SPT2002 South Liverpool Smart Grid Trial - Addendum

Proforma box number/ Spreadsheet	**Where the latest information can be found**
Box 1 (Project summary)	**SP019** details other initiatives which will feed into the project **SP029** discusses the consequences of low carbon technology not being deployed in the trial area and how this is not perceived to be a risk.
Box 2 (Project description)	**SP027** details some of the low carbon technology which will be installed in the trial area. **SP028** and **SP030** provide a justification for the size of storage planned as part of the trial, and how it will be coordinated.
Box 4 (Derogations or Exemptions)	**SP008** clarifies the conditions under which a derogation or exemption would be requested.
Box 5 (Project Plan)	**SP020** details the responsibility for supplying PV generation
Box 13 (Successful delivery reward criteria)	**SP031** includes a revised successful delivery reward criteria.
Box 13 & Box 15 (Net benefits)	**SP021** details how the benefits of community engagement will be shared with relevant parties.
Box 17 (New learning)	**SP022** elaborates on the customer engagement planned for the project.
Box 19 (IPR arrangements)	**SP023** expands on the role of ESRI in the project.
Box 25 (Methodology)	Response to **SP024** details arrangements for specialist assistance in researching results/engagement.
Appendix E section 2.4.1	**SP025** highlights an error in the calculation of Appendix E and clarifies the extrapolation assumptions.
Appendix E section 2.4.2	**SP032** corrects an error in the calculation of benefits.
Appendix E section 2.5.1	**SP033** corrects an error in the extrapolation of net benefits relating to Advanced voltage control relays.

Low Carbon Networks Fund
Full Submission Pro-forma

In completing this proforma DNOs should consider the regulation, governance and administrative processes set out in the LCN Fund Governance Document

Section A: Project details

Project Summary

Box 1: Please provide details of the Project, the Method and Solution

Scottish Power Manweb
South Liverpool Smart Grid

Problem:

At present the adoption of low carbon and Smart Grid technology is largely restricted to small pockets of the UK in terms of both location and societal groups. Typically low carbon distributed generation is limited to rural locations and to the more affluent sections of society; with most low carbon and Smart Grid technology developments are being integrated into green and brown field developments.

In order for the UK to meet its challenging carbon reduction targets it is essential that the up-take goes beyond these applications and becomes integrated into densely populated urban locations. This should encompass existing commercial and domestic properties and be adopted by consumers across a wide spectrum of society. With this project Scottish Power Manweb (SPM) intend to deliver a benchmark scheme that addresses this crucial development key to the UK's low carbon transition.

It will address issues faced by the DNO during the retrofit of Smart Grid technology into an existing inner city network and the issues the UK is likely to face in the education and engagement of diverse urban communities with the UKs low carbon transition techniques and ideals. In doing so the project will provide key learning that will enhance the UK's low carbon transition plan.

It is expected that the development of an urban Smart Grid may create several technological and societal issues. Within the scope of this project it is envisaged that enhanced knowledge on each issue will be generated and potential solutions identified.

Technological: It is expected that the proliferation of Electric Vehicle (EV) charging points, Photovoltaic (PV) generation, Combined Heat and Power (CHP) units, Heat Pumps (HP) and Wind generation will have a significant impact on a densely loaded, low impedance urban networks and as such the following issues are likely to arise:

- Thermal Overloads
- Fault Level Rise
- Technical Network Losses
- Voltage Rise
- Harmonic Distortion
- Non-technical Network Losses

Societal: The UKs Low Carbon Transition plan is highly dependent of the acceptance and participation by the nation's population. This project will trial and report on the success of a community engagement programme developed in unison with the Smart Grid and delivered in a location that comprises of the following demographics:

- Mixed income households
- Mixed uses- commercial/public/community
- Diversity of ethnic resident groups
- Retrofit & new-build applications
- Owner occupiers, tenants and leaseholder properties
- Apartments, terraced & detached property

Solution:
The project is expected to facilitate the connection of innovative technology to reduce the areas carbon footprint through identifying:

- The capacity of the existing urban network to accept EV, PV, CHP, HP and Wind generation; to support revised design policies that will aid future connections across GB.
- The additional capacity available within the urban network to accept the technology once a Smart Grid solution is adopted. Supported by transparent policy that signals the requirement for a Smart solution and recommendations for the selection of the most cost effective to facilitate connections.
- The role energy storage can play within an urban Smart Grid to overcome technical issues incurred through the connection of low carbon technology.
- Quantification of the behavioural changes society can have on electrical usage within an urban environment.
- The identification of potential Demand Response opportunities and their potential impact within an urban network.

Method:

(i) Network Monitoring - To monitor the existing network to a level of detail not previously achievable, before, during and after the addition of renewable and low carbon generation.

(ii) Network Analysis – Observing the performance of the existing and future networks and ascertaining their capacity for each technology and potential solutions to network issues that arise.

(iii) Refined Network Policy – Detailing engineering recommendations that will expand upon the ability of urban networks to accept low carbon technology.

(iv) Network Modelling – To simulate future scenarios involving the adoption of low carbon technology in line with national aspirations.

(v) Community Engagement – To educate the community on the techniques available to them to make the transition to low carbon living.

(vi) Promotion of Low Carbon Technology – The ongoing promotion of new technology and research in the project area to the benefit of the community and the project learning.

Project:
This project will involve a trial of 54 substations being equipped with advanced equipment to monitor the low voltage (LV) network in South Liverpool. The monitoring equipment will be connected to a GPRS communication channel that will transmit the LV network data to the existing Network Management Centre (NMC) in Prenton. At the NMC the data will be processed by software platforms that will facilitate two-way communication between desktop users and the monitors for real time analysis which will be developed as part of this project.

The project will produce learning for the trial a LV connected energy storage device that will be utilised for the retention and distribution of energy from local low carbon generators in a manner that relieves network stresses and can be utilised to increase the connection of future low carbon technology.

The project will explore carbon benefits of the reduction of network losses via technical analysis and automation via Automatic Voltage Controllers (AVCs) linked to substantial generation schemes in the trial area.

As well as the technical developments in the area there will be a strong community engagement covering all ~8,000 properties supplied by the network. The initial selection of the trial area being the scope of the areas major urban renovation and regeneration programmes that will complement the development of a Smart Grid trial and visa versa. As such SPM believe that by working with local partners the project represents an excellent opportunity for a GB DNO to cost effectively develop a Smart Grid trial that is scalable and will deliver benefits to both local customers and to society in general.

