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Bringing energy to your door

# Customer Load Active System Services Second Tier LCN Fund

# Successful Delivery Reward Application

**29 April 2016**

CLASS

Customer Load Active System Services

## VERSION HISTORY

| Version | Date | Author | Status |
|---|---|---|---|
| 1.0 | Mar 16 | S M Brooke | First draft for review |
| 2.0 | 19 Apr 16 | S M Brooke | Second draft for review |

## APPROVAL

| Name | Role | Signature & date |
|---|---|---|
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# 1. EXECUTIVE SUMMARY

The ultimate test of an innovation project is whether it is transitioned into business as usual to deliver value to customers. Electricity North West will deploy CLASS across its network during RIIO-ED1 to deliver significant benefits and carbon savings to our customers. We will also, through our ongoing work on energy markets, show how CLASS can be deployed to replicate these benefits across all DNOs and hence deliver these benefits across GB.

The CLASS project has successfully delivered an ambitious programme of work and has produced significant learning for all stakeholders by increasing the understanding of the voltage/demand relationship. In addition it has demonstrated how the use of innovative voltage management technologies can be utilised to provide demand response for the benefit of GB. All the successful delivery reward criteria (SDRC) have been satisfied, the combined output from the project has more than fulfilled the commitments made and CLASS was delivered significantly under budget returning money to customers.

This Successful Delivery Reward (SDR) application follows on from the comprehensive CLASS closedown report published on the CLASS website where all of the documentation generated by the project can be freely downloaded.

The objectives of the CLASS project were to test the five hypotheses, detailed below in Figure 1.1, in order to prove that a DNO is able to deploy the CLASS functionality without difficulty using existing network assets and without adversely affecting customers or stakeholders. The lasting legacy of the CLASS project is the capability afforded to the system operator and to the DNOs in efficient management of the whole GB power system. The tools, techniques and methodologies delivered by the CLASS project will deliver benefits to customers for years to come and form a blueprint for potential distribution system operator services.

*Figure 1.1: The five CLASS project hypotheses*

| No. | Hypothesis |
|---|---|
| 1 | *The CLASS method creates a demand response and reactive absorption capability through the application of innovative voltage regulation techniques.*<br>PROVEN – see capability assessment and reactive power absorption results in research workstream. |
| 2 | *Customers within the CLASS trial areas will not see/observe/notice an impact on their power quality when these innovative techniques are applied.*<br>PROVEN – see customer survey results in customer engagement workstream. |
| 3 | *The CLASS method will show that a small change in voltage can deliver a very meaningful demand response, thereby engaging all customers in demand response.*<br>PROVEN – see results from load profiling trials in research worksteam. |
| 4 | *The CLASS method will defer network reinforcement and save carbon, by the application of demand decrement at the time of system peak.*<br>PROVEN – see results from capability assessment in research workstream and carbon impact study in Appendix 5.8. |
| 5 | *The CLASS method uses existing assets with no detriment to their asset health.*<br>PROVEN – see results from asset health study in research workstream. |

The key learning headlines from the CLASS project are:

- The satisfaction level of customers across four seasonal waves of engagement throughout the trial period remained constant showing that the effects of CLASS were indiscernible to customers,

- The trials have provided new learning regarding customer load types, behaviour and the method by which new technologies can be integrated to provide demand response,
- The results have shown the potential to provide frequency response services and reactive power services to the Great Britain system operator (GBSO), National Grid, unlocking up to 3.3GW of demand response, equivalent to two combined cycle gas turbine power stations, and up to 2GVAr of reactive power absorption across the whole of GB from the distribution network,
- The asset health studies showed that the impact of the CLASS trials on the transformer and tap changer are negligible, and
- The trials have proved an alternative, low cost, carbon-saving and flexible solution to defer network reinforcement and for provision of ancillary services to GBSO when compared to the existing costly and carbon intensive methods.

This SDR application will show that the CLASS project was effectively managed, all SDRCs have been satisfied and CLASS was delivered significantly under budget.

We stated in the full submission that the "CLASS project will not consider the commercial; market and regulatory aspects of a distribution system operator (DSO) providing these demand response and/or reactive power capabilities to the balancing services market". After accepting the CLASS closedown report Ofgem granted a short extension to undertake a follow-on piece, due to be completed by 31 May 2016 that will "cover the assessment of the commercialisation and market implications associated with full GB-wide rollout of the CLASS technology". This will be the subject of a separate reward application in May 2017.

# 2. PROJECT MANAGEMENT

## 2.1 Summary

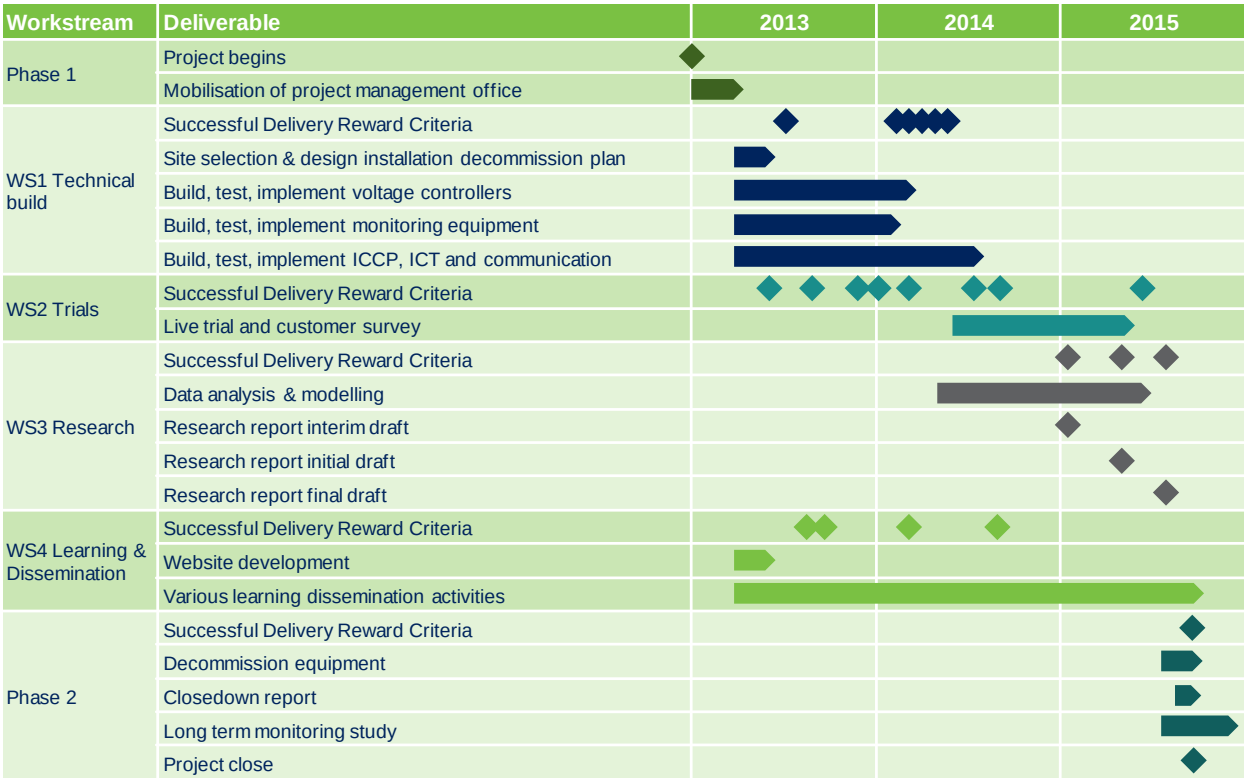
PRINCE2 principles were applied in writing and delivering the CLASS full submission and in the creation of the proposed CLASS project delivery. The submission proposed a structured project delivery method for CLASS by defining phases and grouping similar types of activities into 'workstreams'. The dividing of the CLASS project into manageable stages enabled an efficient control of resources, meaning it would be carried out in a controlled and organised way and facilitated the close monitoring the CLASS project.

The CLASS project delivery approach was implemented as proposed through clear leadership coupled with a structured project management approach and strong governance procedures, based on PRINCE2 principles. Oversight of the CLASS project was tiered and its profile within the innovation programme enabled risks, issues and opportunities to be discussed, with mitigating measures implemented and communicated for risks and issues as delivery progressed. A discussion on the future opportunities for the CLASS functionality led us to talk to Ofgem about a follow-on project examining the energy markets and how CLASS can be deployed to deliver benefits across GB.

## 2.2 A structured approach

Electricity North West's approach to the delivery of the CLASS project was defined, right at the start, in the construction of the CLASS full submission in the summer of 2012. The full submission structured the project into its various phases, which were defined as workstreams, as shown below in Figure 2.1; each workstream was given a name and assigned to a single person. This approach ensured that the costs, project plan, project milestones/outputs and the gathering of evidence to prove or disprove a hypothesis was structured around each named workstream where a single person, the workstream lead, had the responsibility for delivering its defined outputs. This is Electricity North West's proven model to ensure a Second Tier project meets its delivery criteria.

*Figure 2.1: High level view of project plan, showing workstreams*



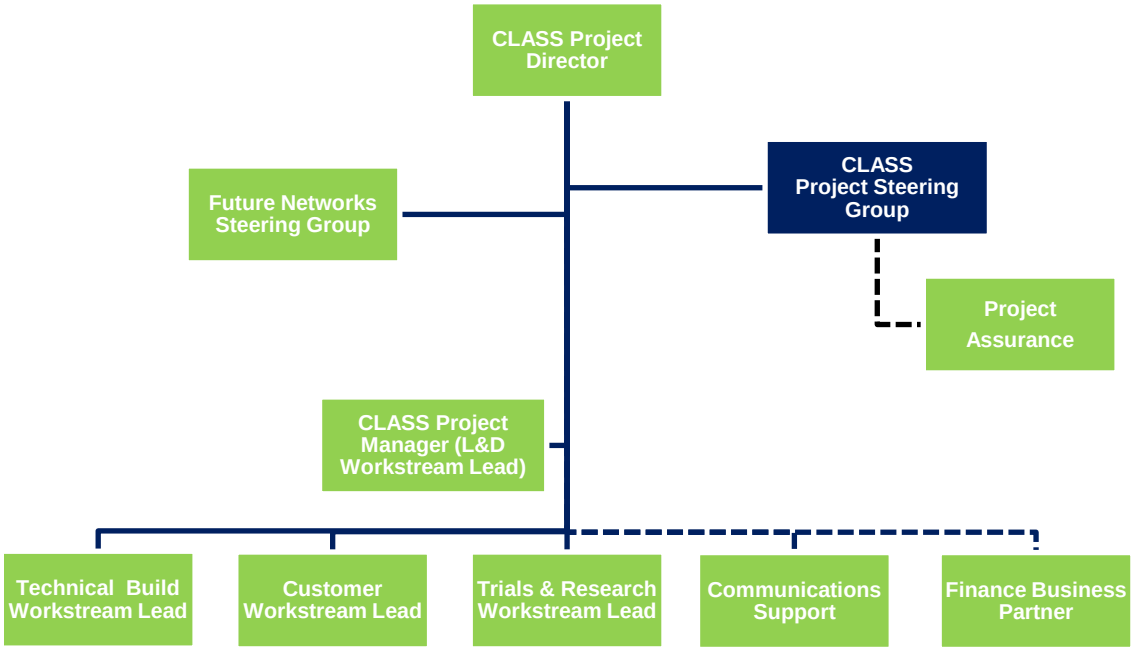
## 2.3 Best practice project management and governance

CLASS was structured to ensure this Second Tier project met its delivery criteria and a strong governance structure was implemented to achieve the milestones through timely and effective decision-making.

