Capacity to Customers
Second Tier LCN Fund
Successful Delivery Reward Application

29 April 2016

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APPROVAL

Name	Role	Signature & date
Steve Cox	Head of Network Engineering	Mr Stephen Cox Digitally signed by Mr Stephen Cox DN: c=GB - UNITED KINGDOM, email=steve.cox@enwl.co.uk, o=Electricity North West Ltd, ou=Network Strategy, cn=Mr Stephen Cox Date: 2016.04.29 15:58:34 +01'00'
Sarah Barrett	Finance business partner	Sarah Barrett 29/04/16
Paul Bircham	Networks Strategy & Technical Services Director	P R Bircham 2016.04.29 16:20:43 +01'00'

CONTENTS

1. EXECUTIVE SUMMARY 4

2. PROJECT MANAGEMENT 5

2.1 Summary 5

2.2 A structured approach 6

2.3 Best practice project management and governance 6

2.4 Management of risks and issues 8

2.5 Change proposal management 8

3. TIMELINESS AND QUALITY 9

3.1 Summary 9

3.2 Assurance processes 9

3.3 Criteria under technology workstream 11

3.4 Criteria under commercial workstream 13

3.5 Criteria under learning & dissemination workstream 16

4. COST EFFECTIVE DELIVERY 19

4.1 Summary 19

4.2 Cost variances 19

4.3 Value for money delivery 20

4.4 Reallocation of budget between categories 21

4.5 Use of contingency budget 21

5. APPENDICES 23

Appendix 5.1: Changes to the project direction 23

Appendix 5.2: Chronology of the Ofgem change requests 24

Appendix 5.3 Cost variances 25

Appendix 5.4: Key learning activities 26

Appendix 5.5: C_2C data 31

Appendix 5.6 – Internal announcement on C_2C go live 41

1. EXECUTIVE SUMMARY

The Capacity to Customers (C_2C) project has successfully delivered an ambitious programme of work and has produced significant learning for all stakeholders by testing a combination of enhanced automation technology, meshed network operation and novel commercial demand side response (DSR) contracts.

This document is the application from Electricity North West for a Successful Delivery Reward (SDR) in respect of the completed C_2C project. C_2C was delivered on time and has met or exceeded each of its 27 successful delivery reward criteria (SDRC) commitments. As a result of robust project management leading to project efficiencies, the C_2C project was delivered significantly under budget with £1.683m returned to customers but with no reduction in benefit.

This SDR application follows on from the comprehensive C_2C closedown report published on the C_2C website where all of the documentation generated by the project can be freely downloaded.

The ultimate test of the success of an innovation project is whether it is transitioned into business as usual to deliver value to customers through cost savings and carbon reductions. The technologies and learning from the project have been transitioned into business as usual (BAU) within Electricity North West and the n-0 concept adopted by a number of other DNOs. We have included several million pounds of associated efficiencies within our Well Justified Business Plan (WJBP) and worked to realise these savings for customers since the final determination. Electricity North West now offers all distributed generation (DG) customers a C_2C contract which has reduced both costs and timescales for these customers. We have also offered and implemented meshed network connections to customers again reducing costs. For existing demand customers we have implemented C_2C demand contracts thereby making significant efficiencies in our load-related investment plans as well as generating valuable revenues for these customers. In addition to carbon savings, our customers will realise costs savings of over £20m during RIIO-ED1 alone as a direct result of C_2C.

C_2C set out to test seven separate hypotheses via a combination of network tests, real time data analysis, network simulation and customer engagement trials. These hypotheses are detailed below in Figure 1.1

Figure 1.1: Proven project hypotheses

No.	Hypothesis
1	*The C_2C method will release significant capacity to customers (in the range of 75% to 100% of available capacity/circuit rating) from existing infrastructure.* PROVEN – see results from technology workstream
2	*The C_2C method will enable improved utilisation of network assets through greater diversity of customers on the network ring.* PROVEN – see results from technology workstream
3	*The C_2C method will reduce like-for-like power losses initially but this benefit will gradually erode as newly released capacity is utilised.* PROVEN – see results from technology workstream
4	*The C_2C method will improve power quality resulting from stronger electrical networks*. PROVEN – see results from technology workstream
5	*The C_2C method will facilitate lower reinforcement costs for customers for the connection of new loads and generation.* PROVEN – see results from commercial workstream
6	*The C_2C method will effectively engage customers in a new form of demand and/or*

No.	Hypothesis
	generation side response thereby stimulating the market and promoting the future use of commercial solutions to address the problem. PROVEN – see results from commercial workstream
7	*The C_2C method will facilitate a reduction in the carbon costs of network reinforcement.* PROVEN – see results from technology workstream

The project tested a combination of novel automation technology and used innovative network operational practices alongside commercial contracts for demand side response (DSR) and delivered the following new learning and benefits:

- *Adaptive network control functionality:* The trial has successfully developed advanced network control functionality that is now available to all UK DNOs through our project partner GE.
- *Demand response commercial templates:* A series of model commercial contracts that can be used by all DNOs to extend the C_2C method and its benefits to all DNO customers.
- *Customer segmentation template:* The trial produced a customer segmentation template, describing how a DNO's customer base can be segmented and hence more efficiently targeted for the introduction of DSR contracts as opposed to traditional reinforcement.
- *New connections process:* The trial produced a new connections process detailing the technical and commercial steps required to extend C_2C's benefits to future customers
- *Overall customer feedback:* The project demonstrated the acceptability of the C_2C method to customers through analysis of feedback from customers participating in all areas of the C_2C project.
- *Network data*: Detailed analysis of the benefits of the C_2C method in respect of network capacity, losses and power quality in the form of a full set of network performance data
- *Modelling/simulation outcomes:* The simulations provided a detailed economic and carbon impact assessment of the benefits of the C_2C solution.
- *New design and planning standard*: The method represents a fundamental change in the evolution of grids from passive to active operation and Electricity North West in conjunction with PB Power have produced new operating and design standards in the form of an amendment to ETR130 which is a guidance document supporting Engineering Recommendation P2/6. This amendment was adjusted and implemented by all DNOs.

This SDR application will show that the C_2C project was effectively managed, all SDRCs have been satisfied and that C_2C was delivered significantly under budget, within the agreed timescale for delivery, and that outputs have been achieved to a high standard of quality.

2. PROJECT MANAGEMENT

2.1 Summary

When writing and delivering the C_2C full submission and in the creation of the proposed project delivery PRINCE2 principles were applied. The submission proposed a structured project delivery method for C_2C by defining phases and grouping similar types of activities into 'workstreams'. Structuring the project in this way enabled an efficient control of resources for controlled and organised delivery and facilitated the close monitoring of the C_2C project.

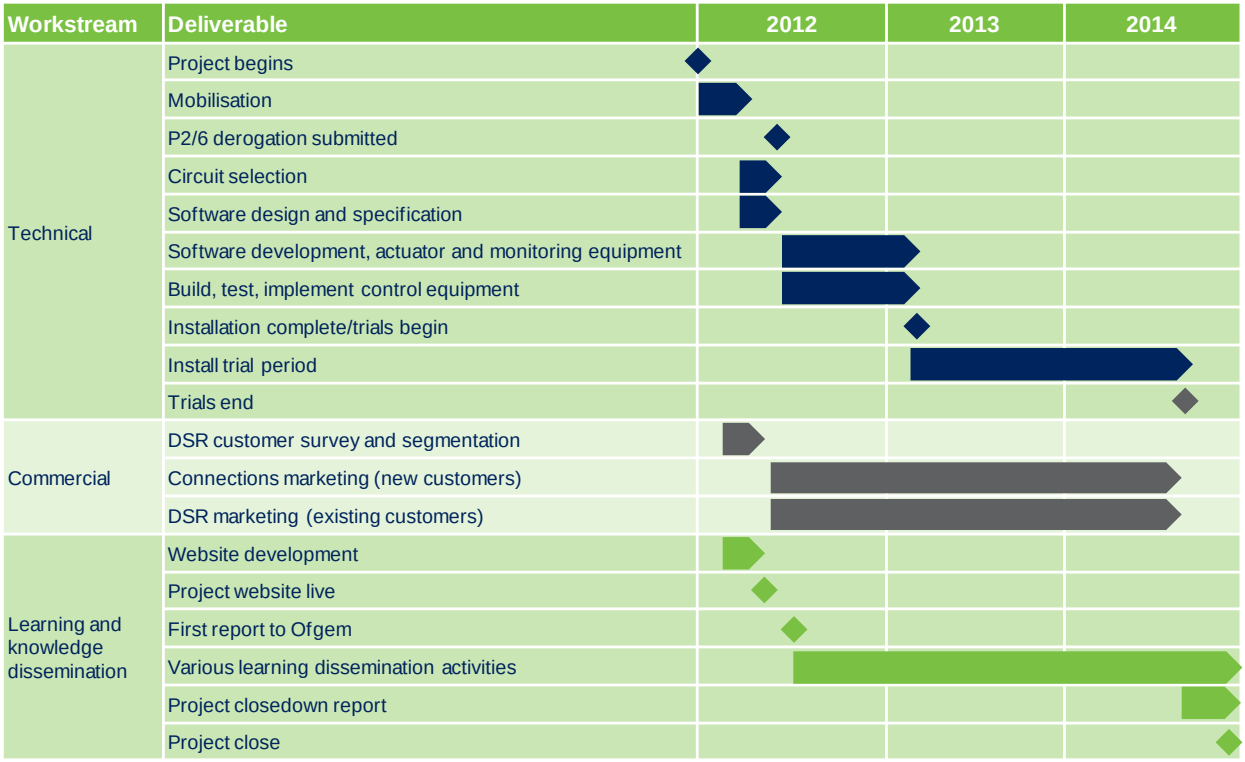
The proposed project delivery approach was implemented through clear leadership coupled with strong governance procedures. Oversight of the C_2C project was tiered and its profile within the innovation programme enabled risks, issues and opportunities to be discussed, with mitigating measures implemented and communicated for risks and issues as delivery progressed.

2.2 A structured approach

Electricity North West's approach to the delivery of the C_2C project was defined, right at the start, in the construction of the full submission submitted to Ofgem in 2011. The submission proposed a project delivery method for C_2C structured around PRINCE2 principles and defining phases and grouping similar types of activities into 'workstreams'. This controlled and organised approach enabled an efficient control of resources and facilitated the close monitoring of the C_2C project.

