WPD Addendum

| **Proforma box number/ Spreadsheet** | **Where the latest information can be found** |
|---|---|
| Box 1 | Responses to WPD004, WPD009, WPD010 provide further clarification on scope of measurements to be undertaken and the types of low carbon initiatives being deployed under the "Arbed" scheme |
| Direct and Net Benefits spreadsheet | The response to WPD002 and WPD003 provided WPD's internal detailed spreadsheet showing derivation of direct and net benefits, information sources and assumptions made<br>WPD have only counted benefits up until 2030/31 – the rationale for this is contained in WPD response WPD008<br><br>In response WPD007 corrected an error on £ units within the submitted direct benefits spreadsheet. |
| General | Response to WPD011 provides information on numbers of customers within sampled networks. |
| Box 13 | WPD's response to the question on success criteria, posed to all applicants, is contained in WPD012 |

# 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**

'LV Network Templates for a Low-carbon Future' The Project – The UK Low Carbon Transition Plan spells out with stark clarity the importance of a transition to a low-carbon economy. In order to meet emissions targets, over 40% of electricity must come from low carbon sources by 2020. The electricity network as it stands today is well suited to centralised, high-carbon generation, such as fossil fuel power stations. However, to meet carbon targets, low-carbon generation must be brought online – but this type of generation brings challenges to the network. Low-carbon energy, such as wind, solar and wave renewables, and energy conservation measures, such as external wall insulation, bring different and varying stresses and benefits to the network as compared to traditional generation. In addition, we have little information about how these stresses actually affect the network.

The part of the network that will be most affected by these necessary changes is the low-voltage (LV) network that supplies homes and businesses. To complicate matters, the LV network is also the part of the network about which we have the least information about, or knowledge of the 'headroom' available to accommodate a low-carbon future. We do not accurately understand the impact of low-carbon initiatives on the LV network, and have little insight into the supply performance of the LV network against the European power quality standard EN50160. Therefore, we do not have a clear picture of how best to design or manage the network to meet these challenges. Nor can we tell National Grid (NG) how much UK LV microgeneration is running – having knowledge of this microgeneration will optimise the UK's spinning reserve.

Solution – The project will give WPD a view of the power flows and voltages of the LV network in South Wales, together with visibility of impacts arising from Welsh Assembly Government (WAG) low-carbon initiatives covering some 3,000 homes, and including 1,000 PVs installations. The project will compare non-stressed and stressed network locations, and thereby measure the impact of these low-carbon stresses. The project will also present NG with the 'hidden' generation available in the monitored areas, which will provide the ability to contribute to network efficiency and reduce the need for high-carbon spinning reserve generation. From the project data, Bath University will create a number of reusable network templates, based on the ENA's templates, composed of varying characteristics about the nature of the network. Ultimately, with the aid of these templates, DNOs across the country will understand, without the need for early investment, further sensor deployment or reinforcement, the characteristics of the network and its varying capabilities to absorb low-carbon stresses and changes in demand, and thus, ultimately, streamline the connection of low-carbon generation. (Please see Appendix 8 for explanation of templates). The data provided about the LV network, by this project, lies at the heart of all UK 'smart grid' endeavours. It should be the bedrock of every other LCNF project, but only WPD offers such a statistically relevant trial, utilising existing and green-retrofitted properties and sites and building on £30m of existing investment by the Welsh Government, providing invaluable network template information to other DNOs to enable them to understand their networks better, easier and more cheaply.

Method – The solution will enable 'visibility' of the LV network by installing over 8,000 voltage sensors and associated communications at over 1,000 distribution substations and over 7,000 selected 'feeder end' points (e.g. customer premises) in the South Wales area, in order to provide accurate information to assess the impacts of low-carbon stresses on the network. The project will directly involve in excess of 7,300 customers, and feature a number of partners and local housing initiatives in South Wales; the span of the network involved in the study encompasses 10% of the South Wales population. These sites/customers have been selected because of their proximity to existing and future Welsh Assembly Government 'Arbed' sites, and npower's Community Energy Saving Programme (CESP) and Carbon Emissions Reduction Target (CERT) customers, in parallel with sites that don't have a quantity of low-carbon stresses. Critically, this project is being undertaken on an existing network – vital when we consider that the majority of low-carbon impacts will not be on new network build. The monitoring equipment will also collect and provide data to NG on the quantity, availability and characteristics of the microgeneration operating on the LV network in the South Wales area, to demonstrate the feasibility of improving their load forecasting and generation scheduling. Bath University will analyse the data in order to evaluate network characteristics that will allow alignment of the network to the pre-agreed 'network templates'.

These templates form a significant part of the project, and are designed to drive benefits across GB network operators. Utilising this broad sensing array deployed by WPD on the LV network in South Wales will generate a number of templates that can be applied to the design of infrastructure across all networks, thereby avoiding or substantially reducing the need for further trials and evaluations in other regions and by other DNOs, and accelerate the facilitation of renewable generation and other low-carbon stresses network-wide. Finally, the results, and the templates, will be disseminated to Ofgem and other DNOs through the mandated channels.

Project – The project consists of WPD, along with External Collaborators npower (an energy retailer, providing access to CERT/CESP customers who have been provided with microgeneration at their premises, and whose low-carbon generation WPD will measure), and Bath University, who will conduct the data analysis. Partners include numerous microgeneration sites (e.g. housing estates or council buildings) built as part of WAG's Arbed scheme ('arbed' means 'save' in Welsh), and these are in addition to npower's customers, and are situated in South Wales.

The project timelines can be seen in the Gantt chart (Appendix D), but as a broad overview, the project is 36 months long, with sensor deployment across a 9 month period, starting in April 2011. Data collection will commence immediately, and analysis of data commence in June 2011. Closedown of the project will be in July 2013.

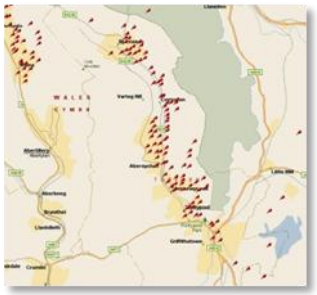
Summary - We believe WPD's 'LV Network Templates for a Low-carbon Future' project is a low-risk, cost-effective and data-rich enterprise that will benefit every DNO, regardless of their networks composition or customer profile. It will provide the UK with its first deep insights into the performance of the LV network during periods of low-carbon stresses, and the ability to characterise these through a template approach, and it will make these templates applicable, and available, to every DNO in the UK. It will generate invaluable information for NG, to inform the UK national generation scheduling and despatch through visibility of currently hidden DG. Crucially, it takes advantage of £30m of investment under WAG's Arbed initiative into 3,000 existing properties, empirically demonstrating the effects and benefits of low-carbon stresses on existing buildings and networks, not just new builds. Finally, a number of academic institutions have expressed a strong interest in the data provided by the project, with Bath University establishing a PhD as a direct result of the project (see Appendix 1). With Ofgem's grant, this data will be available to all DNOs and academic institutions GB-wide.