The CLASS project was Electricity North West's second successful funded Second Tier project, following the previous year's Capacity to Customers ($C_2C$) project. A new CLASS delivery team, co-located with the $C_2C$ delivery team, was created within the future networks team of the networks strategy and technical services directorate; and a best practise approach to project management was adopted based on the PRINCE2 methodology, amended to incorporate Electricity North West's standards and processes focussing on learning outputs and lessons learnt from delivering previous innovation project.

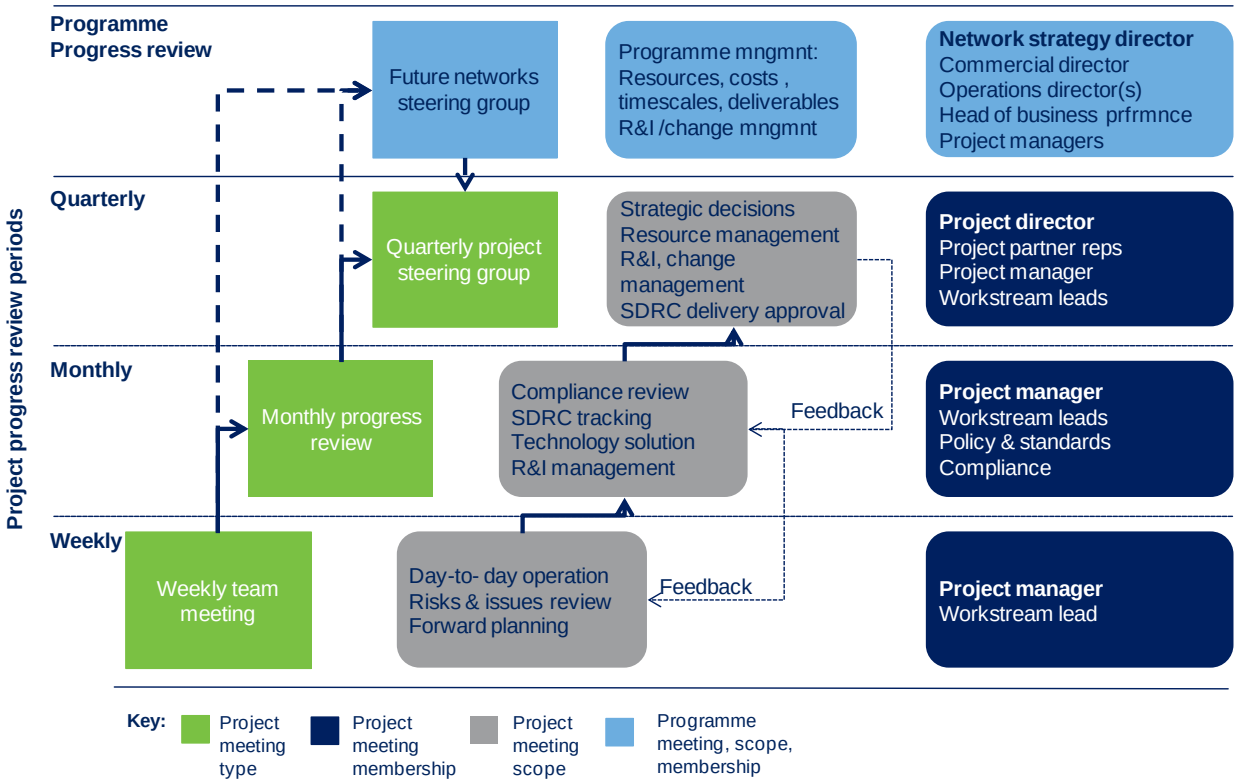
Figure 2.2 below shows the key roles in the CLASS project team and the reporting lines; the dashed lines indicate where part-time support is provided to the CLASS project by the main business. The CLASS project manager took day-to-day responsibility for the delivery of the CLASS project and was supported by the workstream leads. To ensure that the CLASS project was delivered as per the project direction, and in the spirit of the discussions held with the expert panel, the bid manager acted as the compliance manager for CLASS project delivery, supporting the CLASS project manager. Ultimate responsibility for the CLASS project sat with the CLASS project director, a member of the Electricity North West executive or senior leadership team.

*Figure 2.2: Organisational chart of CLASS project team*




The CLASS governance model, shown below in Figure 2.3, facilitated the efficient management of the project ensuring timely and effective decision-making, resolution of issues and mitigation of risks, and identification of opportunities where appropriate. The day-to-day weekly operational meeting, co-ordinated by the project manager, allowed the workstream leads to discuss delivery issues, look forward in the project plan to upcoming milestones and review current risks and issues, as well as pre-emptive identification of risks and uncertainties. The monthly meeting, again co-ordinated by the project manager, involved the workstream leads, finance representative, the compliance manager and a representative from the policy and standards , so that all aspects could be discussed eg the costs, the technology solution and the quality of the learning reflected in the project's deliverables.

*Figure 2.3: CLASS governance approach*




The project steering group (PSG), consisting of project partners and supporters as well as the delivery team and project director, met on a quarterly basis with members of the Electricity North West future networks steering group (FNSG). The purpose of the PSG was to:

- Oversee and provide directional guidance on the CLASS project,
- Monitor programme finances,
- Monitor programme progress against deliverables,
- Monitor key programme risks and issues,
- Act as a source of guidance, information and support,
- Raise matters of concern, and
- Provide a link between the programme, external programme partners and wider industry stakeholders.

This governance structure ensured the project programme met the delivery criteria and project milestones through timely and effective decision-making, resolution of issues and mitigation of risks. At all times, project members acted as ambassadors for the CLASS project and provided employee engagement across the wider organisation.

## 2.4 Management of risks and issues

Just as the roles and responsibilities of key project personnel were identified in the CLASS full submission, a set of potential risks was identified and included in the appendices. The potential risks were described, rated and mitigating actions identified in accordance with the proven risk model employed by Electricity North West.

The risks identified in the full submission were defined further in the project initiation documents (PID); these were produced by the bid manager and used as the official handover of the CLASS project to the newly appointed project manager and workstream leads. A PID was created for each workstream outlining the what? why? who? how? and when? of the CLASS project requirements to give clarity to the project manager and workstream leads on the scope, costs, timescales, deliverables and potential risks outlined in the bid submission materials.

As change is an inevitable part of delivering any project the CLASS project manager had the responsibility for establishing a 'risk action issue dependency change log' and updating the log as well as highlighting potential opportunities at weekly, monthly and quarterly meetings for the actions, issues, risks and changes to be openly reviewed and managed. The purpose of this log was to record in detail and monitor all actions, issues, risks and change requests relating to the CLASS project derived from any level of project meeting. A summary was presented as a highlight report at every PSG and FNSG meeting.

The risks and issues identified in the delivery of the CLASS project were reviewed, tracked and mitigated against in each of the six-monthly progress reports (PPR Jun 2013, PPR Dec 2013, PPR Jun 2014, PPR Dec 2014 and PPR Jun 2015). In the June 2014 progress report we highlighted the delays in commissioning the fully integrated solution at the CLASS trial substation sites due to the complexity of integrating old and new technologies. We had put in place various mitigating actions and the commissioning work was completed without affecting the trial's programme. This generated significant learning which will be valuable for any future rollout of CLASS; the learning was recorded in Section 6 of the June 2014 progress report. This rigorous and consistent approach to the identification of issues facilitated a formal change proposal being raised, where applicable for the project.

### 2.5 Change proposal management

On 30 September 2015 the CLASS closedown report was posted on the CLASS website along with the cumulative learning and outputs from the delivery of the project. Ofgem was informed that the CLASS project had been closed down and was issued with the closedown report. Subsequently the CLASS closedown report was posted on the Ofgem website on 6 November 2015.

At a bilateral meeting with Ofgem on 29 October 2015 we declared our intention to develop the CLASS functionality into a business as usual proposition and discussed undertaking a follow-on piece of work to explore the potential commercial impact for industry participants. This research activity had been included within the scope of the CLASS bid submission in the spring of 2012 but in discussions with Ofgem at the time was excluded in the final CLASS full submission due to concerns over the costs and perceived benefits of the research to DNO customers. Following the success of the CLASS project in proving the technical delivery of CLASS services Electricity North West discussed with Ofgem the importance of the follow-on research work to understand the costs and benefits to DNO customers and the wider industry impact of the commercialisation of the CLASS services. We outlined the scope of the original commercial impact research and the proposed delivery partner as part of the explanation for undertaking this research; and proposed that an expedient approach was to submit a change proposal to extend the scope and timescales of the CLASS project, especially as the CLASS project had delivered an underspend against the project budget. The alternative of submitting a separate NIA or NIC project was dismissed due to our NIA budget constraints and the potential loss of momentum as key colleagues would become engaged on other work, while a follow-on bid was developed. We drafted a change proposal for the CLASS project and informally sought feedback on its content; in the draft change proposal we outlined a standalone time-bound piece of research that could be easily accommodated within the original budget and as a simple extension to the scope and timescales of the original CLASS project.

This engagement led to the submission on 4 November 2015 of a change proposal to extend the CLASS project in terms of scope and timescales to accelerate the benefits to GB customers available from the learning identified in the closedown report. We estimated that the cost of extending the project was £622,000, which could be accommodated within the total amount set out in the original project direction, and we would deliver three new successful delivery reward criteria and close down the extended project by 31 May 2016.

On 12 November 2015 Ofgem agreed to the change proposal and issued an updated project direction highlighting only the amendments; these amendments, detailing the additional obligations, are reproduced in Appendix 5.1. Appendix 5.2 details the stages of the change proposal in chronological order.

# 3. TIMELINESS AND QUALITY

## 3.1 Summary

The project delivery approach, defined in the CLASS full submission, was developed using PRINCE2 principles. Interwoven with the project delivery approach is a series of strong governance procedures for the assurance of quality and timely delivery for all the CLASS learning outputs.

The CLASS website is the primary touch point for the dissemination of learning from the CLASS project to our stakeholders as it is the repository for all the knowledge generated. But we have trialled in CLASS various forms of 'push' technologies to provide signposts and/or knowledge to our stakeholders for them to decide whether to engage, either at that time or at a later time.

There were 24 SDRCs in the CLASS project direction, which requires over 40 individual pieces of evidence to indicate the CLASS project was delivered as proposed. This section details the quality and timely delivery of the evidence to show the CLASS project was successfully completed. Appendix 5.10 contains the links to the six-monthly progress reports and other additional reports generated by the CLASS project that were not satisfying or linked to an SDRC.

## 3.2 Assurance processes

Built into the project governance was the process for assuring the project outputs were delivered on time and were of a high quality. Figure 3.1 shows the high level approach to ensuring that all project outputs were drafted, reviewed and signed off prior to publication. In essence each project output was, as a minimum, peer reviewed once by a colleague and signed off for publication by the CLASS project manager; only then would the project output be posted onto the CLASS website. Where the output contains financial information, additional sign off by the Electricity North West finance business partner was required.

*Figure 3.1: Quality assurance for project outputs*

Each project output was identified separately within the project plan and was targeted for delivery by a given date to comply with the SDRC. The project manager had overall responsibility for tracking the delivery of the project output by the due date and agreed with the author the key dates for draft, review and sign-off within the assurance process. When a project output had been signed off for publication it was date stamped as part of the evidence for compliance with the SDRC; where the output was a document the date was generally visible on the front cover. After sign-off these documents were published on the CLASS website in the Key documents page where the publication date is also displayed alongside the icon enabling download. Where the project output is a milestone either an activity schedule or the results from a test is referenced; for example the schedule for the starting and completing of the baseline of customers surveys and the various actions in between is referenced.