Box 2: Please provide a description of the Project

Geographical Location

The project will be undertaken in the Liverpool inner city districts of Toxteth, Granby and Dingle as highlighted in **Appendix B.1**; incorporating ~8,000 properties. All three districts are primarily residential comprising of a mixture of old terraced housing, post-World War II social housing and a legacy of large old Victorian houses. Industry and commerce is primarily confined to the docks on their western borders and a number of streets running off Parliament Street.

The area has been the focus of significant regeneration investment in recent years to combat poverty and urban degradation. Such schemes have seen the renovation of much of the social housing and several streets demolished and replaced by modern housing developments, with a further 300 new properties expected during the trial.

Thanks to the ongoing efforts of several cultural and community groups there is a strong community presence in the area; the benefits of which have been demonstrated by the communities willing and enthusiasm to trial and adopt new and innovative schemes as a precursor to national adoption.

The project boundary is dictated by the topography of the 6kV (HV) network between the 33kV/6kV primary substations that support the area shown in **Appendix B.2**. The lay of the HV and Low Voltage (LV) interconnected networks and their associated substations and property connections can be seen in **Appendix B.3 and B.4**.

Smart Grid

The project aims to deliver a flagship 'Urban Smart Grid' that will provide the UK DNOs with learning for the rollout of future Smart Grid activities in major urban environments. The project merits its 'Smart Grid' title through its delivery of several of the key elements integral to most Smart Grid visions including the *"Key elements of a UK smart grid"*, as listed in Box 10 of the DECC publication: The UK Low Carbon Transition Plan, July 2009.

Key Elements:

(i) Enhanced Low Voltage Network Monitoring

The project will install advanced LV network monitoring in all 54 substations highlighted in **Appendices B.2 and B.4.** Each substation will receive an advanced network monitor that will measure and calculate multiple parameters of each phase of each LV circuit. **Appendix B.5** shows installation arrangement of equipment.

The data collected from the network will have numerous applications, firstly it will give SPM knowledge of the networks existing capacity / utilisation for low carbon technology following existing connection policy. Secondly measuring the characteristics of the LV network before, during and after the deployment of low carbon technology will allow to the construction of detailed network models that will include accurate electrical representations of each low carbon technology. The monitoring will also provide SPM with visibility of technical and non-technical network losses on the system that can be eliminated.

Networks models will then be utilised to run multiple simulations of future scenarios where the low carbon technology has escalated in line with the UKs low carbon aspirations. It is expected that the simulation results will prioritise the network issues that will arise in these scenarios and enable the trial of novel remedial techniques. The final outcome is expected to be the recommendation to modify SPM and GB DNO connection policies to enable the lower cost connection of low carbon technology based on traditional networks and Smart Grids.

(ii) Smart Grid Software

The emphasis in this project is the utilisation existing software platforms common to all UK DNOs for the processing, display and analysis of Smart Grid data. As such SPM is collaborating with the software developer ESRI (UK) for the development of their Geographic Information System (GIS) software platform to enhance their capability and enable them to bring their expertise to smart grids.

(iii) Storage

It is intended that the project will incorporate a novel trial of a 100kVA / 150kWh storage device connected to the LV network. It is envisaged that the operation of the device will be coordinated with the application of low carbon technology in the surrounding area.

(iv) Low Carbon Technology

Over the last 9-months SPM has formed a close working relationship with a number of organisations with a vested interest in the Liverpool city region; specifically its reduction of carbon emissions and its advancement in the UK's low carbon economy.

Working together it has been agreed that many of these parties will focus efforts of their low carbon activities within the project area and secure funding for the Smart Grid elements outside of the LCNF. As such it is envisaged that the Smart Grid will receive the following third party elements:

- Domestic PV schemes
- School PV schemes
- Commercial PV schemes
- Domestic CHP schemes
- Commercial CHP schemes
- Urban Wind Generation schemes
- HP schemes
- EV trials

(v) Community Engagement

As part of the project SPM in partnership with Liverpool City Council and the resident social landlord Plus Dane Group, both parties with a strong track record in similar initiatives. The partnership will undertake a 3-year engagement programme to stimulate the thoughts and actions of the community in the transition to low carbon living and the positive role of Smart Grids. The key goal will be the empowerment of the community with knowledge to make behavioural changes to their energy usage and to make beneficial decisions around the best use of low carbon technology.

It is expected that the project can bring about future changes in electrical energy usage and the communities net carbon emission. Its successful delivery will enable the approach to be used as one of the benchmarks for future urban community engagement activities across the whole of the UK (e.g. Smart Meter roll out).

(vi)Academia

It is SPMs intention to engage with local academia and academic partners as part of the project to deliver enhanced technical and non-technical knowledge learning from the project that will of benefit to UK DNOs and act as a catalyst for future research activities in this field.

Box 3: Please outline the changes which you have made to the Project since the Initial Screening Process

Does the high level Solution being demonstrated and the high level Method being trialled in the Project remain the same as that contained in your Screening Submission? Yes/~~No~~

Project Changes

The high level solution and method being demonstrated is unchanged from the initial screening submission; however some additional IT elements have been added as it was deemed that these would complement the solution being trialled. As a result additional collaborators have been introduced to facilitate this development. The additional IT elements will allow for the graphical display of data acquired in the project as well as a more robust and easily accessible solution for storing the data that is acquired. This addition will greatly assist with the dissemination of the learning from the project.

Project Costs

These should be the same amounts as detailed in the Full Submission Spreadsheet tab entitled 'Second Tier Funding Request' included as Appendix A

Total Project Cost	£ 3,608,500
External Funding	£246,000
DNO Extra Contribution	£0
DNO Compulsory Contribution	£336,250
Second Tier Funding Request	£2,920,164
Project Completion date	12/2013

Derogations or exemptions

If awarded funding, will you require a derogation, licence consent or exemption, or any change to the regulatory arrangements in order to undertake the Project or cater for contingencies? ~~Yes~~/No

Box 4: If Yes, DNOs must provide a summary of the details of the derogation, licence consent or exemption, or change to the regulatory arrangements required

Derogations or Exemptions
At this stage it is not anticipated that any derogation, licence consent, exemption, or any change to the regulatory arrangements will be required in order to undertake the project or cater for contingencies. Should this situation change then we would make OFGEM aware of such requirements as soon as this became apparent.

Section B: Project Management

DNOs must provide an organogram outlining roles and responsibilities in the Project and the organisational structure. This must be included as Appendix C.

