WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

Date of Submission

01/04/2015
Amended 16/04/2017

NIA Project Registration and PEA Document

Notes on Completion: Please refer to the **NIA Governance Document** to assist in the completion of this form. Please use the default font (Calibri font size 10) in your submission. Please ensure all content is contained within the boundaries of the text areas. The full-completed submission should not exceed 6 pages in total.

Project Registration

Project Title		**Project Reference**
Losses Investigation		**WPD_NIA_005**
Funding Licensee(s)	**Project Start Date**	**Project Duration**
Western Power Distribution (East Midlands) Western Power Distribution (West Midlands) Western Power Distribution (South West) Western Power Distribution (South Wales)	Apr 2015	3yrs 4mth (July 2018)
Nominated Project Contact(s)		**Project Budget**
Chris Harrap - WPD Innovation & Low Carbon Engineer		£2,580,000

Problem(s)

Distribution Network Operators have an obligation to operate efficient and economic networks. As such the effective management of distribution losses is paramount. Current estimates put the technical losses at between 5.8% and 6.6% of electricity delivered ("Management of Electricity Distribution Network Losses" IFI report) worth approximately £900 million across the UK. Approximately £640 million of these losses occur after transformation down to 11kV.

Some improvements with clear cost benefits across the network are being rolled out, as outlined in WPDs losses strategy, however these are restricted to broad brush techniques due to a lack of detailed understanding of the distribution of losses across our network. As such reductions in losses cannot be targeted and the network cannot be optimised.

Method(s)

This project will fully monitor several LV and HV feeders to measure all the in-feeds and out-feeds to the networks. This will enable us to gain a much fuller understanding of flows on the feeders as well as determining network losses. We will also investigate the causes and effects of certain loss influencing parameters such as imbalance and power factor.

The monitored feeders will enable us to build a reference for different loss estimation models which will be developed using restricted data sets. These models will predict the losses using data such as customer types and circuit length and will be compared against the reference allowing us to understand the importance and value of the data. The comparisons will allow us to determine the minimum information needed to assess network losses accurately.

Scope

This project aims to further our understanding of technical losses on the distribution network and help us target them in a cost effective manner. As 72% of technical losses occur on the HV and LV networks, these will be the focus of the project. Losses before the feeder circuit breaker, beyond the meter as well as non-technical losses will not be investigated. The initial investigations will cover the effects of different loading types and patterns on the various networks, determining their effects on losses and where they are most prevalent. This will be incorporated into an initial losses model to test our understanding against the measured values. The second stage of the project will move to predicting losses with reduced data sets. The accuracy of these predictions will be tested against the measured values. This will allow us to determine the minimum information required to target losses and help create the template for a losses register.

Objective(s)

1) Understand technical losses on the LV and HV network
2) Determine the minimum information to accurately predict network losses

Success Criteria

1) Construction of fully monitored HV and LV networks
2) Measurement of network losses on monitored feeders
3) Accurate modelling of losses with full information
4) Several models with limited data sets created and tested
5) Conclusion on level of information needed to accurately predict losses

Technology Readiness Level at Start	Technology Readiness Level at Completion
6	8

Project Partners and External Funding

Manx Utilities

Academic partners (TBC)

Potential for New Learning

The installation of fully monitored LV or HV networks hasn't been done on this scale in the UK. It will allow us to better understand the flows in our network as well as the losses. It should also help us fully understand the effects of different parameters such as imbalance and power factor on losses. The high granularity of the monitoring equipment will also allow us to investigate previous miss-understanding of losses due to averaging effects.

The development of the prediction models will allow us to transfer this improved knowledge onto our unmonitored network and enable a targeted reduction in losses.

Scale of Project

The project has been sized to optimize learning whilst minimizing costs. The range of feeders monitored has been chosen to cover most typical network types to enable the learning to be as broadly applicable as possible.

Geographical Area

The project will take place in two distinct areas.

The investigations into the HV network will build on the monitoring network installed as part of WPDs FALCON project around Milton Keynes.

The LV investigation will take place on the Isle of Man. This has been chosen as it is representative of the UK networks whilst avoiding any interference with the Smart meter roll out. The vertically integrated structure of Manx Utilities will also facilitate the installation of equipment at domestic premises.

