

The logo for Electricity North West, featuring the word "electricity" in a dark blue font and "north west" in a green font below it.

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Bringing energy to your door

Celsius Project Progress Report

Version 1.0
9th June 2017



Celsius

VERSION HISTORY

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V0.1	18/05/2017	Damien Coyle Project manager	First draft	
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REVIEW

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Glossary of terms

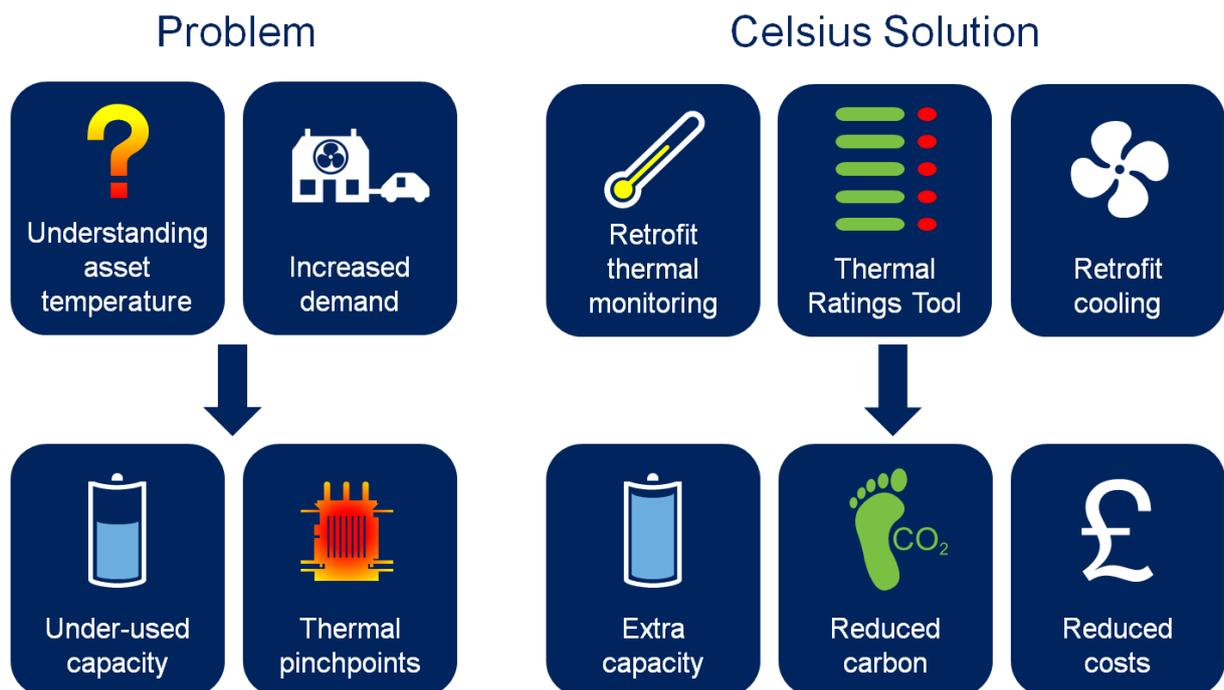
Ambient temperature	Temperature of the air surrounding a component
Cable	An underground conductor used to distribute electrical power, typically buried directly in the ground or installed in ducts or troughs
Capacity	The amount of power that can be delivered by an asset
Current	The movement of electrons through a conductor, measured in amperes, milliamperes and microamperes
Demand	The amount of electrical energy that is being consumed at any given time
Distribution substation	A substation which contains high voltage (HV) switchgear, an HV/LV transformer, LV switchgear and short length of LV cable(s) and can be either pole- or ground-mounted
Distribution network operator (DNO)	The owner and/or operator of an electricity distribution system and associated assets
Energy Networks Association (ENA)	The industry body funded by GB electricity transmission and distribution licence holders and gas transporter licence holders. It lobbies on common issues in the operating environment, at domestic and European levels, and provides technical services for the benefit of members
High voltage (HV)	Voltages over 1kV up to, but not including, 22kV
Low Carbon Networks Fund (LCN Fund)	Funding to encourage the DNOs to innovate to deliver the networks needed for a low carbon economy
Low carbon technology (LCT)	A type of technology which operates with substantially fewer carbon emissions than traditional equivalents
Low voltage (LV)	This refers to voltages of 1kV and below
Reinforcement	Network development to relieve an existing network constraint or facilitate new load growth
Retrofit cooling	Techniques that can be applied to existing assets to reduce operating temperature
SDRC	Successful delivery reward criteria
Substation	A point on the network where voltage transformation occurs
Switchgear	Device for opening and closing electrical circuits
Thermal coefficient	The constant by which the external temperature needs to be multiplied to ascertain the hotspot temperature
Thermal constraint	The restriction of an electrical asset's capacity due to the operating temperature
Thermal headroom	The amount of capacity available for use
Thermal Ratings Tool	Software/Microsoft Excel-based solution which will calculate the available capacity at a site based on inputs of temperature, substation environment and asset type
Transformer	Device that changes the network voltage without changing the frequency

1 EXECUTIVE SUMMARY

1.1 The Celsius project

Celsius is funded via Ofgem's Network Innovation Competition (NIC) funding mechanism. The project was authorised to commence in December 2015 and is expected to be complete by March 2020.