### 3.3 Knowledge dissemination

The CLASS website was used as, and will continue to be, the focal point for the dissemination of learning from the CLASS project as it is the repository for the wealth of knowledge generated by the project. It enables all our stakeholders and customers to read, review and freely download any of the materials created in the delivery of the CLASS project. In order to supplement the website and more widely disseminate knowledge to our stakeholders we utilised other communication channels such as webinars, public dissemination events and a series of presentations at various energy sector events.

CLASS was the first of our Second Tier LCN Fund projects to harness the various forms of communications technology for pushing information to stakeholders; and these were agreed as some of the SDRCs within the learning & dissemination workstream. This was necessary as the knowledge dissemination landscape was becoming congested with 15 Second Tier LCN Fund projects and dozens of First Tier projects in flight delivering a substantial body of knowledge. Creating a community of interested stakeholders and using different types of push communication techniques enabled the project team to provide knowledge to our stakeholders for them to decide whether to engage, either at that time or at a later time. For example CLASS was our first project to use social media to update stakeholders on the progress of the project and to signpost key dates or key reports. We introduced the use of webinar technology to share small pieces of the learning as the project progressed. This enabled stakeholders to engage in areas of interest to them at a convenient time for them. As each webinar was recorded it became a permanent record that stakeholders could view at a time convenient for them. All the communication materials generated in the delivery of the CLASS project followed the standard SDRC assurance process, irrespective of whether the output was an SDRC.

For those stakeholders without prior knowledge of the project wishing to discover CLASS, the closedown report concisely provides the knowledge and learning from the delivery of the CLASS project. A section of the CLASS website has been created that enables easy access to the key leaning outputs and other supporting materials from the CLASS project. Appendix 5.3 shows pictorially the closedown section.

### 3.4 Successful delivery reward criteria review

Figures 3.2 to 3.7 below detail the evidence for the timely delivery and quality of the successful delivery reward criteria delivered under each of the workstreams of the CLASS project. For timeliness the figures detail the date the SDRC was delivered on, and are colour coded to indicate whether it was delivered on time. For quality level the figures detail the assurance process followed plus any additional activities to secure a quality output, and the web link or reference, generally to the CLASS website, as evidence of the output for auditing purposes.

### 3.4.1 Criteria under technology build workstream

*Figure 3.2: Technology build workstream*

| SDRC | Evidence of timeliness | | Evidence of quality of outputs delivered | |
|---|---|---|---|---|
| 1. Publish the design of the regulation scheme for substation voltage controllers by February 2014 | 27 February 2014 | Completed on time | The functional specification of the voltage regulation scheme for the autonomous substation controllers (ASCs)<br>*Normal SDRC assurance process followed with report drafted by workstream lead* | Voltage regulation scheme |
| 2. Publish the site selection report including the methodology by August 2013 | I. 30 August 2013<br>II. 30 August 2013 | Completed on time | Comprehensive reports detailing:<br>I. substation selection methodology for the trial substations, and<br>II. monitoring location selection methodology<br>*Normal SDRC assurance process followed with report drafted by Parson Brinckerhoff* | Trial substation selection methodology<br>Monitoring location selection |
| 3a. Network monitoring equipment installed and commissioned by March 2014 | a. 31 March 2014 | Completed on time | a. Proof of network monitoring equipment installed | See table in Appendix 5.4 containing the installation dates for the monitoring equipment |
| 3c. Publish the commissioning reports by April 2014 | c. 19 April 2014 | Completed on time | c. Extensive report describing the commissioning strategy, test equipment and commissioning records by type of installation | Commissioning report |
| 3d. Technology go-live by April 2014 | d. 8 April 2014 | Commissioned only prior to trials starting | d. Proof of go-live for trials<br>*Normal SDRC assurance process followed with report drafted by workstream lead* | See table in Appendix 5.5 showing results from test regime for Victoria Park substation. Trials started as planned and no impact on test results from staggered autonomous substation controller commissioning throughout spring 2014 |

| SDRC | Evidence of timeliness | | Evidence of quality of outputs delivered | |
|---|---|---|---|---|
| 4a. ICCP installed and commissioned by March 2014 | a. 31 March 2014 | Completed on time | a. Proof of installation and commissioning, and | ICCP test documentation is reproduced in Appendix 5.6 |
| 4b. Publish the ICCP commissioning reports by April 2014 | b. 22 April 2014 | Completed on time | b. Report describing the methodology for commissioning the ICCP link, referencing the ICCP user and configuration guides<br>*Normal SDRC assurance process followed with report drafted by workstream lead* | ICCP report |

### 3.4.2 Criteria under trials workstream

*Figure 3.3: Trials workstream*

| SDRC | Evidence of timeliness | | Evidence of quality of outputs delivered | |
|---|---|---|---|---|
| 1. Publish on CLASS website map of trial area by September 2013 | 30 September 2013 | Completed on time | Map of trial area and postcode search functionality published on CLASS website<br>*Normal SDRC assurance process followed with report drafted by workstream lead* | Trial area map and postcode search |
| 2. Publish on CLASS website trials and test regime report in January 2014 | 14 January 2014 | Completed on time | Comprehensive document describing the design of the trials and detailing the test event schedule<br>*Normal SDRC assurance process followed with report drafted by workstream lead* | CLASS trial design and associated test schedule |
| 3. Baseline customer survey initiated in April 2014 | 7 April 2014 | Completed on time | Baseline customer surveys initiated in April 2014 and completed in May 2014 as part of the recruitment process for trial participants<br>*Normal SDRC assurance process followed with report drafted by workstream lead* | See table in Appendix 5.7 showing results from test regime for Victoria Park substation in April 2014<br>Trial customer updates - Newsletters issued to trial participants |
| 4. Publish on CLASS website an initial | 15 September 2014 | Completed on time | Extensive report on the observed outputs from the trial scenarios describing the capability of the CLASS | Capability report |

| SDRC | Evidence of timeliness | | Evidence of quality of outputs delivered | |
|---|---|---|---|---|
| capability report for all the trial scenarios by September 2014 | | | functionality<br>*Normal SDRC assurance process followed with report drafted by workstream lead* | |
| 5. Evidence of test trial data transferred by July 2014 | 6 January 2014 (original access granted)<br>4 November 2015 (last accessed) | **Completed on time** | The trial data was uploaded into an iHost platform and the University of Manchester were provided access to download the data<br>*Normal SDRC assurance process followed with report drafted by workstream lead* | See in Appendix 5.8 the e-mail confirmation of access to iHost system to University of Manchester lead, and the table of the last access times and dates for system users |

### 3.4.3 Criteria under customer engagement workstream

*Figure 3.4: Customer workstream*

| SDRC | Evidence of timeliness | | Evidence of quality of outputs delivered | |
|---|---|---|---|---|
| 1. Send for approval the customer engagement plan and data privacy statement to Ofgem by July 2013 | 31 July 2013 | **Completed on time** | Customer engagement plan and data privacy statement forwarded to Ofgem; documents approved October 2013<br>*Normal SDRC assurance process followed with report drafted by workstream lead* | Customer engagement plan<br>Data privacy statement |
| 2. Publish on CLASS website customer marketing/campaign materials by September 2013 | 30 September 2013 (date customer leaflet published on the CLASS website) | **Completed on time** | The customer leaflet was distributed in February 2014 to every customer within trial area describing the CLASS project and seeking trial participants.<br>*Normal SDRC assurance process followed with leaflet drafted by workstream lead and reviewed Impact Research* | Customer leaflet |
| 3. First customer workshops held by October 2013; workshops completed by December 2013 | 15/16 October 2013<br>15/16 November 2013<br>4/5 December 2013 (dates of the ECPs) | **Completed on time** | A series of engaged customer panels to develop the survey materials were conducted. A project introduction and ECP stimulus board were generated for the first customer workshop and published on website in September 2013 | Project introduction<br>ECP stimulus board |

| SDRC | Evidence of timeliness | | Evidence of quality of outputs delivered | |
|---|---|---|---|---|
| | 14/15 January 2014 | | An additional workshop held to pilot the survey instrument<br>*Normal SDRC assurance process followed with report drafted by Impact Research* | |
| 4. Publish on CLASS website control group and trial area customer communication by January 2014. | 31 January 2014 (date customer survey communications published on the CLASS website) | **Completed on time** | The final customer survey communications published on CLASS website<br>*Normal SDRC assurance process followed with report drafted by Impact Research.* | Baseline domestic customer survey<br>Baseline I&C customer survey<br>Monitoring domestic customer survey<br>Monitoring I&C customer survey |
| 5. Customer surveys completed, with an initial summary report published by June 2015 | 18 June 2015 (interim) | **Completed on time** | Extensive report, produced by Impact Research, detailing the initial conclusions from the customer surveys completed in conjunction with the CLASS test schedules<br>*Normal SDRC assurance process followed with report drafted by Impact Research, but with an added step as the customer survey methodology was peer reviewed by Prof K Willis of the University of Newcastle* | Customer survey initial summary report |

### 3.4.4 Criteria under research workstream

*Figure 3.5: Research workstream*

| SDRC | Evidence of timeliness | | Evidence of quality of outputs delivered | |
|---|---|---|---|---|
| 1. Publish on CLASS website interim and final network modelling and analysis reports by January 2015 and September 2015 respectively | 24 January 2015 (interim)<br>23 September 2015 (final) | **Completed on time** | The interim and final study reports, produced by University of Manchester, that model the capability of a primary substation to deliver demand response and reactive power absorption capability<br>*Normal SDRC assurance process followed with report drafted by The University of Manchester* | Offline demand response and reactive power capability interim report<br>Offline demand response capability assessment final report |

| SDRC | Evidence of timeliness | | Evidence of quality of outputs delivered | |
|---|---|---|---|---|
| | 18 September 2015 (final) | | | Reactive power absorption capability assessment final report |
| 2. Publish on CLASS website interim and final profile modelling study by January 2015 and September 2015 respectively | 30 January 2015 (interim)<br>31 August 2015 (final) | **Completed on time** | The interim and final study reports, produced by University of Manchester, concluding the developed load models for the network demand response from voltage increment and decrement measured at the trial substations<br>*Normal SDRC assurance process followed with report drafted by The University of Manchester* | Load profiling modelling study interim report<br>Load profiling modelling study final report |
| 3. Publish on CLASS website interim and final asset health study report by January 2015 and September 2015 respectively | 26 January 2015 (interim)<br>28 September 2015 (final) | **Completed on time** | The interim and final reports, produced by the Universities of Manchester and Liverpool, concluding the asset health study<br>*Normal SDRC assurance process followed with combined report drafted by the Universities of Liverpool and Manchester* | Asset health interim report<br>Asset health final report |
| 4. Publish on CLASS website customer survey report by September 2015 | 31 July 2015 (final) | **Completed on time** | The final customer survey summary reports, produced by Impact Research<br>*Normal SDRC assurance process followed with report drafted by Impact Research* | Customer survey final summary report |
| 5. Publish on CLASS website NETS SQSS change proposal report by June 2015 | 29 June 2015 | **Completed on time** | The report detailing the outcome of the reviews, managed by Parsons Brinckerhoff and Chiltern Power, understanding whether the Security and Quality of Supply Standard, Electricity Safety, Quality and Continuity Regulations and Grid and Distribution Codes are affected by the results of the CLASS project<br>*Normal SDRC assurance process followed with report drafted by Parsons Brinckerhoff and peer reviewed by Chiltern Power* | SQSS and code review |

