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Bringing energy to your door

NIA ENWL010
Value of Lost Load to Customers

NIA Progress Report

31 July 2018

VERSION HISTORY

Version	Date	Author	Status	Comments
V0.1	25 May 2018	Tracey Kennelly Customer Innovation Lead	Draft	
V1.0	30 May 2018	Tracey Kennelly Customer Innovation Lead	Final	

REVIEW

Name	Role	Date
Lucy Eyquem	Innovation PMO Manager	19 July 2018
Paul Turner	Innovation Manager	26 July 2018

APPROVAL

Name	Role	Date
Steve Cox	Engineering & Technical Director	31 July 2018

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1 PROJECT BASICS

Project title	Value of Lost Load to Customers (VoLL)
Project reference	NIA_ENWL010
Funding licensee(s)	Electricity North West Limited
Project start date	October 2015
Project duration	36 months
Nominated project contact(s)	Kate Quigley (innovation@enwl.co.uk)

2 SCOPE

Customer engagement research across the full range of distribution network operator (DNO) customers:

- Domestic customers (qualitative ECP and quantitative research): General, worst-served customers, vulnerable customers, fuel poor, adopters of low carbon technologies (LCTs), heavy users (targeted by tariff type)
- Small to medium enterprises (SMEs) (qualitative ECP and quantitative research)*: Targeted at industries with heavy reliance on electricity
- Stakeholders (qualitative depth research): Ofgem, DECC, Citizens Advice Bureau, local government (resilience forums), charities(such as British Red Cross), police, fire brigade, housing associations, emergency services, hospitals, care homes, airports and other transport hubs.

** Large I&C customers are not a primary focus of this survey as they are likely to have provisions in place for dealing with lost load (such as generators).*

3 OBJECTIVES

This research aims to quantify the value of dead load/loss of supply to customers. This will be achieved by answering the following research objectives:

- What is the impact on customers of lost load?
- What is the value of this impact – financial and social costs to customers in £ per kw?
- How does this vary by customer type? Currently all customer types are treated uniformly
- How can Electricity North West and key stakeholders mitigate the costs of lost load to customers?
- How will this vary with LCT adoption?

4 SUCCESS CRITERIA

The project success criteria are:

- An understanding of customer impact, how value is defined and how this might be influenced, eg better communications
- A credible segmentation and future VoLL model by key customer groups (curves) to guide investment decisions
- A demonstration of how these values would help Electricity North West to better plan its network investment strategy
- Guidance on customer compensation strategies.

5 PERFORMANCE COMPARED TO THE ORIGINAL PROJECT AIMS, OBJECTIVES AND SUCCESS CRITERIA

5.1 Phase 1: Understanding the problem

Phase one of the study was devoted to gaining a contextual understanding of VoLL and formalising an optimal method to obtain accurate segmented VoLL estimates. The VoLL methodology statement (version 2), along with three supporting addendums (namely, a literature review, peer review and stakeholder consultation) were produced in phase one and these were published on the project webpage.

5.2 Phase 2: Refining the approach

Phase two of the study comprised:

- Focus group meetings with an engaged customer panel (ECP)
- Depth interviews with a cross-section of difficult-to-reach customers, and with stakeholders likely to be in contact with customers, or support customers, during supply interruptions
- Design, evaluation and pilot of a survey instrument.

Direct customer consultation explored the needs and expectations of a diverse range of customers served by different types of networks, with varied experiences of supply interruptions. Stakeholder consultation was valuable in gaining a wider societal and industry perspective, which guided refinements to the overall research approach. The objectives and outputs of this phase of the study were summarised in the first annual VoLL progress report, published on 22 July 2016. Key findings and lessons learned from consultation with the ECP were published on the project webpage on 23 August 2016 and learning from the depth interviews was published on 31 August 2016.

Relevant customer insights from the focus group meetings and depth interviews were integrated into the design and administration of the customer survey. The resulting questionnaire was subject to a peer review and a robust pilot before being fully launched. These activities were summarised in the second annual progress report, published on 31 July 2017 and are fully documented in the peer review report dated 30 August 2016 and the pilot report dated 30 November 2016, both of which are published on the project webpage.

