FROM INSIGHT TO INFLUENCE

Value of Lost Load to Customers (VoLL2)

Engaged Customer Panel Report

Prepared for Electricity North West

Prepared by Impact

October 2019

Project No. 880

Contents

VERSION HISTORY

Version	Date	Author	Status	Comments
V1	25 October 2019	Impact	Draft	
V2				

APPROVAL

Name	Role	Date

GLOSSARY

Abbreviation	Term
B2B	Business to business
DNO	Distribution network operator
ECP	Engaged customer panel
GB	Great Britain
LCT	Low carbon technology
NIA	Network Innovation Allowance
Ofgem	Office of Gas and Electricity Markets
PSR	Priority Services Register
PV	Photovoltaic
SDRC	Successful Delivery Reward Criteria
SME	Small or medium enterprise
VoLL	Value of lost load

FOREWORD

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, at least partly, driven by a factor which currently fails to recognise any differentiation in customer need, or valuation of service.

Recent Network Innovation Allowance (NIA)-funded research conducted by Impact 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, as reported on the VoLL webpage, 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 Distribution Network Operators (DNOs) to make smarter investment decisions that are more reflective of divergent customer needs.

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. ENWL010 also highlighted the need for further empirical customer research to test the impact of different scenarios. This includes 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, versus the ability to mitigate VoLL by deploying appropriate support mechanisms to manage the consequence of an event.

This follow up project 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); and empirical customer research to provide insight into the multiplier effect and socialisation of cost arising from a revised model (Phase B). The method utilised for Phase B was designed by Electricity North West and its market research partner, Impact, and was set out on the VoLL2 Methodology Statement which encompasses five key stages of customer and stakeholder engagement:

- Stage 1: Desk research and stakeholder engagement
- Stage 2: Qualitative exploration
- Stage 3: Quantification
- Stage 4: Implementation scale analysis
- Stage 5: Validation.

This report and the analysis therein reference the key findings from Stage 2, a piece of strategic qualitative market research carried out with an engaged customer panel (ECP). The research was designed to explore initial perceptions of the VoLL multiplier, relative to scale and duration, in addition to attitudes concerning fairness and cost socialisation and thereby identify how to contextualise and explain VoLL, the potential multiplier effect and cost socialisation concepts. These explanations must be clear enough to ensure research participants (particularly those responding in the subsequent quantitative customer survey stage) are able to sufficiently comprehend the subject matter and provide an informed opinion.

The project is funded by the NIA, which was introduced as part of the RIIO-ED1 price control and provides an allowance for network licensees to fund research with the potential to improve network operation and maintenance, and to deliver financial benefits to the licensee and its customers. The project commenced in November 2018 and will be conducted over an 18-month period.

All documents relating to the project are published on the VoLL2 webpage.

1 EXECUTIVE SUMMARY

1.1 Introduction

This phase of qualitative research was conducted with an ECP to meet the following research objectives set out in the project's customer engagement plan:

- Evaluate customer reactions to the outcomes and implication of the first 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'.

During the planning phase, the engagement plan was amended by adding three further research objectives:

- To explore customers' views on what constitutes reliability in electricity supply and on aspects of supply interruptions
- To test what size of bill increase (if any) customers would accept:
    - To ensure that adequate resources were available during supply interruptions to restore power to vulnerable customers
    - To supports communities that are affected by large scale events (ie providing a hot meal, hot drinks, charging points for mobile phones etc).
- To explore customers' views on the most appropriate socialisation of electricity distribution costs.

1.2 Summary of key findings

1.2.1 Views on supply interruptions

Participants made a number of astute, largely unprompted observations about the impact of planned and unplanned supply interruptions on themselves and others. These covered:

- The key attributes which affect the impact of interruptions (frequency, duration, time of day, season, day of the week, and the type of area where it occurs).
- Less obvious and unexpected impacts of supply interruptions such as water not being available in high-rise buildings dependent on pumps for water pressure
- How different customer segments cope with supply interruptions
- The value of communication during supply interruptions.

This demonstrated that customers can accurately comprehend both the breadth of implications of interruptions and how these differ considerably across customer groups, both of which are key elements inherent in the VoLL concept.

These findings are in line with similar qualitative research conducted during the original VoLL project (ENWL010).

1.2.2 Reactions to the outcomes and implication of the first VoLL study

ECP participants were surprised by the specific variances from average VoLL of several customer segments presented to them, particularly the finding that the fuel-poor segment's VoLL was 85% higher than average while the substantially overlapping low-income segment's VoLL was only 15% above average.

There was also some criticism of some of the bases of segmentation shown: several participants felt that life stages (eg working single or couples without children, households with children) would be a better basis than age because life stage had more relevance to the impact of lost load and age was an inexact and generalised predictor of life stage, for example, individuals might have children when they are in their early twenties, and couples in their early forties may or may not have children living at home.

Worst-served customers also identified that a single SME category was inadequate, particularly for rural SMEs, citing the difference between a village café (totally dependent on electricity) and a sheep farm (could operate as normal at least for a day).

1.2.3 Reactions to the incorporation of VoLL in investment prioritisation

After being shown a simple visual example of differentiated VoLL figures for sub-groups and investment prioritisation, participants demonstrated that they understood that Electricity North West needed to prioritise its investment and that parts of the network serving different customer profiles require different investment. Initially, they generally agreed that it was appropriate to use a differentiated VoLL rather than a single VoLL in making investment decisions.

However, most struggled to envisage situations where it would be necessary to factor VoLL into the decision making process as in reality, respondents believed investment priorities would be determined by demand levels, or the extent to which the equipment is inadequate, rather than the scenarios presented in the group, taking into account specific VoLL values for the area of asset failure.

Combined with this, participants' scepticism about the accuracy of the relative amounts that VoLL of different segments varied from average and the absolute amount that fuel poor customers' VoLL is above average, suggests that they may not consider it a suitable factor in investment decisions.

Furthermore, they also clearly believed that some bases for segmentation are more meaningful than others, in particular that age was not considered meaningful, but life-stage was. The implication of this is that if differentiated VoLL is utilised in investment decisions, it is essential that appropriate bases are selected.

1.2.4 Reactions to lengthy, large scale interruptions

Participants accurately identified impacts on different domestic and SME customer segments which are unique to longer, larger-scale interruptions which reflect those uncovered in the project literature review.

1.2.5 Mitigation strategies during supply interruptions

Participants were willing for their bills to increase by £20 a year if that would enable Electricity North West to reconnect customers in vulnerable circumstances more quickly in the event of an unplanned supply interruption. However, they concluded that there was no practical way to 'ring fence' the substantial extra income which such an increase would generate from across the DNO's operating region for this customer segment, and on that basis did not support it.

Across the groups there was no support for paying more to provide other types of community support such as hot meals.

1.2.6 Perceived ability of customer segments to signal their true VoLL

Participants generally felt that vulnerable customer groups would be unable to signal their VoLL because they would be less able to respond to research seeking to establish it. Others felt that no one could signal their true VoLL because of the complexity of calculating the impact of lost load. Some considered that the ability to signal VoLL was individual rather than specific to certain segments.

All of these findings may have been in the context that participants perceived that VoLL values are established by asking each customer group to estimate the figure themselves.