**Box 2: Please provide a description of the Project**

To provide further detail on the project, please find the requested sections completed below, as per the guidelines provided.

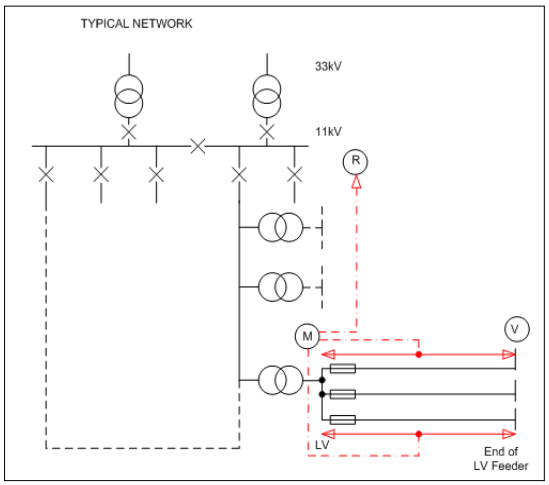
Geographical location

The project will involve substation and end of feeder monitoring at the locations marked on the maps that form Appendix B (sample shown below left), all in the South Wales area. South Wales is an ideal area in which to monitor the LV network. Not only does it composed of a large number of low-carbon stresses through the pervasive and established Arbed scheme, involving some 7,000 properties in the current programme, but it also features a varied network topology, encompassing a number of proposed network templates.

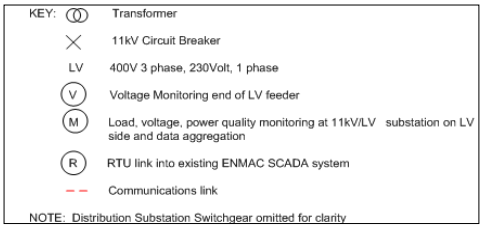


To identify which substations to monitor, WPD has first identified those in proximity to low-carbon stresses (e.g. Arbed sites). Then, these locations were chosen according to the network template they formed part of. These are: major urban retail, commercial, campus / government, major urban high density, urban commuter belt, large town, smaller town, and rural/agricultural hamlets. The number of sites monitored ensures that the test data covers a broad enough sample size and type for detailed statistical analysis. Substations *without* significant low-carbon stresses nearby have also been selected to provide a comparator benchmark, to allow meaningful comparison of the data.

Network Single Line Diagrams




A sample Network Single Line Diagram can be found in Appendix B, and shows where the distribution substation sensing will be installed in a typical network. A copy of this is shown here.




Customer Impacts

This project involves both substation monitoring and end of feeder monitoring, both of which will impact customers. Please see Box 4 for more details on the impact to customers. We note that Ofgem's definition of customer impact relates to those who are directly involved, i.e. who have WPD hardware/equipment installed in their premises. Where the project utilises the data from equipment that has already been installed this is not counted as a customer impact.

Customers have been chosen as a result of their proximity to local low-carbon generation, either in their property or where their property is situated at the end of a feeder. Some will be existing npower CERT/CESP customers with FIT (feed in tariff) generation in their property, while others will receive a voltage monitor, and WPD will liaise with the customer's supplier to arrange this.

*Substation monitoring customer impacts*
Outages for each substation and associated properties will occur to allow the installation of the monitoring, as the substation cannot be live when the installation takes place. More detail on this can be found in Box 4.

*End of feeder customer impacts*
Where voltage and generation monitors/sensors are installed at the end of the feeders by WPD, generally this will be at customer properties. These locations will be determined to be statistically important or occur in a location that can provide important network information and feedback because of local microgeneration. This will affect approximately 7,300 customers.

To mitigate both the impact of home visits and of outages, WPD has prepared a customer contact plan, that has received supplier and consumer group input, as part of a customer care programme that will fully inform customers about the intention to install monitors, scheduling details, how the monitors will impact them, and a copy of their legal obligations and of WPD's obligations to them. Customer benefits include WPD having a greater insight into supply harmonics and voltage problems at customer premises, enabling any hidden faults to be more easily resolved. This pack can be seen in Appendix 3.

In addition, WPD have identified those customers listed as 'vulnerable' who will be impacted by the project. WPD will introduce specific measures to ensure that these customers' specific requirements are met. We will follow our established, top-rated customer service processes to ensure such vulnerable customers will be fully informed about, and unaffected by, the execution of this project. Also, we are fully cognisant of section 4.7 of the Smart Metering Implementation Plan: Consumer Protection, which explicitly states the anxiety around vulnerable customers admitting installers into the home, and our impact plan will specifically address these anxieties. Also, should the code of practice for smart meter installation be in force at the time (94a/10, section 6.15) then we will follow the precepts set out in that instruction.
<u>Contractual relationships with customers</u>
There will be no new contractual relationships between WPD and impacted customers.

**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~~**

The high level solution being demonstrated and the high level method being trialled are the same. However, we wanted to bring the following adjustments to Ofgem's attention:

- The Project title has changed to 'LV Network Templates for a Low-carbon Future'.
- There have been no material changes to the solution of the original proposal. However, WAG have since supplied a detailed breakdown of Arbed site locations (including postcode), and we have therefore been able to select sites using this information. This has been released to WPD under a NDA, which prevents us from disclosing the information to any other parties. Having received this information, we now have detailed analysis of the number of substations to be monitored, resulting in the number changing. This has also had a knock-on effect to the impact of the CI/CML, which is detailed in Box 4.
- Also, because of the change in the definition of collaborative and project funding, the project costs no longer include the financial contribution made by collaborators.
- The ISP submission was predicated on using smart meters for voltage monitoring as the UK core specification included for 5-second sampling. WPD posted an enquiry on the ENA LCNF web portal requesting information from vendors about the availability of such smart meters. No current smart meter was identified but a suitable alternative device has been located, albeit at a higher cost.

## 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** | £9,017,250 |
| **External Funding** | £56,000 |
| **DNO Extra Contribution** | £0 |
| **DNO Compulsory Contribution** | £896,125 |
| **Second Tier Funding Request** | £7,847,579 |
| **Project Completion date** | 07/2013 (Final date for project closedown report sent to Ofgem) |

## 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**

As we intend to install sensing equipment within distribution substations, this will result in planned outages for customers who receive supply from these substations. Where monitoring is installed in ground-mount transformers, the outage will be around 2.5 hours. For pole-mount transformers, the outage will be around 20 minutes.