5.3 Phase 3: Measuring VoLL

Seasonal survey

The final stage of direct customer engagement was to administer the large-scale quantitative survey, which was designed to provide insight into the following research questions:

- Does VoLL vary by customer segment and what are the relative value assignments of these segments?
- How will VoLL vary with LCT adoption?
- How would the level of incentives tested for demand side response in other Low Carbon Networks (LCN) Fund trials compare to future VoLL?
- Which segments, if any, would support a strong VoLL and hence potentially higher investment?
- How does the scale and duration of an interruption affect VoLL?
- Is there a tipping point at which investment to mitigate against supply interruptions becomes the most financially viable option to customers, particularly during extremely infrequent, lengthy and widespread outages?

A total of 6,000 customer surveys were completed during this phase of the study. These took place in two distinct phases over winter 2016/17 and summer 2017, with the latter phase commencing in July 2017 and being completed during this reporting period. This split approach was adopted to ensure that seasonal variations in VoLL were captured, with 50% of each customer type represented in each phase of the survey.

The survey was completed by customers in Electricity North West's operating region and from other GB DNOs, with proportional quotas set for each area. Approximately 5,000 survey respondents were domestic customers and around 1,000 were completed by representatives of small to medium enterprises (SMEs).

The survey included a complex 'stated preference' choice experiment (CE) exercise, which was identified in both the literature review and the independent peer review as being the most robust and reliable technique for measuring VoLL. This exercise involved asking customers to trade off different levels of supply reliability in exchange for receiving hypothetical financial incentives or penalties. A second, similar exercise involves trading a monetary value against various support mechanisms that might mitigate the impact of a power cut.

Interim analysis

Interim analysis of survey responses provides clear evidence of the different impact of a supply interruption across a range of domestic and SME sub-groups, which has the effect of large variations in the segmented assignment of VoLL.

It also demonstrates the influence of frequency and duration along with the effect of LCT adoption, which indicates that future VoLL is likely to change in a low carbon future, with increased customer reliance on electricity.

The research has delivered a set of VoLL estimates that reflect the varying needs of different customer groups far more accurately than the single-value approach currently used. These values, which are currently subject to ongoing validation, have been incorporated into a preliminary VoLL calculation tool, which will enable DNOs to accurately assess the collective VoLL of customers served by specific assets.

Interim results demonstrate how understanding relative VoLL components, at a much more granular level, provides an opportunity for improvements in DNOs' current cost-benefit analysis models, which would provide greater efficiency in future investment decisions.

These will derive greater customer benefit by targeting investments on the basis of a blended VoLL reflecting customer need and dependence.

These early findings provide clear evidence to support the project's primary research objective that a single uniform VoLL, applied to all customer segments, which assumes that all customers are equally impacted, is no longer appropriate.

Further modelling and reporting

This project has received a significant amount of industry interest and it is anticipated that the values for segmented VoLL, calculated as part of the study, will be important in informing DNO policies and investment plans for the RIIO-ED2 price control and beyond.

As such, it was important to subject the overall research approach and early results to an independent peer review to substantiate the findings, before dissemination to Ofgem and other industry stakeholders.

This recommended more detailed modelling to provide like-for-like comparisons with the results of the original London Economics study, along with more detailed reporting around specific 'treatments', which will be reported separately. These treatments compare planned versus unplanned outages, willingness to accept (WTA) versus willingness to pay (WTP) values and domestic versus SME results etc.

The VoLL research project partner, Impact Research, is working closely with an independent peer from the University of Kent to satisfy these requirements.

It is anticipated that the final key findings report, along with the project's conclusions and recommendations will be published and submitted to Ofgem in July 2018.

Next steps

During the next reporting period the findings and lessons learned from phase three of the research will be reported. This document will be accompanied by a final conclusions and recommendation report, along with a credible future VoLL model, calculation tool and user guide. The model will allow DNOs to identify VoLL by key customer groups, in order to help guide investment decisions.

The ECP will be reconvened after the final survey analysis has been reported to review and evaluate the research findings. Feedback will be documented in the project closedown report.

Stakeholder update

- Interim results were presented collaboratively by Electricity North West and its market research partner, Impact Utilities, at the Low Carbon Networks & Innovation conference on 7 December 2017, held in Telford. The presentation was well attended and well received.

