and assumptions that roll out are applicable. This carbon calculation is simple but the estimates are reasonable. UKPN estimates for carbon savings are conservative as they assume that the benefit from new installed capacity is only counted in year one whereas in fact it accrues across time.

The overall Project budget appears to be realistic in light of the Project's scope and objectives.

2. LCNF Criteria Evaluation

Acceleration of the development of a low carbon energy sector

- The Project meets the requirements of the UK government's Low Carbon Transition Plan (LCTP). It outlines how learning from the Project can reduce or defer the need for network reinforcement. The Project delivers carbon emission reductions by enabling Low Carbon Technologies LCTs (primarily onshore wind) to be connected to the network with shorter lead times than would normally be possible using the traditional reinforcement techniques. The consultants note that delays on planning and wayleaves required by traditional methods of reinforcement can cause many years' delay.
- Carbon benefits resulting from the Project are projected to be 242 thousand tonnes CO_2e by UKPN, all of which is realised before 2021 and within the UKPN network. On roll out, the Method is anticipated to deliver 4.8 Mt CO_2e. This is subject to a further phase of work up to 2030.
- We believe that the potential carbon reduction contributions as a result of this Project are additional and credible. They are not overstated.
- The Project claims additional on-shore wind generation of 350MW per year from 2016 to 2021, and 211MW per year thereafter connected to the network. These figures assume that the demands on networks for new wind connections will be the same across all of GB's networks.

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

- The Project meets the requirements of the UK government's LCTP by outlining how knowledge from the Project can reduce or defer the need for network reinforcement. The Project claims carbon emission reductions from enabling LCTs (primarily onshore wind) to be connected to the network on average four months sooner than would normally be possible.
- The potential carbon reduction contributions as a result of this Project are credible and additional. They appear to be conservative.
- The FPP Projects aim to test the use of Smart technologies and commercial arrangements to reduce costs and streamline the process of connecting new onshore wind generation.
- There are significant financial benefits if the approach is successful.
- UKPN has applied engineering judgement and made use of informed estimates to determine the reinforcements that would be required to provide an unconstrained connection to each of the pending renewable generation customers.
- Method costs are based on the costs of deploying Smart applications to connect 188MW of wind generation projects in the planning stage across the 700 km^2 Trial area.
- A forecast benefit of £9.6m by use of the FPP Solution to connect 188MW of wind generation in the Trial area appears to be realistic.

Level of impact on the operation of the distribution system

- The Method's potential for replication is demonstrated in terms of the:
  - Potential deployment to connect 188MW of wind generation in the Trial area;
  - Extrapolation to onshore wind generation Projects in GB to 2021; and
  - Cost savings of avoiding installation of new primary transformers.
- The Method will demonstrate how the open standards platform has implications for future planning standards, enables flexible operational procedures and directly addresses anticipated constraints. The FPP Project creates a Strategic Investment Model (SIM) to identify the most flexible and cost effective solutions for renewable generation connections, using complementary new technology options and contract offerings that will deliver significant cost benefits over traditional reinforcement techniques.
- Significant benefits are forecast for a GB roll out to 2021 based on a conservative uptake for connection of onshore wind generation by other DNOs.
- Financial savings are also predicted from the benefit of open standards ICT platforms including a lower level of technical specification effort, increased competition between vendors, and economies of scale and scope.
- The proposal clearly defines the parties, roles, areas and activities being Trialled and the external contribution of the Project partners. Key learning from their involvement will complement and contribute to the overall Project outcome.
- The Project will conform to the LCNF default IPR principles and it is not anticipated that the Project will develop foreground IPR that will fall outside of the default IPR requirements.

Generates knowledge that can be shared amongst all DNOs

- The FPP Project proposes a Method that is transferable to other DNOs with similar generation dominated areas (GDAs) on their network.
- The learning outcomes are focused and relevant to the transition to the low carbon economy, being part of DNOs' facilitation of the reduction of carbon emissions. The FPP proposal demonstrates a clear communications strategy and defines the roles of the Project participants and an example listing of the Trial outputs.

Involvement of other partners and external funding

- The Project will receive significant contributions from Partner 1, Partner 2, Partner 4 and Partner 6, as well as more modest contributions from the Partner 3, Partner 5 and Partner 7.
- Of the included Project Partners, nine are contributing 10% of the total Project costs.
- The collaboration is appropriate to provide the resources required for a project of this scale. All of the Partners are independent of UKPN.

Relevance and timing

- The UK government estimates that there will be a substantial increase in onshore wind capacity by 2050. The Method uses an open standards platform on 33kV networks to enable an increased capacity for wind technologies to be connected to a DNO network, thereby helping to fulfil government projections.
- The learning captured by the FPP Project will inform the future network and business plans for UKPN. To the limited extent that information is available by 2014; the Project will inform the UKPN Business Plan to be submitted as part of the RIIO-ED1 review. The timing is appropriate for this Project, as it is Trialling solutions which are additional to those proposed in other development and demonstration Projects.
- The learning from the work will inform the RIIO-ED1 process and prove feasibility of the Method, subject to sufficient operational experience being gained within the last 16 months of the Project.

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

- The proposal includes a detailed Project plan. The Project can start on time and the customer impact of implementation is manageable.
- Suitable resources are identified to deliver the Project. The time between deployment of equipment and closure of the Project is 16 months, limiting the operational experience that will be gained from the Trial.
- The Successful Delivery Reward Criteria have met the SMART objectives.UKPN foresee no credible circumstances under which suspension may be an appropriate course of action. We recognise that there some external factors that may occur for which suspension of the Project might be considered appropriate.

3. Detailed Assessment

3.1 Feasibility Assessment

Summary

- The Method is a feasible proposition which may be effectively developed, tested and demonstrated on this Project. There is significant value in developing applications that avoid network reinforcement and, in our view; the proposed applications have merit especially in supporting the connection of additional onshore wind.
- Equally there is value in the development of the capability to integrate these solutions and to be able to design, operate and control them safely and reliably.
- It is feasible to deliver this Project with the experience, knowledge and project management capabilities within UKPN's proposed team and their partners. In our view, there are some technology risks and resource risks to be managed, not all of which are captured on the UKPN Risk Register.
- This proposal puts great importance on the relevance of IEC61850 standard for substation automation. We are aware of the longstanding discussions on the detail of the standard. It is our view that the Method to be Trialled in this Project will demonstrate (if successful) that the standard is effective for integration of multiple applications. However, it is unlikely to confirm that such a standard is the only means of integration in the future. Nevertheless, learning from the successful deployment of the standard will be valuable.