WPD estimate that the distribution substation outages will affect 107,789 customers, resulting in 15,760,800 customer minutes lost and 107,789 customer interruptions. The installation of voltage monitors within the premises of customers at ends of LV feeders involves 7,384 customers, resulting in 73,840 customer minutes lost and 7,384 customer interruptions. Without an exemption, the cost to WPD will be approximately £1.6m.

Accordingly, WPD seeks an IIS exemption to protect against CIs and CMLs. Appendix 4 provides supporting photographic evidence to support how it is not possible to install the sensing equipment while the substation is 'live', and therefore the necessity of this exemption to protect WPD from excessive damage to the CML and CI targets, as well as financial costs.

WPD would capture the CI and CML impacts of the project using specific codes which would then be auditable by Ofgem under the IIS scheme.

In the Governance document Ofgem request that the DNO details when and how they would apply for the exemption. However, because of the cost of the CI and CML impacts, WPD have stressed, and repeat so here, that this project is not viable without the exemption being granted, and consequently the decision on IIS exemption must be made prior to or coincident with the project decision.

# 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:** | Phil West, Policy Manager |
| **Telephone:** | 0117 933 2413 |
| **Email:** | pwest@westernpower.co.uk |
| **Address:** | Western Power Distribution<br>Avonbank<br>Feeder Road<br>Bristol<br>BS2 0TB |

**Box 5: Please provide details of your Project plan**

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

| Date | Milestone |
|---|---|
| 7 January 2011 | Monitor fitters sourced and contract signed |
| 25 March 2011 | Monitor fitters trained and ready to deploy |
| 1 April 2011 | All internal teams ready to support project, and commence sending customer letters |
| 11 April 2011 | Receive first batch of monitoring equipment |
| 28 June 2011 | All software installation/integration complete, ready to receive data |
| 29 June 2011 | First set of data received back from monitors |
| 27 January 2012 | All monitoring equipment fitted (substations and end of feeders) |
| 1 April 2013 | Data analysis complete / final report drafted |
| 26 June 2013 | All external dissemination complete (Bath University) |
| 24 July 2013 | Project close-down report sent to Ofgem |

**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 |
|---|---|---|---|
| Substation monitor fitters | £414,000 | 2400 (12 FTEs) | 90% LCNF / 10% Compulsory Contribution |
| WPD Planning Manager | £187,500 | 550 | 90% LCNF / 10% Compulsory Contribution |

| Staff type | Total Costs | Person days | Funding |
|---|---|---|---|
| WPD B2B External Relation Manager | £112,500 | 330 | 90% LCNF / 10% Compulsory Contribution |
| WPD B2C Manager | £112,500 | 330 | 90% LCNF / 10% Compulsory Contribution |
| WPD Project Manager | £187,500 | 550 | 90% LCNF / 10% Compulsory Contribution |
| WPD Project Management Team – 3 staff | £300,000 | 1320 (440 per individual) | 90% LCNF / 10% Compulsory Contribution |

| Staff type | Total Costs | Person days | Funding |
|---|---|---|---|
| Call centre staff to handle additional call volumes | £35,000 | 220 (FTE equiv.) | 90% LCNF / 10% Compulsory Contribution |

**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 |
|---|---|---|---|---|---|
| Data Concentrator at Substation (1 unit) | Software services to manage data concentrators. | £200,000 | £200,000 | 90% LCNF / 10% Compulsory Contribution | None |
| ENMAC updates (1 unit) | Updates to ENMAC system. | £100,000 | £100,000 | LCN90% LCNF / 10% Compulsory Contribution | None |
| Message Switching / Hub Software (1 unit) | Message switching/routing software for data. | £150,000 | £150,000 | 90% LCNF / 10% Compulsory Contribution | None |
| Enhanced FEP Software (1 unit) | Upgrade to the Front End Processor (FEP) software to communicate with devices. | £95,000 | £95,000 | LC90% LCNF / 10% Compulsory Contribution | None |

| Item description & No. of units | Function in Project | Cost per unit | Total Cost | Funding | Direct Benefit |
|---|---|---|---|---|---|
| Data Concentrator / Substation Monitoring (1035 units) | Data concentrators to send data to WPD. | £1150 | £1,190,250 | 90% LCNF / 10% Compulsory Contribution | None |
| Data Comms Hub (10 units) | Hub to carry data. | £15,000 | £150,000 | 90% LCNF / 10% Compulsory Contribution | None |
| Data Comms Using Meshed Radio type technology (5,250 units) | Communications hardware using mesh-radio. | £140 | £735,000 | 90% LCNF / 10% Compulsory Contribution | None |
| Data comms using PLC technology (2650 units) | Communications hardware using PLC. | £327 | £866,550 | 90% LCNF / 10% Compulsory Contribution | None |

| Item description & No. of units | Function in Project | Cost per unit | Total Cost | Funding | Direct Benefit |
|---|---|---|---|---|---|
| LV end voltage monitors (7355 units) | Voltage monitors in customer homes / end of feeders. | £240 | £1,765,200 | 90% LCNF / 10% Compulsory Contribution | None |
| LV FIT meter installs (545 units) | FIT meters to measure low-carbon generation. | £90 | £49,050 | 90% LCNF / 10% Compulsory Contribution | 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 |
|---|---|---|---|---|
| Monitor fitter contractors /appointment booking contractors | The monitor fitting company will arrange the appointment bookings and install the monitoring equipment in customer homes (not substations). | 90% LCNF / 10% Compulsory Contribution | 10 months | £726,800 |
| Project Management / consultancy | Project management contractors will advise on the deployment and running and control of the project, as well as troubleshoot. | 90% LCNF / 10% Compulsory Contribution | 24 months | £160,000 |
| Bath University | Bath University will carry out cross-faculty analysis of the network data to better understand network utilisation, electricity demand, voltage and load curves. From this information it will derive the applicability of the network 'templates' to the UK on a national scale. Also, Bath University are creating a 3-year PhD to develop a complementary research project as a result of the data gleaned from the project. | 90% LCNF / 10% Compulsory Contribution | 16 months | £306,000 |
| Radio site survey contractors | Site survey contractors will visit each substation and end-of-feeder point to establish the best comms solution for each site. This is critical to ensure the monitors with the correct comms functionality (BPL or mesh radio) are procured and installed. | 90% LCNF / 10% Compulsory Contribution | 2 months | £80,000 |

| | | | | |
|---|---|---|---|---|
| System testing/analysis contractors (SCADA) | Upgrades will need to be made to WPD's SCADA system in order to integrate it with the monitoring equipment. Where external contactors are required for this – specifically, GE contractors – this will be funded by the LCN Fund, but WPD anticipate that a number of its own staff will do this work in conjunction with GE. | 90% LCNF / 10% Compulsory Contribution | 1 month | £20,000 |