Contact details of DNO Principle Project Manager:

Name and Title:	**Martin Hill**
Telephone:	**01698 413000**
Email:	**Martin.hill@scottishpower.com**
Address:	**New Alderston House** **Dove Wynd,** **Strathclyde Business Park,** **Bellshill,** **North Lanarkshire,** **ML4 3FF**

Box 5: Please provide details of your Project plan

DNOs should outline up to ten key milestones associated with their Project.

Date	Milestone
03/11	1. SP Smart Grid website goes live and community engagement programme starts
09/11	2. LV network monitoring installation complete
09/11	3. Initial element of PV generation installed
10/11	4. Establish communication channel with network monitoring to acquire data
11/11	5. Implementation of additional GIS module for displaying data from network monitoring
01/12	6. Specification and procurement of storage device complete
06/12	7. Installation of storage device complete
06/12	8. Automatic Voltage Controllers installed
12/13	9. Review of data acquired from Project and quantification of benefits
12/13	10. Final dissemination of learning

A full Project plan, presented as a Gantt chart, must be provided as Appendix D: DNOs must include a month by month breakdown of the activities associated with a Project; milestones, delivery of outputs and deliverables, dependencies, critical path, responsibilities, phases and key decision points.

Project Budget

DNOs must complete the Full Submission Spreadsheet tab entitled 'Second Tier Funding Request' and include it within Appendix A

Box 6: Please provide a breakdown of your total employment costs for the total Project which you are project managing and highlight where these are funded by, or provided by others

Total employment costs should include all the costs used for labour, including pensions but excluding Contractors (whose costs are detailed separately). Personnel with the same role can be grouped together

Staff type	Total Costs	Person days	Funding
Project Manager	£168,000	400	LCN Fund
Low Carbon Networks Manager	£71,000	150	LCN Fund
Senior Engineer – Engineering:1400 Man days, Internal IT: 264 Days	£700,000	1665	LCN Fund

Staff type	Total Costs	Person days	Funding
Operational Engineer	£36,000	100	LCN Fund
Industrial Resource (Jointers/Fitters etc)	£62,000	230	LCN Fund
Community Liaison Officer	£25,000	100	LCN Fund – potential for external funding from third party depending on responsibilities

Box 7: Please outline the main Equipment costs required for the total Project which you are project managing

Item description & No. of units	Function in Project	Cost per unit	Total Cost	Funding	Direct Benefit
54x LV Monitoring equipment, Rogowski coils and necessary fittings	Monitoring of LV feeders in each of the 54 secondary substations within the trial area. Monitoring power quality on each phase at LV as well as incoming supply.	£8,240	£445,000	LCN Fund, Expectation that supplier will make some contribution to software development	Minimal – Longer term benefit from understanding power flow which will reduce losses and reinforcement requirement.
Energy storage device (100kVA)– technical specification TBC	Energy storage device to be connected to the LV Network rated at 100kVA /150kWh.	£80,000	£80,000	LCN Fund	Minimal - Peak lopping and potential deferred reinforcement.
Invertor and control equipment for storage device, including other misc costs for storage	Connection of the energy storage device to the network and the control of the storage charge/discharge function. Various other costs inc monitoring, shipping, and building modifications as required.	£140,000	£140,000	LCN Fund	As above – costs for facilitating storage device.
Enhanced Automatic Voltage Control Units (x3 units)	Provide voltage regulation on the 6kV network between x3 interconnected primary transformers; taking in to account the effects of large scale distributed generation and enabling voltage reduction schemes.	£7,000	£21,000	LCN Fund	Minimal - Increased network capacity to accept distributed generation.

Item description & No. of units	Function in Project	Cost per unit	Total Cost	Funding	Direct Benefit
OSIsoft PI database for monitoring data collected in the trial	Central standalone database which will hold all information collected from monitors for the Project. Standalone system will not be used for other business purposes	£115,000	£115,000	LCN. Software development and introductory trial provided by OSIsoft (not quantified)	None
Develop analytical module utilising existing Geographic Information System	Analytical module for existing Geographic Information System to provide a user interface for staff to interrogate data acquired by monitors and stored in PI database.	£286,000	£286,000	Part funded by LCN Fund (£216,000) and part funded by ESRI (UK) Ltd, GIS provider (£70k)	None
		£	£		
		£	£		

Box 8: Please outline the Contractor costs required for the total Project which you are project managing

Contractor	Role in Project	Funding	Expected length of contract	Total Cost
Legal Assistance	Legal assistance in developing collaboration/commercial agreements with various parties	LCN Fund	3 months	£50,000
Consultant/ academic	Independent analysis of project results and quantification of resultant and projected benefits. Dissemination of knowledge	LCN Fund	18 months	£50,000
Engineering Technicians	Installation of monitoring equipment in substations	LCN Fund	4 months	£96,000
IT Assistance (Contractor in place for existing IT support)	IT assistance for the installation and testing of hardware and software to facilitate development of new GIS module for the purpose of this project, integration of GIS with other systems. Additional support throughout project	LCN Fund	36 months	£ 124,000

Box 9: Payments to users or Customers

Please outline the details of any payments you wish to make to users or Customers as part of the Project.

Type of user or Customer	Payment per User	Total Payment	Funding
No payments to customers are expected to be necessary for this project. All costs associated with customer engagement/publicity are included in Box 10 – 'Other costs'	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

Box 10: Other costs for the total Project which you are project managing. This should be categorised into the following categories: IT costs, Contingency costs, IPR costs, decommissioning costs, abnormal travel costs and costs associated with public engagement and dissemination of learning

Cost Category	Cost Item	Cost
Equipment (Other)	Misc equipment for facilitating renewables	£7,000
Contractors (Other)	Misc for installing equipment	£23,000
IT	GPRS comms for retrieving data from monitors	£30,000
IT	Misc IT Hardware and Software for PI and GIS	£66,000
IPR Costs	Nil – Legal costs included under contractors	£0
Travel and Expenses	Various travel and accommodation for project	£44,000
Payment to Users	Nil	£0
Contingency	Labour contingency	£100,000
Contingency	Equipment contingency	£140,000
Contingency	Contractors contingency	£35,000
Contingency	IT contingency	£65,000
Contingency	Other contingency	£50,000
Decommissioning	Decommissioning if necessary	£100,000
Other	Community Engagement See **Appendix 1.1**	£270,000
Dissem. of learning	Various See **Appendix 1.1**	£30,000
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Cost over-runs & Unrealised benefit

Box 11: Please detail any cost over-run you anticipate requiring for the Project and express this as a percentage of the funding you are requesting

DNOs must outline (as a percentage of the Second Tier Funding Request[1]) the level of protection they require against cost over-runs

5 %

The default cost over-run funding position has been adopted with a maximum amount of 5% being requested.