1.2.7 Testing the Stage 3 survey instrument

Participants commented on proposed levels for three supply interruption attributes: length, scale, and frequency, to test whether they perceived these as being distinct.

Participants generally felt that there was no real distinction in impact between four and six hour interruptions, although there was no clear view on which should be removed. Some participants suggested that four hours should be retained and an eight hour level be added; others that there should just be a six hour level.

There was support for additional levels being added at 18 hours and 2 days.

Describing the scale of a larger incident in a way that would be both meaningful and consistent for urban, semi-rural and rural customers was found to be difficult, but the following new definitions were proposed:

- A 3-minute walk from my property
- A 15-minute walk from my property/my village or rural parish
- Half of my city/my entire town/my village and surrounding areas
- My city/my rural district
- The whole of the North West.

It was widely agreed that the concept of scale is best explained with a map, although this might not be appropriate for small groups of customers with certain disabilities.

The levels proposed for the frequency attribute were considered to be distinct but participants perceived that many rural customers experienced supply interruptions more frequently than any of these options.

Participants made a number of practical suggestions about the wording and layout of the survey instrument, in particular, requesting that the familiar phrase ‘power cut’ is utilised in preference to ‘supply interruption’.

1.2.8 Socialisation of distribution costs and expenditure

ECP participants identified that the socialisation of distribution costs and, particularly, of investment in the network is complex.

Most were clear that basing distribution costs on usage was fair, although some suggested that a standing charge with a usage-defined variable amount could also be appropriate.

In terms of investment expenditure, participants understood that although only some customers directly benefit from the reinforcement of a particular asset, all customers benefit to a similar extent over time as the network is maintained, and this is both fair and practical.

Almost all of the participants recognised that assets can have competing arguments for investment prioritisation which include economic, environmental and moral aspects. There was considerable support for prioritising higher energy users even though the panel recognised that these customers tend to be more affluent, although the different VoLL levels for these types of customers was not specifically referenced.

1.3 Next steps

The survey instrument for Stage 3 of this phase of the VoLL2 project will be constructed utilising the findings from this qualitative research in terms of attribute levels, wording and layout.

2 OBJECTIVES

As set out in the project methodology statement, the objectives of this initial stage of direct customer engagement are to:

- Evaluate customer reactions to the outcomes and implication of the first 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'.

The last of these involves exploring how best to contextualise and explain VoLL, the potential multiplier effect and cost socialisation concepts in a manner that ensures research participants (particularly those responding in the subsequent quantitative customer survey stage) are able to sufficiently comprehend the subject matter and provide an informed opinion. Contextualisation is particularly important for this research because of concerns about customers' ability to envisage how they would react during low-probability large scale, long-duration outages, which are outside the experience of most. These concerns are highlighted in the literature review that accompanies this document, specifically in the Royal Academy of Engineering report. Careful survey design is required to ensure that respondents are supported in thinking deeply about the context of a major disruption; specifically all of the effects this would have on them and the wider community, before expressing their opinions.

2.1 Changes to the engagement plan

During the planning phase of this stage of qualitative research, the engagement plan was amended by adding three further research objectives:

- To explore customers' views on what constitutes reliability in electricity supply and on aspects of supply interruptions
- To test what size of bill increase (if any) customers would accept:
    - To ensure that adequate resources were available during supply interruptions to restore power to vulnerable customers
    - To supports communities that are affected by large scale events (ie providing a hot meal, hot drinks, charging points for mobile phones etc).
- To explore customers' views on the most appropriate socialisation of electricity distribution costs.

3 METHODOLOGY

3.1 Membership of the ECP

Four ECP groups were convened which met twice during August 2019. Three of these comprised domestic customers who belonged to segments which the previous VoLL study defined as typically having low, average and high VoLL, and also represented both urban and rural participants with a range of experience of supply interruptions. The fourth group comprised representatives of small or medium enterprises (SMEs).

Each group met twice, two weeks apart. Both meetings lasted approximately 90 minutes, and were facilitated by an experienced qualitative moderator. The meetings took place in Manchester and Lancaster.

Based on standard market research protocol, ten customers, reflecting an appropriate balance of age and gender, were recruited to take part in each ECP meeting, on the basis that eight would actually participate on the day. The target of at least eight attendees was achieved for all but the domestic rural group.

Details of the membership of the groups and the meetings are shown in Figure 3.1 below:

Figure 3.1: ECP groups, meeting locations and dates

Customer type	Members	Genders	Location	Meeting dates/times
Domestic, urban	8	4 female 4 male	Manchester	14 and 28 August 2019 6-7:30pm
Domestic, rural	6 (1 did not attend the second meeting)	2 female 3 (2) male	Lancaster	15 and 29 August 2019 6-7:30pm
Domestic, worst-served	8	5 female 3 male	Lancaster	15 and 29 August 2019 8-9:30pm
SMEs	9	4 female 5 male	Manchester	14 and 28 August 2019 8-9:30pm

The participants in the SME group represented organisations of a range of sizes: three were from businesses with more than 100 employees, one was from a business with 15+ employees, and the remainder were from businesses with 2-10 employees.

3.2 Incentivisation

Participants were paid incentives, which were weighted towards the second meeting to encourage attendance, as follows:

- **Domestic customers:** £40 per person paid at the end of the first meeting, and £60 at the end of the second meeting
- **SME customers:** £75 per person paid at the end of the first meeting, and £100 at the end of the second meeting.

3.3 Objectives of each meeting

Previous customer engagement has shown that members of the public generally lack awareness of the structure of the electricity industry, or the role of Electricity North West and how that differs from that of suppliers. In addition, engagement activities during the previous VoLL project had shown that this subject matter is particularly difficult for customers to comprehend. In order to gain informed views to meet the research objectives, the meeting moderators

therefore utilised discussion guides which led participants through a progressive set of concepts, to develop their understanding before testing their views.

The objectives of the two ECP meetings and the topics discussed at each are shown in Figure 3.2. The materials referenced are published on the project webpage.

Figure 3.2: ECP meeting objectives and topics

Meeting	Objective	Discussion topics
1	To understand how customers respond to the new VoLL and their perceptions of impact from different scale power cuts.	• Introduction to Electricity North West (Question and Answer/Video – 10 minutes) • Setting the scene: The last power cut occasion (10 minutes) • Expectations of electricity supply reliability (10 mins) • Reactions to VoLL (30 minutes) • Understanding the real cost of power cuts to customers (leaflet) (25 minutes).
2	To understand how customers evaluate the VoLL questionnaire key features	• Higher VoLL for certain customer groups (20 mins) • Views on impact of large scale but infrequent interruptions (25 mins) • Service Attributes and Levels (25 minutes) • Socialisation of costs (15 Minutes).

4 RESULTS AND ANALYSIS

This section of the report disseminates the key findings of the ECP in detail.

4.1 Views on supply interruptions

This section references the findings directly related to the additional research objective:

To explore customers' views on what constitutes reliability in electricity supply and on aspects of supply interruptions.

All ECP participants, including those who met the classification of 'worst-served', considered their supply to be reliable, and that interruptions are rectified in a timely fashion when they occur. They also agreed that supply is nowadays much more reliable than it was during the 1970s or before.