The full submission detailed the structure of the project through its various phases and defined various workstreams; 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 workstream. The named workstream lead had full responsibility for delivering the defined outputs. This is Electricity North West's standard 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

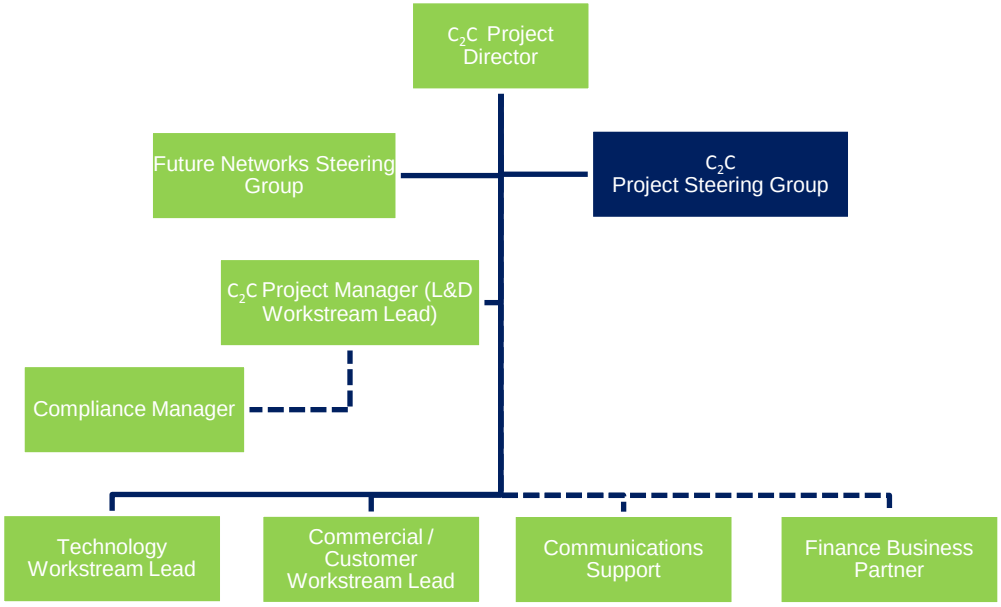
The C_2C project was structured to ensure the project met its delivery criteria and a strong governance structure was implemented from the outset to achieve the milestones through timely and effective decision-making.

The C_2C project was the first successful application from Electricity North West to the Second Tier of the Low Carbon Networks Fund. A C_2C delivery team was created within the future networks department of the networks strategy & technical services directorate; and a standard 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 projects.

Figure 2.2 below shows the key roles within the C_2C project team and the reporting lines; with the dashed lines indicating where part-time support was provided to the C_2C project by the main business. The C_2C project manager took day-to-day responsibility for project delivery and was supported by the workstream leads. To ensure that the C_2C project was delivered as per the project direction and in the spirit of the discussions held with the expert panel, the bid

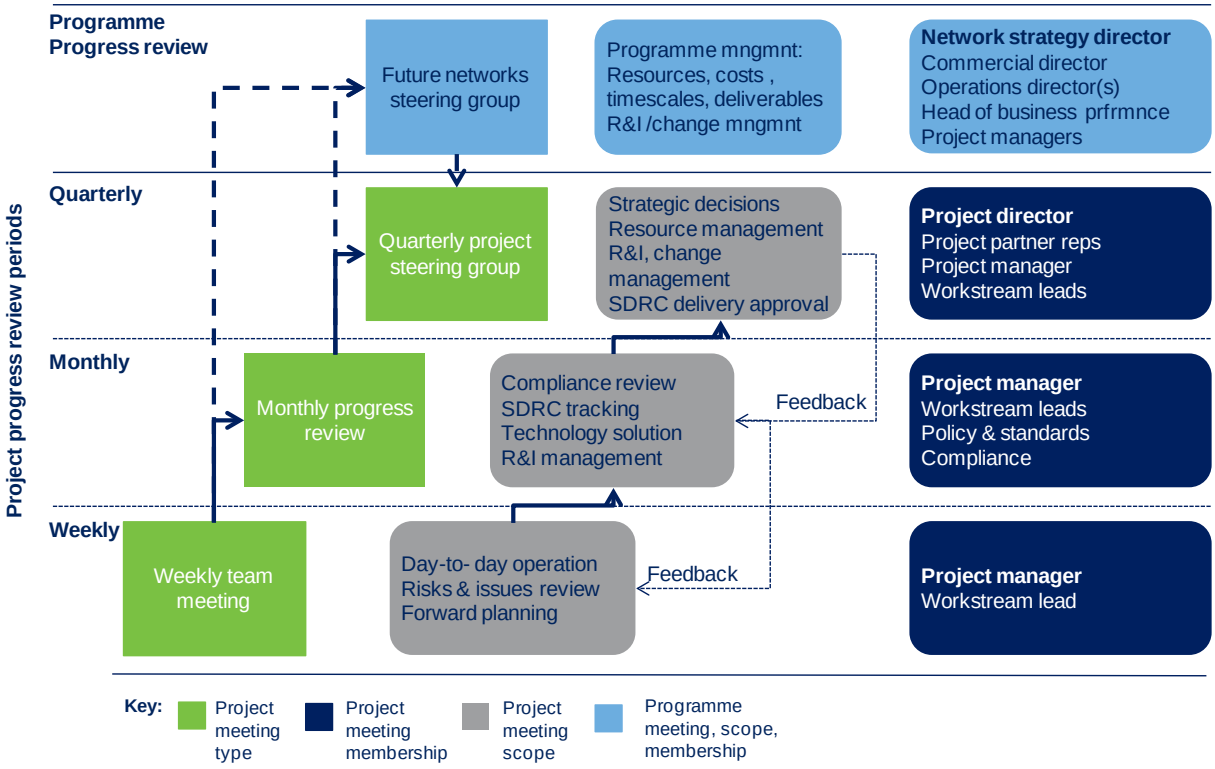
manager acted as compliance manager for C_2C project delivery, supporting the C_2C project manager. Ultimate responsibility for the C_2C project sat with the project director, a member of the Electricity North West executive or senior leadership team.

Figure 2.2: Organisational chart of C_2C project team



The C_2C 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. 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 identifying potential ones. 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 & standards team so that all aspects could be discussed eg the costs, the technology solution, the quality of the learning reflected in the project's deliverables, etc.

Figure 2.3: C_2C governance approach



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

- Oversee and provide directional guidance on the C_2C project and facilitate communication,
- Monitor programme finances,
- Monitor programme progress against deliverables,
- Monitor key programme risks and issues,
- Identify opportunities,
- 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 C_2C 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 C_2C full submission, a set of potential risks were 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), which were produced by the bid manager and used as the official handover of the C_2C 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 project requirements; to give clarity to the project manager and workstreams 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 C_2C 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 C_2C 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 C_2C project were reviewed, tracked and mitigated against in each of the six-monthly progress reports (PPR Jun 2012, PPR Dec 2012, PPR Jun 2013, PPR Dec 2013, PPR Jun 2014 and PPR Dec 2014). This rigorous and consistent approach to the identification of issues gave rise to a formal change proposal being raised where applicable for the project.

2.5 Change proposal management

The C_2C project commenced with expectations about the 'state of the world' during the life of the project. Electricity North West made reasonable assumptions about network capacity for the duration of C_2C.

What was experienced in project delivery was a 6.6% reduction in maximum demand on our network. This led to a situation where most new industrial and commercial (I&C) firm connections could be offered without the need for reinforcement. This was in stark contrast to the 2010 demand position when new connections would have resulted in reinforcement across most circuits. This had an impact on the number of customers to whom a C_2C connection agreement could be offered. To mitigate this, a longer period for securing new customer contracts was requested and a three-month extension granted at a cost of £108k.

The change request was discussed at PSG and impact statements obtained from project partners.

The project team met with Ofgem at Millbank on 27 June 2014 regarding the SDRC to obtain ten new connection agreements. Electricity North West explained that the forecast for converting opportunities to contracts was nine. On 18 July Electricity North West wrote to Ofgem to state that this had increased to 12 opportunities likely to convert by the end of financial year 2014/15. Ofgem's feedback at that time was that there were generally three types of variation, these being time, cost and quality and that a 'time' variation was in principle the most straightforward variation with a 'quality' variation being the most difficult.

In our June 2014 project progress report, Electricity North West forecast an 'at completion cost' of £8.741m against a budget of £10.275m. The variation request required that we maintain resources associated with securing the connection agreements until they were obtained and the project successfully closed down. The estimated revised cost at completion was £8.804m. This would mean that the project successfully delivered all of its SDRC and outperformed project budget by £1.4m. By close down, the project had increased this outperformance to £1.683m which will be returned to customers.

On 19 December 2014, Ofgem issued an updated project direction highlighting only the amendments; these amendments, detailing the additional obligations, are reproduced in Appendix 5.1. The chronology of these change requests to the project direction can be found in Appendix 5.2.

On 31 March 2015 the initial C_2C closedown report was posted on the C_2C website along with the cumulative learning and outputs from the delivery of the project and Ofgem was informed that the C_2C project had been closed down and issued with the closedown report. Subsequently the C_2C closedown report was peer reviewed with revisions posted on the C_2C website on 30 June 2015 and 7 August 2015 incorporating feedback from the peer review and Ofgem respectively. The final closedown report was published on the Ofgem website on 28 September 2015.

3. TIMELINESS AND QUALITY

3.1 Summary

Capacity to Customers committed to deliver a total of 27 SDRCs, all of which were met in accordance with the project direction (incorporating revisions). This section details the quality and timely delivery of the evidence to show the C_2C project was successfully completed. Appendix 5.4 contains the links to the six-monthly progress reports and other additional reports generated by the C_2C project that were not satisfying or linked to an SDRC.

Over the course of C_2C change management processes were undertaken to respond to challenging external factors and changes in the wider economic environment. In response to these external factors Electricity North West requested a number of minor change requests to ensure the full benefits of the project could be delivered to customers. The chronology of these change requests and resulting amendments to the project direction can be found in Appendix 5.1.

3.2 Assurance processes

Built into the robust project governance was the process for assuring that the project outputs were delivered on time and 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. Each project output was peer reviewed at least once by a colleague and signed off for publication by the project manager; only then was the project output posted onto the C_2C website. Where the output contained financial information additional sign-off by the Electricity North West finance partner was required.

Figure 3.1: Quality assurance for project outputs

Key project outputs were identified as SDRCs within the full submission project plan and targeted for delivery by a given date to comply with that SDRC commitment. The project manager took 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 was signed off for publication, it was date stamped as part of the evidence for compliance with SDRC. Where the project output was a report the date was generally visible on the front cover of the report. For other milestone types another method was applied, for example the date when an output is shared publically via the website or date of installation completion or date of newsletter.

Figures 3.2 to 3.7 below detail the evidence for the timely delivery and quality level of the successful delivery reward criteria delivered under each of the workstreams of the project. For timeliness the figures detail the date the SDRC was delivered and are colour coded to indicate whether it was delivered on time or late; while for quality level the figures detail the assurance process followed plus any additional activities to ensure a quality output. Learning and outputs additional to the SDRC evidence is listed in Appendix 5.4.