[1] In the LCN Fund Governance Document the term Approved Amount is used since the description relates to the implemented Project.

Box 12: Please detail the level of protection required against Direct Benefits in excess of the DNO Compulsory Contribution

DNOs must outline the level of protection against Direct Benefits that they wish to apply for

0%

It is not envisaged that this project will have any significant direct benefits over the course of the Project therefore no protection is required for this project.

Successful Delivery Reward Criteria

Box 13: Please set out your proposed Successful Delivery Reward Criteria

Successful Delivery Reward criterion	Evidence
Community Engagement Demonstrate successful community engagement and detail the benefits of the methods used in order that other parties may use the same techniques in future work.	• Quantify the benefits achieved from the community engagement to be shared with relevant parties, • Report on findings to inform other DNOs.
Energy Storage Demonstration and quantification of the benefits achieved from energy storage connected to the Low Voltage network.	• Development of a specification for an energy storage device which can be connected to the LV network, • Quantify the benefits/costs associated with the connection of an energy storage device connected to the LV network in a format that other parties may use, • Recommendations on the future use of such a device.
Network Monitoring Installation, connectivity and recording of data acquired from network monitoring devices. From this data, quantify current asset performance in order to influence future decisions.	• Installation of LV monitoring in all 54 HV/LV substations and collection of electrical load flow data on each LV circuit in a SPM corporate database • Report on findings to inform other DNOs future investment decisions • Comprehensive data on network performance and display via GIS.
Network Analysis and Future Network Recommendations Reporton the impact of the technologies being trialled as part of this project with recommendations on their future deployment. Recommendations on changes that may be made to design/connections policies as a result of this learning	• Detailed network models of the trial area • Verified models using actual measured data • Simulations with increased levels of low carbon technology and load scenarios to explore network issues and test a range of remedial measures • Recommend revised network connection and reinforcement policies • Report on findings to inform other DNOs

Successful Delivery Reward criterion	Evidence
Automation and Control Installation of advanced voltage control relays and quantification of the benefits achieved from this device in the form of energy/carbon saved. Publication of recommendations on the future deployment of this technology.	• Implement advanced voltage control scheme • Measured 'before' and 'after' electrical losses • Evaluate potential for increased Low Carbon Generation and Low Carbon Loads • Report on findings to inform other DNOs
Carbon Benefit Quantify the total carbon benefit realised from the introduction of all of these technologies and publication of recommendations for future smart grid projects by the end of the Project	• Publication of carbon saved as a result of this project • Projection on the benefits across GB • Recommendations to interested parties on the learning from this project

Section C – Evaluation Criteria

Accelerates the development of a low carbon energy sector

Box 14: Outline how the Solution accelerates the development of a low carbon energy sector

The UK Low Carbon Transition Plan identifies the Smart Grid as a key element in facilitating the move to a low carbon economy but acknowledges that the cost and benefits depend on a combination of technologies and their interaction. This project implements several key elements and delivers customer engagement in collaboration with partners committed to accelerating the move to a low carbon economy.

Energy Storage

- Will help regulate the network profile, reducing the need for future reinforcement and facilitate the connection of low carbon loads at convenient times for customers.
- Less reinforcement reduces the carbon emissions associated with replacing assets.
- Smoothing the demand curve locally reduces extra peak demand times which utilises high cost and high carbon generation (ref. DECC Smarter grids – The opportunity).
- The power electronics associated with storage solutions also offers opportunities for carbon savings by using it to improve network power factor.
- More EV charging could be allowed at peak times than would otherwise be the case, removing one barrier to adoption.
- Future generation/demand changes could be rapid in a localised are, therefore temporary storage could also be a requirement.

Monitoring

- Will enhance understanding of the operation and utilisation of the LV network. In turn this will identify opportunities for active management and aid the elimination of technical and non-technical losses which could again reduce reinforcement and facilitate the connection of future low carbon loads.
- Increased monitoring will reduce substation visits, allow under-utilised transformers to be switched out at non-essential times and will provide the information to review connection policies to increase the allowable capacity for low carbon technology.

Optimised Connection of Low Carbon Technology

- Taking a holistic view of multiple network connections as opposed to the current analysis to identify the cheapest connection for individual connections. Reducing the design time and network losses whilst increasing the network capacity and flexibility.

Influence customer behaviour

- Making customers aware of energy consumption at a local level with the support of the data from the monitoring exercise.

Advanced Voltage Control Scheme

- Voltage reduction across the Smart Grid and savings in power/losses.
- We expect that using an advanced automatic voltage control scheme will allow the network voltage to be reduced by up to 2% during times of low load resulting in lower consumption for resistive loads.

The carbon savings net present value to 2050 of the project if rolled out across the country has been estimated to be approximately £6.3 billion.

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

DNOs must complete the spreadsheet tab 'Net benefits' within the Full Submission Spreadsheet and include as Appendix A.

Box 15: Please provide a qualitative account of the net benefits which the Solution has the potential to deliver if rolled out across GB.

The area chosen for the Project is a discrete piece of network which is representative of a dense urban interconnected design, common to Manweb and prominent sections of network nationally. It consists of 3x 33kV/HV primary transformers interconnected at HV via a group of x54 HV/LV substations, supplying ~8,000 properties; this constitutes a large enough area to obtain meaningful results without necessitating a city wide roll out.

Monitoring the entire network within the primary transformer group allows all power flows to be monitored comprehensively in this trial. On an interconnected network electricity can reach customers via several routes; the size and scope of the project is sufficient to ensure all variations of power flow will be monitored. It also allows control groups to be used to compare the impact of actions taken under LCNF with 'business as usual'. The evaluated outcomes from the project will directly affect future customers connected to similar networks as they evolve in support of the reduction of UK carbon emissions.

This project will take place in an area of Liverpool occupied predominantly by low income families and social housing. Working with the local council and other stakeholders, the project aims to use the technology and scale of the Smart Grid, along with regeneration works planned by other stakeholders, as a key part of the rejuvenation and identity of this deprived area. The community engagement exercise proposed in collaboration with the local council and other stakeholders aims to reduce the overall consumption and maximum demand: benefiting customers via a reduction in household electricity consumption. It is expected that the Smart Grid trial will encourage the take-up of other environmental initiatives in this deprived area of the city leveraging further the impact of the funding and benefits presented here.

Benefits to customers arising from the customer engagement and facilitation of generation solutions are**:**

- Potential savings in electricity consumption due to load reduction and/or shifting energy use away from peak periods.
- Additional income for the customer through increased micro generation and the revenues associated from Feed in Tariffs.