The panel made a number of astute, largely unprompted observations about the impact of planned and unplanned supply interruptions on themselves and others. This demonstrated that customers can accurately comprehend both the breadth of implications of interruptions and how these differ considerably across customer groups, both of which are key elements inherent in the VoLL concept.

Almost all of the participants, apart from the worst-served group, had been unaware, prior to commencing this research, that they should contact Electricity North West rather than their DNO in the event of a supply interruption. None had considered how their electricity bill is broken down or the proportion they pay for the distribution element of their supply.

These findings are in line with similar qualitative research conducted during the original VoLL project (ENWL010).

4.1.1 Acceptability of supply interruptions

Participants were quick to identify the components of a supply interruption which contribute to its impact: frequency, duration, time of day, season, day of the week, and the type of area where it occurs (urban versus rural).

They made the following observations about their expectations and what they would find acceptable:

- One interruption every two to three years is acceptable
- Interruptions lasting longer than four hours have more impact
- Expectation of an interruption is higher during storms
- SME customers considered that the frequency of interruptions lasting less than half a day has more impact on them than the interruption's duration
  "You could also go on an early lunch but after an hour it starts to affect your business really." - SME
- Domestic, urban customers felt that duration is more important than frequency in overall impact.

4.1.2 Less obvious/unexpected impacts of supply interruptions

Prompted by an exercise listing potential impacts of supply interruptions which generated further discussion of their own experiences and projections about other customer types, participants identified a broad range of less obvious or unexpected impacts of supply interruptions particularly those that might be associated with a longer duration. Examples cited by the panel included:

- Supply interruptions have a greater impact on off-gas grid properties or those without gas fires or cookers
- Equipment for sterilising babies' feeding equipment would not work
- Staff in businesses need training on how to deal with interruptions and contingency when they have no internet access
- SME customers would need to spend time implementing disaster recovery procedures even when power was restored
- Businesses can't process payments
- Customers of 'business to business' (B2B) companies affected by a supply interruption also suffer because the affected company cannot supply them
- Businesses may suffer through being unable to meet Service Level Agreements with their customers
- Customers can lose their water supply if this relies on pumps (eg residents of multi-occupancy buildings and some rural properties)
- Lifts would not work
- Electrical equipment may need to be reset when power is restored.
- Power surges when supply is restored can trigger automatic emergency 'help buttons'
- Medical practices would be unable to access computerised patient records
- Home and business security systems (eg burglar alarms, CCTV) would not operate
- Railway stations closed
- Streetlights and traffic lights not working
- There would be a low-level impact on entertainment access (including TV programmes not being recorded).

Opinions varied amongst rural customers about whether they would be adversely impacted by traffic lights not functioning during a supply interruption.

4.1.3 Coping with supply interruptions and issues they cause

Participants made the following observations about coping with supply interruptions:

- As supply interruptions are now much less frequent than they were in the 1970s and early 1980s in urban areas, people are now less prepared than they used to be in comparison to those living in rural areas currently
  "You always knew where the candles were. Always. You just expected a power cut." Domestic, urban

- Urban customers recognised that they can more easily cope with localised supply interruptions compared with rural customers as they can go out to eat or to get wifi access
- Rural customers, who might be more likely to experience supply interruptions more frequently than urban customers, are less concerned because they are familiar with what to do and so are less anxious when interruptions happen. Rural customers often have or torches and candles to hand or even own generators or alternative cooking equipment because they do not expect external support during supply interruptions
- All customers understood that what is merely an inconvenience for many can have a more serious impact on those in vulnerable circumstances
- Although domestic customers tend to be less immediately impacted, they expressed concerns about the implications of power going off and coming back on when they are away from home
- Domestic customers expect that the impact of an outage on organisations that provide essential services, such as care homes, would be significant. Therefore, the panel collectively agreed such organisations should have their own resilience plans and contingency arrangements (eg generators) to safeguard the interests of their residents.
- SME customers feel that larger companies have contingency plans in place while small businesses are less likely to.

4.1.4 Communication is key

Customers agreed that communication is very important during all supply interruptions:

- Customers value advance notice of time and duration for planned supply interruptions
- Customers understand that unplanned interruptions happen, but expect an explanation of why the interruption has occurred, what is being done to restore power, and when it will be back on. Communication mitigates anxiety.
  "I really appreciate that some things are out of people's hands. Nothing can be done, whether it's weather or damage or something like that. You just want to be kept informed. That's where you feel less vulnerable, I think." Domestic, urban
  "They keep in touch with you by text. They are good, 'we are still working on your problem, we'll update you.' So there is the communication there." Domestic, worst-served
- Being kept informed, even when the interruption is short, is important for homes with young children
- Respondents prefer pessimistic duration estimates because these allow them to plan for the worst. Speedier restoration would be a bonus. Community social networking groups are a useful communication channel for customers during supply interruptions as long as smart phones have charge.

4.1.5 Customers in vulnerable circumstances

Participants understood how supply interruptions would impact medically dependent customers. However they noted that not all customers who are eligible for priority or extra support during supply interruptions are registered on the Priority Services Register (PSR). The panel recognised that this is often because these individuals do not consider themselves 'vulnerable'. The panel therefore recommended that PSR is promoted with definitions of vulnerability, rather than the phrase 'vulnerable' to encourage registration.

4.2 Reactions to the outcomes and implication of the first VoLL study

This section references the findings directly related to the research objective:

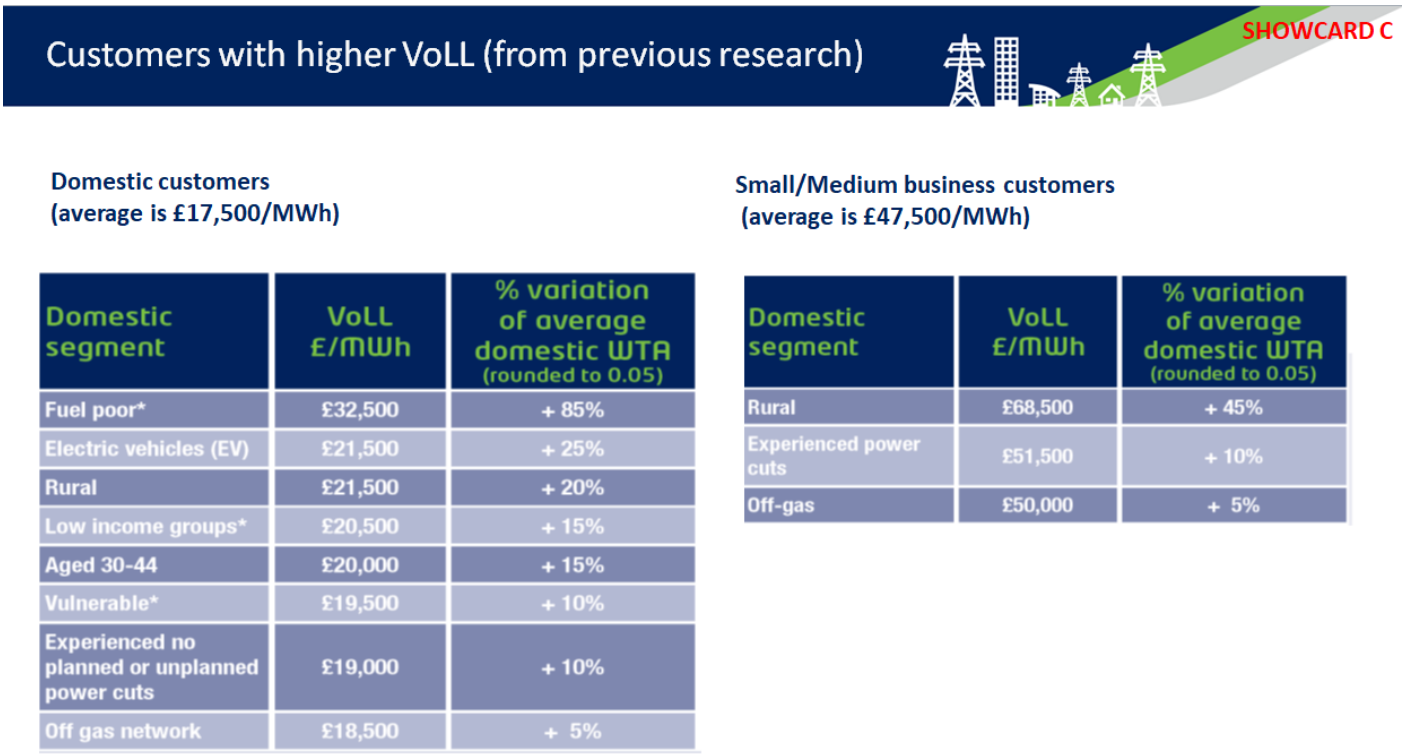
Evaluate customer reactions to the outcomes and implication of the first VoLL study, explore views on the low, medium and high VoLL assignment of specific customer segments.