### 3.4.5 Criteria under learning and dissemination workstream

*Figure 3.6: Learning and dissemination workstream*

| SDRC | Evidence of timeliness | | Evidence of quality of outputs delivered | |
|---|---|---|---|---|
| 1. Publish on CLASS website first video podcast by September 2013, the second by August 2014 and the final one by December 2014 | 1. 23 November 2012<br>2. 7 August 2013<br>3. 20 June 2014<br>4. 1 August 2014<br>5. 19 December 2014<br>6. 2 April 2015 | **Completed on time** | ***Video podcasts***<br>Throughout the CLASS project we delivered the following videos:<br>1. Animation explaining CLASS<br>2. CLASS project introduction from our webinar recorded in June 2013<br>3. Project overview including interviews with the project team and members of our engaged customer panel April 2014<br>4. CLASS progress update from our webinar recorded in June 2014<br>5. CLASS customer survey results reported in December 2014<br>6. CLASS progress update from our webinar recorded in March 2015<br>*Normal SDRC assurance process followed with video podcast created in conjunction with external partner organisation and managed by communication support* | Podcasts and webinars |
| 2. CLASS website and social media forums is live by September 2013 | 30 September 2013 | **Completed on time** | The CLASS website went live, acting as the main touch point for the CLASS project and the repository for all the outputs. Low carbon networks forum created in LinkedIn.<br>*Normal SDRC assurance process followed with website created by external partner overseen by communication support and signed off by project manager* | Website<br>LinkedIn Low Carbon Networks Forum |
| 3. Active participation at annual LCNI conference, and first webinar and learning event held by April 2014 with others to follow as per project plan | 13 November 2013<br>20 October 2014<br>27 November 2015 | **Completed on time** | ***LCNI conferences***<br>Overview of CLASS project<br>CLASS project is key demand response project in Smarter Networks Series<br>CLASS technical description and summary of project findings | Brighton LCNI slides<br>Aberdeen LCNI exhibition panel<br>Liverpool LCNI slides |

| SDRC | Evidence of timeliness | | Evidence of quality of outputs delivered | |
|---|---|---|---|---|
| | 30 April 2014<br><br><br><br>9 July 2015<br><br><br><br>27 June 2013<br>27 June 2014<br>26 March 2015 | | ***Learning & dissemination events***<br>First learning event, held at Manchester's Museum of Science and Industry, introduced the CLASS project and described the planned.<br><br>The second learning event, held at our Manchester office, to share the initial customer and technical results from the CLASS trials, including a visit to a local substation to see the CLASS technology<br><br>***Webinars***<br>CLASS project introduction<br>CLASS project progress update<br>CLASS initial conclusions<br><br>*Normal SDRC assurance process followed with slides drafted by workstream leads and/or project manager, organisation delivery managed by communications support and all materials signed off by project director* | Learning event<br><br>Learning event<br><br><br><br><br>First webinar<br>Second webinar<br>Third webinar |
| 4. Raw monitoring data is downloadable from CLASS website by September 2014 | 30 September 2014 | **Completed on time** | The raw monitoring data was downloadable free of charge from the CLASS website up to 31 October 2015; it is now available on request to: futurenetworks@enwl.co.uk.<br><br>*Normal SDRC assurance process followed with report drafted by workstream lead* | The raw monitoring data was available online until end October 2015. See Appendix 5.9 for screenshots of data which was available to download |

### 3.4.6 Criteria under closedown and long-term monitoring study

*Figure 3.7: Closedown and long-term monitoring study*

| SDRC | Evidence of timeliness | | Evidence of quality of outputs delivered | |
|---|---|---|---|---|
| 1. Provide confirmation from NG that the long-term monitoring study has been initiated | 30 September 2015 | **Completed on time** | Provide confirmation from NG that the long-term monitoring study has been initiated<br><br>*Normal SDRC assurance process followed with monitoring study developed and initiated by project manager with agreement of National Grid* | Appendix C of CLASS closedown report |

# 4. COST EFFECTIVE DELIVERY

## 4.1 Summary

The CLASS project was delivered at a total project cost of £7,214k, significantly under the budget of £8,098k, resulting in an efficiency saving of 11%. This was achieved through effective project management and the use of robust financial controls throughout the 2.75 year life of the CLASS project.

Our approach was to engineer out the delivery risk as much, as practicable, at the bid submission stage through partnership and detailed planning. A strong consortium of project partners with proven delivery credentials were assembled during the bid development stage, with each partner knowing their delivery roles and responsibilities and how they would contribute to the delivery of the SDRCs. The CLASS project partners were identified through an open competitive process, and were selected based on the three criteria of: prior experience in scope of work and reliability to deliver; their involvement represents value for money for our customers; and their commitment to Electricity North West, the CLASS project, its success and the dissemination of the learning. The CLASS partners were the leading experts of their fields, be it in research, technology or customer engagement. Once funding was secured the project team managed the contract finalisation with Electricity North West's procurement team ensuring that all the agreements delivered both cost efficiencies and operational certainty, thereby minimising the risks to the project and maximising the value to customers. These procurement exercises were conducted in line with the requirements of EU legislation, statutory law, and our process and procedures, as defined in our internal control manual.

## 4.2 Cost variances

This section provides details of project cost areas that exceeded the project budget, detailed in the CLASS project direction, by more than 5%. The actual expenditure compared against the forecast expenditure across all the cost categories and cost lines in the CLASS project direction is detailed in Appendix 5.11. The four cost lines, across two costs categories, that show an adverse variance of greater than 5% are detailed below.

**Cost category – Labour:** Overall the costs allocated to this cost category remained under the project budget of £1,948k by £35k (ie cost variance against budget is -2%). There are, however, two areas where the budget was exceeded by more than 5%. These are detailed below as:

- **Data management:** In total this cost was £11k (equal to 35%) higher than the budgeted £32k costs. The additional spend was to improve the support for the response to potential customer calls. To ensure that all internal stakeholders were fully informed and able to link any potential CLASS-related customer enquiries, the trial schedule was verified on a weekly basis and an extract was issued electronically in advance, detailing that week's testing regime. As a further safeguard, our fault management system was updated with details of the testing regime and individual tests were electronically displayed on the date scheduled. Customer contact centre personnel could therefore easily identify and merge any potential CLASS associated quality of supply issues with the appropriate CLASS test. The updating of the fault management system was carried out by our data management personnel and continued on a weekly basis throughout the duration of the CLASS trials.
- **Purchase and installation of substation controllers:** In total this cost was £20k (equal to 21%) higher than the budgeted £99k costs. This budget line was overspent due to additional work being identified at project closure to prepare the equipment for business as usual. The additional work included de-scoping the functionality of the equipment and systems for business as usual and providing additional information on site for operational personnel.

**Cost category – Contractors:** Overall this category remained under the project budget by £112k against a budget of £3,644k (ie cost variance against budget is -3%). There were, however, two areas where spend exceeded the budget by greater than 5%. These are detailed below as:

- **Installation and configuration of ICCP:** Total spend was £5k (equal to 18%) higher than the budgeted £27k. Some additional configuration work on extended data points within the defined dataset was required as more information was needed to be shared via the ICCP than expected. This led to a slightly increased test scope. See section 4.5 as further expenditure was incurred for this activity with associated contingency costs utilised.
- **Customer survey:** Total spend was £25k (equal to 11%) higher than the budgeted £219k. Additional activities were commissioned to continuously validate the robustness of the survey results. The overspend was the additional time incurred by a senior internal reviewer within Impact Research to review and re-validate the complex trials schedule. To ensure validity of the survey results, the proportion of test and control surveys had to be balanced by customer type and trial type. As the test regime and trials schedule progressed, each customer survey schedule had to be reviewed and adjusted; it became a daily task for Impact Research personnel to check the status of tests and select customers for survey.

### 4.3 Value for money delivery

The objective of the project team was to deliver the maximum benefit for every good and/or service procured. At the regular project team meetings the project manager would lead a review of completed, current and future activities within the project plan in conjunction with the current and forecast spend against budget. The embedded finance business partner for the CLASS project had the responsibilities for compiling the regular financial statements and would lead the cost review and oversee the correct expenditure and allocation of costs, in line with our internal control manual. For example, each person working on the CLASS project completed a timesheet. These robust cost controls enabled project efficiencies to be sought through the innovation programme as the finance business partner reported costs through regular project meetings and quarterly updates to the project steering group and the future networks steering group.

Overall the CLASS project made a cost saving of 11%, equating to £884k, against the project budget. The table in Appendix 5.11 highlights the areas of the project budget and that each area was under spent against the CLASS project direction.

- **Cost category – Labour:** Overall Electricity North West internal labour costs made a 2% (equal to £35k) efficiency against the project budget of £1,948k; this was achieved as described above through robust cost controls.
- **Cost category – Equipment:** Overall there was an 18% (equal to £208k) efficiency on equipment costs against the project budget of £1,141k; this was achieved using the same control processes as described above. A saving of £154k (equal to 90%) against the project budget was on the RTU installation activity costs and was made possible by using the spare capacity in existing network RTUs.
- **Cost category – Contractors:** Overall contractor costs made a 3% (equal to £112k) efficiency against the project budget of £3,644k. The saving of £119k (equal to 11%) against the Purchase & installation of Substation Controllers budget was made as a larger percentage of this work was carried out by internal labour rather than contractors; this was due to authorisation and skills level required to carry out the commissioning.
- **Cost category – IT:** Overall IT costs made an 18% (equal to £52k) efficiency against the project budget of £287k. A saving of £59k (equal to 48%) against the Installation & configuration of Dashboard hardware & Software budget was made due to previous development work carried out under our Capacity to Customers LCN Fund project.
- **Cost category – Payments to other users:** Overall payments to other users costs made a savings of £55k (equal to 39%) efficiency against the project budget of £141k as not all trial participants claimed their incentive payments.
- **Cost category – Contingency:** Overall contingency costs made a 63% (equal to £375k) efficiency against the project budget of £595k as above. The control processes for the approval to utilise the contingency budget are described below in section 4.5.
- **Cost category – Other:** Overall other costs made a 14% (equal to £47k) efficiency against the project budget of £341k; this was achieved due to efficiencies in accommodation costs, as a number of innovation projects shared the same self

contained low cost accommodation space. The accommodation space, used primarily by the future networks team, was expressly chosen as a short to medium term location for the programme delivery team. The facility located close to existing Electricity North West offices in Salford provided the functionality and proximity required by the delivery teams.

### 4.4 Reallocation of budget between categories

A detailed breakdown of spend against budget can be seen in Appendix 5.11. None of the cost areas were overspent against budget and there were no reallocation of budget between cost categories. Certain contingency costs were used, but overall only £220k (equal to 37%) of the contingency budget was utilised on the CLASS project; section 4.5 below details the use of contingency costs.

### 4.5 Use of contingency budget

In the CLASS full submission each contingency item was developed from the mitigating actions for the identified risks and issues or from identifying those activities that either have not been fully scoped or there was uncertainty on the activity cost.

Over the 2.75 years of the CLASS project there were tight controls in place to oversee the allocation of contingency costs. At the project meetings each workstream lead would look back reviewing their activities completed to date within the project plan and the spend against budget; and look forward considering future activities and forecast expenditure. These planning activities would consider the risks and issues and where applicable the workstream lead would seek agreement from the project manager for use of a contingency cost for a defined activity. Agreement would only be granted when the project manager and finance business partner were satisfied with the reason for its use, it represented value for money, and the solution complied with our internal control manual.

Of the total contingency of £595k outlined in the budget only £220k (equal to 37%) was used. The expenditure against budget for those utilised contingency costs is presented below in Figure 4.1.

