Date of Submission

October 2018

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**
VOLL 2		**ENWL 021**
Funding Licensee(s)	**Project Start Date**	**Project Duration**
Electricity North West Limited	November 2018	18 months
Nominated Project Contact(s)		**Project Budget**
InnovationTeam@enwl.co.uk		£400,000

Problem(s)

In Great Britain (GB) a single, uniform Value of Lost Load (VoLL) is used to evaluate disbenefit to customers of a supply interruption of average duration. It can be expressed as the value that customers would be willing to pay to avoid an interruption or what they would be willing to accept in compensation if they experience an interruption. A uniform VoLL assumes that all customers are impacted equally as a consequence of the loss of power and attach the same value to their supply reliability. Investment in electricity networks is thereby driven by a factor which currently fails to recognise any differentiation in customer need, or valuation of service.

Impetus for change

Recent NIA funded research conducted by Impact Utilities on behalf of Electricity North West (ENWL010) has demonstrated that VoLL is now notably higher than observed in the previous major GB study in this area, conducted by London Economics for Ofgem, in 2013. This increase is thought to reflect a greater dependency on electricity and changing customer needs and expectations. The study also robustly concluded that a uniform VoLL significantly undervalues the needs of certain customer segments, most notably the fuel poor and early adopters of low carbon technologies; whilst others are over represented, driving potentially inappropriate investments. An output of the VoLL research is a new segmentation model, which will theoretically enable DNOs to make smarter investment decisions that are more reflective of divergent customer needs.

Implementation

To move towards the practical implementation of a differentiated VoLL it is recognised that further detailed analysis is required to explore the requisite level of sophistication needed in a credible decision making tool and the appropriate mechanism for practicable implementation, at scale. The previous Electricity North West study (ENWL010) also highlights the need for further empirical customer research to test the impact of different scenarios, including the 'multiplier' effect on VoLL of scale and duration, when assessed on the basis of the entire community, rather than the individual, ie assessing the overall impact of a large-scale outage affecting a significant number of people versus that of a smaller more localised interruption. This understanding will inform smarter decisions based on the relative value of proactive investment, aimed at preventing or minimising the severity of unplanned interruptions vs the ability to mitigate VoLL by deploying appropriate support mechanisms to manage the consequence of an event.

VoLL 2 will comprise two distinct pieces of research:

A strategic piece of statistical analysis and industry consultation to explore the practicalities and regulatory implications for implementation of an alternative, segmented VoLL model and its applicability (Phase A - strategy).

Empirical customer research to provide insight into the multiplier effect and socialisation of cost arising from a revised model (Phase B - customer).

Phase A - strategy: Will involve further detailed statistical analysis of the disaggregated VoLL indicators derived from the ENWL010 study to identify the key vectors influencing VoLL. This will determine the appropriate level of aggregation and sophistication required of a revised model to practicably implement at a national level. This analysis is expected to establish:

- How the range of factors that influence VoLL should be combined to guide an investment decision and how this understanding can be practicably utilised in more accurate decision making tools.
- The optimum degree of complexity i.e. how sophisticated the approach might need to be and the advantages/disadvantages of a sophisticated, complex model (using an extensive range of indicator data) versus a more simple approach that utilises a limited set of readily available indicator data.
- The level of detail at which VoLL variables might be combined, relative to network parameters, eg substation, circuit, primary group.
- Forecasts and VoLL drivers from official, external (non-industry) sources that might be utilised to enhance the new model.
- The stability/variability of factors that influence VoLL.
- How investment models should account for large scale one-off events.

Phase B - customer: Will involve exploratory customer research to address the following questions to support the practical application of the VoLL segmentation:

- What is the impact of a large event involving a significant number of customers on VoLL versus a smaller, localised outage
    - When assessing the aggregated impact at community level, can this change be simply summated ie is the relationship linear or non-linear?
    - How does VoLL change over the duration of an event? For longer interruptions over 12/18 hours does the rate of increase in VoLL per customer decelerate or plateau?
- How should investment models account for relatively low VoLL if values are influenced by greater resilience, brought about through customer's own proactive mitigation (e.g. medically dependent), or higher levels of tolerance as a result of repeated exposure to supply interruptions (e.g. worst served)
- Are all customer segments able to accurately signal their true VoLL? What are the societal consequences if specific customer groups are unable to effectively signal true VoLL because the wider impacts are not necessarily recognised, ie costs which are not directly borne by the customer but are picked up by society elsewhere?
- Highlight, from a societal perspective, the unintended consequences of replacing one imperfect

model with one that recognises divergence but may also be imperfect.