3.3 Criteria under technology workstream

Figure 3.2: Technology workstream

SDRC	Evidence of timeliness		Evidence of quality of outputs delivered	
Technology workstream – HV circuit selection				
1. In June 2012, publish the HV circuits included within the C_2C trial, the HV circuit selection methodology and the HV circuit variation methodology on the C_2C project website	29 Jun 2012	**Completed on time**	List of trial HV circuits report to Ofgem Trial circuit selection and variation methodology report to Ofgem (contains the HV circuit variation methodology on page 12) *Normal SDRC assurance process followed with report drafted jointly between PB Power and workstream lead.*	List of trial HV circuits HV circuit selection methodology
2. In October 2012, publish information leaflet on the HV circuits selected for trial	31 Oct 2012	**Completed on time**	Trial circuit leaflet published and customer postcode search web functionality live *Normal SDRC assurance process followed with leaflet drafted by workstream lead*	HV trial circuit leaflet Trial area search
Technology workstream – Engineering Recommendation P2/6 Derogation Application				
1. In June 2012, submit derogation application to Ofgem	26 Jun 2012	**Completed on time**	Application for derogation from Standard Licence Condition 24.1(a) issued to Ofgem by networks strategy and technical support director	Application for definite derogation from ER P2/6
Technology workstream – Technology Implementation				
1. Software design completed by April 2012	30 Apr 2012	**Completed on time**	Adaptive network control functional design specification issued to Ofgem and published on the Electricity North West C_2C project website *Normal SDRC assurance process followed with specification developed by Electricity North West lead solution architect and C_2C technology workstream lead. Internal review process included project partner GE and head of engineering*	Functional design specification
2. Software and IT	Mar 2013		Page 5 of the third project progress report states that technology	PPR Jun 2013

SDRC	Evidence of timeliness		Evidence of quality of outputs delivered	
hardware installation, testing and commissioning completed by March 2013			rollout was completed on time during March 2013. Published online.	
3. Actuators, communication and monitoring equipment installed, tested and commissioned by March 2013	29 Mar 2013		C_2C remote installation report issued to Ofgem and published online. Section 2 of the attached report contains a table of installations and dates with the final installation completed on 29 March 2013. *Normal SDRC assurance process followed with report drafted by C_2C technology workstream lead. Internal review by project manager*	C_2C remote control installation report
Technology workstream – project 'go-live'				
1. Live trials commence April 2013	30 Apr 2013	**Completed on time**	Page 5 of the third project progress report states that the project has now commenced the live trial phase with table 5.1 confirming that this SDRC was completed.	Internal communications bulletin announcing commencement of go live – see Appendix 5.6
2. Demand response capability test completed for all contracted C_2C customers by March 2015	Mar 2015		Demand response capability tests were carried out by the control engineer with engineering presence on-site confirming operations Please see Appendix C of the closedown report	C_2C closedown report
Technology workstream – Development, consultation and submission of ER P2/6 change proposals				
1. Complete simulation exercises to inform discussions by April 2013	30 Apr 2013	**Completed on time**	Simulation studies report issued to Ofgem *Standard SDRC assurance process followed. Lead Author of report G Williamson of PB Power; review and sign off of report by technical workstream lead*	Simulation studies report
2. Hold workshops between	24 Jan 2013	**Completed on time**	Consultation accelerated to avoid an overlap between it and an	P2-6 review external

SDRC	Evidence of timeliness		Evidence of quality of outputs delivered	
April 2013 and July 2013 to inform proposals			industry debate regarding its replacement ie the development of ER P2/7 and also to fit in with Ofgem's timetables for ED1 and WS6 (Smart Grids Forum) Workshops were well attended by representatives of all DNOs, including several members of the Distribution Code Review Panel. Attendee list included in Appendix B of the external workshop summary document *Standard SDRC assurance process followed. Consultation drafted and managed by technical workstream lead with review and oversight from compliance manager and project director*	workshop summary
3. Issue industry consultation between September 2013 and December 2013	18 Jan 2013	**Completed on time**	Consultation issued early to inform the workshops and encourage maximum contribution from external stakeholders *Standard SDRC assurance process followed. Consultation drafted and managed by technical workstream lead with review and oversight from compliance manager and project director*	C2C ER P2-6 consultation letter
4. Issue recommendations report in September 2014	10 Feb 2014		P2/6 change proposal report issued August 2013 with a revised and final version re-issued on 10 February 2014 *Standard SDRC assurance process followed. Lead Author of report G Williamson of PB Power; review and sign off of report by technical workstream lead*	Accommodating DSR in ER P2-6 (revised)

3.4 Criteria under commercial workstream

Figure 3.3: Commercial workstream

SDRC	Evidence of timeliness		Evidence of quality of outputs delivered	
Commercial workstream – Demand response customer segmentation methodology				
1. Customer data updated in April 2012	26 Apr 2012	**Completed on time**	*Standard SDRC assurance process followed with report drafted jointly between project manager and workstream lead*	Trial circuit customer data
2. Customer survey	16 Aug 2012	**Completed**	Customer survey completed. Please see page 16, Section 3.7 of	Customer

SDRC	Evidence of timeliness		Evidence of quality of outputs delivered	
completed in August 2012		on time	the customer segmentation report	segmentation report
3. Demand response customer segmentation model completed and published on C_2C project's website in August 2012.	31 Aug 2012	Completed on time	Customer segmentation report issued *Standard SDRC assurance process followed with report drafted jointly between Impact Research and workstream lead*	
Commercial workstream – Customer engagement				
1. Customer engagement plan (CEP) approved by Ofgem in June 2012 and C_2C project's website live in June 2012	21 Jun 2012	Completed on time	Customer engagement plan issued to Ofgem. Letter from Ofgem approving CEP received 28 June *Standard SDRC assurance process followed with report drafted jointly between Impact Research and workstream lead*	Customer engagement plan Project website
2. Trial HV circuits published in June 2012	29 June 2012	Completed on time	Trial HV circuits report sent to Ofgem and link on website *Standard SDRC assurance processes followed with report drafted by the project manager and reviewed by the workstream leads*	List of trial HV circuits
3. C_2C connection offer process published in September 2012	27 Sept 2012	Completed on time	Connections process published on project website *Connections process developed collaboratively between workstream lead and Head of Connections then reviewed by the project manager*	Connections process
4. First trade magazine article published in September 2012	30 Sept 2012	Completed on time	Trade article published in Utility Week. Subsequent trade articles published bi-monthly until March 2014 *Standard SDRC assurance processes followed with advertorial jointly drafted by project manager and the workstream lead with support and review by communications specialist*	30 September 2012 15 November 2013 25 January 2013 14 March 2013 23 May 2013 10 July 2013 10 September 2013 6 November 2013 14 January 2014 5 March 2014

SDRC	Evidence of timeliness		Evidence of quality of outputs delivered	
5. First leaflets distributed in October 2012, with subsequent leaflets delivered as per project plan	12 Jul 2012 9 Nov 2012 (v2) 31 Mar 2013	**Completed on time**	Customer leaflets published: (business customer mailing) *Normal SDRC assurance process followed with leaflet options drafted by workstream lead and Impact Research then reviewed by the project manager. Leaflets also subject to testing clarity with engaged customer panels*	Customer business leaflet C_2C customer leaflet v2 C_2Cdomestic customer mailing
6. New C_2C commercial templates for new connections and existing customers available for issue to customers by December 2012	21 Dec 2012	**Completed on time**	Templates for connection agreements published on C_2C website *Standard SDRC assurance process followed with templates drafted by workstream lead with professional legal support then reviewed by the project manager and head of connections.*	Commercial templates (existing) Commercial template (new)
7. First customer seminar/ workshop delivered in December 2012, with subsequent seminars/ workshops delivered as per project plan	11 Dec 2012 17 Apr 2013 17 July 2013 20 Nov 2013 11 Apr 2014	**Completed on time**	Connections customer seminar delivered at the Reebok Stadium on 11 December 2012 Commercial customer engagement forum (with npower) delivered at the Bolton Arena on 30 April 2013 Seminar held with Electricity North West Construction and Maintenance Services business at Reebok Stadium, Bolton (the evidence kept for this seminar is references in Jul 2013 SDRC letter dated 5 Aug 2013 and project progress report from Dec 2013) Customer seminar delivered on 20 November 2013 Customer seminar (Connections applicants/ agents) delivered on 11 April 2014	11 Dec 2012 17 April 2013 PPR Dec 2013 20 Nov 2013 11 April 2014
8. Various engagement programs continued through until Dec 2014, using various channels including website and e-mail	See over	**Completed on time**	Wide range of engagement activities	A complete list of our engagement activities and links can be found in Appendix 5.4

SDRC	Evidence of timeliness		Evidence of quality of outputs delivered	
Commercial workstream – Demand response contracts				
1. New managed contracts entered into with demand and/ or generation customers or their agents, including: i) At least ten C_2C managed connection agreements by March 2015; and ii) At least ten C_2C managed contracts for demand and/ or generation response with existing customers, either directly and/ or via an agent by September 2014	See over	**Completed on time**	Ten C_2C managed connection agreements with new connection customers were signed by March 2015 and ten C_2C managed contracts with existing customers were obtained by September 2014. See Section 4, page 21 of the project closedown report for a list of the new managed agreements.	Closedown report

3.5 Criteria under learning & dissemination workstream

Figure 3.4: Learning and dissemination workstream

SDRC	Evidence of timeliness		Evidence of quality of outputs delivered	
Dissemination of knowledge				
1. Network data made available to stakeholders throughout C_2C project and available for at least 18 months after project closedown	Sept 2016	Ongoing	Network data was available for direct download via the project website for the duration of the project. This facility has now closed and all data is available on request. A link has been set up to enable this in the technical data section of the C_2C website	Please see Appendix 5.5 for sample data and evidence of access to data from the project website

2. Six-monthly progress reports submitted to Ofgem/industry throughout C_2C project	Jun & Dec 2012 Jun & Dec 2013 Jun 2014	**Completed on time**	All six-monthly reports issued to Ofgem in line with required timescales *Normal project progress report assurance process followed with sections drafted by workstream leads then reviewed between workstream leads and by project manager. Sign off by 3 SLT members*	PPR Jun 2012 PPR Dec 2012 PPR Jun 2013 PPR Dec 2013 PPR Jun 2014 PPR Dec 2014
3. Five industry conferences attended and presented at by March 2015	 26 Oct 2012 17 Apr 2013 24 June 2013 14 Nov 2013 27 Jan 2015	**Completed on time**	Five industry conferences attended and presented at: 1) Presented at LCNI conference 2012 2) Knowledge sharing event 3) Presented at SMIs European demand response seminar 4) Presented at LCNI conference 2013 5) Final dissemination event	 LCNI slides 2012 Knowledge Sharing Event Event website Event slides LCNI slides 2013 Final dissemination event presentation
4. LCNI annual conference attended and presented at by December 2014	22 Oct 2014	**Completed on time**	Presented findings and promoted closedown of project at the LCNI conference, October 2014	LCNI slides 2014
5. Published (or had accepted for publication) six white papers for magazines or journals for industry or academic audiences, as per project plan, throughout C_2C project	See over	**Completed on time**	31 Oct 2012 – White paper – C_2C customer survey 21 Dec 2012 – White Paper – Circuit Selection 25 June 2013 – White Paper – Calculating Network Losses 30 December 2013 – White Paper – Fault Performance of HV rings 26 June 2014 – White paper – carbon impact assessment 18 Dec 2014 – White Paper – C_2C DG capacity 30 March 2015 – White paper – Demand response in smart distribution network planning	White-paper---c2c-customer-survey White-paper---circuit-selection White-paper---c2c-customer-survey White-paper---fault-performance-of-hv-rings White-paper---carbon-impact-assessment White-paper---c2c dg capacity

				White-paper--demand response in smart distribution network planning v2
6. Closedown report submitted to Ofgem in March 2015	31 Mar 2015	**Completed on time**	Closedown report submitted to Ofgem in March 2015. Further revisions to incorporate feedback published online. *Normal project progress report assurance process followed with sections drafted by workstream leads then reviewed between workstream leads and by project manager. Sign off by Paul Bircham, regulation director, Steve Cox, head of engineering and Paul Haigh finance business partner. Additional DNO peer review undertaken*	C_2C closedown report

4. COST EFFECTIVE DELIVERY

4.1 Summary

Total project costs for delivering C_2C were £8,592k; significantly under the allowed budget of £10,275k. This has been achieved through effective project management and the use of robust financial controls throughout the lifecycle of the project.

