WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

Date of Submission

August 2016

NIA Project Registration and PEA Document

Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.

Project Registration

Project Title	**Project Reference**
Industrial & Commercial Storage	NIA_WPD_021

Project Licensee(s)	**Project Start Date**	**Project Duration**
Western Power Distribution East Midlands, Western Power Distribution South Wales, Western Power Distribution South West, Western Power Distribution West Midlands	Aug 2016	2 Years 8 Months

Nominated Project Contact(s)	**Project Budget**
Faithful Chanda – fchanda@westernpower.co.uk	£1,144,000

Problem(s)

With the growth in all types of low carbon generation, such as wind and solar PV, and the introduction of new demand technologies such as EVs and HPs, WPD's electricity network is expected to see unprecedented swings between peaks and troughs of energy usage in localised areas. Part of WPD's approach to this challenge has been to look at new and more flexible ways to design, optimise and manage the network in the future. In the past, network operators have used conventional reinforcement to deal with constraints.

Network reinforcement can be too expensive and time consuming to respond to LCT connections into the LV network. Due to uncertainties in volume, location and type of LV connections, it is not always possible or efficient for WPD to plan network reinforcement ahead of need. However, when the need does arise, network reinforcement is too costly and can take too long to deploy, delaying customers' connections to the network. Storage is an opportunity to help and not to hinder. Through this project it may become possible to develop Alternative Connections for Storage that would operate in a grid friendly way thereby giving customers more connection options. Storage connections will require technical policies to be drafted.

The deployment of Storage devices will provide incentives to I&C Customers through overall reduction in power consumption. Customers would receive offsetting reductions in retail electricity costs from storage in the form of deferred investments, refunds from the wholesale market auction proceeds, and reduced power purchase costs, triad avoidance and lower future DUoS charges due to the reduced reinforcement requirements. Customers would additionally benefit through increased system reliability from avoided distribution outages. Other customer benefits include improved power quality and customer-side renewable energy usage.

Method(s)

Through the tendering process, a suitable storage partner for the project will be identified. The project will be delivered in seven overlapping stages defined in three work packages:

1. Selection of the areas for the trial;
2. Identification of the type and size of the storage devices;
3. Mobilisation (procurement of equipment and services);
4. Trials or field tests (install equipment);
5. Connection Agreements

6. Policy on depot equipment;
7. Analysis and Close Down (Analyse results, evaluate I&C Storage solution)

Scope

The battery energy storage trial will initially be conducted at 4 separate WPD depots. In order to test different configurations and better understand the benefits of this project, the locations have been selected with consideration of size, network complexity and occupancy. Also to minimise the risk, it would be ideal to run the project in our own depots. This project will provide improvements in cost efficiency, customer service, reliability, and the environment and will deliver more options for customer connections, derive and design new technical policies and render grid services. Deployed systems will be used to optimise the energy demand of buildings, provide demand–response to the TSO, and to firm up intermittent generation particularly at sites with intermittent generation.

The three work packages for the delivery of this project are:

1. Review of technologies & contracting time (6 months)

This involves a comprehensive understanding of different technologies and ease of application. Through the tender process, as part of this work package, a number of developers will be asked to provide information on their equipment capability including their benefits and limitations, the installation, operational and repair procedures and their capital and operational costs.

2. Detailed design of trial and experiments (12 months)

In this work package, four sites for the possible installation of a trial in WPD's network will be selected. Detailed design and modelling will be undertaken to justify the selection of each site, explain the installation procedures and requirements. The trial will conduct various tests, measurements and configurations. The results from the trial will be examined in greater detail with a view to understanding the benefits of installing storage facilities in and around I & C premises.

3. Learning overview and recommendations (6 months)

The final work package will provide an overview of the learning that was captured in the previous two stages of the study. The trial will conclude with a suite of recommendations on the operation, safety, and maintenance of storage devices and response to faults. The final outcome of this project will form the basis for new technical policies, customer propositions and connection agreements.

4. Contingency (6 months)

Some additional time in case there is a requirement to include some more field trials and demonstrations or the project fails to deliver on time.

Objective(s)

Investigate the use of I&C storage on WPD's network in order to:

1. Defer Investment - Network reinforcement can be too expensive and requires a vast amount of time to respond to low carbon technology (LCT) connections into the low voltage (LV) network;
2. Alleviate constraints on the distribution system by reducing demand peaks. Allowing transmission and distribution operators to invest, use and exploit energy storage services to strengthen flexibility, reliability and resilience of the grids;
3. Operate storage for local energy management for triad avoidance;
4. Maximising on-site consumption;
5. Grid balancing and other ancillary services, in isolation or in co-operation with other regulated and non-regulated entities;
6. Clarifying and streamlining the position of storage in different regulatory environments (behind-the-meter, third party service, grid operation);
7. Assessing the consequences and opportunities of different regulatory options concerning smart grids and proposing a harmonised approach;
8. Access to flexible markets: The results of all of this work will hopefully combine to open up the market for storage and for flexibility solutions within the electricity system which are a really important part of how we move to a decarbonised electricity system at least cost to the consumer.