**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 |
|---|---|---|---|
| There will be no customer payments as a direct result of the WPD project, barring any Guaranteed Standards payments (e.g. missed appointment). | | | |
| | | | |
| | | | |

**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 |
|---|---|---|
| **IT Costs** | | **£106,450** |
| | Substation equipment mortality | £55,000 |
| | LV ends equipment mortality | £51,450 |
| **IPR costs** | None | £0 |
| **Contingency costs** | General project contingencies | £819,750 |
| **Decommissioning costs** | None – we propose to leave the equipment in situ for future network improvements | £0 |
| **Payments to Users or customers** | None | £0 |
| **Abnormal travel costs** | None | £0 |
| **Public engagement** | | **£123,200** |
| | External PR – literature letters | £10,000 |
| | External local advertising | £50,000 |
| | Customer updates – internet and mailshots | £63,200 |
| **Dissemination of learning** | In addition to Bath University's events, to cover costs of additional events throughout project | £25,000 |

## 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

If a DNO states that they would like protection against a cost over-run the default position is that the maximum amount that can be requested is 5% of the Second Tier Funding Request. If the level of protection you are requesting is not the default then please justify.

Default

We are happy to accept the default position on cost over-runs and unrealised benefits.

[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

The default position for protection against Direct Benefits is 50% of Direct Benefits in excess of the DNO Compulsory Contribution. If the level of protection you are requesting is not the default then please justify.

Default

We are happy to accept the default position on the level of protection required against Direct Benefits in excess of the DNO Compulsory Contribution.

## Successful Delivery Reward Criteria

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

| Successful Delivery Reward criterion | Evidence |
|---|---|
| Data concentrators successfully deployed. | Evidenced by communications being established with monitoring equipment and that voltage data is consistently being received |
| Back office systems upgraded and communications path to sensors proven | All ENMAC and other back office IT integration has been completed and WPD has visibility of monitoring equipment outputs |
| All sensors deployed and operational | All monitoring data processed successfully and visible to WPD |
| Data sent securely to Bath for analysis and modelling | Data received by Bath University in a manner that is applicable to statistical study |

| **Successful Delivery Reward criterion** | **Evidence** |
|---|---|
| We can identify the effects of stresses on the network from local low-carbon installations | The output of the analysis from Bath University will demonstrate these stresses |
| Bath University undertake a statistical comparison of data flows against templates | Report produced by Bath University demonstrating the templates |
| Ability to use proxy FIT meters to reflect local area generation output | Bath's statistical analysis report will demonstrate the ability to understand network headroom to absorb low-carbon stresses through using the templates |
| Provide Ofgem with a 6 monthly project review report | Acceptance by Ofgem of a project review report |

| **Successful Delivery Reward criterion** | **Evidence** |
|---|---|
| Demonstrate provision of actual live data of distributed generation to National Grid to assist them with improved forecasting and generation scheduling in the future | Data on embedded generation load on network areas sent to, and received by, National Grid, on a near-real time basis |
| Share learnings with all partners and other interested parties including Ofgem | 1. Raw data received from sensing network and embedded generation load will be provided to other parties to utilise in their network scenario models<br>2. Output analysis from Bath University shared with DNOs<br>3. DNOs use analysis to assist with network management in response to low carbon stresses and benefits.<br>4. Partipation in annual conference. |

# 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's Low Carbon Transition Plan seeks to achieve a number of changes in the UK power network to facilitate a reduction in carbon emissions through the use of renewable and low-carbon technologies, as well as decarbonising heating and transport. To support The 'LV Network Templates for a Low-carbon Future' project will provide an excellent foundation for assessing network requirements for LV-connected demands and stresses.

Firstly, the project will establish capacity and voltage 'headroom visibility' available in the LV network through the installation of voltage monitors at strategic locations – distribution substations, LV feeders, renewable generation site – to measure power and supply quality characteristics. These measurements will provide accurate information to assess the impacts of low-carbon stresses and energy efficiency measures on the network, and across prescribed network templates, that can be reused by other DNOs. This in turn will assist in the design and planning of national networks in the future, in order to accommodate large-scale renewable generation and changes in customer utilisation. Secondly, it will demonstrate the capacity to provide low-carbon generation information to NG, maximising the scheduling benefits available through FIT generation. The learnings drawn from these outcomes will accelerate the facilitation of renewable generation (and EV/HP) by providing information to produce network templates that can be applied in the design of infrastructure across all networks, thereby avoiding or substantially reducing the need for further trials and evaluations in other regions and by other network businesses.

The project will utilise BPL and low-power radio communications capabilities that provide information from the network in real-time (or near-real-time) to establish power flows and voltage impacts on the network as a result the impact of low-carbon stresses. This information will enable solutions to be developed to accommodate the needs of networks for the future; in particular, the incorporation of dynamic voltage control, demand response, smart metering, network pricing, load management and integrated generation scheduling. Through these developments it should be possible to reduce system losses on the LV network, accommodate the predicted large scale changes in consumption patterns and allow a transfer of supply from mainstream generation to larger-scale volumes of microgeneration (renewable) whilst maintaining supply quality and security.

*Carbon benefits of voltage management*
At present, the LV network is constructed to ensure that the minimum regulatory requirements (technical requirements for appliances) are delivered to all customers. In order to achieve this, a margin above the minimum is provided as 'headroom' to ensure the minimum requirements are achieved. This proposal involves installing sensing equipment at the distribution substations and feeders to provide accurate voltage readings in order to establish the amount of 'headroom' available to accommodate the demands of low-carbon stresses. The information will provide an understanding of the potential for reducing average and maximum voltage levels across the LV network. Further, the availability of microgeneration can be used to support voltage levels in addition to other power factor and quality support equipment to achieve minimum voltage and generation requirements.

Our analysis, outlined in the Full Submission Spreadsheet included as part of Appendix A, suggests that the NPV of carbon benefits associated with our solution is around £114m out to 2030.

## 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.**

A substantial challenge for DNOs in preparing for the impacts of low-carbon policies is to understand how the network will be impacted and how best to respond. Traditionally most issues on the LV network have been managed by DNOs through customer call centres for outage response, manual meter reading and provision of extra capacity to accommodate variability in loads, power quality and networks idiosyncrasies (different network topographies, customer densities etc). However, the substantial impacts expected from changes to environmental policies, increasing costs of energy resources, changes in appliances and customer requirements and the development of new technologies makes it both possible and necessary to achieve greater visibility of the LV network and thereby accommodate changes in network utilisation, cost-effectively.