4.2.1 Understanding the task

Participants were asked to comment on showcards listing domestic and SME customer segments which had above- or below-average VoLL as part of speculative discussions on why VoLL for these segments was above average.

The list shown to the domestic urban and SME panels only contained segments with above-average VoLL as shown in Figure 4.1 below.

Figure 4.1: Customers with above-average VoLL (Showcard)



Participants in the first ECP group queried why some segments were 'missing' from these showcards. As a result, the showcards were revised for the subsequent meetings with the rural and worst-served domestic groups. This involved including additional 'above-average' VoLL segments, some 'below-average' VoLL segments and separating medically dependent vulnerable customers from those with other types of vulnerability. Despite this change participants in the later groups continued to be distracted by 'missing' segments.

Figure 4.2: Customers with above- and below-average VoLL (revised Showcard)

Domestic customers with higher and lower VoLL (established from previous research)

SHOWCARD C

Domestic customers (average is **£17,500/MWh**)	VoLL £/MWh	% variation of average (rounded to 0.05)
Fuel poor customers	£32,500	+ 85%
Vulnerable customers *(average high, medium & low dependency)*	£17,000 / **£19,500***	-3% / **+ 10*%**
Vulnerable *(medically dependent)*	£18,000	+ 5%
Low income groups	£14,000 / **£21,500***	-20% / **+ 15%***
High income groups	£18,000	+2%
Aged 18-29	£16,500	-5%
Age 30-44	£20,000	+ 15%
Aged 60 plus	£17,000 / **£19,500***	- 1% / **+10%***
Experienced NO planned or unplanned power cuts	£19,000	+10%
HAVE experienced planned or unplanned power cuts	£17,000	-5%
Experienced a large scale, lengthy power cut	£12,000	-30%
Rural	£21,500	+20%
Urban	£16,000	-10%
Off gas network	£18,500	+ 5%
Electric vehicles	£21,500	+25%

* Figures adjusted to reflect income

Business customers with higher and lower VoLL (established from previous research)

SHOWCARD C

Small/medium business customers (average is **£47,500/MWh**)	VoLL £/MWh	% variation of average (rounded to 0.05)
Rural	£71,500	+40%
Urban	£45,500	-10%
Have experienced 4 or more **unplanned** power cuts	£80,000	+60%
Have experienced just 1 **unplanned** power cuts	£45,000	-10%
Off gas network	£54,000	+5%

Participants had clearly demonstrated in the opening discussion at their first meetings that they comprehended the impact of supply interruptions varying by customer segment. However, despite careful explanations of this task by the moderator, many participants' responses indicate that they had not fully understood what the data on the showcards represented. As a result, they were unable to provide meaningful views about the variations in VoLL of different customer groups, as established in the original VoLL study and presented in showcard C. For example, one

customer suggested that vulnerable customers should be 'given' a higher VoLL so that they received more support during interruptions, while others found it hard to accept that the VoLL concept is not related to compensation.

Responses referencing these customers are not included in the findings reported below, but nevertheless contributed to one of the learnings in Section 5.

One participant noted that VoLL values are "just a score" and found that a clearer way of understanding how the concept is applied. This insight appeared to assist the wider group in better comprehending the concept of VoLL.

4.2.2 Comments on different customer segments

Fuel poor customers

Almost all participants expressed surprise that the fuel-poor segment's VoLL was so much higher (85% above the average) than other customer segments, particularly because they perceived that this group would overlap substantially with the low-income segment (15%).

"For one to be 85%, and for the other to be 15%, is ridiculous." SME

Vulnerable customers

Most participants who were shown the initial version of the showcards stated that they would have expected customers in vulnerable circumstance to have an even higher VoLL.

"Vulnerable is quite a broad term. If somebody is very reliant on medical equipment for a specific reason would be more than vulnerable, surely." SME

Electric Vehicle (EV) owners

Participants understood that loss of supply would impact individuals whose only vehicle was electric more than average, although they were sceptical about how many people are currently in this situation.

"*If it's their only vehicle then fair enough, but I don't know anybody that's just got an electric car [and doesn't have an internal combustion engine car too] ."* Domestic, urban

"If we're talking in the future when people have them then it could be catastrophic if no one's got a car." Domestic, urban

Another participant suggested that VoLL should be much lower for EV owners as they had the option of utilising public transport if their car was not charged.

Experienced NO planned or unplanned power cuts

Several participants felt that this segment had over-estimated their VoLL because the high levels of reliability which customers have enjoyed in recent years means that they have little experience of supply interruptions. As a consequence, the panel suggested that this group may be afraid of the unknown and are not as prepared or resilient as previous generations were (eg keeping a torch, candle and matches handy).

"*It sounds worse than what it is, potentially*." SME

"*I would put it at the bottom, if anything*." SME

Other domestic segments

Several participants commented that they expected rural domestic, domestic age 60+ and both domestic and SME off-gas grid customers' VoLL to be higher than they are.

"*I'm surprised that rural is so much below fuel poor. I would have thought rural would have been very affected.*" SME

"*Electricity really is your only source of, you know, heat and cooking and everything. There's nothing you can rely on*." Domestic, worst-served

"*The off gas network one is quite a surprise. I couldn't run my business if I had a power cut because nothing will work. I own a café, there's no gas, it's all electric. I can't cook anything, I can't make anybody coffee, there's nothing. I would have to shut and I would have to pay my staff for that day and I wouldn't have any income*" Worst-served domestic/SME.

SME

Participants easily recognised that the impact of lost load on businesses would be higher than on households because of loss of revenue, ongoing costs, and security and reputational risks. One noted that B2B companies not only suffer themselves but their clients suffer because they haven't been supplied with business inputs from the directly affected company.