Celsius explores innovative, cost-effective approaches to managing potentially excessive temperatures at distribution substations, which could otherwise constrain the connection of low carbon technologies (LCTs).



Celsius first seeks to identify potential thermal issues by establishing how different distribution substations in differing environments behave thermally under a variety of load and environmental conditions. Celsius will develop the following methodologies to better understand the real thermal ratings of distribution substation assets in order to unlock capacity:

- **Retrofit thermal monitoring:** By using improved technology to measure asset and ambient temperatures, and relating these to a range of environmental, load and seasonal factors, Celsius will enable understanding of real thermal ratings of assets, rather than the nominal ratings that are used today. This will allow improved understanding of the amount of latent capacity which could be accessed without further intervention
- **Thermal ratings tool:** the learning from the retrofit thermal monitoring trials and analysis will be formalised and transferred into a simple tool that can be used by operations and planning employees at any network operator, to better understand the capacity of the existing or planned network.

Celsius will then identify, evaluate and demonstrate retrofit cooling technologies that can be used to directly manage the temperature of assets. By managing temperature in this way, Celsius will deliver additional capacity release. Customer surveys will establish customer perception of retrofit cooling techniques and whether the application of these techniques is as acceptable to them as traditional reinforcement.

1.2 Project progress

This is the third six-monthly project progress report (PPR) for the Celsius project. This report covers the period from January 2017 to June 2017.

There has been a three-month delay in the installation of monitoring equipment (step 1), this has been due to installation resource availability and two monitoring equipment recalls resulting in site re-visits and re installation. Due to contingency built into the project plan, it is anticipated that this delay will have no detrimental effect on the project deliverables or successful delivery reward criteria (SDRC).

The project is still on track to meet its aims, objectives and all SDRC as per the project plan.

The key project highlights during the reporting period are outlined below:

- Customer Engagement Plan Approved by Ofgem – *February 2017*
- Data Privacy Statement Approved by Ofgem – *February 2017*
- Review of Engineering Recommendations P15 & P17 published on Celsius website - *February 2017*
- Celsius publication in ENW Connect – *March 2017*
- Retrofit Cooling DNO workshop – *May 2017*

The project actual cost to date is £1,999,000 and the estimated at completion cost is £4,878,000 of a planned budget of £5,338,000 (including contingency).

1.3 Risks

There have been a number of changes to the risk log since the last reporting period, the most significant are two new risks that are described below:

R013 - Retrofit Monitoring Resource – Risk Updated

There is a risk that limited resources will be available to deliver the installation of retrofit monitoring. This may lead to a prolonged installation plan or increased costs due to premium time working.

Update

ENW sought additional installation teams from the external market. Unfortunately, no suitably authorised personnel were identified. The impact of this risk was reduced as a result of contingency built into the original project plan and the use of teams working weekends.

R014 - Monitoring Equipment Firmware updates – Risk Updated

There is a risk that the monitoring equipment software will need updating due to unforeseen bugs arising during the monitoring trial. This may lead to loss of data or delay in the trial period.

Update

Two separate equipment recalls were required due to bugs identified in sensor software. These bugs were quickly rectified by ASH wireless by deploying a new firmware onto the KTS01 wireless sensor and the HEX sensor. The impact of this risk was reduced by ASH having a buffer stock of equipment which enabled new installations to continue, however all previously commissioned sites required re-visit and re-installation which added delay to the installation plan.

Project risks are monitored on a continuous basis, including the potential risks that were documented in the full submission. A review of risks is contained in Section 10 and the status of all risks is contained in Appendix A.

1.4 Learning and dissemination

The Celsius project team have participated in a number of learning and dissemination events in this reporting period, the key events are:

- Publication of review of Engineering Recommendations P15 & P17 – *Feb 2017*
- Knowledge sharing using internal ENWL Innovation Roadshows held – *Feb 2017*
- Celsius publicised in ENW Connect Intranet - *March 2017*

The ENW innovation team held a number of company wide Innovation Roadshows this year to promote the innovation portfolio, to share learning and to gain feedback. These were well received and proved a valuable medium for internal stakeholder engagement.

2 PROJECT MANAGER'S REPORT

2.1 Project background

Celsius will develop an understanding of the operating temperatures of distribution substation assets, including transformers and cables, within a range of substation environments. The project will also deliver alternative, innovative ways to optimise thermal capacity, leading to faster, cheaper responses to the connection of low carbon technologies.

The project is currently in the first step trial period. In this trial, data is gathered from 520 distribution substations using the ASH Wireless Kelvin range of power and temperature monitoring equipment. The data gathered is currently being analysed by project partners Ricardo –AEA to improve the understanding of the relationship between asset temperature, load characteristics and the surrounding environment.