Benefits will also be achieved from the monitoring exercise by better understanding the loading of the network within the project area. This will give an indication of asset loading which could influence future investment plans, either for reinforcement or asset replacement. This improved understanding will go some way to identifying problems in advance of failure which could improve the quality of service the customer receives and reduce the cost of the asset replacement as it is not completed under emergency circumstances.

Distributed storage on the low voltage level will also go some way to smoothing out electricity demand. This may have the effect of acting as peak plant which could defer some of the costs associated with building fast response, and quite often carbon intensive peaking plant.

Direct Impact on the operation of the Distribution System

Box 16: Explain the way in which the Project/Solution has a Direct Impact on the Distribution System

The network monitoring, communications and associated IT system will provide dynamic information on network loadings and voltage levels so that SPM's network planners can better understand the dynamic capacity of the network. This will allow:

- Revisions to connection policies to facilitate the low cost connection of additional distributed generation and environmentally friendly loads, such as HPs and EVs as SPM will have the information and visibility of power flows at LV to make an accurate assessment of the capacity available.
- The management of network risks associated with network changes such as switching off under-utilised transformers and/or reduction of network voltages at times of low demand.
- The potential reduction in losses by improving understanding of the LV Networks operation.
- Improved understanding of reverse power flows due to the potential proliferation of PV being connected in a dense network

An additional benefit of network monitoring is that SPM will be provided with information that will enable the early detection (and therefore restoration) of some network faults.

The HV and LV networks in Liverpool are run as closed rings (interconnected network). This arrangement can be found in other urban networks in the UK and creates complex power flows not seen on other open ring (radial) systems. LV monitoring is therefore an essential tool in understanding the impact of measures to reduce carbon emissions on the network dynamics.

Customer Engagement and storage both have the potential to reduce peak demand and thus avoid or defer future reinforcement and or create additional capacity for future environmentally friendly loads,

The versatile power electronics associated with the storage technologies will be used to improve the network power factor by supplying or importing reactive power during the times when the battery is not charging or discharging. The network should therefore be running more efficiently upstream of storage locations.

Intensive monitoring of the network during this project will allow the benefits of visibility of power flows at LV to be achieved but also lead to understanding of the optimum amount of monitoring that is required (particularly for an interconnected network). For example, monitoring every feeder may result in information overload, increased risk of data corruption and unnecessary cost whilst not substantially increasing the visibility of the behaviour of the network. On the other hand the right points of the network to monitor and the appropriate means to extrapolate the measurements to the whole of the network need to be understood. This understanding should minimise the cost of rolling out monitoring at LV whilst still achieving the benefits.

Due to the Project only covering an area of 54s/s, SPM do not anticipate the these direct benefits to materialise into a significant saving over the duration of the Project. For this reason, no direct benefits have been assumed. This Project will however make progress in demonstrating the potential benefits that could be achieved with a larger roll out.

Generates new knowledge that can be shared amongst all DNOs

Answers to this section should be detailed in boxes 17 to 19

Box 17: Explain the new learning which will result from a successful Project

The project will study how the use of storage, monitoring and possibility of influencing customer behaviour by engaging in collaborative partnerships with local councils, landlords, community groups and other stakeholders could all lead to reductions in demand significant enough to avoid reinforcement otherwise required due to increased use of low carbon technologies on our networks.

Much of the UK domestic load is in areas of high-density housing such as the area considered in this project. If the project is successful, the lessons of how to reduce overall consumption and/or reducing the carbon intensity of the consumed electricity can be applied and have a significant impact across UK cities regardless of DNOs geography.

Key learning will be:

- A template for forming collaborative partnerships with other stakeholders in the drive to a low carbon economy
- Successful mechanisms for facilitating the uptake of micro generation and other low carbon technologies in low income areas
- The role of a DNO in customer engagement and education (e.g. provision of network measurement information)
- Leveraging of other sources of regeneration funding by creation of a smart grid in low income areas

In terms of technologies, learning will include:

- Issues with deployment of storage on urban low voltage networks
- Optimum strategies for the use of storage to derive network and carbon benefits
- The influence of smart elements on interconnected networks
- Reconsideration of connection policies due to managed risk when intensive monitoring is employed
- Optimum voltage control strategies in dense urban networks
- The influence a DNO can have on the planning, location, connection and control of EV charging
- The optimum level of network monitoring in future smart grid roll-outs

Whilst interconnected HV and LV networks are not common place amongst UK DNOs they have validity as the testing ground for future Smart Grid networks as they represent possible future network configurations that may emerge with the integration of network automation schemes. The quantification of the capacity of interconnected LV networks (existing and Smart) to accept low carbon technology for comparison against standard network configurations is only likely to be possible in this project. Should the benefits of interconnected networks be proven the project will open the way for future DNO automation schemes and changes in network design.

A robust methodology for the evaluation of the results has been developed including:

- Comparisons of year on year demand during the project and with historical data
- Use of control groups in the smart grid area to assess the impact of measures.
- Use of questionnaires relating to use of renewable generation and customer attitude to energy use.
- The percentage increase in capacity from updated design policies extrapolated to assess additional generation that could be connected across the country.

A number of dissemination events are planned over the course of the three years of the trial for other UK DNOs and, separately for the other community stakeholders.

Box 18: Outline the arrangements for disseminating learning from the Project

Dissemination Strategy

SPM foresee that there are four key parties that the project will be need to be disseminated to:

1. UK DNOs
2. ScottishPower internal staff
3. South Liverpool Community
4. Project Partners, and any other interested parties

As such a Communication Strategy has been produced to engage with all the above parties at relevant stages of the project to provide dissemination (see **Appendix 1.1** for full details); a brief outline of each is detailed below.

UK DNO Dissemination:

(i) Project Reporting
Regular reporting of project progress against milestones, identification of issues and risks arising and proposed corrective actions.

(ii) Information Dissemination
Including project feedback to OFGEM and learning outcomes to other DNOs.

(iii) Network Model Presentation
Representation of the Smart Grid within an electrical analysis platform to demonstrate the learning's from the project.

(iv) Policy Update
Transparent documentation detailing advancement of internal policies for the connection of low carbon technology against the national standards.

(v) Project Close-Out Report
To summaries the project success against aims and objects and to capture valuable lessons learnt.

ScottishPower Internal Dissemination:

Project progress reports will be included within the corporate newsletter, team brief folders, SPM Smart Grid website and key staff will be engaged with the analysis of the projects results at several Smart Grid workshops aimed at refining and introducing ScottishPower internal policy for the connection of low carbon technology.