*Figure 4.1: Use of contingency budget*

| Cost category | | | | |
|---|---|---|---|---|
| **Contingency** | **Spend, £k** | **Budget, £k** | **Variance, £k** | **Reason** |
| Installation & configuration of ICCP | 22 | 147 | 125 | Increased configuration and testing work for the extended dataset to be accepted by system firewalls. |
| Purchase & installation of monitoring equipment | 46 | 124 | 78 | Additional purchase cost for the procured Nortech system due to the required high resolution, as opposed to using a less granular internal data capture and storage solution. |
| Purchase & Installation of substation controllers | 152 | 156 | 5 | Eight installations of Argus 8 solution were completed, as an alternative to the MicroTapp solution to prove simpler retrofit option for DNOs not wishing to employ MicroTapp solution. |
| **TOTAL** | **220** | **427** | **208** | |

# 5. APPENDICES

## 5.1 Amended CLASS project direction

**Schedule**

1. Amend existing section 6 (Project Budget)

Amend the existing Section 6 of the Schedule to the Project Direction to include the following;

'For the Project extension to cover the assessment of the commercialisation and market implications associated with full GB-wide roll-out of the technology the Funding DNO is only required to report against the categories detailed in Annex 2. The Funding DNO will report against the Project Categories detailed in Annex 1 if there is a variation to expenditure detailed in the original Closedown Report.'

2. Amend existing section 7 (Project implementation)

Amend existing Section 7 of the Schedule to the Project Direction in the following manner:

(iii) Complete the Project on or before the Project completion date of ~~31 September 2015~~ 31 May 2016.

3. Amend existing section 8 (Reporting)

Amend the existing Section 8 of the Schedule to the Project Direction to include the following;

'With regard to the Project extension to cover the assessment of the commercialisation and market implications associated with full GB-wide roll-out of the CLASS technology, this requirement will be met by submitting a standalone addendum to its original Closedown Report issued to the Authority on 31 May 2016'

4. Amend existing section 11 (Successful Delivery Reward Criteria)

Amend existing Section 11 of the Schedule to the Project Direction in the following manner:

| Successful Delivery Reward | Evidence |
|---|---|
| **Learning & Dissemination Workstream**<br><br>1. Produce first Video Podcast of the series by September 2013, the second by August 2014 and the final one by December 2014;<br>2. Develop and launch the CLASS Project Website and Social Media Forums by September 2013;<br>3. First Annual LCN Fund Conference attended in 2013, LCN Fund annual conference in 2014 and 2015 attended. Hold three webinars in June 2013, June 2014 and March 2015. Host Learning Event 1 by April 2014 and Learning Event 2 by July 2015;<br>4. Raw monitoring data is initially made available on demand by September 2014, and subsequently updated by December 2014 and April 2015.<br>5. Hold Webinar by February 2016 and host a Learning Event by April 2016 on the market implications of the CLASS services. | **Learning & Dissemination Workstream**<br><br>1. Publish on CLASS website first Video Podcast by September 2013, the second by August 2014 and the final one by December 2014;<br>2. CLASS website and Social Media Forums is live by September 2013;<br>3. Active participation at Annual LCN Fund Conferences. Three webinars held, one by June 2013, one by June 2014 and one by March 2015. Two learning events held, one by April 2014 and the second by July 2015;<br>4. Raw monitoring data is downloadable from CLASS website by September 2014 and subsequently updated by December 2014 and April 2015.<br>5. Webinar and Learning Event held by 30 April 2016. |
| **Close Down & Long Term Monitoring Study**<br><br>1. Produce a close down report and initiate a long term monitoring study with National Grid;<br>2. Produce an addendum to the Closedown report to publish the outputs of the Customer Benefits Workstream by 31 May 2016. | **Close Down & Long Term Monitoring Study**<br><br>1. Provide confirmation from National Grid that the long term monitoring study has been initiated;<br>2. Publish addendum to Closedown report on CLASS website by 31 May 2016. |
| **Customer Benefits Workstream**<br><br>1. Deliver market impact assessment, customer benefit assessment and cost benefit analysis tool(s) by 31 May 2016. | **Customer Benefits Workstream**<br><br>1. Publish report detailing the methodology and results of the benefits modelling and associated model(s) created for the analysis by 31 May 2016. |

5. Amend existing Annex 1 (Annex 1: Project Budget)

Amend existing Annex 1 of the Schedule to the Project Direction to include the following:

'Annex 2: Project Budget (project extension)'

| **Cost Category** | **Cost (£k)** |
|---|---|
| **Labour** | **243** |
| Project Management for extension | 61 |
| Technical and regulatory support to Consultants | 182 |
| **Contractors** | **260** |
| Market modelling research | 210 |
| Policy documentation | 50 |
| **Other** | **76** |
| Publicity & dissemination | 69 |
| Accommodation | 7 |
| **Contingency** | **43** |
| General contingency | 43 |
| **Total** | **622** |

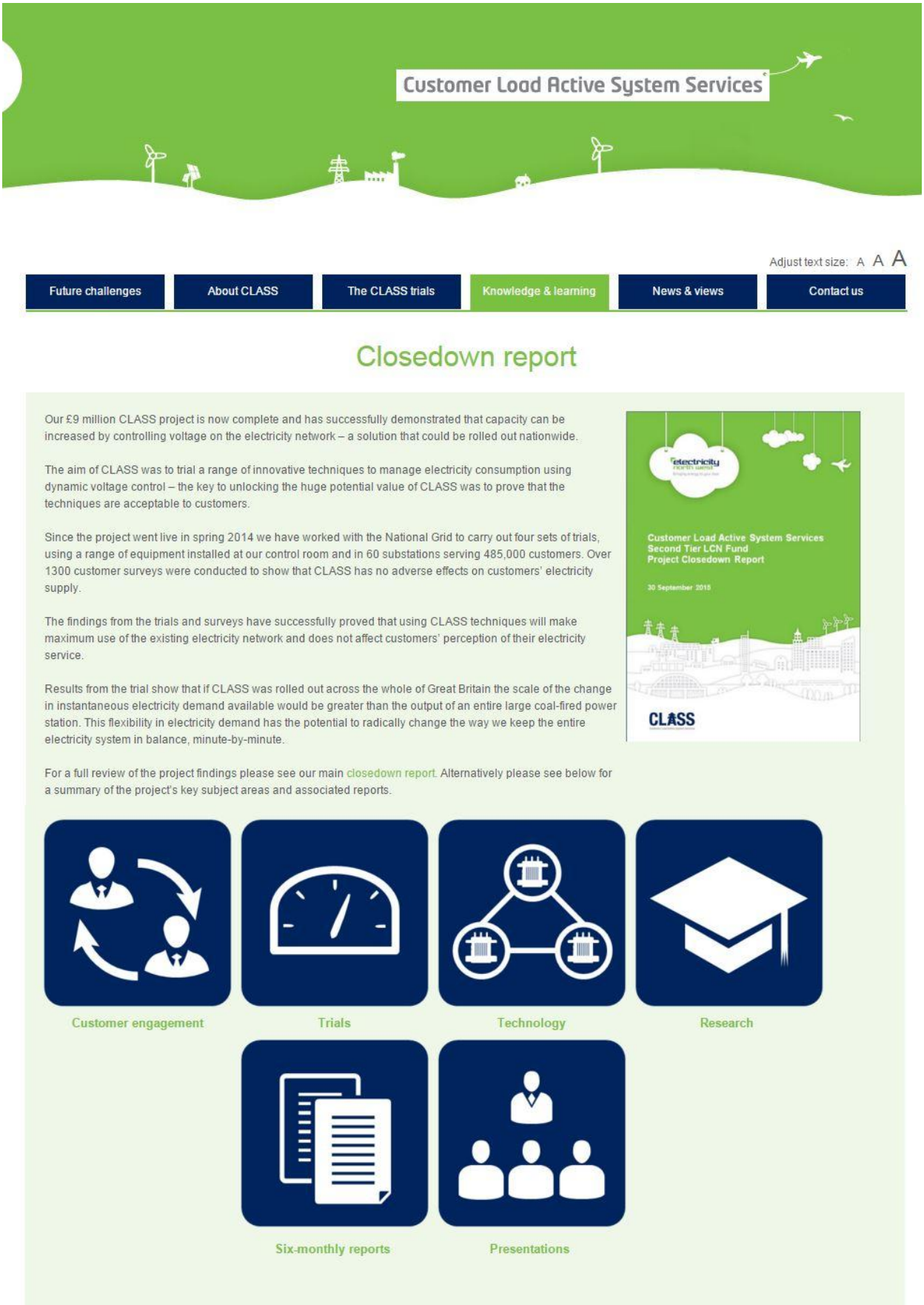
## 5.2 Chronology of the Ofgem change request

*Figure 5.1: Key dates for change proposal*

| Date | Interaction |
|---|---|
| 9 September 2015 | Electricity North West holds CLASS closedown seminar |
| 30 September 2015 | CLASS closedown report submitted to Ofgem |
| 29 October 2015 | Bilateral session between Electricity North West and Ofgem to discuss transforming CLASS services into business as usual |
| 4 November 2015 | Electricity North West issues change proposal for CLASS project extension |
| 12 November 2015 | Ofgem grants change proposal and issues amended project direction |

## 5.3 CLASS website page structured around closedown report

*Figure 5.2: Closedown section of CLASS website*



## 5.4 Commissioning dates for monitoring equipment at named primary substations

*Figure 5.3: CLASS primary substation monitoring equipment commissioning dates*

| Primary substation | Primary monitoring installation and communication date | Primary substation | Primary monitoring installation and communication date |
|---|---|---|---|
| Annie Pit | 28/03/2014 | Victoria Park | 07/02/2014 |
| Chatsworth St | 28/03/2014 | Winifred Rd | 24/02/2014 |
| Egremont | 28/03/2014 | Baguley | 24/02/2014 |
| Kirkby Stephen | 28/03/2014 | Chassen Rd | 24/02/2014 |
| Burrow Beck | 17/03/2014 | Green Lane | 06/03/2014 |
| Westgate | 17/03/2014 | Irlam | 24/02/2014 |
| Ashton – in – Makerfield | 24/02/2014 | Trafford Park North | 06/03/2014 |
| Golborne | 28/03/2014 | Bollington | 23/03/2014 |
| Blackfriars | 17/02/2014 | SW Macclesfield | 24/02/2014 |
| Chamberhall | 11/03/2014 | Bridgewater | 03/02/2014 |
| Harwood | 11/03/2014 | Dickinson St | 24/02/2014 |
| Lostock | 28/03/2014 | Didsbury | 03/02/2014 |
| Trinity | 07/02/2014 | Wilmslow | 24/02/2014 |
| Campbell St | 23/02/2014 | Withington | 24/03/2014 |
| Carr St | 25/02/2014 | Central Manchester | 03/02/2014 |
| Avenham | 24/03/2014 | Denton East | 24/03/2014 |
| Bamber Bridge | 24/03/2014 | Droylsden East | 24/02/2014 |
| Douglas St | 24/03/2014 | Hyde | 24/02/2014 |
| Griffin | 28/03/2014 | Openshaw | 03/02/2014 |
| Blackpool | 28/03/2014 | Stuart St | 24/03/2014 |
| Buckshaw | 27/03/2014 | Belgrave | 20/03/2014 |
| Cecil St | 17/03/2014 | Middleton Junction | 24/02/2014 |
| Cleveleys | 10/01/2014 | Willowbank | 24/02/2014 |
| Tarleton | 26/03/2014 | Gowhole | 25/02/2014 |
| Heady Hill | 24/03/2014 | Levenshulme | 24/02/2014 |
| Hyndburn Rd | 28/03/2014 | Longsight | 17/03/2014 |
| Kings way | 24/02/2014 | Moss Side | 06/03/2014 |
| Littleborough | 24/02/2014 | Romiley | 24/02/2014 |
| Kitt Green | 28/03/2014 | Upholland | 10/03/2014 |
| Skelmersdale | 17/03/2014 | Fallowfield | 03/02/2014 |

**Data sample from Annie Pit primary substation obtained on 1 April 2014**

The following nomenclature applies to Figures 5.6 and 5.7 below:

- Vn is the voltage (measured in volts) of phase n of the transformer
- In is current (measured in amperes) of phase n of the transfomer
- P is the real power (measured in MegaWatts) of the transformer
- Q is the reactive power (measured in MegaVoltAmperesReactive) of the transfomer, and
- PF is the Power Factor (displayed as an absolute number) of the transfomer.