3.1.1 Technical Assessment

Is the Project technically feasible?
• Yes. Risk Management is the key determinant of its success due to the size of the Trial area, its deployment of technologies not used on the 33kV network before and the level of integration and co-ordination being sought. • We have sought assurances from UKPN that there will be sufficient fault activity on the Trial network to test the proposed applications under real fault conditions. UKPN have provided data for the past two years showing 66 faults on the Trial network. Whilst the locations of the faults in the future may not coincide with the location of the applications, there is a good probability of some fault experience being gathered in the Trial.

Is it safe?
• There are implications for safety as new protection is being Trialled. UKPN have provided a convincing statement of both safety management procedures and processes for the Trial, and development of the safety case for the Method for roll-out.
Is it innovative? If so, how?

- Many features of this Project are new, such as the deployment of quadrature boosters on 33kV systems and the integration of dynamic line ratings into the control of generation onto the system.
- The Project includes technology risks that are typical of innovative developments.
- This Project neither depends upon nor contributes to the national Smart Metering roll out programme.

How mature is the equipment?
• Much of the proposed Method is new. Many features of the development, such as new protection, quadrature boosters and weather monitoring, will be built and installed according to well-established principles of design, construction and operation. Other features, such as integration of the devices and development of the communications and software will be more challenging.

What is the technical impact on customers?
• Providing that the risks to security of supply and safety are fully-managed, there should be little impact on customers at large. • The technical impact on Renewable Generation Developers seeking connection will be the reliability of the network, the risk to their plant and the size and frequency of generating restrictions. These factors will be built into the commercial negotiations on connections.

What is the technical impact on normal operations?
• UKPN will be carefully controlling the Project to ensure that safety and security of supply is not compromised by the Trials. • If this Project demonstrates that this Method works, then there will be significant workload to be completed to incorporate the Method into normal business operations. These techniques will be additional to the traditional approach to providing network capacity, and many new policies and processes will be required e.g. to manage issues such as the co-existence of distributed and centralised network control.

3.1.2 Assumptions

Assumption	Comment
The Method being developed, demonstrated and tested in this Project will avoid delays in and excessive costs of renewable generation.	The feasibility of the Method is being tested in the Project. Unless and until the techniques are developed, deployed and assessed on the Trials, the outcome is unknown.
A set of technical solutions may be developed and Trialled on the existing 33kV network without	The Project has been designed to discover both the viability of these techniques and their

risk to security of supply and safety.	effectiveness in avoiding reinforcement. If the Project is run according to plan, these outcomes will be achieved.
A set of new technical solutions may be integrated upon a technical platform based upon IEC61850.	There is debate within the industry as to the value or otherwise of IEC61850. This Project is unlikely to reconcile the differing views. The Project may not prove that the standard is essential for similar developments, nor the best approach. However, it will be able to demonstrate that the standard is effective and may be used elsewhere.

3.1.3 Project Delivery Assessment

Is the Project plan robust?
• Yes. There is a comprehensive Project plan for this proposal. From our discussions with UKPN, our study of their proposal, the answers we have received to additional questions raised and our own experience, we conclude that careful thought has been given to Project resourcing, governance and risk management and the Project planning is proportionate to a Project of this scale and risk.

Is the Project schedule credible?
• The commissioning of Smart devices will not be completed until August 2013, yet the Project end date is 31st December 2014. This does not give much time to test the solutions under a wide range of fault conditions, but fault history of the network suggests that there will be exposure to faults for some experience to be acquired during this period. • The learning to be disseminated to other DNOs and into the RIIO process will be dependent upon the experience gained in operation and control of the trial devices, including operations under fault conditions.

Are resources adequate?
• Resources will always be a risk on Projects of this scale. UKPN have identified potential delays in resourcing and the potential withdrawal of partners as Project risks. Both risks have been mitigated in the Risk Register and have appropriate contingency plans. • UKPN have already identified the key members of the Project team and we acknowledge their experience and skills for a project such as this. • We note and accept that the resource risk has been identified on this Project.

How do partners add value, how are they tied in to the Project, and is their contribution appropriate?
• This Project proposes 11 partners, all of whom have clear roles in providing different services into the Project. • The mix of partners ranges from well-known organisations such as Cable and Wireless, to lesser-known specialist companies such as Fundamentals Ltd, an SME supplying voltage control expertise to the power industry. We have examined the credentials of these companies and note their suitability for the tasks allocated to them in the Project. • The large number of partners provides benefit in the potential for mutual support of additional resources that can be offered if needed and the partners will bring value in providing the right set of skills to the proposal. However, we believe that there is additional risk to the Project in terms of complexity, simply in managing across several separate organisations. This risk is not identified on the Risk Register, but in view of the close co-operation required between partners, we would comment that it should be there, and may be assessed at a level "Requiring Treatment." • The partners' funding contribution is 10% of the total Project cost, and 15% of the Second Tier Funding Request. • There is a six month period up to the 6th June 2012 allocated for completion of contracts. A Memorandum of Understanding is already in place.

Is the customer/stakeholder communication plan appropriate?
• The proposal indicates that there is a plan for dissemination of knowledge and resources are allocated.

Are Successful Delivery Criteria compliant with the LCN Fund Governance Document v.4?
• The first criterion is unusual as it is a report on the "challenges" which are relevant to the Project. • The remaining seven criteria are output-based, relating to the completion of tasks e.g. deployment of equipment. • The evidence for the output-based criteria is largely sign-off on completion. It is implied that this is successful completion. It would have been desirable to note in the evidence how success will be defined. • Otherwise the SMART objectives are met.

Have key risks been identified and mitigated? Is contingency appropriate?
• Various risks have been commented upon above, in earlier parts of Section 3.1. • The Risk Register is clear and includes a quantification of risks, mitigation and contingency.

3.1.4 Assumptions

Assumption	Comment
There will be sufficient resources to complete this Project. The Project is deliverable.	The Project requires studious attention to risk management to ensure that the integration is successful and sufficient learning is extracted regarding both how the proposed techniques can be deployed, and their effectiveness in facilitating renewable connections. UKPN's experience of managing a multi-partner 2nd Tier project (Low Carbon London) will be valued. We have evidence that lessons have been learnt.