South Liverpool Community Dissemination:

SPM will be engaging with the community throughout the project via a number of mediums, i.e. Smart Grid website, schools programme, community group events, local press releases (as detailed in **Appendix 1.1**). Whilst the prime focus will be educating the community, it is acknowledged that there will be significant dissemination of project results at key stages. A final dissemination event is planned for Q4 of 2013 to relay dissemination of key project results / achievements and our gratitude to the community.

Project Partners Dissemination:

Existing and future project partners will be engaged on the project early in 2011 to inform them of the projects activities and goals and encourage further involvement. As the project starts to generate results SPM will inform technology providers of prevalent network issues that arise via the release of technical articles in the hope that the providers focus their technology development in the areas required by UK DNOs for Smart Grid roll out.

Box 19: Outline the arrangements for Intellectual Property Rights (IPR)

Does the Project conform to the default arrangements for IPR? Yes/~~No~~

The full implications of IPR are not yet known at this time. It is envisaged that a number of elements of the project may generate foreground IPR, in particular the generation of new functionality in some of the software for displaying data acquired over the course of the project.

If this is the case, SPM will endeavour for the IPR arrangements to comply with the default IPR arrangements as set out in the Governance Document. In the event that these do not comply, SPM will notify Ofgem in advance of entering the agreement. A proportion of funding has been identified for legal assistance in entering into formal agreements with third parties to complete this project at which time the IRP arrangements will be finalised.

Involvement of External Collaborators and external funding

Does the Project involve External Collaborators and/or external funding? Yes/~~No~~

Box 20: If you have been unsuccessful in attracting External Collaborators and/or external funding to the Project, please detail your endeavours to do so

External funding has been successfully obtained from external collaborators as part of the community engagement work and the software development. Partners involved in this work appreciate the benefits that this project may bring which is what has attracted them to bring funding to the project.

SPM will continue to seek additional funding from external collaborators over the course of this project.

Box 21: Where funding is provided by a third party that is not an External Collaborator, DNOs should provide details of the funder. If there is more than one External Funder, details of others can be included as an appendix:

Organisation name	Not Applicable
Type of organisation	
Amount of funding	
Funding arrangements	
When funds will be provided	
Conditions of funding	
Risks/uncertainties	
Details of contract or agreement	

Box 22: Details of External Collaborators

DNOs should provide details of the 6 main parties who are collaborating with them on a Project. Details of any further External Collaborators should be included as an appendix.

Organisation Name	ESRI (UK) Ltd
Relationship to DNO (if any)	ESRI (UK) Ltd is an External Collaborator and is not owned by ScottishPower.
Type of Organisation	ESRI (UK) is an IT company specialising in providing software and services associated with Geographic Information Systems (GIS). These systems help electricity distributors to manage their networks in a safe, efficient and effective manner
Role in Project	ESRI (UK) will provide IT services including consultancy, software development and system configuration. The solution ESRI (UK) plan to deliver in collaboration with ScottishPower will be based on ScottishPower's existing GIS which will be extended to provide integration with the SCADA repository so that ScottishPower's engineers can query and analyse the performance of their LV network. The GIS can facilitate data collection from a number of sources including LV network sensors, electric vehicle charging stations and field crews. This data can be analysed in a holistic way to provide important insights to facilitate transitions to low carbon economies.
Prior experience brought to Project	ESRI (UK) is the leading provider of GIS in the UK Utility Industry and an existing supplier to ScottishPower, having delivered a significant enterprise wide operational IT system over the last 3 years. ESRI (UK) has a unique understanding of utility networks and a strong reputation for providing systems that help utility companies increase operational efficiency and improve customer service. ESRI has experience of working on a number of smart grid projects which are facilitating considerable change to electricity networks around the world.
Funding	ESRI (UK) is committing 10 man days to the inception phase of this project and a further 45 man days to solution delivery subject to commitments from ScottishPower.
Contractual relationship	Yes. There are contracts in place between ESRI (UK) and ScottishPower covering software and services. It is envisaged these contracts will be extended to cover the LCN Fund Governance Document.
External Collaborator benefits from the Project	ESRI (UK) will benefit in a number of ways: • Increased knowledge and insight into low carbon networks, enabling better address of emerging needs in this area at other utility companies. • Gain a reference site at ScottishPower which could act as a showcase illustrating how GIS can be applied as a low voltage network assessment tool • Create IPR which may be of commercial benefit to us and stimulate us to actively promote similar solutions to other DNOs and utility companies in the UK and worldwide.

Organisation Name	Not Applicable
Relationship to DNO (if any)	
Type of Organisation	
Role in Project	
Prior experience brought to Project	
Funding	
Contractual relationship	
External Collaborator benefits from the Project	

Organisation Name	
Relationship to DNO (if any)	
Type of Organisation	
Role in Project	
Prior experience brought to Project	
Funding	
Contractual relationship	
External Collaborator benefits from the Project	

Organisation Name	
Relationship to DNO (if any)	
Type of Organisation	
Role in Project	
Prior experience brought to Project	
Funding	
Contractual relationship	
External Collaborator benefits from the Project	

Organisation Name	
Relationship to DNO (if any)	
Type of Organisation	
Role in Project	
Prior experience brought to Project	
Funding	
Contractual relationship	
External Collaborator benefits from the Project	

Organisation Name	
Relationship to DNO (if any)	
Type of Organisation	
Role in Project	
Prior experience brought to Project	
Funding	
Contractual relationship	
External Collaborator benefits from the Project	

Box 23: Other partners

Plus Dane Group - Neighbourhood investor (Ni)
Prominent social landlord in the area, with over 30 years' experience of working with urban and inner-city communities in the North West. As a partner Ni has the proven scale, influence and capacity to deliver schemes that meet partner aspirations and local community needs whilst maximising investment in neighbourhoods to enhance people's quality of life, opportunity and choice. Examples:

- Recycling pilot led to city wide roll out of mainstream recycling service city wide.
- Everybody On Line partnership with BT introduced 7,000 people to the web.
- Neighbourhood policing pilot adopted regionally and then nationally.
- The creation of an annual community festival attracting 29,000 visitors.

SPM will work with Plus Dane Group on community engagement in the Smart Grid trial, working with community groups, schools, partners and residents themselves to facilitate a community campaign to reduce carbon emissions and kick start generation.

Liverpool City Council
Liverpool City Council is one of the largest Local authorities in England, presiding over an area that is home to 436,000 residents, 13,800 businesses employing 226,000 people and is the economic, knowledge, transport and cultural centre, of a wider city region area of almost 2 million people, 70,000 businesses and 1 million jobs.