The sample data is shown in one-minute intervals, but the data is available in one-second intervals.

*Figure 5.4: Data extract for three phases of T11 transformer at Annie Pit primary substation at one-minute intervals*

| Timestamp | T11_V1 Volts | T11_V2 Volts | T11_V3 Volts | T11_I1 Amps | T11_I2 Amps | T11_I3 Amps | T11_P MW | T11_Q Mvar | T11 PF |
|---|---|---|---|---|---|---|---|---|---|
| 00:00:00 | 11102 | 11055 | 11063 | 250.61 | 253 | 242.89 | 4.504 | 1.575 | 0.94 |
| 00:01:00 | 11095 | 11052 | 11056 | 251.11 | 252.39 | 243.25 | 4.497 | 1.592 | 0.94 |
| 00:02:00 | 11090 | 11049 | 11051 | 253.18 | 254.46 | 245.83 | 4.536 | 1.606 | 0.94 |
| 00:03:00 | 11091 | 11051 | 11053 | 253.29 | 254.41 | 245.96 | 4.542 | 1.595 | 0.94 |
| 00:04:00 | 11095 | 11052 | 11057 | 251.9 | 253.59 | 244.04 | 4.516 | 1.592 | 0.94 |
| 00:05:00 | 11099 | 11052 | 11058 | 250.68 | 252.93 | 243.46 | 4.505 | 1.58 | 0.94 |
| 00:06:00 | 11100 | 11052 | 11059 | 250.37 | 252.76 | 242.88 | 4.499 | 1.575 | 0.94 |
| 00:07:00 | 11095 | 11049 | 11056 | 250.24 | 252.14 | 242.81 | 4.481 | 1.606 | 0.94 |

*Figure 5.5: Data extract for three phases of T12 transformer at Annie Pit primary substation at one-minute intervals*

| Timestamp | T12_V1 Volts | T12_V2 Volts | T12_V3 Volts | T12_I1 Amps | T12_I2 Amps | T12_I3 Amps | T12_P MW | T12_Q Mvar | T12 PF |
|---|---|---|---|---|---|---|---|---|---|
| 00:00:00 | 11089 | 11052 | 11066 | 229.32 | 232.05 | 223.75 | 4.208 | 1.209 | 0.96 |
| 00:01:00 | 11082 | 11049 | 11060 | 229.24 | 231.06 | 223.63 | 4.193 | 1.224 | 0.96 |
| 00:02:00 | 11076 | 11046 | 11053 | 231.22 | 233.09 | 226.12 | 4.232 | 1.24 | 0.96 |
| 00:03:00 | 11077 | 11047 | 11055 | 231.69 | 233.33 | 226.46 | 4.239 | 1.232 | 0.96 |
| 00:04:00 | 11081 | 11049 | 11060 | 230.53 | 232.63 | 224.68 | 4.216 | 1.232 | 0.96 |
| 00:05:00 | 11084 | 11048 | 11060 | 229.74 | 232.31 | 224.46 | 4.212 | 1.219 | 0.96 |
| 00:06:00 | 11086 | 11048 | 11062 | 229.93 | 232.64 | 224.38 | 4.215 | 1.217 | 0.96 |
| 00:07:00 | 11082 | 11046 | 11059 | 229.95 | 232.19 | 224.43 | 4.204 | 1.241 | 0.96 |

## 5.5 Test results extract for Victoria Park primary substation

*Figure 5.6: Test data extract for Victoria Park primary substation on 8 April 2014*

| Date | Time | Site name & function type | Function type | Alarm state |
|---|---|---|---|---|
| 08-Apr-14 | 14:14:12 | VICTORIA PK PRY CLASS NGT DEMAND REDUCTION RESPONSE | HALF ACTIVATED | Alarm |
| 08-Apr-14 | 14:18:14 | VICTORIA PK PRY CLASS NGT DEMAND REDUCTION RESPONSE | HALF ACTIVATED | Reset |
| 08-Apr-14 | 14:23:17 | VICTORIA PK PRY CLASS NGT DEMAND REDUCTION RESPONSE | FULL ACTIVATED | Alarm |
| 08-Apr-14 | 14:24:57 | VICTORIA PK PRY CLASS NGT DEMAND REDUCTION RESPONSE | FULL ACTIVATED | Reset |
| 08-Apr-14 | 14:32:01 | VICTORIA PK PRY CLASS TAP STAGGER | NGT MVar ABSORPTION ACTIVATED | Alarm |
| 08-Apr-14 | 14:32:02 | VICTORIA PK PRY CLASS TAP STAGGER STAGE 1 | NGT MVar ABSORPTION ACTIVATED | Alarm |
| 08-Apr-14 | 14:36:24 | VICTORIA PK PRY CLASS TAP STAGGER STAGE 2 | NGT MVar ABSORPTION ACTIVATED | Alarm |
| 08-Apr-14 | 14:39:46 | VICTORIA PK PRY CLASS TAP STAGGER STAGE 1 | NGT MVar ABSORPTION ACTIVATED | Reset |
| 08-Apr-14 | 14:40:26 | VICTORIA PK PRY CLASS TAP STAGGER STAGE 3 | NGT MVar ABSORPTION ACTIVATED | Alarm |
| 08-Apr-14 | 14:43:46 | VICTORIA PK PRY CLASS TAP STAGGER | NGT MVar ABSORPTION ACTIVATED | Reset |
| 08-Apr-14 | 14:43:47 | VICTORIA PK PRY CLASS TAP STAGGER STAGE 3 | NGT MVar ABSORPTION ACTIVATED | Reset |
| 08-Apr-14 | 14:45:48 | VICTORIA PK PRY CLASS TAP STAGGER | NGT MVar ABSORPTION ACTIVATED | Alarm |
| 08-Apr-14 | 14:45:50 | VICTORIA PK PRY CLASS TAP STAGGER STAGE 2 | NGT MVar ABSORPTION ACTIVATED | Reset |
| 08-Apr-14 | 14:46:49 | VICTORIA PK PRY CLASS TAP STAGGER | NGT MVar ABSORPTION ACTIVATED | Reset |
| 08-Apr-14 | 14:46:50 | VICTORIA PK PRY CLASS TAP STAGGER STAGE 2 | NGT MVar ABSORPTION ACTIVATED | Alarm |
| 08-Apr-14 | 14:50:51 | VICTORIA PK PRY CLASS FREQUENCY RESPONSE | STAGE 2 AUTOMATIC ENABLED | Alarm |
| 08-Apr-14 | 14:51:50 | VICTORIA PK PRY CLASS FREQUENCY RESPONSE | STAGE 2 AUTOMATIC ENABLED | Reset |
| 08-Apr-14 | 14:53:13 | VICTORIA PK PRY CLASS REINFORCEMENT DEFERRAL | AUTOMATIC ENABLED | Alarm |
| 08-Apr-14 | 14:54:13 | VICTORIA PK PRY CLASS REINFORCEMENT DEFERRAL | AUTOMATIC ENABLED | Reset |
| 08-Apr-14 | 14:55:35 | VICTORIA PK PRY CLASS DEMAND BOOST RESPONSE | HALF ACTIVATED | Alarm |
| 08-Apr-14 | 14:57:34 | VICTORIA PK PRY CLASS DEMAND BOOST RESPONSE | HALF ACTIVATED | Reset |
| 08-Apr-14 | 14:58:56 | VICTORIA PK PRY CLASS DEMAND BOOST RESPONSE | FULL ACTIVATED | Alarm |
| 08-Apr-14 | 15:00:58 | VICTORIA PK PRY CLASS DEMAND BOOST RESPONSE | FULL ACTIVATED | Reset |

## 5.6 Commissioning test schedule for ICCP between Electricity North West and National Grid control rooms

*Figure 5.7: Record of ICCP test schedule confirming tests completed*

*Test schedule for ICCP between National Grid and Electricity North West*

**NGT Client (ENW Server) Associations**

| | | ENW | |
|---|---|---|---|
| | | ENW FEP 1 | ENW FEP 2 |
| NG Main | maiap05p | ✓ | ✓ |
| | maiap06p | ✓ | ✓ |
| NG DBU | dbuap05p | ✓ | ✓ |
| | dbuap06p | ✓ | ✓ |
| NG DDS | ddsap05p | ✓ | ✓ |

**ENW Client (NG Server) Associations**

| | | NG Main | | NG DBU | | NG DDS * |
|---|---|---|---|---|---|---|
| | | maiap05p | maiap06p | dbuap05p | dbuap06p | dbuap05p |
| ENW | ENW FEP 1 | ✓ | ✓ | ✓ | ✓ | ✓ |
| | ENW FEP 2 | ✓ | ✓ | ✓ | ✓ | ✓ |

***** The ENW Client to NG server association for the DDS in normally disabled in normal running.

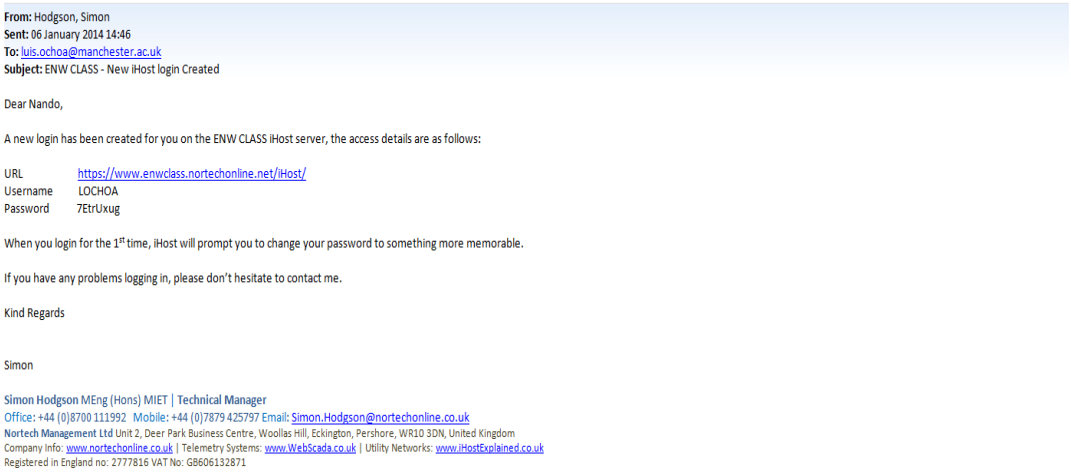
Completed 31 March 2014.