3.2 Commercial Assessment

Summary

- The benefits for this Project will accrue primarily to the generators.
- Some generators will have interruptible network connections as there will be two kinds of access rights: 1) Firm Generation (business as usual); and 2) Interruptible contracts. The interruptible contracts are the new Smart commercial arrangements proposed in the Project.
- UKPN are proposing a commercial framework that provides a 'holistic' development strategy that will provide quicker and cheaper new connection for distributed generation.
- The Project will look at clustering generators and apportion costs between them to lower connection costs for clustered connections.

3.2.1 Nature and Scale of Commercial Impact

Does the Project involve innovative commercial arrangements? If so, how?
• It involves new commercial arrangements offering the generating customers a business as usual contract based on taking firm generation and an interruptible contract. The latter is new and is referred to as the Smart commercial arrangements. • The introduction of the Smart commercial arrangements will be explored in two work packages: o Explore principles of access to be implemented in the FPP Project; and o Create template connection agreements to support interruptible generator connections. • We believe that the new arrangements are a real change from business as usual and are therefore innovative.

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 will deliver faster distributed generation connection. • Equipment that is connected to the plug and play must comply with open standard IEC61850.

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?
• Generators who connect to the network will be actively managed. The order in which generators will be able to access the network in real time must be defined. UKPN claim that generators will need to estimate the volume of generated capacity and availability of access may impact the economics of a Smart connection. • Equipment connected to the network must comply with open standard IEC61850.

• The Project will explore groups of generators together and apportion costs between them and could deliver lower cost connections charges for future clustered generators.

Within current regulatory frameworks, where will financial benefits accrue within the supply chain (suppliers, DNOs, customers etc.)?
• UKPN claim that all of the savings are made by the Distributed Generation (DG) customers and not the DNO.

Are these commercial arrangements replicable across the GB distribution network on roll out?
• The commercial arrangements are applicable across the rest of GB. However, the development of distributed generation requires local planning consent and the time of this consent is a key element for the roll out of DG. UKPN have worked closely with their local authority, Cambridge County Council, who is supportive. Such support will not be so forthcoming from all local authorities. • It is noteworthy that this Project has support from Scottish Renewables who state that this Project could have long term benefits to Scottish Renewable members and the industry in general.

3.2.2 Assumptions

Assumption	Comment
Assumes that local authority planning approval is not a constraint for connection going forward.	This will vary widely across the country.
Equipment connected to the network must comply with the IEC61850 open standard. It is assumed that this standard will be widely adhered to.	UKPN report that this standard is widely used overseas but is only beginning to be adopted in the UK.

3.3 Wider Context Assessment

Summary

- The FPP Project will Trial and model alternative approaches to optimise the connection of renewable wind generation to the grid and will be informed by the early results from the UKPN's LCNF 2010 Tier 2 'Low Carbon London'. The Trial will use the open standard IEC61850 in developing the Smart applications on the grid.
- The concept is extendable and is equally applicable to other DNOs with renewable generation to be connected to the network.
- Derogation will be required for SLC 14 and the associated Common Connection Charging Methodology and Statement (CCCMS). Similar consent will be required for new connectees and potentially for any roll out.

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

- The Project, if successful, addresses technical and commercial obstacles to a low carbon network by Trialling a cost effective mechanism to connect to the network and to implement an open standards platform to enable peer-to-peer communications and Active Network Management. The commercial and contractual aspects will be Trialled and tested with the Project.
- The Project will test that the costs of renewable generation connections are lower than for traditional methods and provide more certainty for the business case.
- If successful, the model will address a number of obstacles to the low carbon network as it supports:
  - Evaluation of technical reinforcement requirements leading to reduced investment risk and increased certainty and innovation; and
  - Greater transparency of costs and an anticipated reduction in connection and distribution costs.

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

- The Project facilitates the cost effective connection of renewable generation to the existing network.
- The Project will test the open standards platform based upon the IEC61850 protocols that will support Smart technologies, controls and applications leading to more efficient use of the existing assets.
- The FPP will develop the Strategic Investment Model (SIM) that will quantify the impact of different commercial arrangements and seek the most cost effective and viable solutions for connecting renewable generation to the network.

To what extent will the Project demonstrate new system approaches that could have widespread application?
• The Project will deploy an open standards platform based on IEC61850 standards and an IP communications strategy to support the end-to-end communications between distributed smart network technologies. • The innovation of the SIM will allow the DNO to determine the most effective options for connecting renewable generation to the network.

3.4 Carbon Emissions Reduction Assessment

Summary

- The FPP Project will demonstrate how to build an open standards platform that will enable the progressive and flexible addition of new Smart devices and applications. These applications will directly address existing or anticipated constraints and operational limitations of the network in order to facilitate and accelerate the connection of LCTs in a constrained or DG dominated network. The submission stated that it is anticipated that the benefits accruing from this Project will enable DNOs to move from a passive 'fit and forget' to a 'fit and flex' approach which will subsequently provide customers with the ability to connect more renewable capacity more quickly.
- We believe this to be a reasonable and achievable outcome.

3.4.1 Nature and Scale of Carbon Emissions Reduction

Does the Project align with the Low Carbon Transition Plan? If so, how?
• Learning from the FPP Project Trials will inform how the deployment of Smart devices and applications, and the accompanying ICT, can reduce or defer the need for new distribution network capacity to facilitate the deployment of renewable generation. This aligns with the goals of the Renewable Energy Strategy. However, the primary means for aligning with the LCTP is to facilitate additional wind capacity on DNO networks. This will help GB reach targets set out in the LCTP and 2050 Energy Pathways Analysis. • UKPN anticipate that the FPP will be applicable to other parts of GB thus directly aligning with one of the goals of the Low Carbon Transition plan (to plan and enable timely investment in network infrastructure). • We believe that these outcomes are reasonable although they do rely on assumptions of roll out and applicability.

What is the nature of claimed carbon emissions reductions and what is the balance between the technological and behavioural change?
• We believe the nature of carbon emissions reductions enabled by the FPP to be a technological change; additional network capacity will help to facilitate LCT uptake as well as reduce barriers to existing planned LCT connections (e.g. wind farms) by increasing the maximum generation limits placed upon them by the DNO.

Nature of emissions reductions

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

xxx - Main focus
x - Secondary focus

What is the size of claimed carbon emissions reductions?
• The FPP Project proposal states that it will deliver 242 thousand tonnes of CO_2e emission savings by 2020. Using DECC non-traded shadow carbon prices this equates to an equivalent financial benefit of £10.5m NPV. • On roll out it is estimated that the FPP will lead to a further carbon emissions reduction of 4.8 Mt CO_2e, which converts to a financial saving of £192m NPV. This is subject to further phases of work and assumptions that roll out are applicable.