The City Council together with key private and public sector partners has spearheaded investment in the City which has introduced dramatic improvements in jobs, economic growth, and investment over the last decade. Key examples include the Liverpool One development, the revitalised waterfront including the Echo Arena and convention centre.

Despite the recent transformation of the City Centre significant challenges remain. Liverpool's relative economic position remains low and the City was still ranked as the most deprived local authority area in England in the 2007 Indices of Deprivation (ID2007). Liverpool City Council is committed to working with partners including Plus Dane to empower local residents to develop thriving neighbourhoods connected into the City's wealth of economic and cultural opportunities. Liverpool City Council and Plus Dane Housing have a ten year history of working in effective partnership in the South Liverpool Area to create safe, vibrant and sustainable neighbourhoods.

Participation in the South Liverpool Smart Grid trial is an opportunity for the city to bring together our low carbon economic priorities with our neighbourhood regeneration priorities to develop a unique project with wide potential benefits for local regeneration.

The Mersey Partnership
Since 1993 The Mersey Partnership (TMP) has been at the very heart of the regeneration of the Liverpool City Region, acting increasingly as the catalyst for change and pressing home the City Region's advantage as a location for inward investment. Representing over 500 businesses across the Liverpool City Region including manufacturing and trading companies, local authorities, government agencies, universities - all working together for the future economic growth by promoting the City Region as a place in which to invest, live, work and visit.

The development of a low carbon economy has been adopted by the City Region as one of four transformational actions to bring a step-change improvement to the local economy. The development of Smart Grid has been formally recognised as a vital element in this transformation. TMP developed the integrated Liverpool City Region team with Liverpool City Council and Plus Dane Group to deliver a dedicated and coherent response to SPM's Smart Grid ambitions.

TMP will promote the Smart Grid project to the wider world, providing a gateway into the project from external investors capable of delivering additional value in the project and the South Liverpool Community.

See **Appendix 2** for Letters of Intent from each of the above partners.

Relevance & Timing of Project

Box 24: Please outline why the learning from the Project is relevant to Network Operators

Network Issues
The anticipated problems integral to the roll out of low carbon technology in urban environments are predominantly those associated with the network and the constraints (voltage range, thermal capacity and fault level) introduced by the connection of PVs, EVs, CHP, HPs and Wind generation schemes that limit their proliferation.

Against the backdrop of these emerging issues there is growing pressure on UK DNOs to address the feasibility of reducing network losses without replacing assets, the ability to improve network security, whilst optimising the efficiency of network connection and reinforcement solutions.

Feed-In-Tariff
The advent of the Feed In Tariff has escalated scale and number of distributed generation schemes (particularly PV) in mature urban areas and SPM are concerned that aforementioned network issues are arising with increasing regularity and require urgent new efficient solutions. Should the present economic down turn dissipate it could be envisaged that the issues will escalate to a level beyond UK DNOs present acceptable levels and delay aspects of the low carbon transition plan. As such it is felt that the South Liverpool Smart Grid project needs to get underway quickly to inform these solutions for SPM and other DNOs.

Policy Change
Changes in SPM design and operational policies are anticipated as a direct result of the trial. Benefits would be gained through making a wider range of network solutions available in DPCR6 (e.g. more advanced network voltage control may be shown to facilitate loss reduction). In addition, benefits would still result even if the particular technology or idea trialled does not deliver the anticipated positive result or is not cost-effective as this would inform the future direction of network trials and solutions.

Interconnected Networks
Whilst interconnected HV and LV networks are not common place amongst UK DNOs they have validity as the testing ground for future Smart Grid networks as they represent possible future network configurations that may be explored with the integration of network automation schemes. The quantification of the capacity of interconnected LV networks (existing and Smart) to accept low carbon technology for comparison against standard network configurations is only likely to be possible in this project. Should the benefits of interconnected networks be proven the project will open the way for future DNO automation schemes and changes in network design.

Community Engagement
The project is timely, particularly as the project timescales are aligned with plans of partners such as the Plus Dane Group housing regeneration. The scale and scope of the projects community engagement in the area and the results it generates will provide indication of the characteristics of future networks in the advent of Smart Meters and greater customer awareness.

Local Enterprise Partnership
The project approach taken by the DNO in establishing a partnership with local authorities and businesses is similar to that of the proposed Local Enterprise Partnerships (LEPs) being advocated by the present government. The DNO insight from the partnership will prove beneficial as LEPs become more prevalent and engaged in low carbon initiatives.

Demonstration of a robust methodology and that the Project is ready to implement (answers should be detailed in boxes 25 to 27)

Box 25: Please demonstrate that the Project has a robust methodology and can start in a timely manner

Proven Technology, Communication Channels & Software
SPM's underpinning philosophy for this Year 1 LCNF project was to wherever possible utilise and develop existing proven technology, communication channels and software platforms in a novel manner in the delivery of a Smart Grid. This utilisation of existing assets has multiple benefits, it has allowed greater control of costs ensuring the project is of a high value, it has allowed SPM to draw on existing expertise in the business, but most importantly it ensures that the project will deliver results on schedule.

Prior to this submission SPM has undertaken a rigorous in-house selection of the majority of the Smart Grid elements, establishing collaborative agreements with a number of partners, identifying preferred vendors for other elements with almost only the more common elements left for the tendering process. Key to the selection of each element was the assurance that they could be supplied in accordance to our project schedule. Upon notification of success SPM would be in a position to finalise and order the vast majority of the project elements within an 8 week period.

Project Management
In readiness for being successful, SPM has begun an internal recruitment drive to identify a number of candidates with the essential experience, knowledge and skills to ensure this project is delivered.

Project Schedule
Whilst much learning is dependent on the contribution to the project by third parties, the same cannot be said for the projects initiation. Any delays by third parties in the delivering their elements will be utilised by SPM to validate the existing networks performance and the new communication and software platforms.

Proven Partners
As detailed previously, in choosing partners in Liverpool City Council, Plus Dane Group and the Mersey Partnership, SPM have selected partners not only with a shared interest in Liverpool's low carbon transition but also have a strong history of delivering large development and community schemes.

The initial selection of South Liverpool for the development of a Smart Grid was from the Strategic Technology Platform (STP) presided over by EA Technology. The case proposed for the provision of support in the development of a Smart Grid by the aforementioned partners was agreed upon by the DNOs members as being the best UK prospect for the early delivery of a Smart Grid.