### 5.7 CLASS baseline survey activity schedule

Figure 5.8: Baseline survey activities spring 2014

| Date | Activity completed |
|---|---|
| 7-13 April 2014 | Domestic baseline survey scripted, checked and approved. |
| | I&C baseline survey scripted, checked and approved. |
| | FAQs and survey endorsement letters approved and sent to printers. |
| | Leaflets and shopping trolley token received at offices |
| | Pre-registered sample and quotas shared with recruiters along with a screening survey to support recruitment activity. |
| | Interviewer briefings held. |
| | MPAN master database cleaned in advance of fieldwork, separated into domestic vs I&C and split by primary substation. |
| 14-20 April 2014 | Tablets devices dispatched to interviewers. |
| | Interviewing amongst free found sample started. |
| | Rejection of pre-registered customers commenced based on quota fulfilment. |
| | 39/700 surveys completed. |
| 21-27 April 2014 | 74 domestic surveys. |
| | 35 I&C surveys. |
| 28 Apr - 4 May 2014 | 230 domestic surveys. |
| | 116 I&C surveys. |
| 5-11 May 2014 | 407 domestic surveys. |
| | 164 I&C surveys. |
| 12-15 May 2014 | 496 domestic surveys. |
| | 200 I&C surveys. |
| | Total of 696 surveys completed |

## 5.8 Confirmation of log on details for access to monitoring data



**From:** Hodgson, Simon
**Sent:** 06 January 2014 14:46
**To:** luis.ochoa@manchester.ac.uk
**Subject:** ENW CLASS - New iHost login Created

Dear Nando,

A new login has been created for you on the ENW CLASS iHost server, the access details are as follows:

URL https://www.enwclass.nortechonline.net/iHost/
Username LOCHOA
Password 7EtrUxug

When you login for the 1st time, iHost will prompt you to change your password to something more memorable.

If you have any problems logging in, please don't hesitate to contact me.

Kind Regards

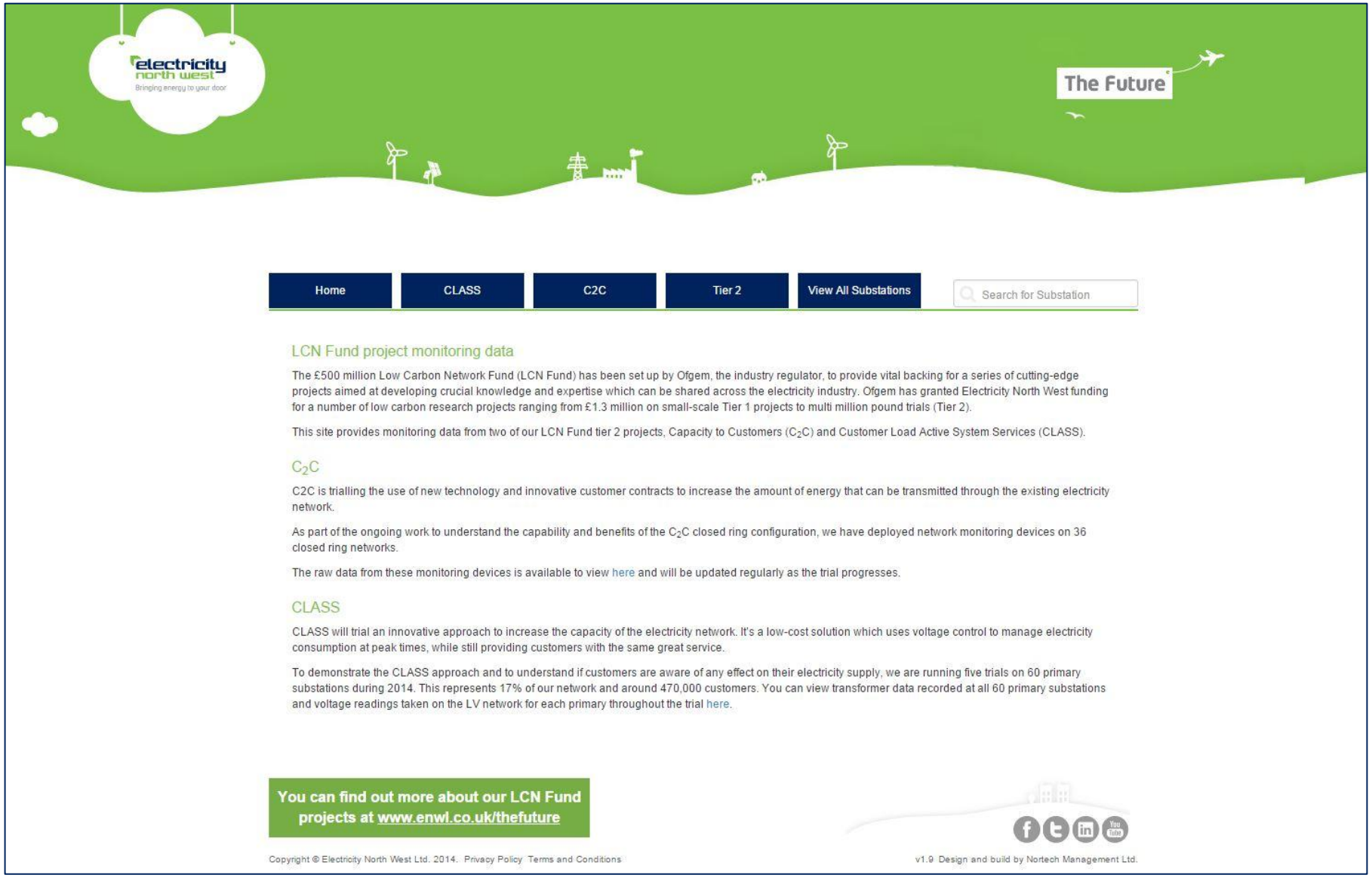
Simon

Simon Hodgson MEng (Hons) MIET | Technical Manager
Office: +44 (0)8700 111992 Mobile: +44 (0)7879 425797 Email: Simon.Hodgson@nortechonline.co.uk
Nortech Management Ltd Unit 2, Deer Park Business Centre, Woollas Hill, Eckington, Pershore, WR10 3DN, United Kingdom
Company Info: www.nortechonline.co.uk | Telemetry Systems: www.WebScada.co.uk | Utility Networks: www.iHostExplained.co.uk
Registered in England no: 2777816 VAT No: GB606132871

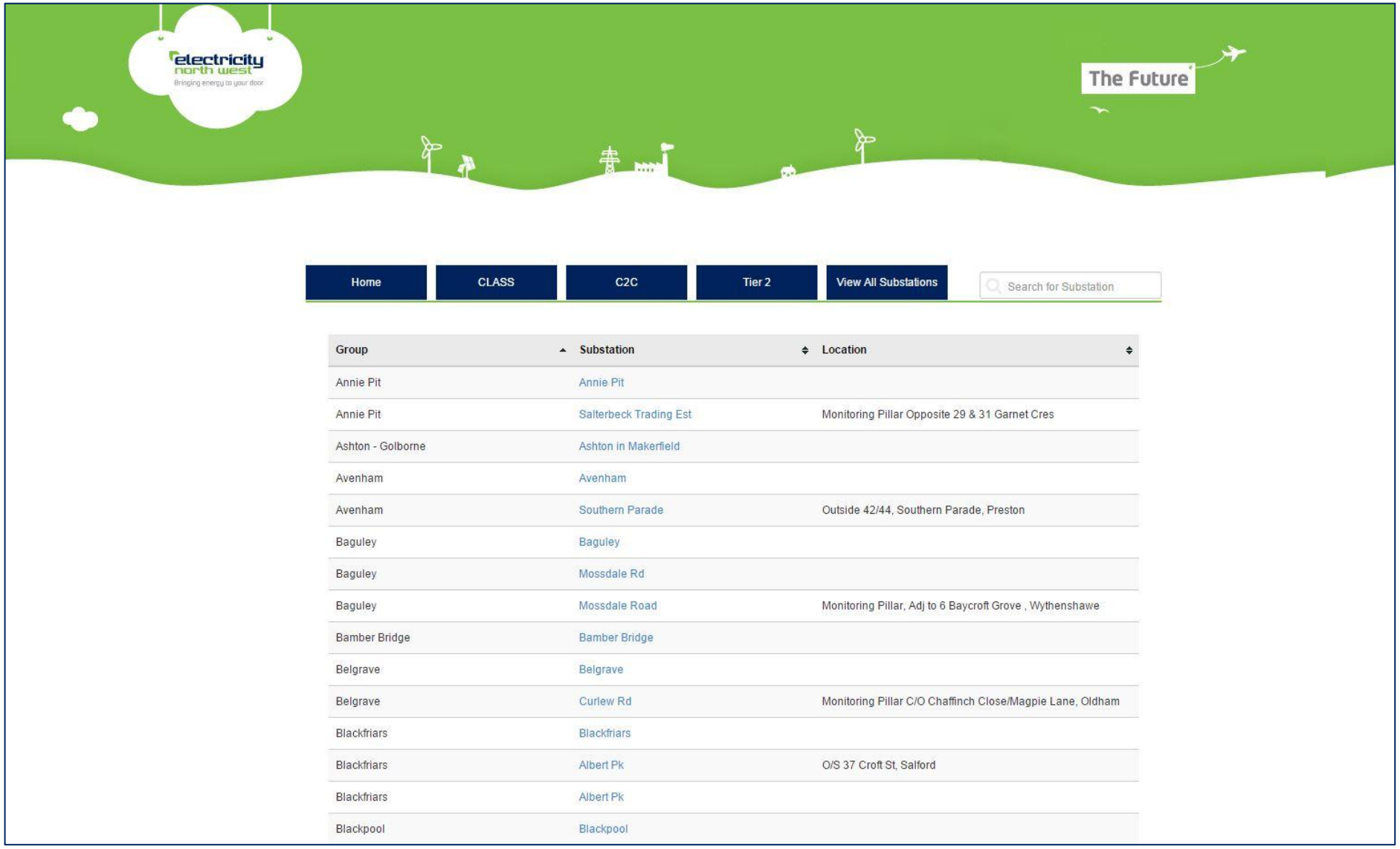
*Figure 5.9: iHost system users and the time and date of the last time each logged in*

| User | Date and time of last log on |
|---|---|
| System administrator | 01/04/2016 15:11:04 |
| Tom Morris (Nortech) | 09/11/2015 09:00:57 |
| Dongmiao Wang (Manchester University) | 04/11/2015 16:29:16 |
| Gary Louden (Electricity North West) | 28/10/2015 13:11:45 |
| Paul Turner (Electricity North West) | 12/10/2015 09:12:19 |
| Andrea Ballanti (Manchester University) | 24/09/2015 09:06:30 |
| Taiwo Owoeye (Manchester University) | 10/09/2015 11:26:28 |
| Yue Guo (Manchester University) | 27/08/2015 13:01:45 |
| Tracey Kennelly (Electricity North West) | 08/07/2015 09:40:11 |
| Steve Stott (Electricity North West) | 25/06/2015 10:19:09 |
| Kazi Hasan (Manchester University) | 10/06/2015 20:12:02 |
| Julian Brown (Nortech) | 02/06/2015 07:41:16 |
| Steve Davenport (Electricity North West) | 30/04/2015 02:06:26 |
| Dave Wagstaff (National Grid) | 12/02/2015 12:49:53 |
| Damien Coyle (Electricity North West) | 28/01/2015 14:30:37 |
| Victoria Turnham (Electricity North West) | 25/11/2014 10:52:45 |
| Simon Rushton (Electricity North West) | 21/08/2014 10:53:10 |
| Rita Shaw (Electricity North West) | 07/08/2014 09:22:48 |
| Graham Shaw (Electricity North West) | 24/04/2014 09:01:44 |
| Sid Hoda (Nortech) | 27/03/2014 10:18:06 |
| Nando Ochoa (Manchester University) | 25/02/2014 11:32:02 |
| Haiyu Li (Manchester University) | 20/02/2014 15:45:19 |
| Ged Flanagan (Electricity North West) | 06/01/2014 14:15:36 |