Project related procurement was conducted in line with the requirements of EU legislation, statutory law, and our own internal control manual. All procurement was carried out by the Electricity North West procurement team supported by the project delivery team to ensure that the agreements were delivered at a competitive cost.

On 28 December 2012 Electricity North West requested approval of a transfer of £758,000 from the "Labour" category to the "Contractors" category due to changing our delivery method for several activities to use contractors rather than Electricity North West employees. This change was to allow realisation of efficiencies identified within the budget. The change required Ofgem approval, which was received on 24 January 2013.

4.2 Cost variances

This section provides details of project cost areas that exceeded the project budget, detailed in the C_2C project direction, by more than 5%. The actual expenditure compared against the forecast expenditure across all the cost categories and cost lines in the C_2C project direction is detailed in Appendix 5.3. There are nine cost lines that show an adverse variance of greater than 5%, these are detailed below with a more detailed breakdown found in Appendix 5.3.

Cost category – Labour: Overall this category has remained under the project direction budget by £165k (9%) against a budget of £1,755k. There are four sub categories where the budget line element was exceeded. These are shown below:

- **Monitoring equipment installation:** In total this cost was £63k, which was £41k (190%) higher than the budgeted £22k costs. The installation rate was higher than expected due to the re-allocation of sites because of on-site issues which prevented the equipment from being fitted at the proposed site eg not possible to connect rogowski coils to measure current. Also the manual collection of data was under provisioned for in the budget.
- **Specifications and testing approval:** In total this cost was £27k, which was £7k (37%) higher than the budgeted £20k costs. The reason for overspend in this area was due to a greater than expected time required for drawing up detailed specifications and testing script approval. These changes were necessary to secure certainty of successful delivery.
- **Dissemination Electricity North West and customer engagement:** Total costs were £34k, which was £6k (21%) higher than the budgeted £28k. Dissemination costs were higher than anticipated due to more time being allocated to ensure full understanding of the project method and benefits by other DNOs.
- **Remote control installation Electricity North West resource:** Total costs were £102k, which was £17k (21%) higher than the budgeted £84k. The variance to budget was due to additional time spent on resolving post go live bug fixes. This variance was offset by the efficiencies made in contractor costs (18%) under budget and £140k under spend vs. budgeted £760k.

Cost category – Equipment: Overall this category remained under the project direction budget by £452k (15%) against a budget of £3,078k. There was, however, one area where budget was exceeded as detailed below:

- **Monitoring equipment installation plant:** Total costs were £179k, which was £68k (61%) higher than the budgeted £112k. Despite competitive tendering the project incurred higher than expected unit costs for equipment.

All of the monitoring equipment devices were purchased following a full and proper tendering process, with the most competitive and technologically suitable products being chosen for purpose.

Cost category – Contractors: Overall this category remained under the project direction budget by £222k (7%) against a budget of £3,012k. There was, however, one area where budget was exceeded as detailed below:

- **Circuit selection:** Total costs were £38k, which was £7k (21%) higher than the budgeted £32k. Selection of circuits took longer than expected as technical restrictions on circuits and the fault rate requirement meant the circuits selected had a high drop out rate. This meant more detailed analysis than anticipated to ensure that they properly represented the UK network characteristics.

Cost category – IT: Overall this category remained under the project direction budget by £129k (17%) against a budget of £740k. There were, however, three areas where budget was exceeded as detailed below:

- **Visual display functionality for CRMS:** Total costs were £78k, which was £5k (6%) higher than the budgeted £73k. Higher than expected costs were incurred to ensure adequate visibility of the innovative running arrangements with the control room systems. This was necessary to enable safety management systems within the control room and assure service to customers in the trial area.
- **Initial data load functionality:** Total costs were £88k, which was £33k (60%) higher than the budgeted £55k. Higher than expected costs due to the amount of work required to make sure that the data transferred correctly between the two network management systems.
- **System integration and testing:** Total costs were £73k, which was £7k (10%) higher than the budgeted £66k. Higher than expected costs were incurred in testing which was expanded to assure service to customers in the trial areas. This extra testing ensured that customers supplies were not removed during the trial as a result of a IT problem.

4.3 Value for money delivery

The objective of the project team was to deliver the maximum benefit from the goods and services that it provided or acquired. To ensure that this objective was achieved, robust cost controls were implemented and efficiencies within the project were sought by: holding monthly review meetings with the finance business partner; the filing of regular reports to the project board; quarterly updates to the future networks steering group; and providing the six-monthly project progress reports to Ofgem.

In total despite upward cost pressures in the above areas the project made a cost saving of £1,683k (16%) against the project budget. The table in Appendix 5.3 highlights the areas of the project budget and that each area was under spent against the C_2C project direction.

- **Labour:** Overall Electricity North West internal labour costs made a £165k (9%) efficiency against the project budget of £1,755k. This was achieved through robust cost controls. Efficiencies were identified and implemented within the project through monthly review meetings with the finance business partner, the filing of regular reports to the project board and quarterly updates with the future networks steering group.
- **Equipment:** Overall equipment costs made a £452k (15%) efficiency against the project budget of £3,078k; this was achieved using the same controls processes as above. The major saving of £345k (61%) versus the project budget was on remote control installation. The circuit selection process highlighted that some circuits could be selected with pre-existing remote control which resulted in less devices being fitted.
- **Contractors:** Overall contractor costs made a £222k (7%) efficiency against the project budget of £3,012k; this was achieved using the same controls processes as above. The major saving of £140k (18%) versus the project budget was on remote control installation.

The circuit selection process highlighted that some circuits could be selected with pre-existing remote control which resulted in less devices being fitted.

- **IT:** Overall IT costs made a £129k (17%) efficiency against the project budget of £740k; this was achieved using the same controls processes as above. The major saving of £91k (91%) versus the project budget was on the purchase cost of the necessary database licences. These savings were made due to purchasing licenses through a project partner rather than directly.
- **Payments to other users:** Overall payments to other user costs made a £61k (20%) efficiency against the project budget of £300k; this was achieved using the same controls processes as above.
- **Contingency:** Overall contingency costs made a £614k (65%) efficiency against the project budget of £947k through using the same project controls processes as above. Overall only 35% of the contingency budget was used; see detail in the table below.
- **Other:** Overall other costs made a £39k (9%) efficiency against the project budget of £445k; this was achieved using the same controls processes as above.

4.4 Reallocation of budget between categories

A detailed breakdown of cost over and under spend can be seen in Appendix 5.3.

4.5 Use of contingency budget

In the C_2C full submission each contingency item was developed from the mitigating actions for 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 C_2C project period tight controls were in place to oversee the allocation of contingency costs. At the project meetings, each workstream lead would review 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 contingency 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, that it represented value for money, and the solution complied with our internal control manual.

Of the total contingency of £947k outlined in the budget only £332k (35%) was used. The details are presented in Figure 4.1 below.

Figure 4.1: Use of contingency budget

Cost Category				
Contingency	**Spend £k**	**Budget £k**	**Variance £k**	**Reason**
Development and preparation	14	44	29	External legal support for review of contracts
Publicity, training and dissemination	80	125	46	Workshops and dissemination costs higher than expected as held in London to increase attendance
DSR and interruptions	13	101	88	This is due to the increase work in collating customer data for the DSR surveys
Project management	3	28	25	Increased costs for extra document peer review.

Cost Category				
Contingency	**Spend £k**	**Budget £k**	**Variance £k**	**Reason**
Connections	7	102	94	Increased costs due to project extension
Monitoring equipment	82	77	(5)	Higher than expected rates for labour and equipment
Installation and configuration of IT and Implementation of PowerOn Fusion	108	109	1	Configuration between both network management system more complex than expected
Circuit selection and data upload	9	24	15	The data was uploaded at regular intervals increasing costs
System integration and testing	16	13	(4)	Increased testing to prevent failures
TOTAL	**332**	**623**	**289***	*rounded

5. APPENDICES

Appendix 5.1: Changes to the project direction

Schedule to direction

Successful Delivery Reward criterion	Evidence
Demand response customer segmentation methodology 1. Update and enrich customer data for I&C customers on selected HV circuits. 2. Undertake customer survey of I&C customers on selected HV circuits. 3. Create customer segmentation model.	**Demand response customer segmentation methodology** 1. Customer data updated in April 2012. 2. Customer survey completed in ~~June~~ August 2012. 3. Demand response customer segmentation model completed and published on C_2C project's website in ~~July~~ August 2012.