Roll-Out at Scale

	tonnes CO_2	Base case emissions	Method emissions	Net carbon emissions reduction
Trial / Method	Facilitated wind capacity	0	-4,800,000	4,800,000
	Total	**0**	**-4,800,000**	**4,800,000**

When will the carbon emissions reduction occur?
• The following tables indicate that emissions reductions will occur over a period of 18 years (2013-2030), with the majority of these savings occurring on roll out from 2016 onwards. The proposal states the Project will deliver 242 thousand tonnes CO_2 (Table 1) and, at roll out, carbon emissions benefits will equate to over 4.8M tonnes CO_2 (Table 2).

Table 1

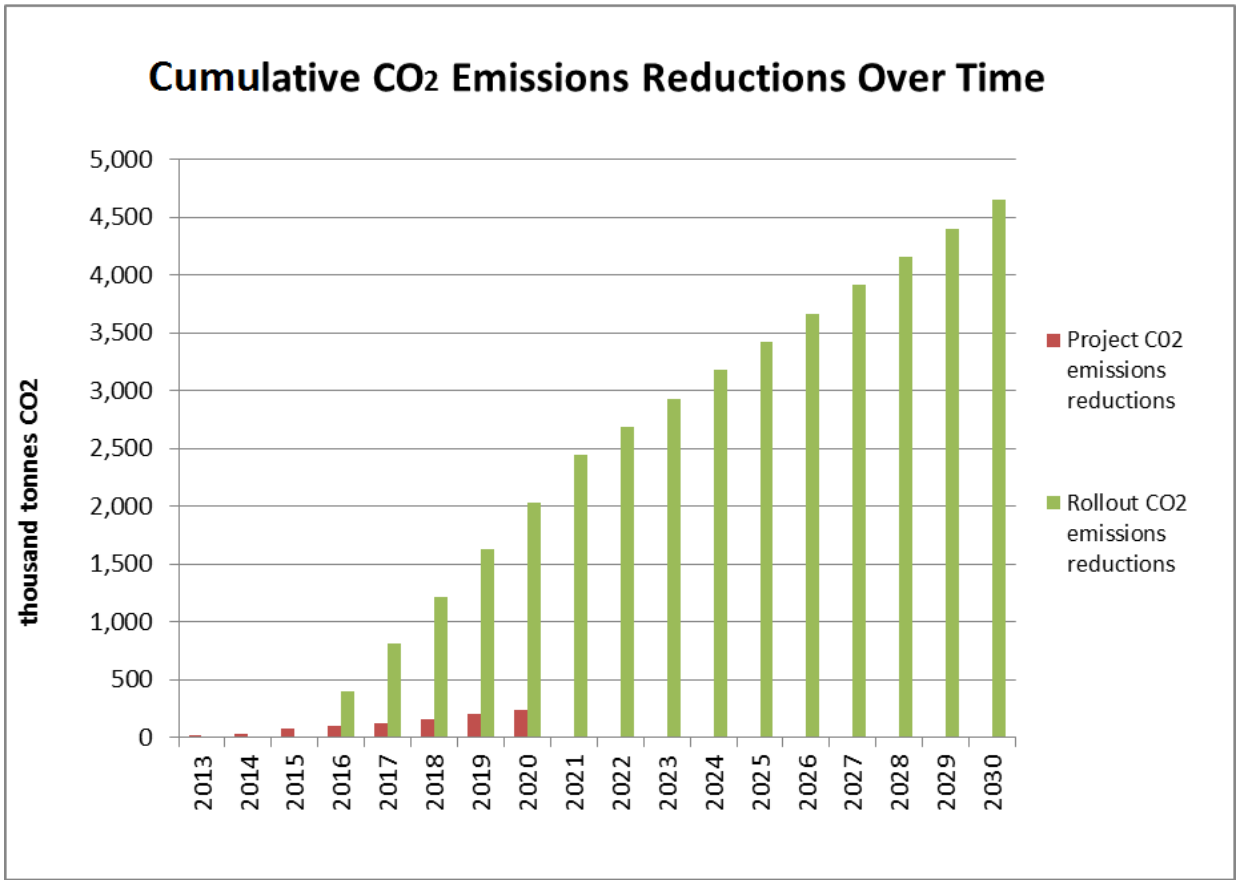
Emissions reduction over time

		Year								
	thousand tonnes CO_2	2013	2014	2015	2016	2017	2018	2019	2020	Total
Trial / Method	Facilitated wind capacity	19.4	18.1	37.5	23.2	23.2	41.3	41.3	41.3	245.3
	Total	**19**	**18**	**38**	**23**	**23**	**41**	**41**	**41**	**245.3**
	Cumulative total	**19.4**	**37.5**	**75**	**98.2**	**121.4**	**162.7**	**204**	**245.3**	

Table 2

Emissions reduction over time

		Year															
	thousand tonnes CO_2	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Trial / Method	Facilitated wind capacity	407	407	407	407	407	407	245	245	245	245	245	245	245	245	245	4,647
	Total	**407**	**407**	**407**	**407**	**407**	**407**	**245**	**245**	**245**	**245**	**245**	**245**	**245**	**245**	**245**	**4,647**
	Cumulative total	**407**	**814**	**1,221**	**1,628**	**2,035**	**2,442**	**2,687**	**2,932**	**3,177**	**3,422**	**3,667**	**3,912**	**4,157**	**4,402**	**4,647**	



3.4.2 Carbon Emissions Reduction Assessment

How comprehensive are the carbon emissions reduction estimates?
• The proposal focuses primarily on the additional wind capacity that would be enabled through the Project and then a subsequent roll out across all of GB's networks. It does not include the potential positive impact for other technologies. Furthermore, the figures for roll out anticipate that the level of demand from new wind connections will be the same across all of GB's networks. There is little acknowledgement of differing LCT demands that would be experienced in other DNO networks. • The proposal incorporates MARKAL Carbon Intensity in grid mix figures into calculations and therefore takes account of anticipated reductions in grid carbon intensity over time.

- When comparing the government's 2050 Energy Pathways Analysis (July 2010) to Projected MW capacity that will be enabled on roll out, it appears that the estimates are credible. GB onshore wind generation is anticipated to amount to between 20GW and 32GW by 2050 (with this capacity having been installed by 2030). Therefore, with FPP laying claim to an additional 2.1GW capacity by 2021 and a further 1.9GW by 2030 (4GW total) this accounts for a 12.5-20% increase in capacity.