To achieve these goals, however, we first need to understand the dynamics of the LV network. The project proposed by WPD will deliver the information necessary to effectively assess the current state of the LV network and its capabilities to accommodate the anticipated changes in network utilisation. This is achieved by receiving near-real time or real-time information from sensors installed across the LV network in South Wales.
The scale of this proposed project has been developed to test the ability to generate robust statistical results that can be confidently applied to the broader population with the minimum installation of equipment. The study will capture data on power quality and network impacts from microgeneration and low-carbon transition developments for the prescribed templates. To achieve this, the study has been confined to specific network assets in the South Wales region. It leverages off existing projects for microgeneration and community energy efficiency. Substations and feeders have been selected to align with microgeneration and enable sufficient impacts on the network to be recorded. The sample is also segmented by network template, with a minimum threshold of sites establishing statistical significance. This approach allows us to derive maximum benefit from other low carbon projects to expedite LCNF programme delivery and make the best utilisation of available funding. The net (GB) benefits seen are:

- Benefit from microgeneration numbers incorporated into NG schedule & dispatch
- Template re-use – WPD carrying out this work means that other DNOs need not monitor a proportion of the network, as the templates the WPD project delivers enables them to understand their network capability without costly monitoring
- Reduction in transformer failure – substation sensing gives a greater understanding of transformer cyclic loading, and can prevent overloading
- Loss reduction benefit – substation sensing will provide greater understanding of transformer load cycles that will facilitate loss reduction through targeted CBA on old transformers having higher energy loss
- Energy saving benefit – results from substation sensing templates will enable better utilisation of voltage tolerance. Results will be evaluated to calculate available headroom. Based on this, voltage on the network will be optimised resulting in energy savings
- Network deferral benefit – network templates will be used to evaluate the available 'headroom' in terms of time of day demand / voltage compliance and whether further demand and DG capacity can be accommodated. This analysis will help in integrating EV and HP capacity on the network and using this capacity efficiently in times of peak demand.

## 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 migration towards achieving electricity networks that will accommodate the future low carbon requirements will eventually lead to more sophisticated integration of communications and electricity network control. These are also likely to include dynamic interaction with customers, possibly including measures such as load control, dynamic pricing, home energy management, appliance automation, consumption feedback, energy storage, local generation and many more features. However the future smart grid design needs to be well informed based on sound technical and consumer information.

The WPD proposal builds on existing technologies to take the next logical steps towards smart grid, low carbon developments by obtaining information from the LV network regarding power quality characteristics. The communications systems chosen have been demonstrated in practice and therefore offer a lower risk proposition for the project. The customer sites have been selected to leverage off existing programmes which also enables a rapid project start and lower risk programme delivery. The information regarding network impacts will be collected under prescribed templates which will establish the robustness of these templates for broad utilisation leading to quick and practical application of the project results across other parts of WPD's network, and beyond to GB applicability. As this project will leverage off other existing programmes – CESP/CERT and Arbed, it also enables the programme to progress with significantly reduced risks of comprising customer sensibilities over data privacy and complex consumer / retailer issues.

The net GB benefits arising from the WPD proposal include the following:
*Qualitative*

- lower risk and rapid delivery
- leveraging existing projects
- Utilise templates to standardise results and guide design of future networks to;
    - Accommodate microgeneration integration, operation and placement
    - Reduce LV network loss
    - Reduce voltages on the LV to reduce energy supply requirements
    - Reduce energy supply requirements
    - Reduce the necessity of installing sensors throughout the entire network by applying templates to identify only those areas where they are most needed
- Demonstration to WPD customers that the company is focussed on their needs for the future
- Provides a platform to enable alignment between WPD and community projects

*Quantitative*

- Benefit from microgeneration numbers incorporated into NG scheduling and dispatch (£114.39m)
- Template re-use benefit (£42.04m)
- Reduction in transformer failure (£4.12m)
- Loss reduction benefit (£1.39m)
- Energy saving benefit (£13.38m)
- Network deferral – transformers benefit (£80.23m)
- Network deferral – cables benefit (£210.63m)

These figures have been arrived at utilising recognised sources wherever available, a sound methodology and erring on the side of caution.

## 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

Level of learning expected to be provided by the Project

The project will provide statistically robust data about the voltage quality in the LV network in South Wales as a variety of low-carbon stresses are applied. The project will provide National Grid with near real-time generation data from monitored microgeneration. In tandem, we expect to apply the statistical data to a number of templates, allowing other DNOs to: a) categorise areas of their networks by applying the 'template test', which will then suggest what template the area most resembles; b) understand how the area will react to low-carbon stresses and benefits, based on analysis of WPD's trial areas; c) determine whether sensors are likely to be required in their network areas based on the local template and the amount of network stressing.

The applicability of the new learning to other DNOs

Learnings from the exploration of the network template concept, and the fact that the project is based on existing built network, make the outputs of this project critical to other DNOs. Monitoring the impact of low carbon stresses on the LV network will provide further data about how different templates react under the resultant network stress. With this information, we can extrapolate these learnings to support a GB understanding of how different parts of the national LV network will respond to the integration of low-carbon technologies. This will drastically improve the network planning and deployment strategies for DNOs, and be applicable to existing networks, which form the majority of DNO infrastructure (as opposed to more limited numbers of new build that will come on-line in the future).

Explain how the learning will be captured

Learning capture will be undertaken by a specific workstream embedded in the project organisation. This workstream will be active across the entire lifecycle of the project. Knowledge capture will pertain to a number of data items and learnings: raw sensor data, which is automatically captured, outputs of Bath University's analyses of that data (which will feed into and validate/define the template work), and learnings around the operations – e.g. lessons learned from wide-scale sensor deployment, communications successes and failures, customer engagement strategies and procurement methodologies.

Detail whether the Solution requires the extrapolation of an outcome, and demonstrate the extrapolation approach is statistically and technically sound, reliable and verifiable

The solution will provide valuable data without extrapolation, however, Ofgem require the data extrapolated from the trial be calculated on a national scale. Therefore, data analysis will be conducted by Bath University, who will ensure that every element of the statistical analysis, from the sample size to the extrapolation method, is rigorous, reliable verifiable and scalable. This is supported by the concept of the networks, which provide a way of identifying how another, similar network, would perform, thus providing an extra sense check on the extrapolated data.