Project Costs
As mentioned above, in selecting existing technology, communication and software elements SPM has been able to deliver a project budget that has a high level of certainty to it. The development costs have been forecasted for each element by persons of suitable expertise and experience.

Where elements new to SPM have been incorporated into the project (e.g. storage) SPM has estimated the financial contribution required by listening to the thoughts of industry experts and the delivery costs of similar elements elsewhere in the business.

- SPM has not under valued the contribution of the cross-section of human resources required for the delivery of the project. The estimation of these elements has been agreed upon with relevant experts in each particular field.

Box 26: Please provide details of the risks associated with the Project

SPM has identified that there are three key risks associated with the delivery of the project:

Storage
The inclusion of an energy storage device to any DNO network may create several health and safety, environmental, design, operational and construction issues that will have to be overcome prior to the devices being commissioned. Any one of these issues carries with it a significant risk to the projects delivery of this element and its associated learning.

It is for this reason SPM has not yet committed to selecting one single device for the project; instead SPM intends to carry out a thorough analysis of the short listed devices known to match the required profile. It is envisaged that this process in the first quarter of 2011 would address several of the most pertinent issues and ensure it adheres to relevant national and international standards to ensure its safety and environmental performance and ensures it would be suitable for delivery and activation within the limits of the project schedule

Third Party Smart Grid Elements
As detailed in the bid, SPM does not have the ability to fund many of the elements integral to Smart Grids, e.g. PV, EV, CHP etc. As such SPM is reliant on the delivery of these aspects by third parties who have a vested interest in their delivery. However ultimately SPM has no control of the finances of these parties and cannot dictate their actions.

SPM intend to manage this risk by ensuring the Project Management structure maintains a close working relationship with the partners throughout the project, providing necessary support to ensure they deliver the necessary elements. SPM will also actively promote the participation of additional partners capable of providing these elements and community benefits.

Community Engagement
A risk exists that despite of the best interests of the community engagement and the effort put into it by SPM and partners that it does not gain sufficient participation and/or deliver a successful outcome.

Whilst SPM has faith in the detailed community engagement strategy created in conjunction with the project partners it is appreciated that to ensure participation is achieved a level of flexibility will have to be factored into the strategy. SPM and partners intend to monitor participation and continuously strive to improve the strategy over the course of the project, seeking the input of key community figures.

Cost Over Run
A prudent contingency has been included within the costing of the project and is clearly stated within the project budget. As detailed in Box 27, a rigorous project management and reporting mechanism will be in place to monitor costs at all times.

Box 27: Please provide details of the risk monitoring procedures you will put in place for the Project

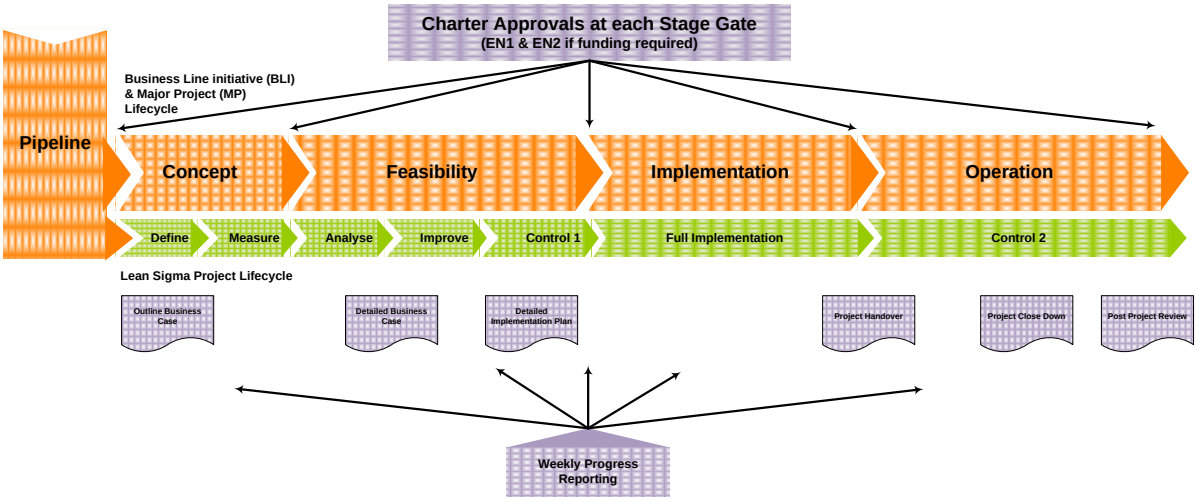
Project Monitoring Procedures and Processes

The project will be monitored through the Energy Networks Business Change Programme processes and governance model. The Change Programme is a permanent and independent function within the Energy Networks business established to monitor and deliver key strategic projects. The function is lead by the Business Change Director (who reports to the Director, Energy Networks) and is staffed by experienced project and programme managers, including a dedicated programme office service. All projects within the Change Programme are subjected to the same rigorous monitoring process which include:

- Weekly reviews of key project milestone progress (baseline against actual);
- Monitoring of key risks and issues, including mitigating actions and the effectiveness of their application;
- Monthly Steering Group meetings, attended by the Energy Networks Executive Team, were actions are logged and tracked to conclusion;
- Weekly project status reporting, including risks to scope, milestone delivery, costs and project deliverables;
- Financial reporting, including value of work against forecast and budget;
- The effectiveness of communications and stakeholder management plans; and
- Monitoring of resource utilisation, including both internal and external parties.

These robust programme management and governance arrangements are designed to ensure a high level of project success and give early warning of risks allowing both the Programme and Project Managers to identify appropriate risk mitigation measures to either reduce the risk to an acceptable level or provide Ofgem with an early warning of an unmitigated risk to the project (i.e. cost over-run etc).

Business Change Programme - Project Lifecycle



Section D: Appendices

Please list all the appendices you have attached to this pro-forma and outline the information which they provide. Where these appendices support any information provided in the pro-forma, that information should be adequately referenced

Appendix A	**Full Submission Spreadsheet**
Appendix B	**Maps and network diagrams**
Appendix C	**Organogram**
Appendix D	**Project plan**
Appendix E	**Information sources referenced in Box 14/15**
Summary	If DNOs include further information attached to this Pro-forma than that required by Ofgem then they must provide an executive summary of that information in less than 1000 words which should be attached to this pro-forma after Appendix D, and before the numbered appendices. All further details in the numbered appendices must be clearly referenced in the text in the pro-forma.
Appendix 1	Communication Strategy and Costs
Appendix 2	Letters of Intent from Project Partners
Appendix 3	
Appendix 4	
Appendix 5	
Appendix 6	
Appendix 7	