The output of this package of work will be a Thermal Ratings Tool, which will require minimal inputs, such as temperature and environment, to quantify available capacity.

Work has now commenced researching cooling technologies to support the second phase of the project – Retrofit Cooling. A call for innovation was submitted to the ENA Innovation portal to identify potential cooling suppliers and with suitable solutions.

ENW hosted a DNO cooling workshop in May to ensure the requirements of other GB network operators were being addressed and met. The workshop also proved to provide valuable feedback and lessons learnt from previous projects. One interesting learning point raised by UK Power Networks from the FUN LV project was the need to be aware of the customer impact of forced air outlet ventilation and careful consideration as to how this is designed and managed.

The final selection of cooling technologies will be circulated to the DNOs and published on the Celsius website in July 2017.

2.2 General

This is the third reporting period. Since the last reporting period there have been a number of issues that have led to a delay in the installation plan.

As discussed above in section 1.3 Risk R013, due to resource constraints a third installation team could not be sourced. This resulted in slower progress being made on the installation plan than originally anticipated.

Furthermore, the occurrence of Risk R014 exacerbated the resource issue, as all completed sites required a re-visit and re-installation. The occurrence of both risks added a delay to the thermal monitoring installation plan.

The total delay to plan is 12 weeks, however more than 80% of the installation has now taken place and completion is expected by July 2017.

The monitoring phase is expected to provide 12 months' data from each of the sites. The project plan was designed with a three-month window between the end of the thermal monitoring trial and commencement of the retrofit cooling trial. Therefore, no detriment is anticipated to the 12-month data capture or to the overall project plan.

There are a number of interdependent SDRCs related to the thermal monitoring installation, the impact of this delay is explained below:

1. **SDRC:TW.1** - Publish equipment specifications and installation reports by September 2017. – No impact is expected on this SDRC deliverable as the installation phase will be completed by July 2017.
2. **SDRC:TAW.1.2** - Publish asset temperature behaviour analysis report on Celsius website by September 2018 – No impact is expected to this deliverable as Ricardo currently have a sufficiently large data set to commence analysis to support this activity.
3. **SDRC:TAW.4.1** - Develop Thermal Ratings Tool using monitoring data to evaluate site capacity on Celsius substations by October 2018. – No impact is expected as a complete data set will be available to develop and validate.

Electricity North West has now taken delivery of 100% of the monitoring equipment from project partners ASH Wireless and no further equipment recalls are expected.

The National Physics Laboratory (NPL) was selected to deliver the Thermal Flow Study in the last reporting period however the contract was finalised and agreed in this reporting window.

The key project management activities undertaken during the reporting period are summarised below:

- **Contract agreed with NPL to deliver Thermal Flow Study:** NPL submitted a successful competitive bid to deliver the Thermal Flow Study and contract agreed.
- **Installation of monitoring equipment:** Monitoring equipment has now been installed at 424 sites. The remaining 96 (of 520) sites are on track to be installed by July 2017.
- **DNO Cooling Workshop:** ENW hosted a DNO workshop to evaluate cooling technologies.
- **Project monitoring and control:** The monitoring and control of the delivery of the Celsius project is on going.
- **Regular engagement with project partners:** The Electricity North West Celsius project team hold a weekly progress update meeting with the project partners to review project actions, risks and issues. Additionally bi annual Project Steering groups are held that include key stakeholders.

2.3 Technology, trials and analysis workstreams

As discussed above in section 2.2 there has been a delay to the installation of monitoring equipment however more than 80% of the installations have now been completed and are online. These sites report power and thermal monitoring data to the Celsius data management system. It then stores and processes the data, provides visualisation and

enables downloading for further analysis. A new data dashboard is currently under development (see figure 1. below for proposed design).



Figure 1. Proposed dashboard design

ENW submitted a call for innovation via the ENA Innovation Portal in order to identify possible new cooling techniques and manufacturers. These technologies along with market searches for other types of cooling identified in the bid have provided a robust number of solutions for evaluation.

The DNO cooling workshop was held on the 31st May and a preliminary review of technologies and proposed solutions was presented to the group. The outcome of this workshop resulted in a new method of scoring being drafted and further areas of research have been identified for inclusion in the final review.

NPL were selected to carry out the Thermal Flow Study in the previous reporting window however the contract has been finalised and agreed in this period. NPL have commenced data gathering and formulating models to develop the Thermal Flow Study

In the next reporting period, the technology, trials and research workstreams will undertake the following activities:

- Publish the Thermal Monitoring Installation and Specification Report.
- Publish review of the highest scoring cooling technologies.
- Step 2 - Cooling trial design
- Cooling Technology Procurement

2.4 Customer workstream

The key activities undertaken by the customer workstream, during the reporting period January to June 2017, are summarised below:

- Mobile application software has been updated to capture customer specific data
- OFGEM formally approved the Customer Engagement Plan and Data Privacy Statement on 15 February 2017
- Work has commenced to develop focus group stimulus materials
- Focus group dates and venue have been confirmed and an ECP engagement strategy developed.