Are carbon emissions reduction estimates additional to business as usual?
• The carbon emissions reductions will be additional to the usual course of business if the Project enables a greater capacity of LCTs, specifically wind, to be connected to the 33kV network at a faster rate and lower cost.

Are carbon emissions reduction estimates realistic?
• The carbon calculation is simple but the estimates are reasonable. Savings estimates are lower than expected because UKPN assume that the benefit from new installed capacity is only seen in year one whereas it in fact accrues across time. • The figures for roll out anticipate that the demands on networks as a result of new wind connections will be the same across all of GB's networks.

3.4.3 Assumptions

Assumption	Comment
LCT capacity that is anticipated to be installed is outside the control of the Project.	The Project assumes that wind demand is uniform across each DNO network without accounting fully for geographical variations in demand. The carbon savings assume that the new wind capacity is installed in line with the new capacity on the network being opened up. This is outside the control of the Project and so may be open to delay by other external factors.
Demand for wind will continue over the next 20+ years.	This is deemed a low risk assumption due to clear government and market signals that indicate wind generation to be a key part of GB's future energy mix.
The capacity factor for wind is 0.3. This takes into account the intermittent nature of the wind, the availability of the wind and array losses.	The calculated carbon savings are highly sensitive to this assumption: +/-10% in the capacity factor has a corresponding +/-10% impact on carbon saved. 30% is a reasonable estimate for this

	factor and so does not present significant risk to the credibility of carbon savings predicted.
Carbon savings are only counted in the first year that new wind capacity comes on stream. The new capacity will continue to produce power beyond year one but this benefit is not counted.	This underestimates the carbon savings. A quick calculation by the consultants suggests that the potential carbon savings are approximately four times larger than UKPN figures, if it is assumed that the new wind capacity continues to displace existing grid-mix power through to 2020.

3.5 Project Costs and Cost Benefits Assessments

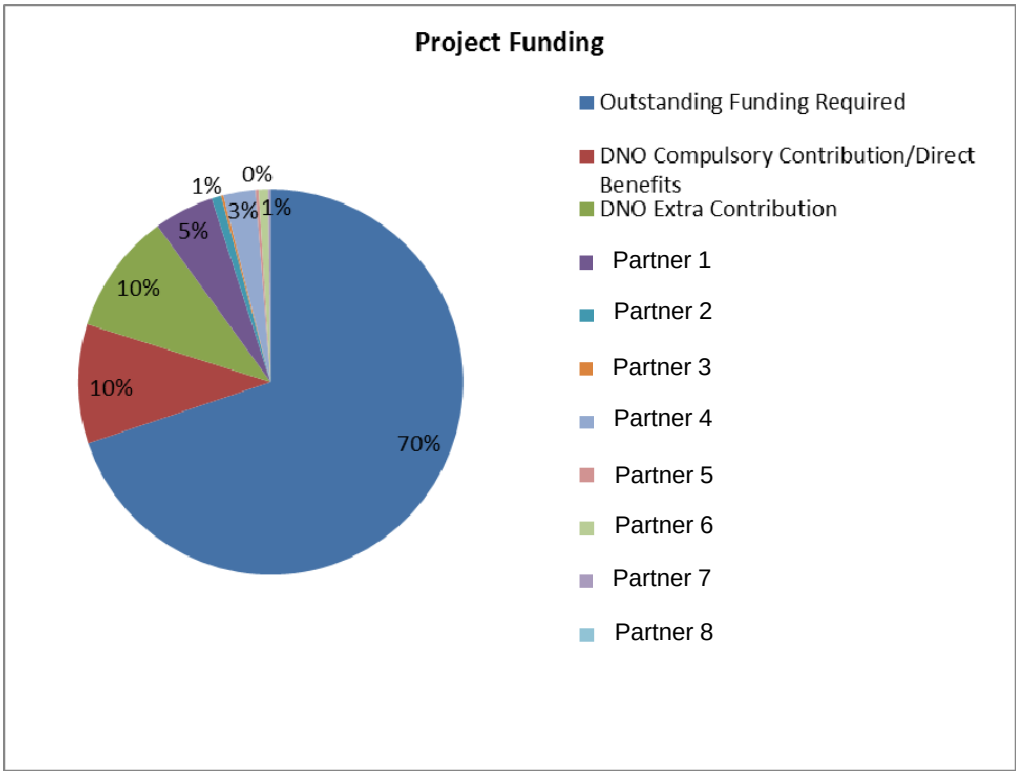
Summary

- The overall Project budget appears to be comprehensive and realistic in light of the Project's scope and objectives.
- The experimental nature of the Project is reflected in high costs of equipment in customer premises and substations.
- The FPP approach is expected to allow Smart solutions to be deployed as an alternative to EHV network reinforcement resulting in significant financial savings.
- Methods costs are based on costs of deploying Smart applications to connect 188 MW of wind generation projects in planning stage across the 700 km^2 Trial area.
- Base Case costs are based on the conventional reinforcement that would be required to connect 188MW of wind generation in the Trial area. This is understood to include replacement of four existing Grid transformers (132/33kV). Significant benefits are forecast in GB roll out to 2021 based on a conservative uptake for connection of onshore wind generation by other DNOs.