- The results and implications of VoLL findings were disseminated to industry stakeholders at an innovation and learning event hosted by Electricity North West on 4 July 2017.

- Quarterly update reports were sent to industry stakeholders and Electricity North West's executive leadership team (ELT) in August 2017, November 2017, January 2018 and April 2018.

- In line with the vision of the NIA funding mechanism and the project commitments, all outputs and learning attained from VoLL customer engagement activities will continue to be made available to other DNOs. Specifically, materials developed and learning derived from this project will be publicised on the VoLL webpage. This will be updated with the VoLL project closedown report, during the next reporting period.

6 REQUIRED MODIFICATIONS TO THE PLANNED APPROACH DURING THE COURSE OF THE PROJECT

6.1 Phase 1 & 2: Understanding the problem/refining the approach

Based on the learning from phases one and two of the study, a far more complex research methodology than had been originally anticipated was necessary in phase three. This could not have been anticipated in advance of the research and resulted in a divergence from the proposed approach, which was to replicate the core principles of the VoLL study, conducted by London Economics for Ofgem in 2013. The project team is confident that the resulting methodological changes were justified to deliver robust and credible results at a granular level.

The required modifications to the planned approach arising in phases one and two were summarised in the second annual progress report, published on 31 July 2017.

Implementation of these changes has been completed with the exception of the following, which will be conducted during the next reporting period:

- **Expansion of the role of the engaged customer panel (ECP)**

  In response to feedback from the former Department of Energy and Climate Change in 2016 (during phase one), the role of the ECP will be expanded to include an evaluation of the research findings and implications. Focus group meetings will be held following publication of the final phase three findings and recommendation reports. All reasonable attempts will be made to re-convene a representative sample of the original panel, who because of their prior education, are better placed to review, interpret and contextualise the findings against the project's objectives, than a newly convened panel. The lessons learned from this activity will be documented in the project closedown report.

6.2 Phase three: Measuring VoLL

Winter survey

Following a peer review of the survey instrument and the pilot survey, a number of refinements were made to the questionnaire and accompanying educational materials before launching the full survey. These modifications were summarised in the second annual progress report in July 2017 and are fully documented in the peer review report dated 30 August 2016 and the pilot report dated 30 November 2016.

No further changes were required to the survey instrument or its administration.

Analysis and reporting

The stated preference (CE) scenarios used in the customer survey were designed to follow a similar format to the earlier London Economics study for compatibility. However, the content of Electricity North West's CE and its analytical approach differed in a number of respects to derive more robust, granular VoLL assignments, by distinct customer segment.

Interim findings verified significant variations in VoLL across a range of customer segments and these results were externally peer reviewed by two independent academic experts

during this reporting period. However, in view of the deviation from the original methodological approach, the critique has recommended further modelling to substantiate the findings and compare attribute definitions with the earlier London Economics study. Therefore, in compliance with the terms of NIA governance, the following modifications have been implemented to substantiate key findings and benefit the overall learning outcomes:

- More detailed modelling of data to demonstrate compatibility and continuity with the previous study
- Further advanced analytics to validate the granular outputs and evaluate the range of certainty around these values
- Enhanced reporting and further external validation to add credibility to the overall findings and satisfy industry stakeholders that best practice methods have been implemented
- The VoLL project has generated extensive stakeholder interest, dictating wider dissemination activities.

This change could not have been anticipated in advance of the study. This variation extends the proposed project end date from February 2018 to September 2018 and represents an increase in the estimated expenditure from £671,200 to £731,000.

In April 2018 Electricity North West updated the project information page of the ENA portal, with an explanation of why the change had been made and provided Ofgem with details of the justification. This project variation conforms to NIA project change requirements ie, it has no impact on the project's title, problem, objectives, success criteria or the internal IPR arrangements.

7 LESSONS LEARNED FOR FUTURE PROJECTS

7.1 Phase 1: Understanding the problem

Lessons learned during phases one and two are referenced in the 2016 and 2017 progress reports. The latter report also included early lessons learned from phase three, specifically, administration of the winter survey. The following represents lessons learned from the summer and final phase of customer survey fieldwork and the subsequent analysis:

7.2 Phase three: Measuring VoLL

The benefit of a comprehensive pilot survey, followed by thorough analysis of responses cannot be underestimated. There should be scope to conduct small or large scale changes at this early stage to benefit the overall research.