Method(s)

Phase A – strategy

- Develop a credible segmentation model based on key vectors influencing VoLL. Define the appropriate level of complexity and establish the optimum degree of aggregation ie which variables might be combined, relative to network parameters.
- Identification and evaluation of official sources forecasting changes in the factors influencing VoLL that might be incorporated to future proof the segmentation model and provide an indicator of the stability (or not) of VoLL drivers over time.
- Define what business processes should be adopted and how existing systems can be adapted to maximise the benefit from a differentiated VoLL model?
- Consultation with key stakeholders including Ofgem, BEIS, other DNOs and relevant industry think tanks to assess the appetite, appropriateness and practicalities for implementation of a segmentation model.

Phase B - customer

To derive a comprehensive understanding of how a) VoLL varies by scale and duration and b) evaluate perceptions on fairness and the socialisation of cost from adopting an alternative model, the method will encompass four key stages of customer and stakeholder engagement:

Stage One: Desk research and stakeholder engagement. Desk research to gain contextual understanding; comprehensively reviewing previous research on the 'multiplier' effect and the impact of longer duration interruptions. Review of existing literature on cost socialisation and investment prioritisation. Formalisation of best methods of evaluating fairness and the efficiency of alternative investment models. Proposed methodology document produced and peer reviewed. Meetings with key stakeholders, eg Citizens Advice to outline the proposed approach, seek feedback and challenge. Finalisation of research questions that will be explored.

Stage Two: Qualitative exploration. Qualitative research in the form of Engaged Customer Panels (ECP) and in depth interviews with customer groups; including but not limited to segments with a low, average or high VoLL:

Three domestic ECPs will be convened, supplemented by in-depth interviews with hard to reach or vulnerable customers including those with medical dependency. An ECP of small to medium enterprise (SME) customers will also be convened, with a focus on specific industry sectors heavily reliant on electricity. In common with previous research, larger industrial and commercial customers will be excluded as they are likely to have resilience capabilities and the ability to access mitigation in the event of an outage.

This research will:

- Evaluate customer reactions to the outcomes and implication of the VoLL study, explore views on the low, medium and high VoLL assignment of specific customer segments
- Evaluate customer perception of potential benefits/disadvantages of DNOs adopting an alternative approach to investment prioritisation.
- Assess reactions to the likely impact of a lengthy, large scale outage (perceived or experienced) and explore how this might differ relative to a short, localised outage
- Further explore various mitigation strategies and views on their relative appropriateness to understand the drivers of perceived fairness
- Explore the perceived ability of customer segments to signal their true VoLL
- Test and refine a survey instrument for use in Stage Three of the research, including how to best

conceptualise a 'large scale interruption'. In depth probing will identify areas of misunderstanding and the cognitive process involved in completing the exercises, to maximise comprehension and the quality of survey responses.

Due to the sensitivity of the subject matter these issues will be explored independently amongst segmented groups of customers who are more likely to have shared experiences. Groups will be tasked with representing their unique perspective e.g. rural; however, they will also consider how these needs interact with and might differ from others in society.

A deliberative workshop will be convened in parallel with the ECPs intended to facilitate meaningful engagement with key stakeholders (including but not limited to Citizens Advice). To ensure strategic alignment stakeholders will be primarily recruited from existing DNO strategic stakeholder advisory panels, including those established by Electricity North West. The pool of stakeholders participating will be supplemented with specialists who are well positioned to debate the wider societal consequences of a differentiated VoLL investment model and how this would be implemented in practice. This will provide an educated and engaged pool of stakeholders who are able to contribute robust challenge and discuss the merits of applying a more sophisticated decision making tool, reflective of divergent customer need, when making investment decisions.

Stage Three: Quantification. Large scale robust quantitative survey amongst a representative sample of GB customers, expected to include approximately 1,500 domestic customers and 500 SMEs. The research design adopted will build on the learning transferred from Stages One and Two and be subject to peer review. Customers will be presented with a series of detailed outage scenarios with examples of how each could impact them individually and the extent of potential impacts on their community. Customers will be asked their views on such events and the choices they might make as a result.