The robustness of the methodology of results capture / learning dissemination to DNOs

The methodology used to capture the results will be a direct and complete information feed from the sensors through the ENMAC system, ensuring no data is lost. This data will be analysed by Bath University's Energy and Environment Research team, which is also part-funding a PhD utilising the data, ensuring academic rigour and quality to the analysis. The resulting information dissemination will take place through the official channels as requested by Ofgem, as well as academic and, where appropriate, public and industry disseminations.

The treatment of IPR

The learnings will all stem from the analysis of data, the results of which will be freely distributed to DNOs and the public, as detailed elsewhere in this document.

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

WPD recognise the critical importance of knowledge dissemination with the other DNOs and academia, in order to help DNOs better prepare for the changes that may need to happen as the UK transitions to a low-carbon economy.

At the core of this project is establishing the characteristics of network templates that can be extrapolated and applied GB-wide. To support the GB dissemination, WPD will adhere to the dissemination plans as stipulated by Ofgem, including the annual presentation and the six-monthly project review report.

In addition, a major thrust of this project is the backing received by academic institutions. Bath University are proposing to disseminate the findings through a number of specific channels: academic publications, dissemination conferences (audience including regulators, policymakers, Government, industry and academic groups), conference attendance, press articles, local teaching and events and through a wealth of linked projects. Please see Appendix 1 for more information on this.

Bristol University have also shown a significant interest in the outputs of the project, with their proposal that the data will directly support their bid to EPSRC around the mathematics underpinning energy and the digital economy. Their letter of support can be seen in Appendix 5.

Therefore, working through recognised academic channels, WPD and its partners will bring an academic rigour to the knowledge dissemination, which will be driven through to other DNOs through the annual conference and the eventual availability of the network templates for DNO use. A number of other universities have expressed the need for data of this sort to underpin further academic research, and WPD will make this data freely available, while preserving customer data privacy, as all data will be anonymised and aggregated.

**Box 19: Outline the arrangements for Intellectual Property Rights (IPR)Does the Project conform to the default arrangements for IPR? Yes/~~No~~**

WPD believe that none of the outputs from the project will be subject to IPR arrangements, and therefore the default arrangements are acceptable. Bath University have baulked a little at the wording 'warrant' and prefer 'best endeavour', but we do not envisage this to be a problem.

## 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**

| |
|---|
| N/A |

**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 to this project** |
|---|---|
| **Type of organisation** | Charity, Government, Business, etc |
| **Amount of funding** | |
| **Funding arrangements** | DNOs should provide the name and description of the funding source, for example the specific fund or grant. |
| **When funds will be provided** | DNOs should indicate when the funds will be received during the Project, and how much will be received. |
| **Conditions of funding** | DNOs should set out any conditions attached to receiving the funding (e.g. matching funds, submission of progress reports) |
| **Risks/uncertainties** | DNOs should detail any uncertainty around receiving the funding or any risks identified that could mean that the funding is not received |
| **Details of contract or agreement** | What is the current status of the funding (signed contract/written agreement/nothing)? Will a contract be signed? Provide a summary of any elements that may affect/interact with the DNOs project and the funding being requested from the LCN fund |

**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** | **RWE npower** |
|---|---|
| **Relationship to DNO (if any)** | RWE npower is a wholly owned subsidiary of RWE AG. It is independent to WPD. |
| **Type of Organisation** | RWE npower is a leading integrated UK energy company which serves around 6.7 million customers and produces around 8% of the electricity used in Great Britain. RWE npower neither owns nor operates a network business, they are keen to establish relationships and to work with other DNO companies in order to contribute value to the understanding of Smart Grid operation in the UK. |
| **Role in Project** | Where npower has CESP/CERT projects in the area we will seek to use these as a platform from which to conduct trials in the domestic sector. This could include the addition of further demand reduction measures and renewable technologies where possible, beyond basic energy efficiency. |
| **Prior experience brought to Project** | Through their Energy Services business, npower has established strong commercial relationships in South Wales that has enabled them to deliver significant carbon savings to the area. npower is a main sponsor to the Warm Wales-Cymru Gynnes programme which has delivered £26M of investment into Wales. npower will use their stakeholder network to raise awareness of the trial, encourage participation and help educate end users in the benefits of Smart Grids. They will also introduce third party organisations to the project who have the technology to stress the network and provide this visibility to WPD. |
| **Funding** | RWE npower will provide the relationship and coordination with npower CERT/CESP customers and supply partners. They will also support developing customer comms. |
| **Contractual relationship** | **Will the DNO have a contract in place which ensures the External Collaborator complies with the LCN Fund Governance Document? Yes/~~No~~**<br>RWE npower and WPD have signed a MoU to cover project activities. |
| **How funding relates to benefits from Project** | Through their collaboration on the project, RWE npower seeks to gain valuable, practical knowledge in the challenges and opportunities that the development of smart grids will have on communities. They hope to use their role in LCNF to leverage additional value from the CERT and CESP activities that they will undertake over the lifetime of the project, value that will benefit both the communities within which these activities are undertaken and to RWE npower itself. The learning will help RWE npower to develop the products and services that customers will demand as the UK transitions to a low carbon economy. |

| **Organisation** | **The University of Bath** |
|---|---|
| **Relationship to DNO(if** | The University of Bath has collaborated with WPD on a number of research projects over several years in the field of power engineering. |
| **Type of Organisation** | The University of Bath was established in 1966 by Royal Charter, and is recognised by the British Government for the award of degrees. |
| **Role in Project** | Through its Dept of Electronic & Electrical Engineering and Dept of Mathematical Sciences the University will undertake statistical analysis of the data to determine 'templates' or 'clusters' that can be overlaid across the network to support better network utilisation. The aim of the research will be to develop a number of network templates and use these to evaluate the available 'headroom' in terms of thermal and voltage constraints, time of day and other network stresses as to whether further demand and DG capacity can be accommodated.<br><br>The analysis of the data will consist of two parts, starting with an initial data exploration where possible structures in the series of data will be explored using time series techniques. Loads might be expected to exhibit patterns at different temporal resolutions, e.g. seasons and days. Of particular interest will be the identification of regular patterns in the data, e.g. peaks with days and longer-term seasonal patterns.<br><br>After this first step, 'cluster analysis' techniques will be used to group series of data, for example time series of loads from substations, into groups of substations that exhibit similar patterns at a chosen temporal resolution. These groups, or 'clusters' will form the basis of the templates that will be developed based on the data and will later be compared to those templates hypothesised by WPD. |
| **Prior experience brought to Project** | The academic input from Bath will come from Dr Furong Li (Elec. Eng) and Dr Gavin Shaddick (Maths). Dr Li's experience is in all aspects of power system planning, operation, analysis and power system economics. Her network charging methodology (adopted by WPD) assisted Ofgem to reform its distribution pricing structure, formed the principle of a common charging methodology for the distribution industry winning her the 2009 Rushlight Award. Dr Gavin Shaddick is a Senior Lecturer in Statistics whose expertise is in time series, spatial statistics and their combination in spatio-temporal models. |
| **Funding** | The University of Bath will provide 50% funding (£56,000) towards a 3 year PhD studentship to be undertaken during the course of the LCNF project. The PhD will allow for additional research to be undertaken on the data set and, e.g., could relate the templates to potential needs for network investment, tariff development or even deeper interrogation of the templates/clusters for sub groups within a template. |
| **Contractual relationship** | **Will the DNO have a contract in place which ensures the External Collaborator complies with the LCN Fund Governance Document? Yes** |
| **How funding relates to benefits from Project** | The University will benefit in multiple ways from the project:<br>1. Access to real-time data. Having access to the 'real-world' data will allow the University to carry out very interesting network based research projects at both undergraduate and postgraduate levels.<br>2. The opportunity to work with industry on a research project with high impact potential and have Bath research influence potential changes within the industry.<br>3. The opportunity to produce high quality academic journal papers (co-authored with WPD)<br>4. Developing in conjunction with WPD, dissemination events to engage industry stakeholders in the research being undertaken. |