Early analysis of the winter survey confirmed that amendments made to simplify the CE following the pilot survey had a positive impact on respondents' ability to comprehend the exercise in the main survey. Refinements made following the pilot ensured there was greater parity in the trade-off scenarios, which meant that it was easier for respondents to make considered choices when stating a preference. Analysis of a second pilot was conducted before proceeding to the main survey. This found that respondents provided more complete information than in the initial pilot, even though the time taken to complete the CE was shorter. These findings were confirmed in the main seasonal survey. The enhancements made are summarised as follows:

- Splitting the CE so that respondents only ever traded off planned or unplanned scenarios. For example, planned attributes and levels were evaluated alongside other planned attributes and levels. This approach was clearer for respondents, allowing

them to consider more meaningful comparisons. The approach also provides greater insight in customer attitudes towards planned versus unplanned outages.

- Removing some of the levels in the CE for attributes found to have a linear relationship (duration, frequency and cost). Analysis confirmed that this did not negatively impact the ability to calculate VoLL.

Respondents may not read communications materials embedded into a survey; they may be unwilling to spend time sourcing accurate information (in this instance from electricity bills) and are sometimes reluctant to provide information that could identify them.

Analysis of the main seasonal survey identified the following key lessons concerning responses the survey instrument:

- Customers found it difficult to identify their DNO with 35% selecting 'don't know' even when provided with a map clearly defining regional boundaries. It is therefore useful to collect postcode information, when conducting a GB-wide survey, to validate both domestic and commercial respondents' DNO/IDNO.

- Despite the provision of clear instruction SME customers found it difficult, or were unwilling, to provide their meter point administration number (MPAN), further validating the need to collect postcode, address or company information, where required to substantiate key responses.

- Domestic and SME customers are more inclined to provide postcode information when its purpose is clearly explained; however, it should be recognised that a proportion of respondents will actively safeguard their anonymity and purposefully omit data which links them to their residence or place of work. Appropriate mitigation should be incorporated into similar survey instruments to minimise the potential for erroneous entries.

- Actual electricity consumption data was obtained from meter readings, with the explicit consent of respondents. This was achieved by using the MPAN, postcode and address details provided, to retrieve records held in the DUoS and Associated Distribution Systems national database. However, the data contained some anomalies and it was necessary to develop a tool to calculate annual consumption for the purpose of the analysis. This took into consideration: meter changes; multiple readings associated with 'multi rate differential tariffs'; erroneous readings; and those where an incorrect number of digits were recorded.

- When questioned about LCTs, customers are generally familiar with (and can therefore make informed decisions about) solar panels and electric vehicles; however, the pilot research identified that this does not apply in the case of electric heat pumps. The majority of respondents had limited understanding or were completely unaware of what heat pumps are and, consequently, required additional educational information and context before they could make reasonably informed choices in response to the presented scenario questions. The additional communication materials introduced in the main seasonal surveys led to a significant decrease in the proportion of customers reporting that they did not know whether their heating and/or hot water was supplied by a heat pump.

Sufficient time and financial contingency should be factored into projects to accommodate the implementation of pertinent recommendations that arise when outputs are subject to independent critique.

In view of the deviation from the original methodological approach and the industry interest generated by this research project, it was considered prudent to conduct a more extensive critique of the general approach and findings than was anticipated at the outset. This

recommended further modelling to validate some of the findings and compare attribute definitions with a previous study conducted for Ofgem.

Consultation with experts involved in previous studies and direct comparison of analytical methods, to provide like-for-like comparisons in results, is recommended in future projects. This will underpin findings arising from methodological divergence, particularly where industry implications are significant and outputs are likely to be subject to high levels of scrutiny.

8 THE OUTCOMES OF THE PROJECT

9 DATA ACCESS

Electricity North West's innovation data sharing policy can be found on our website.

Average annual electricity consumption was calculated using meter readings held in the DUoS and Associated Distribution Systems database. This was achieved with the explicit consent of respondents who provided their MPAN and/or postcode and address, specifically for this purpose.

10 FOREGROUND IPR

There is no foreground IPR associated with this project.

11 PLANNED IMPLEMENTATION

Not applicable.

12 OTHER COMMENTS

Not applicable.