The customer and technology workstreams have continued to work closely with project partner Ricardo-AEA to ensure that mobile application software was appropriately modified, to satisfy all workstream needs. Refinements have been completed and the software is now able to capture pertinent site specific data, during the monitoring installation phase. This data will inform future customer engagement in Celsius and includes the distance of the nearest customer to each substation and customer type. It also provides a visual and audio assessment of each site.

This data will be used to assess overall customer perception of existing distribution assets in benchmarking research. It will also inform likely changes in perception after retrofit cooling technologies have been installed.

The customer workstream liaises regularly with its technical delivery colleagues, to ensure that any customer facing issues that might arise on site are resolved. No such issues have yet occurred or are anticipated during the installation of monitoring equipment.

During the next reporting period (July to December 2017) the customer workstream's most significant activities are as follows:

- Finalise a suite of suitable engagement materials, which introduce Celsius to a representative panel of Electricity North West customers in July 2017.
 - These materials are being designed to ensure the ECP understand the problem Celsius is seeking to resolve and overall project objectives.
- Deliver customer focus group workshops
 - This initial educational phase of customer engagement in Celsius will introduce the materials, currently under development. ECP feedback will guide refinement of the materials, to ensure they are understood by previously unengaged customers later in the project, during the survey/fieldwork research phase. The panel will also guide the development of a customer survey instrument and evaluate its final design, ensuring it is understood by survey respondents, can be easily administered and is able to elicit robust results.
- Produce a report documenting the lessons learned from testing customer communication materials with the ECP. This report will be published on the Celsius website in December 2017.

2.5 Learning and dissemination workstream

The Celsius project team have participated in a number of learning and dissemination events in this reporting period, the key events are:

- Publication of review of Engineering Recommendations P15 & P17 – *Feb 2017*
- Knowledge sharing Innovation Roadshows held – *Feb 2017*
- Celsius publicised in ENW Connect Intranet - *March 2017*

The Celsius communications register that details all communications to date is detailed in Appendix F.

ENW had planned to hold an Innovation Event Day to enable all stakeholders an opportunity to learn more about ENW's full Innovation portfolio. A Celsius project update was to be presented to the participants, this event was planned to take place in Manchester on the 24th May however this event was cancelled due to the tragic events that occurred at the Manchester Arena on the 22nd of May. This event has now been rescheduled in July.

In the next reporting period, the learning and dissemination workstream will undertake the following activities:

- Hold annual knowledge sharing event – This is scheduled for the 5th July
- Publish Celsius advertorial.

- Participate at the annual LCNI conference (now scheduled for December 2017)

3 BUSINESS CASE UPDATE

The project team are not aware of any developments that have taken place since the issue of the Celsius project direction that affects the business case for the project.

4 PROGRESS AGAINST PLAN

The project plan is monitored, reviewed and updated on a continuous basis. This process takes into consideration potential risks that were documented in the full submission and any change to these risks. The process also considers newly identified risks and issues that are highlighted during the project lifecycle.

As highlighted in section 2.2 there is a 3 month delay to the thermal monitoring installation, and as discussed this has no impact on detrimental impact to interdependencies in the project plan.

5 PROGRESS AGAINST BUDGET

The project budget as defined in the project direction is shown in Appendix C.

Actual spend to date compared to project budget is summarised in Table 5.1 below. The report includes expenditure up to and including 31st May 2017. It is noted that the project is currently performing favourably relative to budget. Project expenditure as at the end of May 2017 was £1,999,000 compared to a cost baseline of £2,920,000 including contingency.

This variance minus contingency is £644,000; this is for the most part due to the three-month delay in completion of the monitoring installation. £517,000 of the variance is contractor payments, which are due to be paid when the installation phase completes. The overall contractor forecast is still within budget with a forecast underspend of £5,000 by the end of the project.

Once the monitoring phase has reached completion it is expected the forecast spend profile will align with the project actual costs.

Additionally the Thermal Flow Study is also associated with contractor costs, this has been profiled as spent; however this is forecast in two milestone payments due in June 2017 and October 2017 that total £91,388.

The variance in IT cost is due to the budget spend profile being spread across the both technology trial periods, however actual costs are profiled in milestone payments associated with delivery of the back end data management system and delivery of the Celsius dashboard.

In the previous reporting period £71,942 was spent on contingency due to change to the monitoring solution. Since the last reporting period there has been an increase of £5,685 expenditure of contingency budget, raising total spend to date to £77,627. This additional spend is a result of additional spend on equipment to support the thermal monitoring installation, of which the budget is fully allocated.

Table 5.1: Summary of project expenditure

£'000s Excluding Partner Funding Ofgem Cost Category	Spend to date			Total Project		
	Actual	Plan	Variance	Forecast	Plan	Variance
Labour	307	471	164	1,205	1,203	(1)
Equipment	1,027	1,070	43	1,335	1,333	(1)
Contractors	376	893	517	1,760	1,765	5
IT	138	62	(76)	209	209	(0)
IPR Costs	0	0	0	0	0	0
Travel & Expenses	0	0	0	0	0	0
Payments to Users	0	0	0	30	31	0
Contingency	77	353	277	78	537	460
Decommissioning	0	0	0	29	29	0
Other	75	71	(4)	233	230	(3)
Total	1,999	2,920	921	4,878	5,338	459

Detailed expenditure is shown in Appendix D at project activity level.