Ref	Successful Delivery Reward criterion	Evidence
9.3.8	**Customer Engagement**	8. Various engagement programs continued through until ~~Dec 2014~~ March 2015, using various channels including website and e-mail.
9.4	**Technology Implementation and project `go live'** 3. Testing to prove capability of network management system to monitor and manage network events (thereby releasing network capacity and allowing customers to engage in managed contracts for new connections and new demand response contracts).	2. Demand response capability test completed for all contracted C_2C customers by ~~December 2014~~ March 2015.
9.6.3 9.6.6	**Dissemination of knowledge** 3. Identification of suitable industry conferences to attend. 5. Production of final C_2C project close down report.	3. Five industry conferences attended and presented at by ~~December 2014~~ March 2015. 6. Close down report submitted to Ofgem in ~~December 2014~~ March 2015.
9.7.1	**Demand Response Contracts** 1. Enter into a number of new commercial arrangements for the provision of a demand and/ or generation response, including both: i) New C_2C managed connection agreements;	1. New managed contracts entered into with demand and/ or generation customers or their agents, including: i) At least ten C_2C managed connection agreements by ~~September 2014~~ March 2015;

Appendix 5.2: Chronology of the Ofgem change requests

Figure 5.2.1: Extension to project deadline

Date	Interaction
27 Jun 2014	27 June meeting at Ofgem to discuss risk to obtaining the stated number of new connection agreements
18 Jul 2014	Letter to Tim Aldridge of Ofgem requesting a variation to C_2C SDRC
15 & 18 Aug 2014	Impact statements from The University of Manchester and University of Strathclyde
20 Aug 2014	Consultation letter on proposed time extension issued via email to DNOs by Simon Brooke
29 Aug– 08 Oct 2014	Consultation responses received
9 Oct 2014	Revised change request incorporating additional information and consultation responses issued to Ofgem
29 Oct 2014	Ofgem response received from Tim Aldridge
11 Dec 2014	Final details sent to Ofgem
19 Dec 2014	Decision to approve requested amendments to the successful delivery reward criteria and revised project direction received from Ofgem

Figure 5.2.2: Extension to SDRC completion for customer engagement plan

Date	Interaction
30 Mar 2012	Customer engagement plan (CEP) and data privacy statement (DPS) submitted to Ofgem for review
30 May 2012	Comments on CEP and DPS received from Ofgem
6 Jun 2012	Electricity North West issue response to comments with proposed new SDRC deadlines
7 June 2012	tracked changes version of project direction sent to Ofgem
14 Jun 2012	Second letter from Electricity North West with (re) amended SDRC timescales and committing to revised CEP and DPS submitting to Ofgem 15th June
15 June 2012	Word versions of CEP and DPS submitted reflecting and tracking proposed changes
19 June 2012	Ofgem requested clarification on some parts of the documents
19 Jun 2012	ENWL respond to Ofgem request
21 Jun 2012	CEP and DPS submitted for approval

Appendix 5.3 Cost variances

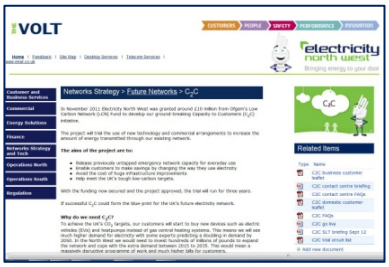
Figure 5.3: Forecast and actual cost comparison reported in project direction format

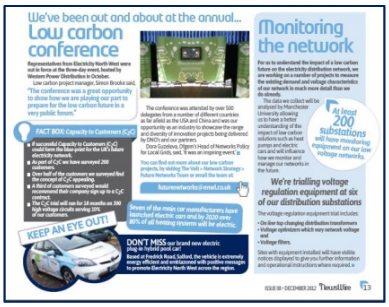
£'000s Excluding Partner Funding Ofgem Cost Category	Total Project Actual	Total Project Re-based Budget	Total Project Var	Total Project % Var
Labour	**1,589**	**1,755**	**165**	**9%**
Monitoring Equipment Installation - Labour	63	22	(41)	-190%
Business input into specs and testing & CIO System Design Approval	27	20	(7)	-37%
Connections – Clerical	61	65	5	7%
Connections - Customer Relationship Management	180	241	60	25%
Dissemination - ENWL & Customer engagement via email & training	34	28	(6)	-21%
Maintenance & Support for PowerOn Fusion	70	187	117	63%
Project Management - ENWL (Labour)	803	790	(13)	-2%
Involvement in developing Future Network Planning/Operational Standard	9	15	5	36%
Connections - Connections Design (Labour)	241	303	62	21%
Remote Control Installation - ENWL Labour	102	84	(17)	-21%
Equipment	**2,625**	**3,078**	**452**	**15%**
Publicity Materials - Informational Pamphlets & postage & packaging	17	18	1	4%
Remote Control Installation - Plant	1,812	1,954	142	7%
Monitoring Equipment Installation - Plant	179	112	(68)	-61%
Remote Control Installation - Materials	218	563	345	61%
Commissioning SCADA link to Remote Control Devices	0	31	31	100%
Delivery and configuration of GE IT hardware and software	399	399	0	0%
Contractors	**2,790**	**3,012**	**222**	**7%**
Demand Side Response Customer Survey	402	391	(11)	-3%
Project Management - ENWL (Contractors)	87	115	27	24%
Remote Control Installation - Labour	620	760	140	18%
Remote Control Installation at Customers' Premises	74	159	85	53%
Contractors Travel & Publicity - Informing Affected Customers	37	42	5	11%
Carbon Analysis	41	40	(1)	-2%
Data Analysis and Economic Modelling	192	185	(7)	-4%
Power System and Technical Modelling	182	175	(8)	-4%
Project Management - GE	351	351	0	0%
Circuit Selection	38	32	(7)	-21%
Developing Future Network Planning/Operational Standard (Contractors)	50	53	4	7%
Implementation of PowerOn Fusion	714	709	(5)	-1%
IT	**610**	**740**	**129**	**17%**
Data Capture and Cleanse	54	55	1	3%
Database Licenses	10	100	91	91%
Develop CRMS Reporting Capability	10	11	1	13%
Develop CRMS/PowerOn (SOAP) Interface	81	87	6	7%
Develop New Interface to PowerOn Fusion	92	87	(4)	-5%
Develop Real-time Data Update Functionality	53	55	2	4%
Develop Visual Display Functionality for CRMS	78	73	(5)	-6%
Initial Data Load Functionality	88	55	(33)	-60%
System Integration & Testing	73	66	(7)	-10%
Testing and Development Workstation	4	10	6	62%
Upload and Store Estimates (into historian)	45	85	40	47%
Upload CRMS Diagram and Managed Loads	24	55	31	56%
Payments to users	**239**	**300**	**61**	**20%**
Contingency	**332**	**947**	**614**	**65%**
Other	**406**	**445**	**39**	**9%**
Totals	**8,592**	**10,275**	**1,683**	**16%**

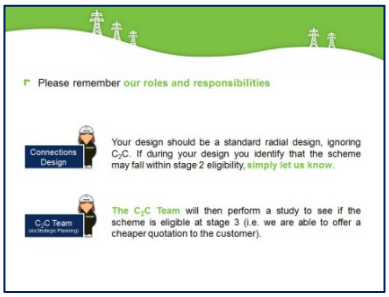
Source: c2c closedown report August 2015

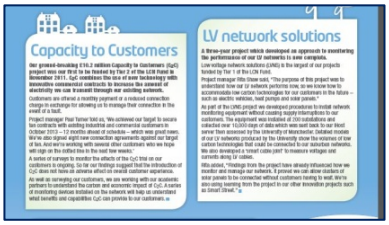
Appendix 5.4: Key learning activities

Figure 5.4: Additional learning outcomes

Date	Activity	Audience	Evidence
Nov 2011	Flash video explaining C_2C concept	All	You Tube
June 2012	Launch C_2C website	All	C_2C website
June 2012	Publish trial circuits	Trial customers	Trial area postcode search
June 2012	Six-monthly project progress report no 1	Ofgem	Project progress report no 1
Sep 2012	C_2C page on company intranet	Electricity North West employees	
Sep 2012	Trade magazine article on C_2C project introduction	All	Utility Week article
Sep 2012	Publish C_2C connection offer process online C_2C website	I&C customers in trial areas	C_2C connections process
Sep 2012	Story in internal magazine NewsWire	Electricity North West employees	
Oct 2012	Distribute customer leaflets	I&C customers in trial areas	Commercial customer leaflet
Oct 2012	White paper on customer survey published on C_2C and Utility Week websites	All	White paper – C_2C customer survey
Oct 2012	LCNI annual conference	Industry and regulatory stakeholders	Presentation to LCNI annual conference (part1) Presentation to LCNI annual conference (part2)
Nov 2012	Trade magazine article on C_2C survey	All	E&T magazine article
Dec 2012	Six-monthly project progress no 2	Ofgem	Project progress report no 2

Date	Activity	Audience	Evidence
Dec 2012	Story in internal magazine NewsWire	Electricity North West employees	
Dec 2012	Customer seminar/workshop	All	C_2C customer seminar
Dec 2012	White paper on circuit selection	External stakeholders	White paper Dec 2012
Jan 2013	P2/6 technical workshop	Industry stakeholders, DNOs	Presentation - Review of standards accommodating response demand in ER P2/6
Jan 2013	Trade magazine article on C_2C commercial templates	All	Utility Week article
Jan 2013	C_2C newsletters issue 1	All	C_2C newsletters
Feb 2013	Customer mailing	All domestic and I&C customers on trial circuits	C_2C Customer good news leaflet
Mar 2013	Engaged customer panel findings report	Ofgem	Engaged Customer Panel Findings
Mar 2013	Story in internal magazine NewsWire	Electricity North West employees	
Mar 2013	Trade magazine article on C_2C project update	All	E&T magazine article
April 2013	C_2C knowledge sharing event	External stakeholders	C_2C knowledge sharing event
April 2013	C_2C newsletter issue 2	All	C_2C newsletters
Apr 2013	Presented at Demand Side Response seminar (with npower)	Industry and regulatory stakeholders	Event slides
May 2013	Trade magazine article on C_2C sales promotion	All	E&T magazine article
Jun 2013	White paper on calculating network losses published on C_2C and IET websites	External stakeholders	White paper June 2013 IET white papers
Jun 2013	Six-monthly project progress report no 3	Ofgem	Project progress report no 3

Date	Activity	Audience	Evidence
Jun 2013	C_2C briefing sessions	Customer contact centre	
Jun 2013	Presented at SMI's European Demand Response Seminar		Event slides
Jul 2013	C_2C newsletter issue 3	All	C_2C newsletters
Aug 2013	Internal briefing to connections team	Internal connections teams	
Nov 2013	LCNI annual conference	Industry and regulatory stakeholders	LCNI conference slides
Nov 2013	Presented at Fourth Customer Seminar		Event slides
Nov 2013	Trade magazine article on monitoring effects of C_2C	All	E&T magazine article
Dec 2013	Six-monthly project progress report no 4	Ofgem	Progress report number no 4
Dec 2013	C_2C newsletter issue 4	All	C_2C newsletters
Jan 2014	Trade magazine article on C_2C project update	External stakeholders	E&T magazine article
Feb 2014	P2/6 change proposal	Ofgem, external stakeholders	P2/6 change proposal
Feb 2014	C_2C newsletter issue 5	All	C_2C newsletters
Mar 2014	Trade magazine article on analysing the effects of new technology on the electricity networks	All	E&T magazine article
Apr 2014	Presented at fifth customer seminar	Industry and regulatory stakeholders	Event slides
Apr 2014	C_2C newsletter issue 6	All	C_2C newsletters
Apr 2014	Technical data published	External stakeholders	Technical data
Apr 2014	C_2C customer seminar	External stakeholders	C_2C customer seminar presentation slides