**Box 23: Other partners**

Other partners and participants in the project, but who are not contributing financially, are:

Bristol University

Please see Appendix 5 for a copy of the University of Bristol's letter of support for the project, including details of the EPSCR (Engineering and Physical Sciences Research Council) grant, to which the data from WPD's project would be invaluable.

Welsh Assembly Government's (WAG) and the Arbed scheme

Whilst not providing funding, WAG is supporting the Arbed scheme in Wales. WAG have provided to WPD the project details of over 7,000 low-carbon installations under the Arbed scheme, including details of wall insulation, PVs, EVs, solar water heating, air-source heat pumps, and other low-carbon initiatives. Some 3,000 of these installations are captured within this LCNF project. An anonymised sample of this data is provided in Appendix 6, as this data has been provided to WPD under a non-disclosure agreement.

## Relevance & Timing of Project

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

Paragraph 4.33 in the Smart Metering Implementation Programme: Statement of Design Requirements states that *'for low voltage electricity distribution networks, traditionally data about usage at domestic premises has typically been based on generic assumptions about demand levels. This is because the costs of deriving more specific information from other sources was prohibitive – essentially the low-voltage network on which homes and many businesses sit has to date been largely invisible to network operators. With the changes expected to generation and demand patterns within the domestic sector, use of generic assumptions becomes less effective.'* WPD's project addresses that specific need for greater information about the LV network, and therefore we believe that this project is extremely relevant to Network Operators. Having greater visibility of the LV network is critical to introducing renewable and low-carbon generation and storage. This project enables a rapid, cost-effective, technologically ready and effective solution to sourcing this data and providing the learnings to other Network Operators.

Because of the relatively straightforward technology and deployment characteristics, information can be gathered by the project as soon as the sensors go-live. The interfaces with the ENMAC system have been used previously. In short, strong information to inform DPCR6 will be available to WPD, and other DNOs, very quickly after implementation and the first analyses are conducted.

The project is timely for a number of reasons: the development of Government initiatives and targets, including the 2050 Pathways document, the Low Carbon Transition Plan, and various numbers around the estimated quantity of low-carbon generation and EV rollouts, all point to the requirement to have access to high-quality data about the LV network. The movement toward retail-led smart metering will introduce more information in about power quality in the home, and encourage PV and EV take-up (requiring the grid to be ready for the resultant impact) – the need to understand flows within the LV network in order to avoid reinforcement, reduce losses and understand the control requirements for managing flows. In fact, WPD are already seeing local concentrations of stress on the LV network, through the Arbed data, and many local councils are pushing through plans for, for example, greening their public transport fleets, resulting in local 'hotspots'.

The project will impact business plan submissions in future price control review periods, including DPCR6, by refining reinforcement forecasts and potentially enabling loss-reduction initiatives. Other ways in which the project will affect business planning will not be clear until results flow from the project. For example, the wider deployment of substation monitoring and FIT integration into SCADA will not be known until the outputs of the study have been delivered and subject to wider debate with Ofgem and other parties. The Planning Manager, part of the project LCNF team, will be used to draw together the project learnings related to planning policy and implement them. Finally, as part of relevance and timing, the project is future-proof – particularly, the installing of monitoring in the substations will provide a communications backbone that could subsequently be utilised for grid management. The project is not sensitive to technology developments, and thus exhibits less risk for that.

## 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

The project has a robust methodology and can start in a timely manner, demonstrated by a number of critical activities and factors:

- WPD's relationship with npower is a sign of supplier commitment, particularly the signing of a Memorandum of Understanding (MOU-see Appendix 2 for a copy of this)
- Logistics around procurement and deployment have already been put in place (see Appendix 7 for evidence of establishing installation costs of monitors), and ITTs are ready to be issued for each component of the solution that require one
- The underlying IT is present at WPD, and so there are minimal integration costs
- The templates that will be used to assess network characteristics already exist and so are both accepted by the energy community and some of the effort to define them has been done (at a high level)
- The technologies employed (monitors / communications) have been demonstrated elsewhere (but not in the UK nor in this capacity)
- The WPD board has approved the hiring of LCN Fund project managers to oversee the project, should it receive funding
- The partners involved (primarily through WAG) are operating independently of the LCN Fund, reducing project complexity and risk, and allowing the project to achieve cost savings by 'piggybacking' on their schemes.
- A customer communications pack has already been put together with consultation from Consumer Focus and the supplier community for appropriateness
- We have utilised the Ofgem/LCNF sharepoint to reach out to external vendors around the best technology for our solution (the only DNO to do so, at the time or writing)
- The methodology is robust because the solution is relatively straightforward – the technology exists and the monitoring and integration with existing WPD hardware and software has been done previously. However, the LCN Fund allows WPD to reach a wide spectrum of microgeneration sites and substations, providing a far greater opportunity for learnings for other DNOs.
- A trial conducted by WPD last year in Pontypool established the feasibility of installing monitoring in substations to measure voltage levels – albeit at a far smaller scale that the proposed LCN Fund project. However, it provided valuable learnings for this project and has proven the technology and deployment.
- There is naturally variability in the time (and therefore cost) of undertaking individual installations. However, we have based our estimate on the best knowledge of current market pricing and we have experience of such operations through our Pontypool IFI experience
- We have investigated the arrangements to set up the project bank account