"Two hundred people not doing anything for an hour or two, it was pretty hard," SME

"We have a dental lab. We had a power cut about eighteen months ago, when the weather was bad, so it was just shut up shop and go home. A lot of disappointed customers and dentists." SME.

4.2.3 Criticisms of some segmentation bases

Several participants felt that life stages (eg working single or couples without children, households with children) would be a better basis than age. The common view was that life stage had more relevance to the impact of lost load and age was an inexact and generalised predictor of life stage. For example, individuals might have children when they are in their early twenties or late thirties, and couples in their early forties may or may not have children.

"I would take the age thing out altogether. I would remove that and let them fall into whichever category" SME

Worst-served customers also identified that a single SME category was inadequate, particularly for rural SMEs, citing the difference between a village café (totally dependent on electricity) and a sheep farm (could operate as normal at least for a day).

"I think you would need to find another way to work out some kind of algorithm to work out the effect on a business based on SIC code, number of employees you know or whatever; this doesn't cut it because for some rurals, if you're out of gas, they may be 80%+." Domestic, worst-served

Several participants (both urban and rural) queried whether the increasingly substantial segment of people who work from home had been considered.

4.3 Reactions to the incorporation of VoLL in investment prioritisation

This section references the findings directly related to the research objective:

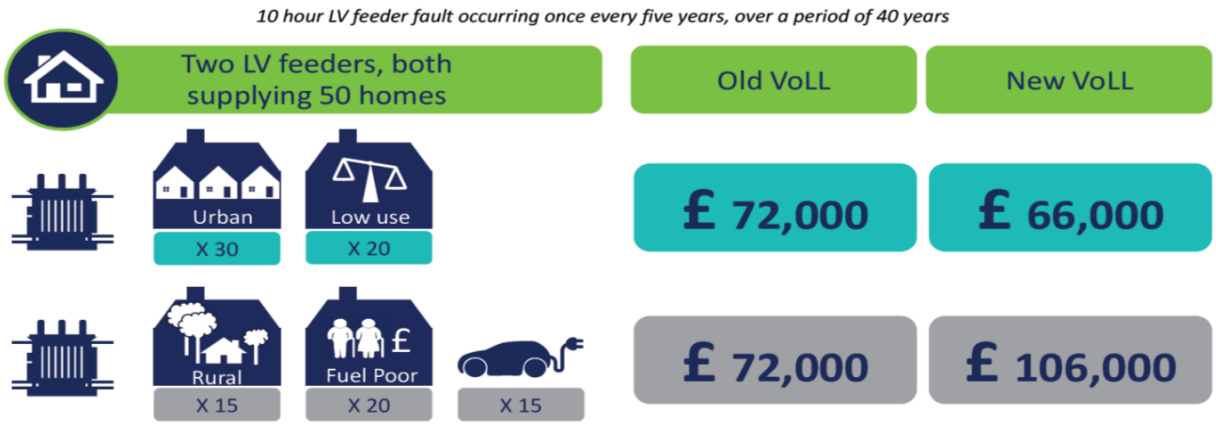
Evaluate customer perception of potential benefits/disadvantages of DNOs adopting an alternative approach to investment prioritisation.

Participants were shown a simple visual example of how using a differentiated VoLL could prioritise investment.

Figure 4.3: Illlustration of the effect of a differentiated VoLL on investment prioritisation

Example:

SHOWCARD F



The panellists understood that Electricity North West needed to prioritise its investment and that parts of the network serving different customer profiles require different investment. Initially, they generally agreed that it was appropriate to use a differentiated VoLL rather than a single VoLL in making investment decisions.

"*[Single VoLL] is faulty. Not everything is the same, there's other factors involved. It's just a simple way… the easy way*." SME

"It's fairer than a blanket rule." Domestic, rural

Worst-served (rural) customers believe themselves to be much more accepting of supply interruptions than urban customers but nevertheless saw that differentiated VoLL might improve the reliability of their supply, which they would welcome.

"I'm sitting here thinking, this is a fantastic idea for all rural areas because it is going to skew the investment infrastructure more to the rural areas, which it kind of needs, because we sit here accepting all these cuts that urban areas simply wouldn't even begin to tolerate." Domestic, worst-served

Several customers in the domestic, rural group did not agree that the different impact interruptions have on unique segments should be taken into account in investment planning, although they were unable to articulate why they felt this. The domestic worst-served group, however, who also lived in rural locations, supported differentiated VoLL.

"A fine-tuned version of it. I mean, I think the principle's sound and what we have seen tonight has got holes in it, but I think lot more money for rural communities is my vote." Domestic, worst-served

Of the participants who accepted the basic concept of differentiated VoLL, most struggled to envisage situations where it would be necessary to factor it into the decision making process. They were sceptical that there would, in reality, be situations where two assets were equally likely to fail. They therefore expected that investment priorities would be determined by demand levels or the extent to which the equipment was inadequate.

"*What I thought is if a substation needs replacing because of the old equipment etc., the VoLL shouldn't come into it. The equipment, if it's faulty or it's old, or it needs replacing that's the main priority*." Domestic, urban

"*I think the first and foremost priority is the state of the equipment*." Domestic, urban

"They know the substations which are coming offline, they know what needs replacing, so it should be a rolling program." Domestic, urban

One felt that social concerns should play a part, although he did not extend his views to cover situations where multiple vulnerable groups had to be prioritised, suggesting that he would support utilising differentiated VoLL for this purpose.

"If they said to me, right, well we can only do one at a time and we can do your substation or we can do the substation that covers the old folks home across the estate, would I say, well, do that one first?" Domestic, urban

SME participants were much more aware than domestic customers about Electricity North West reinforcing or extending the network, although some believe that prioritisation would be determined by the council.

4.3.1 Credibility of differentiated VoLL

As referenced in Section 4.2, participants readily agreed that the concept of differentiated VoLL was appropriate for domestic and SME segments. However, their scepticism about the accuracy of the relative amounts that the VoLL of different segments varied from the average. The panel also felt that the degree to which fuel poor customers' VoLL is above average could result in the company discounting it as a suitable factor in investment decisions.

Furthermore, they also clearly believed that some bases for segmentation are more meaningful than others; age was not considered meaningful, but life-stage was. The implication of this is that if differentiated VoLL is utilised in investment decisions, it is essential that appropriate bases are selected.

4.4 Reactions to lengthy, large scale interruptions

This section references the findings directly related to the research objective:

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.