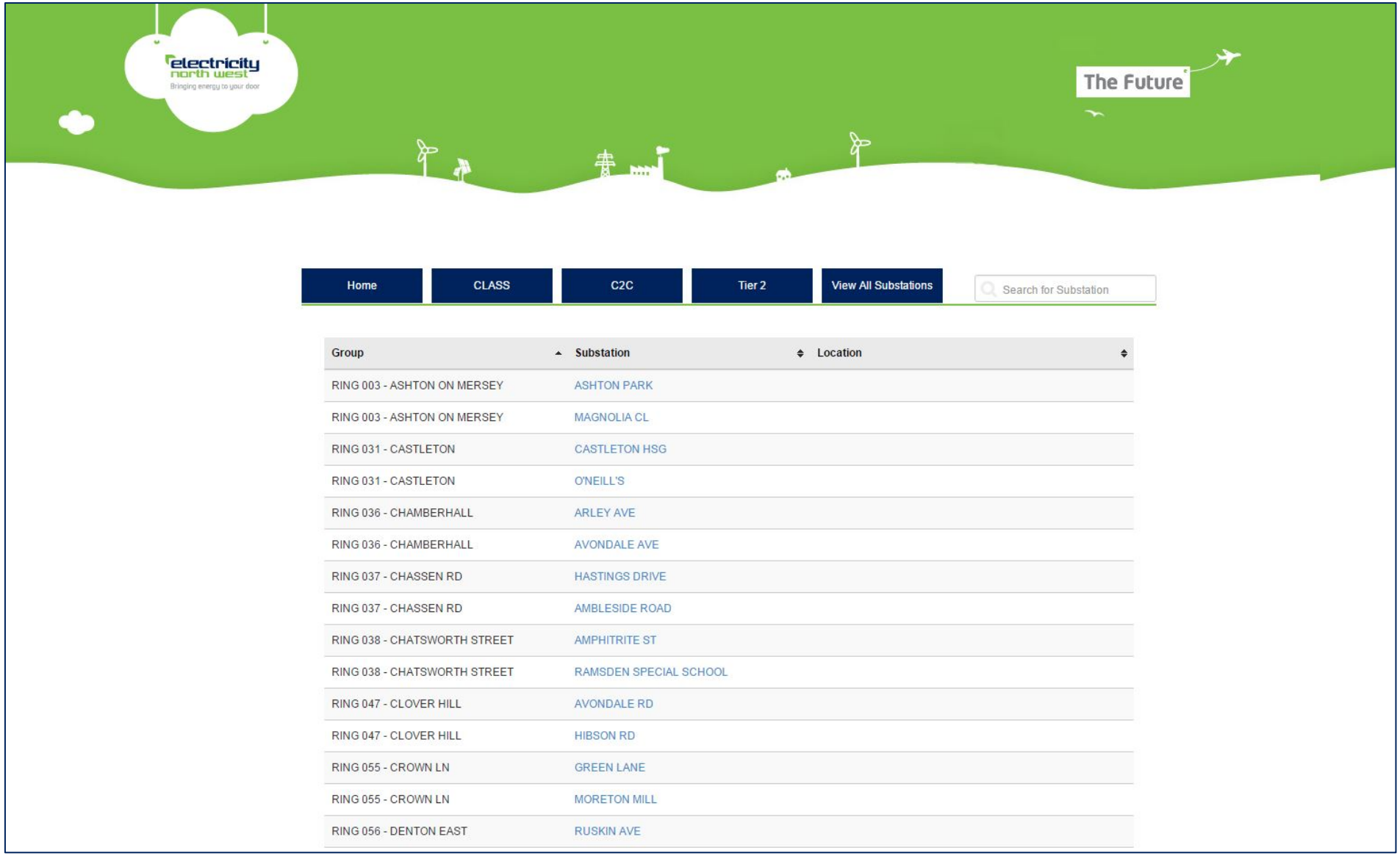
Date	Activity	Audience	Evidence
Apr 2014	C_2C customer seminar on Twitter	External stakeholders	
Jun 2014	Six-monthly project progress report no 5	Industry and regulatory stakeholders	Progress report no 5
Jun 2014	White paper on carbon impact assessment published on C_2C and IET websites	Industry and regulatory stakeholders	White paper June 2014 IET white papers
Jul 2014	C_2C newsletter issue 7	All	C_2C newsletters
Sep 2014	End of trial letter	Existing C_2C customers	End of trial letter
Oct 2014	LCNI annual conference	Industry and regulatory stakeholders	Event slides
Oct 2014	C_2C newsletter issue 8	All	C_2C newsletters
Nov 2014	Article in November issue of employee magazine, NewsWire	Electricity North West employees	
Dec 2014	Six-monthly project progress report no 6	Industry and regulatory stakeholders	Progress report no 6
Dec 2014	White paper on DG capacity published on C_2C and IET websites	Industry and regulatory stakeholders	White paper December 2014 IET white papers
Jan 2015	C_2C final learning and dissemination event	Industry and regulatory stakeholders	Slide presentation
Jan 2015	C_2C final learning and dissemination event on internal social media channel Yammer	Electricity North West employees	
Jan 2015	C_2C final learning and dissemination event on Twitter		

Date	Activity	Audience	Evidence
Feb 2015	Story in internal magazine NewsWire	Electricity North West employees	 C2C shows the way forward C2C releases extra capacity and delivers economic and carbon benefits Our industrial and commercial customers are willing to sign up to C2C contracts C2C improves our customers' power quality perception "C2C is only the start of transforming how we offer new services and value to our customers. It's great to see C2C already delivering benefits for our customers and shareholders. Over the next few years we will see many changes like this as our projects move from research to become business as usual."
Mar 2015	Closedown area of website launched	All	Website link
Apr 2015	C_2C newsletter issue 9	All	C_2C newsletters

Appendix 5.5: C_2C data

Figure 5.5.1: Homepage

Figure 5.5.2: C_2C data – list of substations



Group	Substation	Location
RING 003 - ASHTON ON MERSEY	ASHTON PARK	
RING 003 - ASHTON ON MERSEY	MAGNOLIA CL	
RING 031 - CASTLETON	CASTLETON HSG	
RING 031 - CASTLETON	O'NEILL'S	
RING 036 - CHAMBERHALL	ARLEY AVE	
RING 036 - CHAMBERHALL	AVONDALE AVE	
RING 037 - CHASSEN RD	HASTINGS DRIVE	
RING 037 - CHASSEN RD	AMBLESIDE ROAD	
RING 038 - CHATSWORTH STREET	AMPHITRITE ST	
RING 038 - CHATSWORTH STREET	RAMSDEN SPECIAL SCHOOL	
RING 047 - CLOVER HILL	AVONDALE RD	
RING 047 - CLOVER HILL	HIBSON RD	
RING 055 - CROWN LN	GREEN LANE	
RING 055 - CROWN LN	MORETON MILL	
RING 056 - DENTON EAST	RUSKIN AVE	

RING 058 - DICKINSON ST	GEORGE ST
RING 058 - DICKINSON ST	MANCHESTER TOWN HALL
RING 058 - DICKINSON ST	NICHOLAS ST
RING 058 - DICKINSON ST	THE ART HS
RING 058 - DICKINSON ST	TUSCANY HS
RING 063 - DROYLSDEN EAST	OLD FARM CRES
RING 063 - DROYLSDEN EAST	WATER LANE
RING 069 - EXCHANGE ST	GRIME ST
RING 069 - EXCHANGE ST	HARWOOD STREET
RING 072 - FARNWORTH	PRIMROSE ST
RING 072 - FARNWORTH	ROOSEVELT RD
RING 078 - GREAT HARWOOD	DELPH MILL
RING 078 - GREAT HARWOOD	MOUNT ST
RING 080 - GREEN LN	DELAHEYS RD
RING 080 - GREEN LN	TITHEBARN RD
RING 085 - GREENHILL	LEES BROOK MILL
RING 085 - GREENHILL	WOODEND MILL
RING 088 - GRIFFIN	MIRE ASH
RING 088 - GRIFFIN	REVIDGE RD
RING 096 - HEYWOOD	GLAMIS AVE
RING 096 - HEYWOOD	HOPWOOD REC
RING 099 - HIGHER MILL	GATLEY RD
RING 099 - HIGHER MILL	GATLEY RD (NO. 90)
RING 101 - HOLME RD	MULBERRY AVE
RING 101 - HOLME RD	WHITEFIELD RD
RING 104 - HYDE	GRANGE RD
RING 104 - HYDE	PUMP STATION

RING 114 - LEVENSHULME	CLIFTONA WORKS
RING 114 - LEVENSHULME	FAIRBOURNE RD
RING 116 - LEVENSHULME	MOSELEY RD
RING 116 - LEVENSHULME	CROSSLEY RD
RING 121 - MIDDLETON JUNCTION	GREEN ST
RING 121 - MIDDLETON JUNCTION	MILLS HILL SEC SCHOOL
RING 123 - MONTON	ALBERT ST
RING 123 - MONTON	VICARS STREET
RING 128 - MOSS NOOK	DAWSON ROAD
RING 128 - MOSS NOOK	QUEENSWAY NO. 173
RING 131 - MUSGRAVE RD	OAKWOOD DRIVE
RING 131 - MUSGRAVE RD	STAPLETON AVE
RING 147 - REDDISH VALE	GOLDSMITH ROAD
RING 147 - REDDISH VALE	LINDFIELD ROAD
RING 149 - ROMAN RD	ABBOTSFORD AVENUE
RING 149 - ROMAN RD	LONGSHAW MILL
RING 152 - ROYTON	FIR LANE ESTATE
RING 152 - ROYTON	OOZEWOOD RD
RING 153 - SALE	DANE MORNINGTON
RING 153 - SALE	TEMPLE ROAD N
RING 156 - SOUTH EAST MACC	HEAPY ST
RING 156 - SOUTH EAST MACC	THE WHARF
RING 161 - SPA RD	KAYS HANOVER ST
RING 161 - SPA RD	KENT STREET
RING 164 - ST ANNES	BLUNDELL RD
RING 164 - ST ANNES	KILNHOUSE ESTATE

RING 164 - ST ANNES	KILNHOUSE ESTATE
RING 176 - WHALLEY RANGE	RYEBANK RD
RING 176 - WHALLEY RANGE	WOOD RD
RING 180 - WOODLEY	MIDDLESEX RD
RING 180 - WOODLEY	TRAVELLERS CALL

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.