Revenue Allowed for in the RIIO Settlement

NIL

Indicative Total NIA Project Expenditure

£2,322,000

Project Eligibility Assessment

Specific Requirements 1

1a. A NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

A specific piece of new (i.e. unproven in GB, or where a Method has been trialled outside GB the Network Licensee must justify repeating it as part of a Project) equipment (including control and communications systems and software)	☐
A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)	☒
A specific novel operational practice directly related to the operation of the Network Licensees System	☐
A specific novel commercial arrangement	☐

Specific Requirements 2

2a. Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees ☒

Please answer one of the following:

i) Please explain how the learning that will be generated could be used by relevant Network Licenses.

The learning from this project will allow all network licenses to assess the data needed to evaluate losses. This will facilitate the targeted reduction of losses across the UK. The feeders monitored in the project will be selected to cover most typical network types allowing the knowledge gained to be as broadly applicable as possible.

ii) Please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the Project.

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This project will help fill the significant gap in our data and knowledge of network losses as specified in section 6.8.7 of WPD's innovation strategy. The project also addresses section 8.1 of WPD's losses strategy, increasing our understanding of losses

Is the default IPR position being applied?

Yes	☒
No	☐

If no, please answer i, ii, iii before continuing:

i) Demonstrate how the learning from the Project can be successfully disseminated to Network Licensees and other interested parties

ii) Describe how any potential constraints or costs caused, or resulting from, the imposed IPR arrangements

iii) Justify why the proposed IPR arrangements provide value for money for customers

2b. Has the Potential to Deliver Net Financial Benefits to Customers ☒

Please provide an estimate of the saving if the Problem is solved.

This project should allow us to accurately target the most economically viable mitigation techniques allowing us to reduce losses where action presents a net benefit.

If 10% of distribution losses after transformation to HV were reduced with a 10% lifetime saving this would equate to a saving of £1.61 million per year in terms of direct energy savings and £896 thousand per year in terms of carbon reduction.

Please provide a calculation of the expected financial benefits of a Development or Demonstration Project (not required for Research Projects). (Base Cost – Method Cost, Against Agreed Baseline).

The base cost for the reduction in losses is to do nothing.

From the Digest of UK Energy Statistics 2014 (DUKES) the final electricity consumption across the UK was 317TWh in 2013. Of this approximately 25.2% or 83.7TWh is consumed within WPDs network. With the conservative figure of 5.8% losses in the distribution network this means that 4.64TWh is lost on WPDs network, of this approximately 3.34TWh (72%) is lost after transformation down to HV. Using the Ofgem value of £48.42/MWh this is worth £161.9 directly with a further contribution of £103 million from the value of the carbon emitted generating it (figures of 524.62 TCO2/GWh and £59/TCO2 was used from the NIA benefits guide)

Base cost = £161.9 million+ £103.5million=£265.4million per year

If we can target losses and reduce 10% of the technical losses on the LV and HV networks with a saving of 10% then the method cost would be:

Method cost = (1-0.1*0.1)* 265.4= £262.75 million per year

This gives a financial benefit in WPDs network of £2.65 million a year

Financial benefit = 265.4-262.75= £2.65 million per year

Please provide an estimate of how replicable the Method is across GB in terms of the number of sites, the sort of site the Method could be applied to, or the percentage of the Network Licensees system where it could be rolled-out.

The feeders monitored in the project shall be selected to cover most typical network types. These will be chosen to cover a range of IIS 11kV circuit types and different LV templates found in the "LV network templates" project. This should insure that the learning is as applicable as possible.

Certain circuit types have not been included in the investigation as the monitoring costs would be too high or the benefits too low. These exclusions have been kept to a minimum with only 8.86% of HV circuits and only LV template 10, "Public lighting", discounted.

Please provide an outline of the costs of rolling out the Method across GB.

Across the whole of the UK the losses in distribution networks after transformation down to HV equates to approximately 13.24TWh, or £1.05 billion per year. If the above savings, 10% reduction for 10% of losses, were scaled up across the UK the benefits would be £10.5 million per year

2c. Does Not Lead to Unnecessary Duplication ☒

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

This project is building on learning from the IFI "Management of electricity distribution network losses" project. It will add real measurements to help refine the assumptions in the report and help implement some of the conclusions.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

N/A