## 5.9 CLASS data – homepage



*CLASS data – list of substations*




| Group | Substation | Location |
|---|---|---|
| Annie Pit | Annie Pit | |
| Annie Pit | Salterbeck Trading Est | Monitoring Pillar Opposite 29 & 31 Garnet Cres |
| Ashton - Golborne | Ashton in Makerfield | |
| Avenham | Avenham | |
| Avenham | Southern Parade | Outside 42/44, Southern Parade, Preston |
| Baguley | Baguley | |
| Baguley | Mossdale Rd | |
| Baguley | Mossdale Road | Monitoring Pillar, Adj to 6 Baycroft Grove , Wythenshawe |
| Bamber Bridge | Bamber Bridge | |
| Belgrave | Belgrave | |
| Belgrave | Curlew Rd | Monitoring Pillar C/O Chaffinch Close/Magpie Lane, Oldham |
| Blackfriars | Blackfriars | |
| Blackfriars | Albert Pk | O/S 37 Croft St, Salford |
| Blackfriars | Albert Pk | |
| Blackpool | Blackpool | |

| | | |
|---|---|---|
| Blackpool | Blackpool | |
| Blackpool | Bank St Flats | Junction of Banks Street / Promenade, Blackpool |
| Bollington | Bollington | |
| Bollington | Priest Ln | Monitoring Pole 4 |
| Bridgewater | Bridgewater | |
| Bridgewater | Atwood St | O/S 84-86 Princess St, Manchester |
| Buckshaw | Buckshaw | |
| Buckshaw | Dawson Lane O/D | Opposite Jones Farm, Dawson Lane, Whittle le Woods |
| Burrow Beck | Burrow Beck | |
| Burrow Beck | Moss Lane | Monitoring Adj Bambers Farm, Moss Lane |
| Campbell St | Campbell Street | |
| Carr St | Carr Street | |
| Carr St | Wardley Hall Lane | Monitoring Pillar, Opposite 62 Wardley Hall Lane, Walken |
| Cecil St | Cecil Street | |
| Central Manchester | Central | |
| Central Manchester | Altrincham St | Monitoring Pillar ADJ Cycle track London Rd, MCR |
| Central Manchester | Altrincham St | |
| Chamberhall | Chamber Hall | |
| Chamberhall | Park Farm PMT | Monitoring Pole 4 |
| Chassen Rd | Chassen Road | |
| Chassen Rd | Woodhouse rd | Monitoring Pillar Opposite 48/50 Nursery Rd, Urmston |
| Chatsworth St | Chatsworth Street | |
| Cleveleys | Cleveleys | |
| Cleveleys | Osbourne Rd | Outside 478, Broadway, Fleetwood |
| Denton East | Denton East | |
| Denton East | Denbigh Rd | Monitoring Pillar S/O 2 Carlisle Way, Denton, manchester |
| Dickinson St | Dickinson Street | |

| | | |
|---|---|---|
| Irlam | Barton Grange Farm | Monitoring Pillar, In track near to S/S , Irlam |
| Kingsway | Kingsway | |
| Kingsway | Charles Babbage | Monitoring Pillar O/S Charles Babbage S/S, Milnrow |
| Kirkby Stephen | Kirkby Stephen | |
| Kirkby Stephen | Sandford W | Monitoring Adj Pole 12804 |
| Kitt Green | Kitt Green | |
| Kitt Green | Athletics Arena | Monitoring Pillar, Opposite Car park on Loire Drive, Wigan |
| Levenshulme | Levenshulme | |
| Levenshulme | Westcroft Rd | Monitoring Pillar Opposite 38 Brayside Rd Burnage |
| Littleborough | Littleborough | |
| Littleborough | Stanfield Meadows | Monitoring Pillar, 53/55 Drake Rd, Littleborough |
| Longsight | Longsight | |
| Longsight | Melrose Apartment | Monitoring Pillar, O/S 195 Hathersage Rd, Manchester |
| Longsight | Melrose Apartments | |
| Lostock | Lostock | |
| Lostock | Snowden Drive | Monitoring Pillar, O/S 10 Douglas Ave, Lostock |
| Middleton Junction | Middleton Junction | |
| Middleton Junction | LBM Stakehill Lane | |
| Moss Side (longsight) | Moss Side | |
| Moss Side (longsight) | Spring Bridge | Monitoring Pillar, O/S 1 Highbury Rd, Manchester |
| Openshaw | Openshaw | |
| Openshaw | Cadium Walk | Monitoring Pillar, Opposite 71 to 81 Collin lane, Openshaw |
| Romiley | Romiley | |
| Romiley | Mayfield Rd | |
| Romiley | Mayfield Rd | Monitoring Pillar, Opposite 177 Compstall Rd, Romiley |
| S.W. Macclesfield | South West Macclesfield | |
| Skelmersdale | Skelmersdale | |

| | | |
|---|---|---|
| Stuart St | Stuart Street | |
| Stuart St | Repton Ave | Monitoring Pillar, Opposite 51 North Crescent, Manchester |
| Tarleton | Tarleton | |
| Tarleton | Carr Lane PMT | Monitoring On Pole 482203, Moss House Lane |
| Trafford Park North | Trafford Park North | |
| Trafford Park North | Tenax Rd | Opposite Tenax Rd Roundabout S/S |
| Transformer Temperature | Class Unit 1 Romiley T11 | Green Lane, Romiley, Stockport |
| Transformer Temperature | Class Unit 2 Irlam T12 | Tramway Rd, Irlam |
| Transformer Temperature | Class Unit 3 Longsight T11 | Carmoor Road, Longsight, Manchester |
| Trinity | Trinity | |
| Trinity | New Quay St | Monitoring Pillar On Water St Close to Back Quay St |
| Upholland | Upholland | |
| Upholland | Clifton Rd | Monitoring Pillar, ADJ to club, Carr Mill Rd, Wigan |
| Victoria Park | Victoria Park | |
| Westgate | Westgate | |
| Westgate | Chapel Lane | Monitoring O/S 5 Church Grove, Overton |
| Willowbank | Willowbank | |
| Willowbank | Finland Rd | Monitoring Pillar, Opposite PSV on Touchet Hall Rd, Middleton |
| Wilmslow | Wilmslow | |
| Winifred Rd | Winifred Road | |
| Withington | Withington | |
| Withington | Hathersage Rd | Monitoring Pillar, Opposite apartments on Bax Rd, manchester |

**You can find out more about our LCN Fund projects at www.enwl.co.uk/thefuture**



v1.9 Design and build by Nortech Management Ltd.

## 5.10 Key learning documents, in addition to SDRC reports

*Figure 5.10: Additional learning outcomes*

| Reference | Description |
|---|---|
|  Carbon impact assessment final report | An overview of the carbon impact assessment approach and findings of the CLASS method |
|  CLASS dashboard | Explanation of the functionality of the CLASS dashboard |
|  ECP summary report | Summary of the key findings from the engaged customer panel |
|  Project progress report 1 | Project progress report No 1 (dated 16 June 2013) |
|  Project progress report 2 | Project progress report No 2 (dated 19 December 2013) |
|  Project progress report 3 | Project progress report No 3 (dated 23 June 2014) |
|  Project progress report 4 | Project progress report No 4 (dated 22 December 2014) |
|  Project progress report 5 | Project progress report No 5 (dated 21 June 2015) |

## 5.11 Cost variances

*Figure 5.11: Forecast and actual cost comparison reported in project direction format*

| £'000s<br>Excluding Partner Funding<br>Ofgem Cost Category | Total Project<br>Spend, £k | Budget, £k | Variance, £k | Variance, % |
|---|---|---|---|---|
| **Labour** | **1,913** | **1,948** | **35** | **2%** |
| Data Management | 43 | 32 | (11) | -35% |
| Data routing configuration | 60 | 99 | 39 | 39% |
| Installation & configuration of Dashboard hardware & software | 74 | 83 | 10 | 11% |
| Monitoring Equipment | 240 | 236 | (4) | -2% |
| Project Management | 1,027 | 1,035 | 8 | 1% |
| Purchase & Installation of substation controllers | 120 | 99 | (20) | -21% |
| Publicity and Dissemination | 20 | 20 | 0 | 0% |
| SOAP Interface to PoF | 142 | 156 | 14 | 9% |
| Voltage Controllers interface | 188 | 188 | (0) | 0% |
| **Equipment** | **934** | **1,141** | **208** | **18%** |
| Purchase & Installation of substation controllers | 591 | 657 | 66 | 10% |
| RTU installation | 18 | 172 | 154 | 90% |
| Monitoring Equipment | 326 | 313 | (13) | -4% |
| **Contractors** | **3,533** | **3,644** | **112** | **3%** |
| Purchase & Installation of substation controllers | 1,006 | 1,125 | 119 | 11% |
| Installation & configuration of ICCP | 33 | 27 | (5) | -20% |
| Customer Survey | 244 | 219 | (25) | -11% |
| Development of Change Proposals | 41 | 60 | 18 | 31% |
| Carbon Impact assessment | 34 | 41 | 7 | 17% |
| Research - Technical | 923 | 886 | (38) | -4% |
| Project Management | 895 | 912 | 17 | 2% |
| Design of voltage regulation scheme | 357 | 375 | 19 | 5% |
| **IT** | **235** | **287** | **52** | **18%** |
| Installation & configuration of Dashboard hardware & software | 63 | 122 | 59 | 48% |
| Installation & configuration of ICCP | 172 | 165 | (7) | -4% |
| | | | | |
| **Payments to users** | **86** | **141** | **55** | **39%** |
| Incentive to attract customers to complete surveys | 86 | 141 | 55 | 39% |
| **Contingency** | **220** | **595** | **375** | **63%** |
| Installation & configuration of ICCP | 22 | 147 | 125 | 85% |
| Purchase & installation of monitoring equipment | 46 | 124 | 78 | 63% |
| Incentive to attract customers to complete surveys | 0 | 33 | 33 | 100% |
| Purchase & Installation of substation controllers | 152 | 156 | 5 | 3% |
| Installation & configuration of Dashboard hardware & software | 0 | 78 | 78 | 100% |
| Research - Technical | 0 | 56 | 56 | 100% |
| **Other** | **293** | **341** | **47** | **14%** |
| Publicity and Dissemination | 194 | 194 | 0 | 0% |
| Accommodation | 99 | 146 | 47 | 32% |
| | **7,214** | **8,098** | **884** | **11%** |

Source: CLASS Closedow n Report September 2015

## 5.12 Glossary of terms

| | |
|---|---|
| ASC | Autonomous substation controller |
| CCC | Customer contact centre |
| CCGT | Combine cycle gas turbine |
| COMA | Customer operational and maintenance agreement |
| DCODE | Distribution code |
| DG | Distributed generation |
| DNO | Distribution network operator |
| DR | Demand response |
| DUoS | Distribution use of system |
| ECP | Engaged customer panel |
| FFR | Firm frequency response |
| FR | Frequency response |
| GB | Great Britain |
| GCODE | Grid code |
| I&C | Industrial and commercial |
| ICCP | Inter control centre communication protocol |
| MSC | Mechanical switched capacitor |
| NETSO | National electricity transmission system operator |
| NG | National Grid, UK electricity transmission system operator |
| NMS | Network management system |
| PDR | Peak demand reduction |
| PoF | Power On Fusion, general electric network management system |
| QoS | Quality of supply |
| RIIIO | Revenue = Incentives + Innovation + Outputs |
| RP | Reactive power |
| RTU | Remote terminal unit |
| SQSS | System security and quality of supply standard |
| SVC | Static var compensator |
| TSO | Transmission system operator |
| UoL | University of Liverpool |
| UoM | University of Manchester |