Figure 5.5.3: C_2C data – substation detail

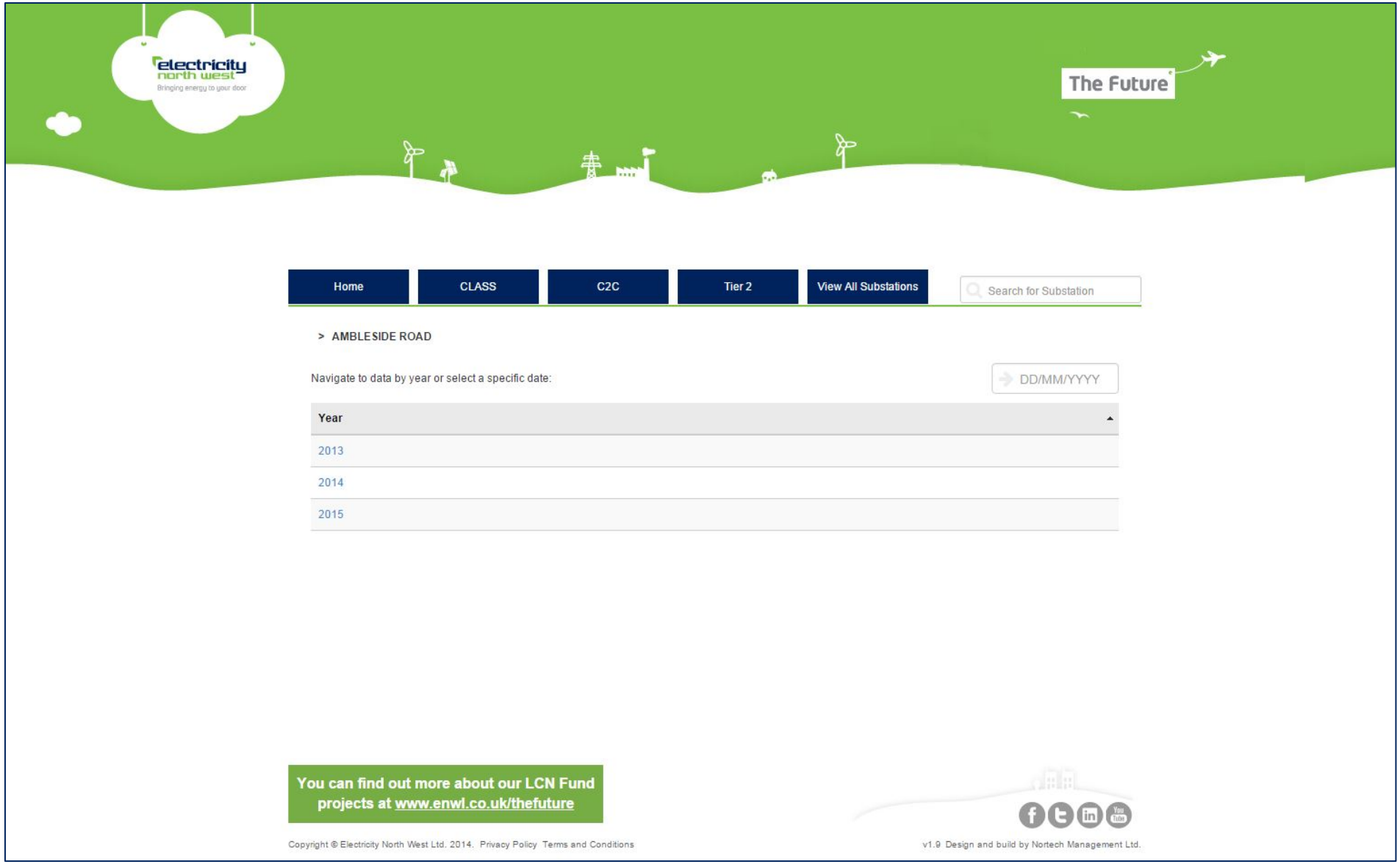


Figure 5.5.4: C_2C data – substation by year

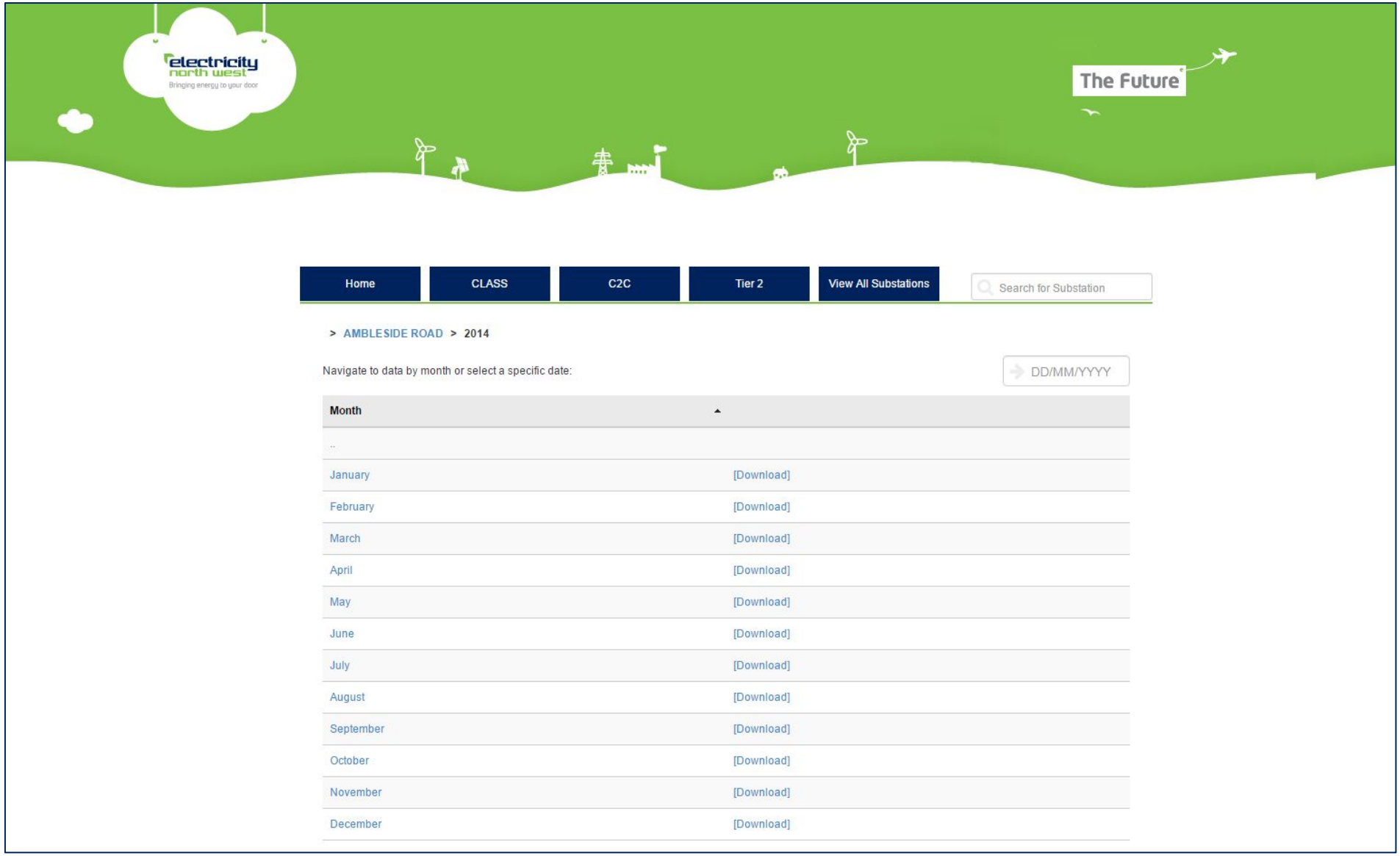


Figure 5.5.5: C_2C example data – harmonics

PQube Harmonics Trend																
Location_Name	(location not set)															
PQube_ID	(PQube ID not set)															
Note_1	(note not set)															
Note_2	(note not set)															
Power_Configuration	Wye/Star															
Nominal Line-to-Line Volta	400V															
Nominal Line-to-Neutral V	231V															
Max_Current_of_Interest_	500.5															
Time	H0 Harmo	H0 Harmo	H0 Interha	H1 Harmo	H1 Harmo	H1 Interha	H2 Harmo	H2 Harmo	H2 Interha	H3 Harmo	H3 Harmo	H3 Interha	H4 Harmo	H4 Harmo	H4 Interha	
27/06/2014 00:00	0.403	0	0.819	112.082	51.1	0.253	0.212	266.6	0.186	12.517	30.6	0.164	0.124	299	0.125	
27/06/2014 00:15	0.197	0	0.628	115.133	50.4	0.232	0.118	279.1	0.229	10.834	27.5	0.14	0.177	78.8	0.133	
27/06/2014 00:30	0.052	0	0.343	103.15	48.4	0.142	0.278	235.5	0.164	11.022	25.8	0.15	0.135	75.3	0.187	
27/06/2014 00:45	0.272	0	0.346	90.013	49	0.279	0.144	298.7	0.178	10.718	25.2	0.137	0.11	10.7	0.184	
27/06/2014 01:00	0.083	0	0.199	108.479	46.3	0.175	0.222	234.6	0.165	10.275	19.8	0.157	0.138	33.8	0.167	
27/06/2014 01:15	0.213	0	0.479	84.301	48.5	0.134	0.208	123.8	0.18	9.717	22.3	0.147	0.161	20.1	0.145	
27/06/2014 01:30	0.154	0	0.306	79.793	47.5	0.239	0.44	279	0.189	9.29	23.4	0.207	0.11	92.8	0.148	
27/06/2014 01:45	0.123	0	0.295	81.254	46.4	0.207	0.144	155.3	0.115	9.458	27.2	0.163	0.167	33	0.142	
27/06/2014 02:00	0.146	0	0.371	81.244	45.4	0.188	0.141	311.3	0.208	8.996	24.6	0.168	0.142	99.6	0.205	
27/06/2014 02:15	0.476	0	0.299	73.45	47.9	0.26	0.255	267.6	0.104	9	28.8	0.155	0.155	72.5	0.193	
27/06/2014 02:30	0.06	0	0.436	78.764	46.5	0.208	0.209	269.6	0.157	8.762	23.7	0.147	0.161	33.3	0.124	
27/06/2014 02:45	0.074	0	0.315	74.12	47	0.188	0.277	241	0.177	8.96	25.2	0.153	0.155	62.1	0.183	
27/06/2014 03:00	0.087	0	0.575	76.941	45.6	0.158	0.107	162.6	0.115	8.57	31.3	0.181	0.154	279.2	0.226	
27/06/2014 03:15	0.314	0	0.25	71.561	45.8	0.204	0.156	349.7	0.137	8.693	25.5	0.12	0.069	209.6	0.16	
27/06/2014 03:30	0.09	0	0.41	84.11	39.9	0.236	0.133	304.8	0.245	7.797	38.9	0.219	0.115	16.2	0.228	
27/06/2014 03:45	0.168	0	0.236	74.993	44	0.18	0.294	201.2	0.222	8.551	21	0.203	0.118	39.2	0.172	
27/06/2014 04:00	0.106	0	0.306	75.64	45.9	0.212	0.338	213.6	0.251	8.472	22.5	0.189	0.215	4	0.125	
27/06/2014 04:15	0.261	0	0.472	71.091	46.6	0.189	0.225	254.6	0.196	8.891	24.1	0.186	0.138	40.7	0.23	
27/06/2014 04:30	0.216	0	0.371	72.818	44.8	0.201	0.095	352.2	0.175	8.77	22.4	0.103	0.078	29.1	0.144	
27/06/2014 04:45	0.098	0	0.4	64.905	47.7	0.126	0.147	231.5	0.152	8.371	21.7	0.128	0.214	9	0.121	
27/06/2014 05:00	0.347	0	0.55	70.839	47.6	0.131	0.176	264.3	0.137	8.437	20.5	0.113	0.13	9.7	0.11	
27/06/2014 05:15	0.042	0	0.426	66.715	48.4	0.204	0.14	326.6	0.143	8.487	18.5	0.143	0.172	37.8	0.188	
27/06/2014 05:30	0.23	0	0.26	63.587	47.1	0.191	0.234	259.9	0.165	8.402	17.9	0.16	0.158	30.8	0.167	
27/06/2014 05:45	0.136	0	0.368	61.309	53.1	0.211	0.136	284.1	0.123	8.789	16.3	0.103	0.142	84	0.182	
27/06/2014 06:00	0.212	0	0.533	75.419	50.4	0.18	0.096	176	0.186	8.892	18.5	0.173	0.172	84.6	0.165	