A trade-off exercise will be developed between the various scenarios and hierarchical bayesian (HB) techniques to derive utility values for each attribute level. The proposed attributes include but are not limited to: length of interruption, scale of interruption and frequency of interruption (once every 3 years, once a year, 3 times per year). The levels related to the attributes will be co-designed and tested during the qualitative design stage.

The trade-off exercise will be subject to academic review prior to roll out, to ensure the instrument is sufficiently robust to deliver the desired outputs.

The survey will also capture sentiment towards current and alternative future investment prioritisation models and robustly measure the level of public support for a change to the status quo and more specifically where targeted prioritisation is justified.

Stage Four: Implementation scale

Undertake detailed analytics to understand the practicalities of implementing a differentiated VoLL approach at different scales, based on network parameters. This will need to take account of current DNO data estates in terms of network connectivity models and access to external data models which include the relevant data sets on external factors, eg fuel poverty, LCT take-up. This analysis will consider a potential range of application from DNO-level VoLL values down to MPAN (meter point), and also consider the required degree of sophistication required to include future forecast VoLL values that will pertain over the lifetime of the asset investment decision being considered.

Due to the analytics aspect of this element of the project, an additional analytics specialist will be recruited as a project partner to undertake this work, which is expected to run in parallel with stages Two and Three.

Stage Five: Validation

Stakeholder feedback will be sought throughout the project. Once results are available, a workshop session will be held and key stakeholders invited to review and challenge the results, and finalise the design of the VoLL decision making tool. Stakeholders will be asked to provide feedback on:

- How this data should be used to inform improved decisions between supply interruption measures and impact mitigation measures if a disruption occurs

Scope

Qualitative and Quantitative research with a broad spectrum of DNO customers:

- Domestic (General, rural, urban, worst served customers, vulnerable customers, fuel poor, adopters of LCT, experienced a lengthy interruption)
- SME customers from a range of market sectors (including but not limited to those heavily reliant on electricity / early LCT adaptors).

Objective(s)

Phase A – strategy:

- Optimise the VoLL decision making tool by providing guidance on the appropriate combination of VoLL drivers and the requisite level of sophistication and aggregation.
- Identify, evaluate and incorporate appropriate forecasting features to future proof the model / demonstrate stability/variability over time.
- Deliver an understanding of the relative value of investment to prevent an event vs that of managing the consequence of the event.
- Undertake analytics to identify the appropriate network scale to which the differentiated VoLL value should be applied.
- Develop sample investment plans to understand options for implementation and potential impact on affordability and quality of outcomes for different customer segments.
- Engagement with key industry stakeholders to identify implications, formalise an appropriate VoLL decision making tool and establish a strategy for transition to national implementation, identifying regulatory mechanisms currently or potentially driven by a VoLL function.

Phase B – customer:

- Determine the increased sense of equity and DNO service provision that can be achieved through implementation of a differentiated VoLL model.
- Quantify the impact of scale and duration of an outage on VoLL
- Deliver an understanding of the societal value of investment to prevent an event vs that of managing the consequence of the event
- Measure societal acceptance of a differentiated VoLL model, segmented by customer need
- Substantiate which segments are perceived by society to have the greatest need
- Quantify the likely effects of a differentiated VoLL investment model on society, now and in the future.

Success Criteria

The project success criteria are:

Phase A – strategy:

- Identification of key vectors influencing VoLL and the degree of sophistication requisite in a credible decision making tool using a differentiated model.
- A preferred network scale of implementation following assessment of potential outcomes and data requirements.
- Sample investment plans to understand options for implementation and how that could impact affordability and quality of outcomes for different groups of customers.

- An understanding of the relative value of preventing an event vs managing the consequence of the event
- Consult key industry stakeholders to establish acceptability, regulatory and wider impacts.
- Establish required adjustments derived from learning in this project that key stakeholders support and can be implemented as a next step into our core processes.
- Establish implications for RIIO-ED2 and a strategy for national implementation.

Phase B – customer:

- Evaluation of potential social impacts of implementation of a future differentiated VoLL model by key customer and stakeholder groups.
- Deliver an understanding of the societal value of investment to prevent an event vs that of managing the consequence of the event

A practical demonstration of how the VoLL model can help DNOs to more effectively plan investment levied in areas where the consequence of asset failure are much higher, in a manner which delivers greatest value to the DNO, and benefits those most impacted but which is fair to all.