6 BANK ACCOUNT

The Celsius project bank statement is shown in Appendix E. The statement contains all receipts and payments associated with the project up to the end of May 2017.

7 SUCCESSFUL DELIVERY REWARD CRITERIA (SDRC)

There were three SDRC due in this reporting period all of which were delivered according to plan, these are shown in Table 7.1 below.

Table 7.1: Celsius SDRC due in this reporting period

SDRC evidence	Planned date	Status
CI.3.2 - Publish any areas for change identified at the ENA workshop and publish change proposal options to ER P15 and ENA ER P17 on Celsius website by February 2017	Feb-17	Delivered
LDW.2.2 - Publicise Celsius within Electricity North West via the Volt intranet site, email bulletins and/or Newswire company magazine by June 2016, March 2017, March 2018, March 2019 and March 2020	Mar-17	Delivered
TW.2.1 - Hold retrofit cooling workshop by May 2017	May-17	Delivered

The SDRC due in the next reporting period are shown in table 7.2 below.

Table 7.2: Celsius SDRC due in the next reporting period

SDRC evidence	Planned date	Forecast date
TW.2.2 - Review of highest scoring technologies, circulate workshop outcomes to DNOs and publish on the Celsius website by July 2017	Jul-17	On track
CW.2.1 - Deliver customer focus group workshop by July 2017	Jul-17	On track
TW.1 - Publish equipment specifications and installation reports by September 2017	Sep-17	On track
LDW.5.2 - Hold annual knowledge sharing events in September 2016, 2017, 2018 and December 2019. Provide one-to-one briefing sessions	Sep-17	On track
LDW.3.2 - Publish advertorials annually by October 2016, October 2017, October 2018 and October 2019	Oct-17	On track
TAW.2 - Publish thermal flow study report and initial recommendations for substation design on Celsius website by November 2017	Nov-17	On track
LDW.4.2 - Participate at four annual LCNI conferences from 2016 to 2019	Nov-17	On track
CW.2.2 - Publish lessons learned from testing customer communication materials on Celsius website by December 2017	Dec-17	On track
LDW.6.4 - Issue project progress reports in accordance with Ofgem's June and December production cycle and publish on the Celsius website	Dec-17	On track

The status of the evidence for all Celsius SDRC is shown in Appendix B. Progress against the SDRC and the project plan will continue to be monitored.

8 LEARNING OUTCOMES

During this reporting period much of the work has evolved around the installation of the monitoring technology and the issues involved with this. The previous reporting window highlighted the benefit of utilising smart technology to manage the installation in the form of the Celsius commissioning tool. This commissioning application has been developed further in this reporting window to enable mapping of sites, which enables installation teams to more efficiently plan installations.

Another learning outcome of this reporting window is the benefit of equipment suppliers retaining a buffer stock, which in Celsius enabled ASH Wireless to quickly apply fixes to their stock and replenish the ENW stock whilst recalling deployed equipment. This minimised the impact of the installation issues.

In the next reporting period, it is expected further learning will be generated from data analysis and dashboard development. In addition, there will be a significant piece of work selecting and procuring multiple cooling technologies from numerous vendors, which will require clinical organisation and planning in order to deliver within the project timescales.

9 INTELLECTUAL PROPERTY RIGHTS (IPR)

Electricity North West is following the default IPR arrangements. No IPR have been generated or registered during the reporting period. The IPR implications of forthcoming project deliverables are currently being considered, and will be reported in the next project progress report.

10 RISK MANAGEMENT

Electricity North West employs recognised tested and audited risk management systems and processes as part of its day-to-day operations. Celsius benefits from this approach, which is further, refined to fully accommodate the requirements of Celsius and to incorporate learning from previous experience in the delivery of Low Carbon Networks Fund (LCN Fund) projects. This approach considers risks and issues that are business as usual and those specifically related to Celsius, all of which are documented in a common format.

The project risks identified in the Celsius bid document have been migrated into the Celsius delivery risk register, reviewed and are still valid. Risks will be monitored on a continuous basis, including the potential risks that were documented in the full submission. Project risks are described in detail in Appendix A.

Changes since the last reporting window:

R005 - Project Installation impact on BAU. Status: OPEN

There is a risk that internal transformer monitoring or retrofit cooling methods (and their installation) may have an impact on the network as a whole leading to disruption or outage.

Update: The Probability of this risk has been reduced to Unlikely (1) due to successful testing and roll out. These installations are being audited weekly and alerts are being designed into the dashboard to highlight any on site issues.

R007 - Availability of Technology providers. Status: OPEN

There is a risk that a lack of suitable retrofit cooling technologies and vendors may result in a poor response to invitations to tenders, leading to reduced competitiveness of quotes and reduced value for money.