Success Criteria

1. Technology of Energy Storage Systems (ESS) - A comprehensive review of technology is presented;
2. Relationship with Supplier - A case study of how the technology can bring benefits to WPD's networks is demonstrated and a

relationship with suppliers has been established;
3. Recruitment - Recruiting the right supplier/partner through tender;
4. Network - Identify trial areas/sites and Customers - WPD depots engaged for trial;
5. Market - Agree a new set of conditions that allow and incentivise DNOs to operate storage;
6. Demonstration - Demonstrate enhanced value to the DNO and the customers from deployment of I&C Storage - such as network investment deferral, constraint alleviation and energy savings;
7. Knowledge - Document and share all key learning that is achieved in order that results should be replicable across all UK DNOs;
8. Operational - Train new or existing staff to manage the I&C Storage requirements;
9. Systems - Identify, develop and demonstrate new policies, processes and systems that are required in order for WPD to operate I&C Storage (monitor, control, meter and settle), development of business processes (polices, standard techniques etc.);
10. Commercial - Connection Agreements agreed.

Technology Readiness Level at Start	Technology Readiness Level at Completion
7	7

Project Partners and External Funding

Through the tendering process, a suitable partner for the project will be identified.

Potential for New Learning

In line with our Innovation Strategy, this project will lead to innovative developments in the broad areas of low carbon networks (supporting future electricity demand and generation) and smart grids and meters. Specifically, this project will address aspects of Section 6.9.22 of the Innovation Strategy, relating to Customer Solutions Improvement. WPD will engage with Industrial and Commercial customers to test battery energy storage, determining the scope of terms and conditions and practical implications of using batteries on the LV networks. Other DNOs will also be able to gain a comprehensive understanding of storage after reviewing this project's reports and results. They can use the results to evaluate the benefits that could be brought to their networks by using storage. The knowledge from suppliers could also be used by other DNOs if they wish to pursue trial projects.

Scale of Project

The project will investigate different configurations in the application of storage. These include but not limited to peak shaving, load shifting, transmission and distribution support, phase balancing, reverse power flow mitigation and emergency backup. The project may simulate a range of Transmission System services such as STOR, response services, constraint management, reactive power, energy contracts, Enhanced Frequency response and any future services. The outcomes of the project will depend on site conditions, accessibility, measurements and identifying risk and mitigation measures. The project will effectively run for 24 months with a further 6 months allowed for contingency and will include a number of demonstrations.

Geographical Area

Areas that have intermittent generation will have the strongest business case for the implementation of such a trial. Therefore, four sites with Solar PV and wind generating will be selected for this trial. The trials will be conducted at WPD sites as it removes unnecessary disruption to customers and allows us to conduct experiments in a controlled environment.

Revenue Allowed for in the RIIO Settlement

Nil

Indicative Total NIA Project Expenditure

£1,029,600

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 generated is directly applicable to all Network Licenses in mitigating network constraints as well as managing investment deferral which are significant to the DNO's core business.

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

Section 6.9.22 of our Innovation Strategy on Customer Solutions Improvement describes our commitment towards the improvements we intend to provide as solutions to customers. This project will address the problem of improving overall customer solution activities in the form of cost efficiency and environmental improvements.

2b. 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 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

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

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

The project aims to trial an alternative solution to lengthy overhead line reconductoring which is often quoted to customers for Distributed Connections. In an area where there are several DG connections connected to the same primary or feeder implementing a scheme of this sort would be more cost effective. This trial is to demonstrate the technical benefits in allowing the use of storage which can reduce the unit cost of connecting at the I&C customer level and therefore deferring the investment and mitigating against grid constraints that way.

ii) 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).

A 50kW/210kWh ESS will be installed at each of the four sites. The cost per site including fitting an Export Limiting device of £5,000 would be: £310,000 + 5,000 = £315,000.00. As is often the case that reinforcement may be required at a voltage different from that at the PoC to enable a new connection, the one-voltage rule requires the customer to pay towards those reinforcements. The reconstruction of a 33kV circuit with stout poles and larger conductor would cost in the region of £1.1m for a 10km with a timescale of 24 months. If we took a conservative argument that we will be required to upgrade the 33kV circuit in order to accommodate new generation, we would be saving in the region of £785,000 per installation. If we also assume that the cost of electricity will reduce to a conservative average of £75,000 per month at each of the 21 sites, there will be a direct saving of about £450,000 in electricity consumption per year.

iii) 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.

Suitable for use in all license areas. I&C customers are prevalent in all areas.

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

The cost of deploying the I&C Storage at one side is itemised below:

- System Costs (50kW/210kWh): £167,000
- Installation Cost: £29,000
- Logistics to the UK: £15,000
- Communications Equipment: £17,500

Total Cost: £228,500

If we were to install units in 100 I&C customers, the cost would be 100 x £228,500 = £22,850,000

2d. Does Not Lead to Unnecessary Duplication ☒

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

This project has not been trialed anywhere else in the UK.

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