3.5.1 Project Costs

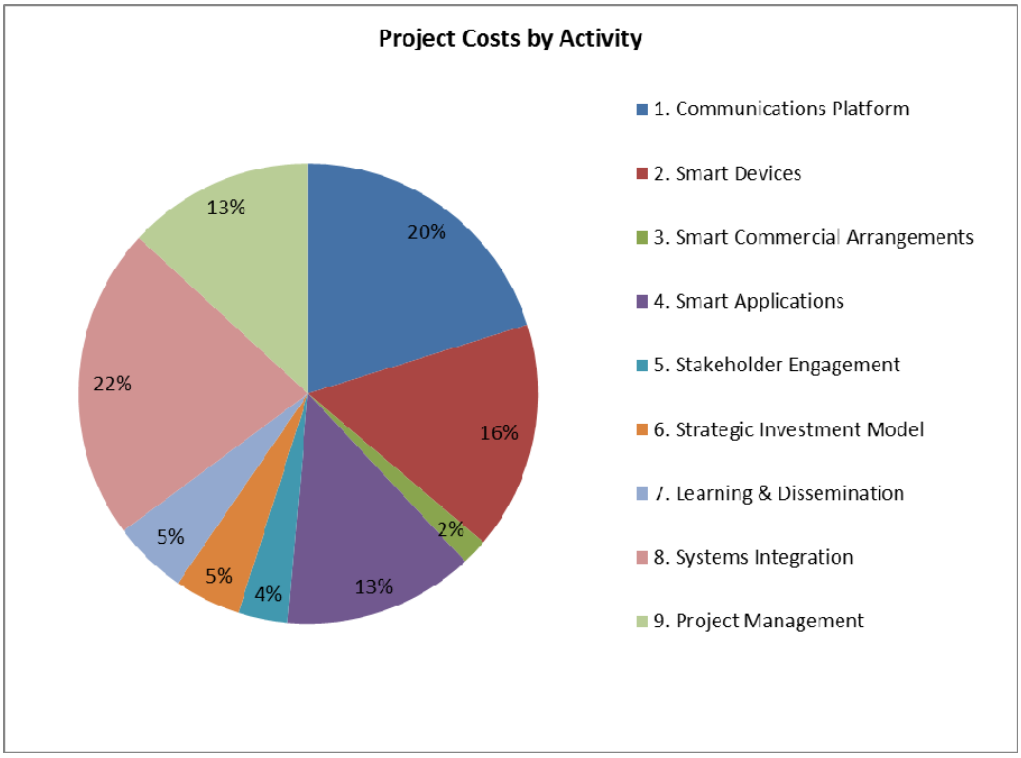
Project Funding

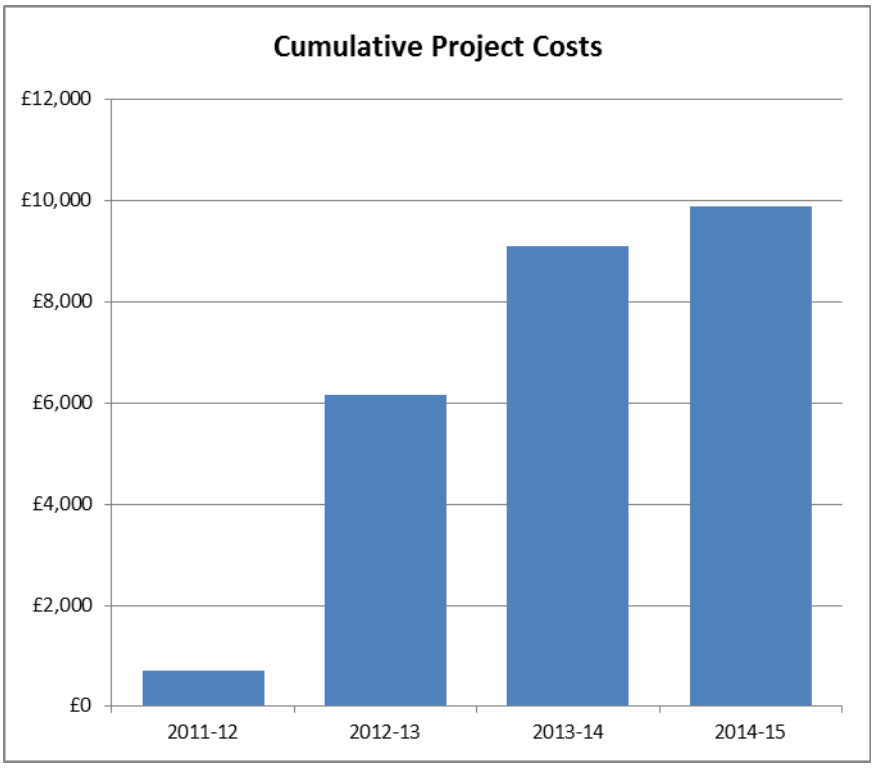
		Total
Project Participants Contribution (£'000s)	Partner 1	£499
	Partner 2	£80
	Partner 3	£20
	Partner 4	£265
	Partner 5	£27
	Partner 6	£79
	Partner 7	£20
	Partner 8	£0
	DNO Extra Contribution	£1,003
	DNO Compulsory Contribution/Direct Benefits	£989
	Outstanding Funding Required	**£6,908**
	Total Project Costs	**£9,889**



Project Costs by Activity and Year

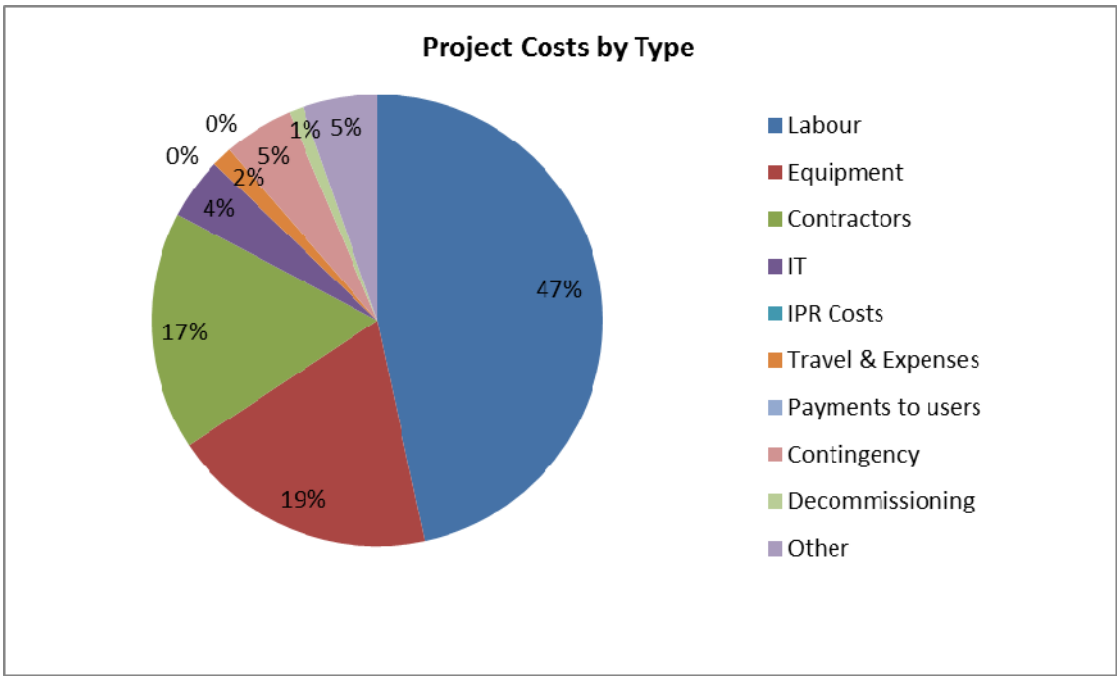
		Year				
		2011-12	2012-13	2013-14	2014-15	Total
Costs of activities (£'000s)	1. Communications Platform	£205	£1,113	£598	£78	£1,994
	2. Smart Devices	£28	£1,300	£253	£5	£1,585
	3. Smart Commercial Arrangements	£16	£70	£60	£35	£181
	4. Smart Applications	£30	£825	£430	£40	£1,325
	5. Stakeholder Engagement	£10	£150	£70	£115	£345
	6. Strategic Investment Model	£0	£231	£231	£0	£463
	7. Learning & Dissemination	£40	£165	£214	£99	£518
	8. Systems Integration	£191	£1,012	£712	£262	£2,176
	9. Project Management	£180	£588	£377	£157	£1,302
	Total	**£699**	**£5,454**	**£2,945**	**£790**	**£9,889**
	Cumulative total	**£699**	**£6,154**	**£9,098**	**£9,889**	