Drawing on the example of major flooding event in 2015 which left the whole of Lancaster and around 100,000 people without electricity for more than 24 hours, participants identified impacts which are unique to longer, larger-scale interruptions which reflect those uncovered in the project literature review:

- If a wide area loses supply, individuals cannot go to local friend or family member's home, or to a café to keep warm
- Key communication channels could stop working (including mobile phone cells, though it was also expected that these would have generator backup) although communication is easier in dense, urban areas, for example through leaflets or physical notices
- Card payments would not work in shops and cash would run out as ATMs would not work
- Panic buying of essential items
- Schools would be closed causing childcare implications for parents who still had to go to work
- Home-based freelance workers could suffer loss of earnings if they could not make up the hours once power was restored
- Emergency services might be expected to cope with a large increase in incidents
- Food in freezers can be spoiled
- Medication which has to be refrigerated – both at home or at doctors' surgeries/pharmacies – could become unusable
- Crime may increase as streets are dark, eg muggings, burglary, or looting of business premises
- The longer an interruption lasts, the greater the chance that the elderly and others with mobility issues might fall and sustain injuries in the dark or because their stairlift battery had run out

- Inability to flush toilets because of electric water pumps not working causing hygiene risks
- Key life events such as weddings and funerals might need to be postponed
- People may begin to panic causing further impacts
- Businesses also noticed that they could lose customers or suffer reputational damage if they were unable to serve their customers normally for a prolonged period, particularly if their customers did not realise that they were experiencing a supply interruption
- Appointment-based businesses such as dentists would have a 'backlog', disrupting them and their customers/patients beyond the restoration of power
- There is a risk of animal welfare impacts (eg on farms where milking machines would not work) during prolonged interruptions.
- Backup systems run out (eg fuel for generators or battery backups).

However, domestic customers also noted that communities can respond well when faced with shared adverse circumstances, and this can mitigate the impact of an interruption compared with one affecting a much smaller area.

"I think if it's just your house you feel more vulnerable because you think, ooh, you know. When it's the whole village or the whole street you think, we're all in it together." Domestic, urban

"It's almost like there's more of a sense of community if it's an act of God, like you say, because we all rally round going, 'Ooh, so and so is going to need to keep warm', for example, so we will make sure they are OK". Domestic, worst-served

Similarly, another customer stated,

"*I think also the bigger the area, the more patient I would be.*" Domestic, rural

One rural customer emphasised the value of local radio for longer-term interruptions once mobile phone batteries had run out.

Many expected that they would be able to cope with a longer or more widespread interruption.

"You'd take yourself away from the situation, depending on the time of day." Domestic, urban

"If you've got family and friends in different areas." Domestic, urban

"I think initially you're going to panic and then after a time if it's not been resolved you just have to accept it, and get on, and do what you can. There's no point in staying angry for thirty-six hours." Domestic, urban

"There is always something you can do unless you are in a rural area and it's a whole area outage" SME customer talking about the impact on domestic customers

However, SME customers identified serious risks and impacts on their businesses:

"Security would be worst issue." SME customer running a jeweller's shop

"I've got loss of wages. Six hours on the lowest wage, that's like ten grand, for two hundred staff." SME customer

For other types of business, reputation was the greatest concern.

Communication is as essential:

"I would be worried about the reality of the power cut itself, what the situation was in terms of why… what was being done in the longer term prognosis of solving it; and I would want information if it wasn't going to be solved relatively quickly ie 24, 48 hours, what that situation was so I could plan ahead." Domestic, rural

4.5 Mitigation strategies during supply interruptions

This section references the findings directly related to the research objective:

Further explore various mitigation strategies and views on their relative appropriateness to understand the drivers of perceived fairness.

Participants were asked whether they would accept a bill increase:

- To ensure that adequate resources were available during supply interruptions to restore power to vulnerable customers
- To supports communities that are affected by large scale events (ie providing a hot meal, hot drinks, charging points for mobile phones etc).

They were not briefed about the support Electricity North West already provides to meet and exceed its regulatory obligations in supporting vulnerable customers and communities during supply interruptions.

Participants felt that even the maximum amount proposed - £20 – was acceptable:

"Twenty pound a year's not much is it?" Domestic, urban

"They could get away with more." Domestic, urban

However, while the amount of money was acceptable in principle, many would only be happy to pay this if it was guaranteed to help vulnerable customers. Several felt the concept was impractical:

"How can you just help the vulnerable?" Domestic, rural

"I don't mind putting that towards… as long as I get a breakdown of where the money is being invested." SME customer

"£20 a year OK As long as it was ringfenced and assured it was going into a separate pot, I would pay twenty pounds a year. But I would need assurance." Domestic, worst-served

Others were suspicious that such an extra charge would just increase shareholder profits, or that it would be impossible to guarantee that this is what it was used for, or that it is practical to help vulnerable customers ahead of other customers.

"Things just get very, very murky in a big business... Twenty quid is nothing, but I may as well set fire to it, to be honest." SME customer

"Twenty quid from everyone in North West is quite an amount." Domestic, rural

"I'm going to say zero pounds per year because I can't see how even if you ringfence it…" Domestic, worst-served

"In rural areas, investment in the infrastructure is going to benefit the fuel poor vulnerable communities just as much as it is for the well-to-do. Because in small villages, you have very affluent and the very vulnerable." Rural, worst-served

Across the groups there was no support for paying more to provide other types of community support such as hot meals.

4.6 Perceived ability of customer segments to signal their true VoLL

This section references the findings directly related to the research objective:

Explore the perceived ability of customer segments to signal their true VoLL.

ECP participants generally felt that some customer groups would be unable to signal their true VoLL for various reasons.

"[The calculation] could be skewed. You might not get a true reflection because you might get groups missing data because of their inability to send in feedback." Domestic, urban

"This is all about people getting their say, but they don't understand the terminology and they're not going to understand" Domestic, urban

Others felt that no one could signal their true VoLL because of the complexity of the impact. This may have been in the context of believing that the VoLL values had been established by asking each customer group to estimate the figure themselves, implying scepticism about the accuracy of the 'true' VoLL values rather than the abilities of certain segments.

"I think as well, by virtue of it being a massive inconvenience to you, you're going to struggle to put a proper value on it yourself anyway." SME customer

"I don't think everybody will be able to. I mean it's so subjective, isn't it? And like it comes down to a person's ability to articulate how a power cut affects them over somebody else's." Domestic, rural

The main customer group which participants felt would be unlikely to be able to signal their VoLL accurately was vulnerable customers.

"Vulnerable people are going to struggle in all forms or walks." SME customer

Many felt that younger people, those with higher incomes, and businesses would be more likely to be able to express themselves or identify the impacts of an interruption, although they recognised that this was a generalisation. They were also unsure whether being able to articulate a view clearly had an effect.

"A younger person definitely could [be more vocal and more able to express themselves]." SME customer

"*The younger generation now just rely on charging their mobile phones, computers, computer games, things like that, so if they have a power cut, the world has come to an end. So they would be able to explain it better probably, because if I get a power cut, it doesn't matter, I cope."* Domestic, rural

"I think that sometimes people who are more intellectual have a better way of putting things across; might be able to get their point across better." SME customer

"If you're in a professional environment, you're more used to dealing with more businesses, so you can get to the crux of the matter, you sort of do speak the same language, and you can convey what you want, because you're used to doing it every day, aren't you?" SME customer

Others felt that the ability to signal VoLL was individual rather than specific to certain segments.

"It depends, because different people of different ages can express themselves, it's all down to the person in general, isn't it?" SME customers (x3)

"Are higher income people, better and more used to it, and more accustomed to being listened to?" SME customer

"No, because they could be in higher income all different sorts of reasons. You can earn money no matter what you do, it's all down to yourself, what you're in and what you do. It doesn't mean you can't make sense." Different SME customer

4.7 Testing the Stage 3 survey instrument

This section references the findings directly related to the research objective:

Test and refine a survey instrument for use in Stage Three of the research, including how to best conceptualise a 'large scale interruption'.