The costs and benefits of the Project have, in WPD's opinion been reasonably estimated: the unit costs are easily quantified, while the nature of the project mean their number (established at the outset) are circumscribed and very unlikely to increase. This provides a stable cost base. The solution is seeking to capture known information (e.g. volts/VAR) – the difference is that this project is capturing them from an LV perspective. Finally, the business case is built upon a solid evidence base: *Benefits of Advanced Smart Metering for Demand Response based Control of Distribution Networks,* Imperial College, London; ENA; SEDG, *Carbon Appraisal in UK Policy Appraisal: A revised Approach, National Renewable Energy Action Plan for the United Kingdom, Article 4 of the Renewable Energy Directive 2009/28/EC, The Cost of Generating Electricity*, PB Power; Royal Academy of Engineering, *ENSG: A Smart Grid Vision CBA*, ENSG and DECC, *Digest of UK Energy Statistics (DUKES) (last updated 29 July 2010),* DECC, Unit Costs from Table 17 of the December 2009 Ofgem DPCR Final Proposals, GB asset counts aggregated by Ofgem from Table T4 of DPRCR5 FBPQ Submissions, James Hope.

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

Key delivery risks, and their associated mitigating factors in the contingency plans:

| ***Risk*** | ***How mitigated or featured in contingency*** |
|---|---|
| *Technical risks* | |
| GE capacity to meet DNO demand, given all DNOs utilise GE products at some point | Opened dialogue with GE to establish development window – in-house teams to supplement shortfall, using existing knowledge |
| Monitor specification not supporting requirements | Speculative tenders have been issued to several monitors manufacturers already, to establish monitors will read/record voltage |
| Integration with NG systems not been tried before | Will establish relationship with NG technical teams and a small working group to implement data integration and comms |
| *Delivery risks* | |
| Skills shortage of contractors to install the required number of monitors | Speculative tenders have been issued to several meter operators, and go/no-go agreements will be in place pending Ofgem decision |
| Project learnings not conclusive or disseminated | Ensure robust project methodology (processes, data capture, data analysis) and embed learnings workstream into project plan |
| *Financial risks* | |
| Cost of CI/CML 'hits' prove prohibitive | Agree exemption with Ofgem before funding decision made |
| Cost of components increases over project lifetime | Fix price of hardware at first procurement |
| Funding from External Collaborators falls through | Financial exposure is limited |
| *Political/external stakeholder risks* | |
| Non-cooperation at microgeneration sites, perhaps due to contractual breakdown | MOUs agreed with key partners / participants ahead of Ofgem go/no-go decision |
| Non-starting or non-availability of key WAG schemes, reducing data quantity | Monitor sufficient locations to make negligible the dropping out of small numbers of participants (currently over 3,000 participants identified) |
| Wide-scale customer refusal of FIT/voltage monitor install | Ensure customer comms plan is rigorous and complete. Ensure Consumer Focus 'vet' the customer communications for seal of approval |
| Bath University does not produce suitable modelling from data | Sample data has been ordered and the outputs tailored based on this, ensuring correct outputs |
| Non-availability of WAG/Arbed data on potential projects | Obtained in advance of project start |
| | |
| *Internal stakeholder risks* | |
| Two internal support teams (Records and Customer Contact teams) not ready for go-live | Implement robust training, change and re-engagement processes to 'on-board' new teams successfully |
| Management unsupportive of ongoing project value | Rapidly produce results following sensor installation and hold regular monthly stakeholder meetings to ensure alignment |

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

Risk monitoring is a part of a larger risk management process, and involves a systematic approach to identifying, evaluating and mitigating risks, taking informed decisions and analyses of potential outcomes, and proactively identifying, transferring, avoiding or controlling risks where possible. This active risk management will continue throughout the life of the project.

Project monitoring procedures and processes

***Identify and Classify Risk*** - Identifying risks will be the responsibility of every team member on the project. The identification of risks occurs throughout the project lifecycle, and risks will be recorded on the WPD LCN Fund shared drive risk log. At the point of identifying the risk a title, brief description, the source and category of the risk, and the risk owner will be documented. The risk will also be categorised: resources, equipment, financial, contractual, scope, solution, hardware/software, and for any of these, internal/external.

***Analyse the Risk -*** Once a risk has been identified, the team member who identified the risk should determine as much detail about the risk as possible. To do this they will consider a number of characteristics, such as impacted area, risk handling approach, risk owner, risk impact and likelihood, mitigating actions, status, escalation, final resolution, and estimated value of risk (£). All risks documented in either register will be scored in three areas: Estimated Value of Risk; Impact; and Probability of Occurrence. These categories provide a framework for determining risk mitigation opportunities and actions. For example, the higher the risk on the scales the more planning that should be done up front.

***Determine Approach to Identified Risk -*** The initial approach to the identified risk will be proposed by the risk identifier. This will then be reviewed and updated by the Risk and Issue Management Board and team leads. The actions will be documented in the mitigation field in the risk log, with responsibilities assigned. Risks will be prioritised according to risk exposure. The highest priority risks (exposure greater than 16) will be discussed in the Risk and Issue Management Board meetings and logged in status reports.

***Track Risks*** – Risks will be tracked through the WPD LCN Fund shared drive risk log which the PMO will coordinate with the workstream leads to update on a bi-weekly basis. The PMO are responsible for ensuring that when a new risk is added sufficient detail is included and that all risks are being progressed in a timely fashion. Risks and their status will be tracked at the weekly Team Meetings and risk metrics are reported on a monthly basis.

***Mitigate Risk –*** Actions to mitigate each risk should be determined firstly by the team member that has identified the risk and will then be discussed (and where necessary updated and prioritised) with the Team Lead at the relevant team meeting. The mitigations will follow one or more of the following strategies: Investigation, Accept, Avoid, Transfer, Mitigation, Share.

Following this strategy will ensure that the project anticipates risk and has the governance structure and plan in place to meet them. Should escalation to Ofgem be required, perhaps having identified that a suspension may be necessary or a cost over-run will need to occur, this escalating will be done transparently and in a timely fashion.

# 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 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** | University of Bath letter of engagement and support, and their data analysis methodology |
| **Appendix 2** | Memorandum of Understanding between WPD and npower |
| **Appendix 3** | Customer communications pack |
| **Appendix 4** | Installing monitoring in LV substations |
| **Appendix 5** | Support letters – University of Bristol / WAG |
| **Appendix 6** | Sample extract of Arbed data (anonymised) |
| **Appendix 7** | RFQ issued to monitor installers re the installation of voltage sensors at end of feeders / Provisional design of end-of-feeder voltage monitors |
| **Appendix 8** | An overview on the concept of network templates |