Project Costs by Type and Year

		Year				
		2011-12	2012-13	2013-14	2014-15	Total
Costs by type (£'000s)	Labour	£383	£2,415	£1,353	£458	£4,609
	Equipment	£50	£1,382	£454	£0	£1,886
	Contractors	£172	£1,022	£467	£28	£1,689
	IT	£35	£150	£254	£0	£439
	IPR Costs	£0	£0	£0	£0	£0
	Travel & Expenses	£9	£51	£73	£10	£143
	Payments to users	£0	£0	£0	£0	£0
	Contingency	£0	£230	£174	£90	£494
	Decommissioning	£0	£0	£0	£100	£100
	Other	£50	£205	£170	£104	£529
	Total	**£699**	**£5,454**	**£2,945**	**£790**	**£9,889**



Direct Benefits

Are the Direct Benefits of the Project realistic?
• In the UK Power Networks DPCR5 Full Business Plan Questionnaire, there was no allowance for distributed generation 'shared costs' capital expenditure as it was assumed that any costs would be recovered through connection charges. UK Power Networks will not receive any Direct Benefits in DPCR5 as a result of undertaking the FPP Project.

3.5.2 Project Costs Assessment

How comprehensive are the Project costs?
• The Project involves a total of nine workstreams including project management. • The content of the workstreams have been clearly defined in the proposal for the FPP Project and appear to be appropriate and comprehensive.

Are the Project costs realistic?
• The overall Project budget appears to be realistic in light of the Project's scope and objectives. • The total Project budget is £9,889k of which 72% relates to technical aspects of the Project (communications platform, Smart devices, Smart applications and systems integration). • £1,994k or 20% of the Project cost relates to design, installation and support of the IP communications platform in the Trial area, which will be delivered Partner 1. • Smart devices will be supplied by Partner 2, Partner 3, Partner 4 and Partner 8. This workstream accounts for £1,585k or 14% of the total Project budget. • Partner 4 will also provide systems integration and support services that account for part of the £2,176k budgeted for systems integration (22% of total). £1,208k of the systems integration budget is accounted for by equipment and contractors costs. • UKPN's cost estimates are based on receiving quotes from partners and benchmarking them where possible; previous experience on such projects; and cost comparison of certain items with Low Carbon London. • UKPN have agreed a MoU with Project partners and a set of principles of collaboration is in place with Project partners. • Project delivery and risk management will be based on industry-leading and proven UKPN delivery methodologies (based on Prince 2) and governance. • UKPN is making an additional contribution to the Project of £1,003k.

Does the Project provide value for money?
• The FPP Project aims to test the use of 'Smart' technologies and commercial arrangements to reduce costs and streamline the process of connecting new onshore wind generation. • The financial benefits are to be significant if the FPP approach is successful. • The communications and control technologies to be Trialled are generally applicable across the GB distribution network. • The Project includes the first demonstration of a quadrature booster at distribution voltage levels in the UK.

Is the Project feasible within the budget?
• The Project appears to be feasible within the total budget.

3.5.3 Assumptions

Assumption	Comment
Project costing is sufficient.	Cost build-up has been reviewed and estimates are considered to be reasonable. Wherever possible, costs have been benchmarked.

3.5.4 Cost Benefits Assessment

Financial Benefits

- The FPP approach is expected to allow Smart solutions to be deployed as an alternative to EHV network reinforcement, resulting in significant financial savings.
- Financial savings are also predicted to arise from the benefits of open standards ICT platforms including a lower level of technical specification effort, increased competition between vendors, and economies of scale and scope. FPP provides a demonstration of the open standards technologies and may accelerate uptake by GB DNOs. However competition, for example, in overseas markets would be expected to provide these benefits over time.

Non-Financial Benefits

- FPP is expected to improve engagement with renewable generation customers by streamlining the connection process.
- Technical reports on each Smart solution will be produced and made available to the DNO community.
- The Strategic Investment Module developed by the Project will inform the future network and business plans of UK Power Networks.

Method Costs

	Description		Comment
Method Costs (£m)	Communications platform	£1.9	-
	Smart devices	£1.1	FPP project will test 7 types of smart device
	Smart applications	£1.2	Design and engineering effort
	Systems integration	£0.8	
	Project management	£0.6	
	Total (£m)	**£5.5**	

Are the unit Method costs calculated on an appropriate basis and are the unit Method costs realistic?
• Method costs are based on the costs of deploying Smart applications to connect 188MW of wind generation projects that are in the planning stage across the 700 km^2 Trial area. • Cost build up correctly excludes one-off costs in FPP Project such as the development of the Strategic Investment Model. • Costs of Smart devices are lower than in the Trial to reflect reduced R&D and design costs for the quadrature booster and no costs for contractors. • Likewise costs of Smart applications are lower than in the Trial to reflect reduced pre-production costs for the quadrature booster and reduced engineering configuration time. • Method costs have been calculated on an appropriate basis. Costs will be verified by the FPP Project.