Panellists were asked to comment on proposed levels for three supply interruption attributes: length, scale, and frequency. Findings relating to these are set out below.

4.7.1 Attributes and levels

Duration

The levels proposed for this attribute were:

- 20 minutes
- 1 hour
- 4 hours
- 6 hours
- 12 hours
- 24 hours
- 3 days.

Participants generally felt that there was no real distinction in impact between four and six hour interruptions, although there was no clear view on which should be removed. Some participants suggested that four hours should be retained and an eight hour level be added; others that there should just be a six hour level.

There was support for additional levels being added at 18 hours and 2 days.

"Four to six are quite close." SME

"There's not a huge difference between four and six." Domestic, worst-served

"I'd do six and drop four, because then you've got something between one and twelve. And I just think you need one thing between one and twelve." Domestic, worst-served

"I would expect eight to be between six and twelve. Because eight is a working day, isn't it?" SME

"I think one, six and then 12." Domestic, worst-served

"I think after the point four hours you want a lot more info, don't you?" SME

"I think you'd have an eighteen hour one. You wouldn't go from 12 to 24. Because a lot could happen in that 12 hours." Domestic, urban

One participant felt it was confusing for most of the levels to be expressed in hours but one in days.

Scale

Panellists were first presented with five different ways in which the scale of the interruption could be described:

- Number of properties affected
- Radius of the area affected in miles
- Named geographical locations
- The driving distance to an unaffected location
- A map.

There was strong support for utilising a map to present this attribute. Named geographical locations were also popular, and clearer than postcodes which can cover a wide area in rural districts, although the locations listed would need to be customised to each survey respondent's location and this is impractical.

"I'd prefer the map. The map's the most accurate, it's the most visual." Domestic, urban

"Number of properties, less relevant; number of miles, unless it's a circle, it doesn't help. How about the names of the geographical locations?" Domestic, urban

"I wouldn't understand what postcode ranges affected… in the area I live now." Domestic, urban

"And who knows a five-mile radius as well?" SME

"What about if you're vulnerable and you couldn't read that map? At least if you were [named geographical locations], you'd read where you live." SME

"The trouble with a list, if it's a wide area, it could be that many, that's big a list. Think about Chorley and all the little villages." Domestic, worst-served

One participant noted that some customers might not be able to interpret a map, and therefore a combination of a map and location names would be preferable, a proposal supported by others in his group. This might be practical for surveys administered face-to-face or over the phone to small numbers of domestic customers.

Following this discussion, participants were asked to evaluate five proposed levels for the scale attribute, expressed in relation to the respondent's location as follows:

- My road
- My immediate neighbourhood
- My entire town/area
- The whole region/city
- The whole of the North West.

This type of description was not one of the five that the group had previously evaluated, and their presentation led to discussions about how to interpret them rather than whether they were distinct. The implication of this finding is that the wording of these attribute levels needs to be expanded to be inclusive for sparse rural, village, town and city customers, and that the definitions should be established at the beginning of the survey with example maps at least for rural and urban areas. This will ensure that the scale levels are unambiguous and that the survey results are robust.

"I couldn't tell my area, immediate city, immediate neighbourhood, it's just a bit woolly." SME

"It's really difficult to define these for us because we all live in very different scales to people who live in an urban area." Domestic, worst-served

Urban customers were clear about the area encompassed by a '**neighbourhood**', but rural customers were not, although they noted that 'village' was not specified in any of the options, and this might be an appropriate equivalent to 'neighbourhood'.

"You can't quantify exactly what it means or what it is, but everybody has, in their own mind, what their neighbourhood is." Domestic, urban

"What if there's only one street?" Domestic, rural

"My immediate neighbourhood is village, I think it probably serves rows of scattered farmhouses." Domestic, worst-served

"Can we add village?" Domestic, worst-served

Participants noted that 'parish' is a widely-used civic (ie not church-related) term in rural areas, which encompass properties outside villages but recognised this phrase would not translate to urban settings.

"The line usually goes through the empty fields in between the villages. So you do think about the parish that you're in. I mean, there are [more] parishes in a big village then a tiny one," Domestic, worst-served

There was little consensus on what the word 'region' meant.

"To me, as soon as you mention the word region, it has a town or a city, it's an economic area." Domestic, worst-served

"When I think region I think North West, so the district that you suggested would be better, I think." Domestic, rural

"If you think about the regional news it covers the North West." Domestic, rural

As a result of these findings, the following amended list is proposed which is more inclusive of all customer types, and consistently lists urban descriptions first followed by rural descriptions.

- A 3-minute walk from my property
- A 15-minute walk from my property/my village or rural parish
- Half of my city/my entire town/my village and surrounding areas
- My city/my rural district
- The whole of the North West.

Frequency

The levels proposed for this attribute were:

- Once every three years
- Once per year
- Three times per year.

ECP participants felt that these levels were distinct but perceived that many rural customers experienced supply interruptions more frequently than any of these options.

"Add once a week or once a fortnight." Domestic, worst-served

"Six a year is about normal." Domestic, worst-served

One participant suggested that the options be reworded so that the word/number 'three isn't used in more than one option eg change 'Three times per year' to 'Once every four months' which would also be consistent wording with the other options.

4.7.2 Choice experiment layout and wording

All participants found that the layout of the showcard for the choice experiment was confusing, although the moderator explained that the actual survey layout would be different. Many also made suggestions for amendments to the wording.

"We have had two sessions now and everyone is fairly intelligent, quite lucid, so you can imagine other people…" SME

Several participants spontaneously and strongly recommended that the term 'power cut' be used consistently in the survey instrument and related materials in preference to 'supply interruption'.

"People know what a power cut is better than power interruption." Domestic, rural

"You're talking about length of interruption. Why don't you just call it length of power cut? Because to some people, interruption, knocking on my door is an interruption." Domestic, rural

Several participants stated that their choices between options would depend on further attributes which were not specified, namely, time of day for shorter interruptions, season and whether the interruption was during the week or at weekends.

SME participants identified that the wording should make it clear that the questions relate to unplanned interruptions. Some also suggested that it should be made clear to survey participants that they would be responding to a number of sets of options.

Participants in all groups had difficulty in comprehending the question, "Which of these situations would be the WORST for you, and which would be the LEAST BAD?"

"I just don't think they sound grammatically right, I'd probably say something like the least disruptive option." Domestic, urban

"it almost feels like the same question, there's two negative options…it was the same thing in two different ways." Domestic, urban

Participants were also confused by inconsistent terminology; usage of the word 'situation' in the question at the top of the showcard but 'option' elsewhere.

It was noted that it might be necessary to present the attributes in different orders across separate questions to ensure that survey participants' decisions were not biased by the first attribute. However, when choosing between the options given in the example, participants focused on duration and frequency, suggesting that scale should be emphasised, particularly as the objective of the VoLL2 study is to explore the multiplier effect.

Consensus was that the question would be more easily comprehended if it was "Which of these options would be the MOST DISRUPTIVE for you, and which would be LEAST DISRUPTIVE?" Participants also recommended that the wording by the radio buttons should include 'A, B or C, ie "Select the most disruptive option (A, B or C)", and "Select the least disruptive option (A, B or C)".