Update: Impact reduced to moderate (3) due to good response from call for innovation.

R013 - Retrofit Monitoring Resource. Status: OPEN

There is a risk that limited resources will be available to deliver the installation of retrofit monitoring. This may lead to a prolonged installation plan or increased costs due to premium time working.

Update: ENW sought additional installation teams from the external market. Unfortunately, no suitably authorised personnel were identified. The impact of this risk was reduced as a result of contingency built into the original project plan and the use of teams working weekends.

R014 - Monitoring Equipment Firmware updates. Status: OPEN

There is a risk that the monitoring equipment software will need updating due to unforeseen bugs arising during the monitoring trial. This may lead to loss of data or delay in the trial period.

Update: Two separate equipment recalls were required due to bugs identified in sensor software. These bugs were quickly rectified by ASH wireless by deploying a new firmware onto the KTS01 wireless sensor and the HEX sensor. The impact of this risk was reduced by ASH having a buffer stock of equipment, which enabled new installations to continue, however all previously commissioned sites required re-visit, and re-installation which added delay to the installation plan.

There are currently no uncontrolled risks that could impede the achievement of any of the SDRC outlined in the project direction, or which could cause the project to deviate from the full submission.

11 CONSISTENCY WITH FULL SUBMISSION

At the end of this reporting period, it can be confirmed that the Celsius project is being undertaken in accordance with the full submission.

12 ACCURACY ASSURANCE STATEMENT

This document has been reviewed by a number of key business stakeholders. The project team and select members of the Celsius project steering group, including the lead member of the bid development team, have reviewed the report to ensure its accuracy. The narrative has also been peer-reviewed by the Electricity North West Engineering and Technical Director.

The financial information has been produced by the Celsius project manager and the project's finance representative who review all financial postings to the project each month to ensure postings are correctly allocated to the appropriate project activity. The financial information has also been peer reviewed by the Electricity North West risk, control and assurance (finance) manager.

The Engineering and Technical Director has approved issue of this document.

13 APPENDICES

Appendix A: Status of all risks

Risk Register ID	Risk Title	Project phase/workstream	Description	Probability score	Impact score	Mitigating action/contingency action	Revised probability score	Revised impact score	Status
R001	Project partner Mobilisation	Mobilisation	<p>Risk closed Dec 16 - following successful mobilisation</p> <p>There is a risk that the project partners are not able to mobilise their resources in time because of other commitments leading to a delay in achieving potential milestones, which could have a project reputation and financial repercussion.</p>	0	0	<p>Suitable partnership agreements that ensure collaborative working, value for customers' money and achievement of learning objectives in a timely manner have been identified for all partners.</p> <p>A project initiation document will be issued to the project partners to ensure that all parties are ready.</p> <p><i>Contingency: Electricity North West will seek new partners should existing partners fail to mobilise.</i></p>	0	0	Closed

Risk Register ID	Risk Title	Project phase/workstream	Description	Probability score	Impact score	Mitigating action/contingency action	Revised probability score	Revised impact score	Status
R002	Thermal Sensor lead time	Technology	<p>Risk Closed October 2016 – Commenced Installation</p> <p>There is a risk that the lead-time for delivery, installation and/or configuration of the thermal monitoring sensors may lead to a delayed start on the monitoring trial.</p>	0	0	<p>Project plan specifies that a purchase order will be raised to procure the sensors allowing the partner to begin manufacture.</p> <p>Regular meetings/reports to track progress against the plan.</p> <p>Commitment to additional operational resource should any delays occur to the installation, testing and commissioning programme. <i>Contingency: Flexibility is built into the installation programme; phased installation plan starts in autumn 2016 to be completed by spring 2017.</i></p> <p><i>A full year's data for comparison with the cooling trial could be gained by overlapping these tasks more than planned.</i></p>	0	0	Closed

Risk Register ID	Risk Title	Project phase/workstream	Description	Probability score	Impact score	Mitigating action/contingency action	Revised probability score	Revised impact score	Status
R003	Inadequate existing load monitoring	Technology	<p>Risk Closed Dec 16 – existing load monitoring units were found to be unsuitable and planned contingency was initiated</p> <p>There is a risk that sites with existing load monitoring may not be suitable or the existing monitoring units may require a software/hardware update for the sites to be included in the Celsius project.</p>	0	0	<p>Allowance in budget and plans to move some existing load monitors if necessary.</p> <p>Communications with manufacturers of existing equipment to identify solutions early. Allowance in budget and plans to carry out updates. <i>Contingency: New power monitoring units, supplied by project partner Ash Wireless will be installed where this is deemed most cost-effective.</i></p>	0	0	Closed
R004	Monitoring Equipment Reliability	Technology	<p>There is a risk of monitoring equipment failure leading to a requirement for additional resource to attend site to fix or replace.</p>	2	4	<p>Phased rollout of equipment to ensure systems are working properly before all sites are installed.</p> <p>Some remote monitoring and diagnostics will be possible, for example of performance of the communications and through data validation. <i>Contingency: Budget for additional resource.</i></p>	2	4	Open