Base Costs

	Description		Comment
Base Case Costs (£m)	Replace four grid transformers	£8.6	New 90 MVA 132/33 transformers
	Upgrade existing 33 kV circuits	£6.5	Total 75.2 km overhead line and 3.2 km underground cable
	Total (£m)	**£15.1**	

Are the unit base case costs calculated on an appropriate basis and realistic?
• Base Case costs are based on the conventional reinforcement that would be required to connect 188MW of wind generation in the Trial area. This is understood to involve replacement of four of the 14 existing primary transformers, and upgrade of overhead lines and underground cables. • UKPN has applied engineering judgement and made use of informed estimates to determine the reinforcements that would be required to provide an unconstrained connection to each of the pending renewable generation customers.

Summary of Net Benefits of Roll Out

		Base Cost (£m)	Method Cost (£m)	Net benefit (£m)
Trial / Method	Trial area to connect 188 MW of wind generation	£15.1	£5.5	£9.6
	Connection of 2.1 GW of onshore wind generation over period to 2021	£169	£61	£108

Are the forecast benefits of roll out realistic?
• A forecast benefit of £9.6m by use of the FPP Solution to connect 188MW of wind generation in the Trial area appears to be realistic. • The extrapolation methodology assumes that an additional 5.8GW of onshore wind generation will be connected in GB to 2021 based on estimates in recent authoritative reports[123]. It is also assumed that this additional generation could be enabled by the FPP Project. • The ENA report "Evaluating the case for introducing location DUoS charges for CDCM generators" indicates that the additional 5.8GW of wind capacity would be supplied by 157 primary substations, equivalent to a total of about 11 projects of the scale of the FPP Trial. • The scaling factor appears to be conservative as the extrapolation based upon predicted installed power would suggest a 31-fold increase in benefits.

3.5.5 Assumptions

Assumption	Comment
Onshore wind capacity will increased by 5.8GW to 2021.	Proposal cites several authoritative reports.
All future network reinforcements required for onshore wind power would be enabled by the FPP solution.	Trial area may not be representative of GB as a whole. Different DNOs may apply different solutions.
Costs of roll out identical to those estimated in Trial area.	Portfolio of Smart devices and applications selected may not be the same as those expected to be applied in the Trial area.

[1] *Evaluating the case for introducing locational DUoS charges for CDCM generators*, Frontier Economics, April 2011

[2] *ENSG: Our Electricity Transmission Network: A Vision for 2020*, Department of Energy and Climate Change, March 2009

[3] *2050 Pathways Analysis*, DECC, July 2010

3.6 New Learning Potential

Summary

- In the Consultants' view UKPN has developed a high-level credible learning and knowledge dissemination plan that identifies the learning areas alongside the processes and responsibilities for gathering data, undertaking the analysis and managing the knowledge dissemination.
- UKPN have clearly stated that a key objective is to share the knowledge and actively influence the uptake of LCTs.
- UKPN have clearly defined the roles and responsibilities amongst the 11 Project partners regarding learning and knowledge dissemination. In the Consultants' opinion the clarity and diversity of the parties enhances the learning potential, provided that the co-ordination is effective.

3.6.1 New Learning Assessment

What is the potential for new learning?
• UKPN will Trial an integrated set of solutions to deliver a cost-effective mechanism to connect renewable generation to the existing network employing the following alternative solutions: open standards protocol; decentralised monitoring and control; a Strategic Investment Model and innovative commercial arrangements. • UKPN clearly identify the learning opportunities, highlighting the following key areas: principles of access on the development of distributed generation; implications of active network management; and the deployment and use of open standards platform based on IEC61850. In the Consultant's view, there are key learning opportunities and risks associated with a slow take-up. • UKPN anticipate building upon UKPN's existing LCNF Tier 2 Low Carbon London programme.

What are the plans for disseminating such learning?
• UKPN has defined a clear high-level plan with defined roles and responsibilities for disseminating the knowledge to the DNOs, stakeholders and government. • UKPN has provided a high-level view of the knowledge that will be created and disseminated, which includes skills sets for DNOs. The dissemination is under the control of designated parties and through a variety of communications channels. • The learning from the Trial may be delayed by systems integration issues.

What is the IP management strategy and does it deviate from the default IPR conditions? If so, how?

- Parties and stakeholders have progressed with the IPR arrangements through the Memorandum of Understanding which will be progressed to the contract stage if the application is successful.
- The treatment of the IPR complies with the Low Carbon Network Fund requirements.

Are the IP benefits to partners adequately reflected in the proposal?
• There are 11 Project Partners, each has a defined role and contributes existing expertise to the Trial and will share in the learning and benefits from the deployment of the Method. • The IPR strategy meets the LCNF default conditions, and there are some elements of the scheme that will benefit the contributors and may be applicable to other initiatives.

3.6.2 Assumptions

Assumption	Comment
The open standards platform is not compatible with the proposed Smart applications.	Identified and mitigated within the Project Risk Register.
Derogation is required.	The derogation is a critical aspect of the FP Project.
Early identification of the participating commercial customers.	This is a key criterion and learning area.

3.7 Risk Assessment

Summary

- The technical interventions do have inherent risk but are considered feasible by the consultants.
- As the Method focuses on connecting onshore renewable wind generation, it is applicable only to Generation dominated areas (GDAs) within the GB networks.
- .
- The six key risks identified by UKPN are summarised in the Project Risk table below, although each has a contingency, the consultants consider that the risk of too few renewable generators seeking connection cannot be mitigated by the UKPN activity
- The consultants understand that the Method's IP platform delivers the basic interoperability and IEC61850 compatibility there is a potential roll out risk that the detailed communications solution design may differ for the other GDA's on the GB Network

UKPN Flexible Plug and Play Low Carbon Networks				
PROJECT RISK				
Index	***Type***	***Risk***	***Mitigation Plan***	***Contingency***
1	Project	Failure to secure suitable mounting positions/ space for the communications equipment leading to lengthy negotiations and programme delay.	Yes	Yes
2	Project	Insufficient levels of RG connecting.	Yes	Yes
3	Project	Different vendor protocols/ characteristics could potentially compromise the interoperability trials which may cause delays during system integration.	Yes	Yes
4	Project	Failure of partner to obtain licence to use the communications spectrum prior to Trial commencement.	Yes	Yes
5	Project	System integration issues.	Yes	Yes
6	Project	Failure to secure suitable location for the equipment, lengthy negotiations and programme delay.	Yes	Yes

UKPN Flexible Plug and Play Low Carbon Networks				
FURTHER RISK				
Index	***Type***	***Risk***	***Mitigated***	***Contingency***
1	-Roll Out	UKPN FPP's IP communication platform to facilitate interoperability and the carriage of the IEC61850 may not be representative of all GDAs communications solution design in the GB network. .	No	Not stated