Figure 5.5.6: C_2C example data – statistics

Main Char	Today	Since 2013/02/04
Energy	-2.58 MWh	-1.59 GWh
Apparent E	2.63 MVAh	1.62 GVAh
Carbon	-0.84 kg	-514.99 Mg
Analog Ch	Today	Since 2013/02/04
Energy	0.00 Wh	0.00 Wh

L-N RMS 10-Cycle (V)	
Summary	
Median	246.30V
Mode	246.83V
Mean	246.34V
Range - m	197.53V
Range - m	264.30V
	Percent of Duration
Coverage	100.00%
Uncovered	0.00%
UnderRang	0.00%
OverRange	0.00%
Flagged	0.00%
Cumulative Probability	
Percent of	From(V)
20.00%	245.52
25.00%	245.52
40.00%	245.52
50.00%	245
55.00%	245
60.00%	245
65.00%	244.48

L-L RMS 10-Cycle (V)		
Summary		
Median	426.59V	
Mode	426.59V	
Mean	426.69V	
Range - m	333.22V	
Range - m	466.75V	
	Percent of Duration	
Coverage	100.00%	
Uncovered	0.00%	
UnderRang	0.00%	
OverRange	0.00%	
Flagged	0.00%	
Cumulative Probability		
Percent of	From(V)	To(V)
20.00%	425.02	428.15
25.00%	425.02	428.15
40.00%	425.02	429.2
50.00%	423.98	429.2
55.00%	423.98	429.2
60.00%	423.98	429.2
65.00%	423.98	429.2

Current RMS 10-Cycle (A)	
Summary	
Median	145.94A
Mode	154.29A
Mean	148.42A
Range - m	-0.13A
Range - m	1068.27A
	Percent of Duration
Coverage	100.00%
Uncovered	0.00%
UnderRang	0.00%
OverRange	0.00%
Load Duration	
Percent of	>A
0.01%	317.05
0.05%	300.36
0.10%	292.01
0.50%	275.32
1.00%	258.62
2.50%	241.93
5.00%	225.24

Probe 1 Temperature (deg C)		
Summary		
Median		
Mode		
Mean		
Range - min		
Range - max		
	Percent of Duration	
Coverage		
Uncovered		
UnderRange		
OverRange		
Cumulative Probability		
Percent of	From(deg	To(deg C)

Probe 1 Humidity (% RH)		
Summary		
Median		
Mode		
Mean		
Range - min		
Range - max		
	Percent of Duration	
Coverage		
Uncovered		
UnderRange		
OverRange		
Cumulative Probability		
Percent of	From(% R	To(% RH)

Probe 2 Temperature (deg C)		
Summary		
Median		
Mode		
Mean		
Range - min		
Range - max		
	Percent of Duration	
Coverage		
Uncovered		
UnderRange		
OverRange		
Cumulative Probability		
Percent of	From(deg	To(deg C)

Figure 5.5.7: C_2C example data – trends

PQube Daily Trend	27/06/2014																		
Location_Name	(location not set)																		
PQube_ID	(PQube ID not set)																		
Note_1	(note not set)																		
Note_2	(note not set)																		
Power_Configuration	Wye/Star																		
Nominal Line-to-Neutr	231V																		
Nominal Line-to-Line	400V																		
Max_Current_of_Inter	500.5																		
Start Date and Time	Flags	L-N RMS 1	L-N RMS 1	L-N RMS 1	L-N RMS 1	L-N RMS 1	L-N RMS 1	L-L RMS 1	L-L RMS 1	L-L RMS 1	L-L RMS 1	L-L RMS 1	L-L RMS 1	Current RI	Current RI	Current RI	Current RI	Current RI	Current RI	Probe 1
27/06/2014 00:00		247.1	248.1	248.9	247.1	248.2	248.7	428.2	429.8	431.5	428	429.8	431.3	110.32	124.76	149.71	110.86	124.68	148.94	
27/06/2014 00:01		246.4	248	248.9	246.6	248	248.7	427	429.7	431.5	427.1	429.7	431.3	107.23	125.58	149.92	108.25	125.46	149.46	
27/06/2014 00:02		246.4	247.2	247.9	246.6	247.2	247.8	427.1	428.2	429.4	427.1	428.1	429.4	107.64	126.82	154.04	108.25	126.77	153.11	
27/06/2014 00:03		246.5	247.3	247.9	246.6	247.2	247.9	427	428.3	429.8	427.1	428.3	429.7	107.64	122.7	137.96	108.25	122.59	137.72	
27/06/2014 00:04		246.3	247.2	247.8	246.5	247.2	247.8	427	428.2	429.4	427.1	428.1	429.3	108.06	120.02	145.59	108.51	119.99	143.72	
27/06/2014 00:05		246.3	247.1	247.7	246.4	247.1	247.6	426.8	428	429.2	426.9	428	429.2	110.74	122.08	137.96	111.12	122.07	134.07	
27/06/2014 00:06		246.3	247.1	247.7	246.3	247.1	247.6	426.9	428	429.2	426.9	428.1	429.1	110.94	122.08	141.67	111.64	122.07	137.98	
27/06/2014 00:07		246.4	247.2	247.8	246.5	247.2	247.7	427	428.2	429.4	427.1	428.1	429.4	103.93	121.05	146.2	104.34	121.03	141.9	
27/06/2014 00:08		246.5	247.3	247.9	246.6	247.3	247.8	427.2	428.4	429.9	427.3	428.4	429.8	103.31	123.93	150.54	103.55	123.9	148.94	
27/06/2014 00:09		246.8	247.6	248.1	246.9	247.6	248	427.6	428.8	430.3	427.7	428.8	430.1	103.72	122.49	154.25	104.34	122.33	151.03	
27/06/2014 00:10		245.8	247.3	248.5	245.8	247.3	248.4	425.9	428.4	430.8	426	428.3	430.7	101.04	121.05	146.62	101.47	121.03	145.81	
27/06/2014 00:11		245.7	246.5	247.1	245.8	246.5	246.9	425.9	427	428.4	426	427	428.3	102.08	122.49	157.96	102.51	122.59	157.03	
27/06/2014 00:12		245.5	246.5	247.1	245.6	246.5	247	425.6	426.9	428.5	425.8	426.9	428.3	104.76	127.03	170.95	105.12	127.03	158.07	
27/06/2014 00:13		245.5	246.2	247.2	245.6	246.3	247.1	425.5	426.6	428.4	425.6	426.6	428.2	116.72	129.5	146.41	117.38	129.64	143.98	
27/06/2014 00:14		245.5	246.2	246.8	245.6	246.1	246.7	425.3	426.4	427.6	425.4	426.4	427.5	114.65	131.15	146.82	115.29	131.2	144.77	
27/06/2014 00:15		245.2	246	246.9	245.2	246.1	246.7	424.9	426.2	427.9	425	426.2	427.7	107.23	123.52	146.2	107.99	123.64	145.55	
27/06/2014 00:16		245.4	246.2	246.9	245.5	246.2	246.7	425.1	426.5	428	425.3	426.4	427.9	105.17	121.46	148.68	105.64	121.29	146.59	
27/06/2014 00:17		245.6	246.3	247	245.7	246.3	246.9	425.3	426.7	428.2	425.4	426.7	428	105.17	121.25	148.47	105.64	121.29	145.55	
27/06/2014 00:18		245.8	246.5	247.3	245.9	246.5	247.2	425.7	427	428.3	425.9	426.9	428.2	106.61	118.37	143.32	106.94	118.16	142.16	
27/06/2014 00:19		245.4	246.2	247.1	245.5	246.2	247	425.2	426.5	428	425.3	426.4	428	105.99	116.51	128.06	106.42	116.33	126.77	
27/06/2014 00:20		245.5	246.1	246.7	245.6	246.1	246.7	425.3	426.3	427.4	425.3	426.3	427.3	105.58	115.07	131.98	106.42	115.03	127.55	
27/06/2014 00:21		245.4	246.2	246.9	245.4	246.2	246.8	425.1	426.5	427.7	425.2	426.4	427.6	107.85	119.19	135.89	108.25	119.2	134.59	
27/06/2014 00:22		245.6	246.3	246.9	245.7	246.3	246.8	425.6	426.7	427.7	425.7	426.6	427.7	106.61	119.4	136.31	106.94	119.46	134.85	
27/06/2014 00:23		245.5	246.2	246.8	245.6	246.2	246.7	425.5	426.5	427.4	425.6	426.5	427.3	116.92	121.67	135.28	117.38	121.81	132.25	

Appendix 5.6 – Internal announcement on C_2C go live

From: Electricity North West Communications
Sent: 05 April 2013 12:31
To: Electricity North West All Users
Subject: Weekly Communications Bulletin - week ending 5 April 2013

electricity north west
Bringing energy to your door

Weekly Communications Bulletin

Friday 5 April 2013

C_2C go live

Our Capacity to Customers (C_2C) trial is now live. C_2C will trial the use of new technology and commercial arrangements to increase the amount of energy transmitted through our existing network.

The 18-month trial started on 1 April following the installation of the 500 remote control devices and monitoring software needed for the trial to take place.

Three industrial and commercial customers have already signed up to take part in C_2C. Each will receive incentive payments in exchange for signing up to a managed contract.

We are currently briefing all operational employees about the technology installed on the network. If you would like to attend a briefing or have any questions please contact us at futurenetworks@enwl.co.uk.

Find out more about C_2C on The Volt or our website.