Risk Register ID	Risk Title	Project phase/workstream	Description	Probability score	Impact score	Mitigating action/contingency action	Revised probability score	Revised impact score	Status
R005	Project Installation impact on BAU	Technology	<p>There is a risk that internal transformer monitoring or retrofit cooling methods (and their installation) may have an impact on the network as a whole leading to disruption or outage.</p> <p>Update: Probability reduced due to successful testing and roll out.</p>	2	5	<p>The technical and installation issues and requirements will be assessed before any installation is carried out, which should identify any risk at an early stage to allow this to be mitigated, or for the technology to be discounted from the trial.</p> <p><i>Contingency: If any issues occur, then the technology will be removed and made good at the earliest signs.</i></p>	1	5	Open
R006	Poor Communications signal coverage	Technology	<p>There is a risk that there is inadequate signal at sites and communication outages or battery life issues could prevent data being sent to data management system for the duration leading to gaps in data sets.</p>	2	2	<p>The data communications will use 'roaming' SIM cards, the signal will be checked prior to installation, if required an aerial will be installed. If inadequate signal the site will be excluded from the trial.</p> <p>Data will be sent once a day, any failures to send data will be identified automatically and corrected.</p> <p>Data being received will be continuously validated to identify missing or unrealistic data, so issues will be identified quickly.</p> <p>Battery life requirements have been defined and agreed at an early stage.</p> <p><i>Contingency: Select sites without signal issues. Where</i></p>	2	2	Open

Risk Register ID	Risk Title	Project phase/workstream	Description	Probability score	Impact score	Mitigating action/contingency action	Revised probability score	Revised impact score	Status
						<i>gaps in data occur, analysis can be carried out on the remaining data, and where necessary, missing data will be simulated. Sensors that are still required will be replaced.</i>			
R007	Availability of Technology providers	Technology	There is a risk that a lack of suitable retrofit cooling technologies and vendors may result in a poor response to invitations to tenders, leading to reduced competitiveness of quotes and reduced value for money. Update: Impact reduced to moderate (3) due to good response from call for innovation.	2	4	A call for innovation in Celsius development showed that products are available from a number of vendors. A thorough market search will identify as many options as possible. <i>Contingency: Early vendor engagement. If there is significant difficulty in identifying enough suitable technology vendors, then the cooling trial can be implemented with fewer technology types.</i>	2	3	Open

Risk Register ID	Risk Title	Project phase/workstream	Description	Probability score	Impact score	Mitigating action/contingency action	Revised probability score	Revised impact score	Status
R008	Installation delay of cooling technologies	Technology	There is a risk that the lead-time for the retrofit cooling techniques may lead to a delay in the installation of this technology and delay the start of the monitoring trial.	3	4	<p>During technology selection, each technology will be assessed based on a number of characteristics, including readiness and deployment issues. This will reveal early potential issues.</p> <p><i>Contingency: Flexibility is built into the installation programme with a phased installation plan starting in winter 2018 and to be completed by summer 2018.</i></p> <p><i>If delays are unavoidable, then technology analysis could be carried out using less than one year's data. The limitations to the assessment caused by this will be identified.</i></p>	3	4	Open
R009	Customer Impact of Retro fit technology	Customer	<p>There is a risk that customers on trial networks might notice a visual or audible affect from a local retrofit intervention, or be inconvenienced during the installation of the technology.</p> <p>This risk might result in a breakdown in customer relationship and reputation.</p>	3	4	<p>To ensure that there is no public or reputation damage to Electricity North West; Celsius will embed a process to quickly and appropriately manage any customer impacts.</p> <p><i>Contingency: Customer impact will be carefully considered during site selection. This will mitigate against deploying specific interventions on certain networks where the risk of an adverse customer impact, specific to the customer/network/asset/environment type, from a particular technique, is</i></p>	3	4	Open

Risk Register ID	Risk Title	Project phase/workstream	Description	Probability score	Impact score	Mitigating action/contingency action	Revised probability score	Revised impact score	Status
						<i>considered excessively high.</i>			
R010	Attendance at Project Events	Learning dissemination	<p>There is a risk that attendance at events may be low due to the number of projects and knowledge dissemination events already taking place.</p> <p>Learning may be inhibited due to stakeholders having different interests and learning styles</p>	2	3	<p>Electricity North West will try where possible to merge dissemination events and choose dissemination channels optimised to achieve maximum reach and coverage.</p> <p>Dissemination will be carried out through multiple communication channels including 121 briefings</p> <p><i>Contingency: Interested parties are able to contact the project team for any queries and request additional information.</i></p>	2	3	Open