Technology Readiness Level at Start	**Technology Readiness Level at Completion**
2	4

Project Partners and External Funding

Not applicable

Potential for New Learning

The following new learning is anticipated:

- Using differentiated VoLL to guide investment decisions for Electricity North West and other DNOs.
- How the VoLL segmentation tool translates into the quantification of network impacts in decision making, eg in setting reliability incentive rates, quantification of network risk and definition of cost-benefit analysis.
- An understanding of what fairness means to society, in the context of socialised costs and divergent investment, based on an improved awareness of customer needs.
- An understanding of the preferred practical scale of implementation given current data etc.
- An understanding of how the alternative VoLL model could inform investment decisions to accelerate the uptake of LCTs.
- A clearer understanding of how VoLL is likely to change over time in the context of investment decision making on long-lived assets.

Scale of Project

GB wide customer survey

Geographical Area

Qualitative research predominantly in the Electricity North West region, quantitative research will be GB wide.

Revenue Allowed for in the RIIO Settlement

Zero

Indicative Total NIA Project Expenditure

£360,000

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.

Currently there is a universal view of VoLL. This research will provide differentiation of VoLL by customer type and allow investment decisions to be guided accordingly.

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

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.

The scale of financial benefits to customers will be a key deliverable from the research – Customers will inform us of the VoLL and therefore what appropriate compensation would be for accepting a lower level of reliability.

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).

Not required as research project

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.

A differentiated VoLL will result in more appropriate targeting of investment for GB customers. An understanding of the distribution and scale of the benefits, including how an alternative model might impact affordability and quality of outcomes for different groups of customers is a deliverable of the research.

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

Not applicable.

2c. Does Not Lead to Unnecessary Duplication ☒

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

Through the contacts we have with other DNO's we have attempted to determine if any of these companies either have this information currently, or are looking to carry out similar research. We have not identified any extant capability in this regard, therefore we believe this is a unique project in the DNO community.

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

Additional Governance Requirements
The project is innovative (ie not business as usual) and has an unproven business case where the risk warrants a limited Research, Development or Demonstration Project to demonstrate its effectiveness ☒

(i) Please identify why the project is innovative and has not been tried before.

The findings of the original VoLL project raised further questions which this project will attempt to answer.

(ii) Please identify why the Network Licensee will not fund such a Project as part of its business as usual activities

This project is in the research phase and is deemed risky to be funded as BAU.

iii) Please identify why the Project can only be undertaken with the support of the NIA, including reference to the specific risks (eg commercial, technical, operational or regulatory) associated with the Project

The outputs from this project are of national interest from both DNOs and regulatory bodies. The use of NIA funding ensures that all parties are exposed to the project and are able to access the findings.

Has been approved by senior member of staff	☒

Additional Registration Information

Short Name

VOLL 2

Introduction

Identification of the VoLL multiplier effect, the socialisation of investment costs and the practicalities of implementing a revised model.

Benefits

Technologies (Please Select one of the following)

Active Network Management	☐
Asset Management	☒
Carbon Emission Reduction Technologies	☐
Commercial	☐
Comms & IT	☐

Community Schemes	☐
Condition Monitoring	☐
Conductors	☐
Control Systems	☐
Cyber Security	☐
Demand Response	☐
Demand Side Management	☐
Distributed Generation	☐
Electric Vehicles	☐
Energy Storage	☐
Energy Storage and Demand Response	☐
Environmental	☐
Fault Current	☐
Fault Level	☐
Fault Management	☐
Harmonics	☐
Health & Safety	☐
Heat Pumps	☐
High Voltage Technology	☐
HVDC	☐
Low Carbon Generation	☐

LV & 11kV Networks	☐
Maintenance & Inspection	☐
Measurement	☐
Meshed Networks	☐
Modelling	☐
Network Automation	☐
Network Monitoring	☐
Offshore Transmission	☐
Overhead Lines	☐
Photovoltaics	☐
Pre-Heat	☐
Protection	☐
Resilience	☐
Stakeholder Engagement	☐
Substation Monitoring	☐
Substations	☐
System Security	☐
Transformers	☐
Voltage Control	☐
Gas Distribution Networks	☐
Gas Transmission Networks	☐