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| Network Innovation Competition 2020 Supplementary Answer form | | |

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| Project Name | QUEST | | |
| Question number | #26 | Pro forma section | 3 |
| Question date | 08/09/20 | Answer date | 10/09/20 |
| Question summary | Do your estimates for reduction in losses and reduction in consumption assume a constant voltage:current relationship to 2050? If they do, please illustrate how these benefits might be moderated by change in that relationship resulting from new LCTs on the network. | | |

## 

## Answer (please retain document formatting and do not exceed 2 pages unless otherwise agreed with Ofgem)

Our approach to estimating the reduction in losses and consumption associated with our use of QUEST differs for HV and LV connected customers.

For HV customers, we use the voltage demand relationship initially developed in the CLASS LNCF project. The relationship is described by the following equation:

* where P0 and V0 are the power and voltage before the voltage reduction, P and V are the power and voltage after the voltage reduction and kp is the voltage exponent of real power.

During the CLASS project trials, a range of values of kp were calculated using network measurements, depending on seasonality and the mix of customer type as presented in table 1.

As this as HV, in our assessment of QUEST benefits, we have selected the ‘mainly non-domestic’ seasonal average kp values (highlighted in blue) and assumed they remain constant out to 2050.

*Table 1: kp values calculated in the CLASS trials*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Mainly domestic | | | Mainly non-domestic | | | Mixed | | |
| **Min** | **Max** | **Ave** | **Min** | **Max** | **Ave** | **Min** | **Max** | **Ave** |
| Spring | 0.83 | 1.86 | 1.32 | 1.02 | 1.80 | 1.39 | 0.8 | 1.68 | 1.20 |
| Summer | 0.72 | 2.11 | 1.25 | 1.02 | 1.97 | 1.52 | 0.7 | 1.58 | 1.20 |
| Autumn | 0.67 | 1.91 | 1.31 | 0.95 | 1.98 | 1.53 | 0.71 | 1.8 | 1.23 |
| Winter | 0.87 | 1.93 | 1.33 | 0.86 | 1.85 | 1.47 | 0.7 | 1.91 | 1.23 |

Our estimates for the reduction in losses and consumption for LV customers used the ‘CVR factor’ first calculated in the Smart Street LCNF project. This produced a range between 0.97 and 1.09.

To illustrate how QUEST benefits might be moderated by changes in the relationship between voltage and demand, we have examined sensitivities on the kp and CVR factor values used. The results are presented in table 2 with the QUEST bid assumption highlighted in blue:

*Table 2: kp Sensitivity analysis*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | Minimum | Lower Quartile | Average - Base Case | Upper Quartile | Maximum |
| HV kp | Spring | 1.02 | 1.215 | 1.39 | 1.605 | 1.80 |
| Summer | 1.02 | 1.2575 | 1.52 | 1.7325 | 1.97 |
| Autumn | 0.95 | 1.2075 | 1.53 | 1.7225 | 1.98 |
| Winter | 0.86 | 1.1075 | 1.47 | 1.6025 | 1.85 |
| LV CVR Factor | | 0.97 | 1.00 | 1.03 | 1.06 | 1.09 |
| 2050 NPV at ENW Scale (£m) | | 28.00 | 30.22 | 32.62 | 34.38 | 36.32 |
| 2050 NPV at GB Scale (£m) | | 218.58 | 243.12 | 266.71 | 282.75 | 300.73 |

This reveals that QUEST maintains a positive NPV (both for ENW and GB scale) even with significant reductions to the Base Case kp and CVR values, thus providing increased confidence in the validity of this assessment.

Furthermore, the intelligent AVC relays deployed as part of the CLASS roll-out and proposed for QUEST calculate the kp value in real time, sharing the results with our central systems via SCADA. The relay measures the voltage and current on tap-change initiation and again on tap-change completion, and the equation above is used to determine the kp value. A recent review of this data shows that the kp values remain broadly consistent with the range obtained during the CLASS trials in 2015.

While the voltage-demand relationship has not changed over the proceeding 5-years, we acknowledge that there is uncertainty as to how this might change out to 2050. Given this, we will now include for an additional deliverable in the QUEST project, undertaking research on how and by what degree this relationship might change in this period. We will fund this research through an increase in our project contribution, thereby ensuring that the project cost to customers remains unaffected. We expect to conduct a competitive tender in the early stages of the project to recruit the most appropriate organisation to assist us with this research.