Depending on the exact proposed layout of the options in the survey instrument, some respondents suggested that expressing each option in a different colour would help indicate that each one is a package.

4.8 Socialisation of distribution costs and expenditure

The panel were shown a showcard illustrating the impact of different LCTs on the network. This demonstrated that heat pumps and EVs place much higher demand on the network than established electrical equipment in the form of domestic appliances such as dishwashers. This contextualised the electricity usage/needs of different customer segments for a discussion of the socialisation of distribution costs.

ECP participants identified that the socialisation of distribution costs and, particularly, of investment in the network is complex.

Most were clear that basing distribution costs on usage was fair, although some suggested that a standing charge with a usage-defined variable amount could also be appropriate.

"So what I'm saying is there should be a standing charge per house, per month or per year that doesn't vary depending on how much electricity you use, the same as your line rental for your phone line." Domestic, rural

They quickly identified that there are other ways that costs can be socialised, some of which would be fairer but would also be impractical.

One SME customer observed that the size of electricity bill overall for domestic customers isn't a straight multiple of the number of occupants of a home (ie the bill for a family of four is not four times the size of that for a single person) so the proportional charge for distribution is unfair in that smaller households are paying more per person.

Another SME customer took a different perspective on the 'per person' bill-proportional distribution costs:

"Just because someone lives in a bigger house and uses more energy, I don't believe they should have to pay more towards the same thing." SME

Other customers in this group felt that usage is the key factor, as charges based on this also reward energy-efficiency and agreed that distribution costs should not be based on the rateable value of the property.

"But they're putting more strain on the network so they should basically pay… well going back to percentages they should pay more." Domestic, rural

"[It should be that if] you are in a big house, and you don't use a lot of electricity or whatever, you still the pay the same as someone in a small house." SME

The moderator then explained that customers with photovoltaic (PV) panels may have lower bills because they use less mains electricity, yet microgeneration can also overload the network. There was some support for applying a standing charge to microgeneration customers or for distribution costs to reflect supply as well as demand.

"It should be a standing charge for solar panels." Domestic, urban

"To take electricity away from the house by the solar panels, you are still carrying, so there should be a charge on that." SME

However, there was also recognition that this could have unintended, adverse consequences in terms of discouraging what was perceived to be an environmentally desirable technology installed at those customers' own expense.

A further complexity was noted in relation to fuel-poor, off-gas customers, who can pay more to use the electricity network than customers with gas central heating:

"Fuel poor customers often use more electricity because they don't have alternatives. They don't have central heating, they don't have curtains or double glazing." Domestic, rural

In terms of expenditure, participants understood that although only some customers directly benefit from the reinforcement of a particular asset, all customers benefit to a similar extent over time as the network is maintained, and this is both fair and practical.

"It's just practical distribution." Domestic, urban

"I don't see any other way." Domestic, worst-served

"Nobody gets left out eventually everyone gets their substation replaced." SME

Almost all of the ECP participants recognised that assets can have competing arguments for investment prioritisation which include economic, environmental and moral aspects. There was considerable support for prioritising higher energy users even though these customers tend to be more affluent, although the different VoLL levels for these types of customers was not specifically referenced.

"It's difficult this isn't it? They've both got pluses and minuses of why they should be first." Domestic, urban

"And the richer they are, the people with the electric cars, they need to go to work because there's people relying on them." Domestic, urban

"And they've paid more for their electric car to try and help the environment and you know that kind of thing, and yet it feels like they're being penalised for doing that." Domestic, urban

"If you invest in the wealthy to begin with you are getting the money in, the funds in, to carry on to do future works." SME

"*If you're going to overload it, you're going to blow your substation which will affect everybody, so, they've got to cover for that increased use as the priority."* Domestic, worst-served

"[PV owners may pay less but] I think they are helping the environment." SME

"I think the people that use less aren't putting as much strain on the network, so they should be prioritised. If people are putting more strain on the network because they're using more, they should put them on the back burner." Domestic, rural

"There's more likely to be power interruptions if you don't invest in the high users." Domestic, rural

"In my mind, some of that discount [the fact that feed-in tariffs are lower than purchase tariffs] of what you get when you sell into the grid should be because a contribution is being made to fortify the grid to be able to handle your very inconvenient overloading of the system at random intervals when it's not most wanted." Domestic, worst-served

"If you're interested in reducing your CO2 emissions, what you want is for people to take up electric cars and to install heat pumps." Domestic, worst-served

Another panellist felt that emissions should not be factored into the calculation.

One customer was clear that a poorer area of households with high VoLL which contributed less to network charges should be prioritised ahead of a more affluent area with lower VoLL:

"Morally bankrupt if you do anything else." Domestic, worst-served

5 LESSONS LEARNED FOR FUTURE INNOVATION PROJECTS

The following lessons were learned for future phases of this and other innovation projects:

- **Representing different customer segments:** Customers find it hard to comprehend lists containing customer groups from more than one segmentation base eg an age-based group and a segment based on experience of supply interruptions. For similar future engagement on VoLL, the heading "% variation on average (rounded to 0.05)" should be reviewed; "Amount higher/lower than average (to the nearest 5%)" might be more appropriate.
- **Representing VoLL data:** Customers may find it easier to comprehend VoLL if it is expressed as a score rather than a monetary value, as this prevents them interpreting it as a compensation payment or a fine DNOs might have to pay if such customers have their supply interrupted.
- **Example trade-off exercises:** When tested, these should use the actual layout to be used in the survey instrument.
- **A map is the clearest method of describing a geographical area** whether rural or urban. If areas are to be described in words in general terms (ie not place names), they must be inclusive for rural, semi-rural and urban customers who live in isolated locations, villages, towns or cities.

6 CONCLUSION

This phase of qualitative research reinforced the findings of the first VoLL study in finding that domestic and SME customers are able to identify the wide range of different impacts that supply interruptions have different customer segments, and how these impacts are affected by the duration, timing, frequency and scale of the interruption, including for long, large-scale interruptions.

However, the findings demonstrate that this is a complex subject matter. The findings also suggest that although customers support the VoLL concept, they question some of the calculations made in the initial VoLL study, and are uncertain that VoLL should be a major factor in network investment decisions. Participants put forward a number of views that support prioritising investment based on expected load (eg in areas of high low carbon technology (LCT) adoption) ahead of in lower-usage, poorer areas, although they recognised that decisions are highly complex.

Participants' uncertainty, conflicting views, and recognition that this is a complex area highlights the importance of the further detailed analysis this project seeks to provide om exploring the requisite level of sophistication needed in a credible decision making tool, and the appropriate mechanism for practicable implementation, at scale, for a differentiated VoLL.

7 NEXT STEPS

The survey instrument for Stage 3 of this phase of the VoLL2 project will be constructed utilising the findings from this qualitative research in terms of attribute levels, wording and layout. The subsequent results will be analysed and peer reviewed before publication, which is due March 2020.

This qualitative research highlighted the need for extremely careful design of the survey instrument. As a result, a pilot phase was added to the methodology for the next, quantitative phase of the research, to ensure that the survey instrument is robust.

8 APPENDIX

The discussion guides and showcards utilised in this qualitative research are published on the VoLL2 webpage.