Risk Register ID	Risk Title	Project phase/workstream	Description	Probability score	Impact score	Mitigating action/contingency action	Revised probability score	Revised impact score	Status
R011	Governance Changes	Closedown	There is a risk that new obligations and guidance will be released on key deliverables, such as the closedown report (eg the need to get it peer-reviewed) leading to a longer preparation and review period required.	3	3	Communication channels from Ofgem will be monitored and any updates to such requirements identified as early as possible. <i>Contingency: Additional time is allowed for closedown reporting and a DNO partner embedded in the project to provide ongoing review and challenge throughout project delivery.</i>	3	3	Open
R012	Project Progress Report	Project Management	There is a risk that the financial reporting contained in the 6 monthly Project Progress Report (PPR) may be inaccurate due to the requirement to submit the document on the 9th of each reporting month. ENWL's finance system compiles project costs on the fifth working day of the subsequent month. This results in a small window for internal approval before release to OFGEM.	3	4	The risk has been highlighted to the ENW finance team and the approval managers, and a delivery plan is agreed for each reporting period however there is still a risk that all finances are not up to date for the last month of the reporting period. This has been brought to the attention of OFGEM.	3	4	Open

Risk Register ID	Risk Title	Project phase/workstream	Description	Probability score	Impact score	Mitigating action/contingency action	Revised probability score	Revised impact score	Status
R013	Retrofit Monitoring Resource	Project Management	There is a risk that there is limited resource available to deliver the installation of retrofit monitoring. This may lead to a prolonged installation plan or to increased cost due to premium time working. Update: Impact reduced due to contingency built into project plan	4	4	Two teams have been acquired for the installation period and we are seeking a third team. The installation plan is based upon two installation teams, working normal hours. If a third team is sourced this will reduce the likelihood of this risk. Also if there is any delay to the plan there is the option for premium time working to increase outputs and catch up with the plan.	4	3	Open
R014	Monitoring Equipment Firmware updates	Technology	There is a risk that the monitoring equipment software will need updating due to unforeseen bugs arising during the monitoring trial.	3	4	To reduce the impact of this risk, project partners ASH increased the functionality of the HUB monitoring device to allow for over the air (OTA) software upgrades. This has been tried and tested successfully.	3	4	Open

Appendix B: Summary of project SDRC

SDRC evidence	Planned date	Status
CW.1 - Send customer engagement plan and data privacy statement to Ofgem by June 2016	Jun-16	Delivered
LDW.2.1 - Publicise Celsius within Electricity North West via the Volt intranet site, email bulletins and/or Newswire company magazine by June 2016, March 2017, March 2018, March 2019 and March 2020	Jun-16	Delivered On track
LDW.6.1 - Issue project progress reports in accordance with Ofgem's June and December production cycle and publish on the Celsius website	Jun-16	Delivered
LDW.1 - Launch Celsius project website by July 2016	Jul-16	Delivered
LDW.5.1 - Hold annual knowledge sharing events in September 2016, 2017, 2018 and December 2019. Provide one-to-one briefing sessions	Sep-16	Delivered On track
LDW.3.1 - Publish advertorials annually by October 2016, October 2017, October 2018 and October 2019	Oct-16	Delivered On track
LDW.4.1 - Participate at four annual LCNI conferences from 2016 to 2019	Nov-16	Delivered On track
CI.3.1 - ENA workshop with DNOs held by November 2016 (to agree areas of changes to Engineering Recommendations P15 and P17)	Nov-16	Delivered On track
LDW.6.2 - Issue project progress reports in accordance with Ofgem's June and December production cycle and publish on the Celsius website	Dec-16	Delivered On track
CI.3.2 - Publish any areas for change identified at the ENA workshop and publish change proposal options to ER P15 and ENA ER P17 on Celsius website by February 2017	Feb-17	Delivered
LDW.2.2 - Publicise Celsius within Electricity North West via the Volt intranet site, email bulletins and/or Newswire company magazine by June 2016, March 2017, March 2018, March 2019 and March 2020	Mar-17	Delivered On track
TW.2.1 - Hold retrofit cooling workshop by May 2017	May-17	Delivered
LDW.6.3 - Issue project progress reports in accordance with Ofgem's June and December production cycle and publish on the Celsius website	Jun-17	Delivered On track
TW.2.2 - Review of highest scoring technologies, circulate workshop outcomes to DNOs and publish on the Celsius website by July 2017	Jul-17	On track
CW.2.1 - Deliver customer focus group workshop by July 2017	Jul-17	On track
TW.1 - Publish equipment specifications and installation reports by September 2017	Sep-17	On track
LDW.5.2 - Hold annual knowledge sharing events in September 2016, 2017, 2018 and December 2019. Provide	Sep-17	On track

SDRC evidence	Planned date	Status
one-to-one briefing sessions		
LDW.3.2 - Publish advertorials annually by October 2016, October 2017, October 2018 and October 2019	Oct-17	On track
TAW.2 - Publish thermal flow study report and initial recommendations for substation design on Celsius website by November 2017	Nov-17	On track
LDW.4.2 - Participate at four annual LCNI conferences from 2016 to 2019	Nov-17	On track
CW.2.2 - Publish lessons learned from testing customer communication materials on Celsius website by December 2017	Dec-17	On track
LDW.6.4 - Issue project progress reports in accordance with Ofgem's June and December production cycle and publish on the Celsius website	Dec-17	On track
LDW.2.3 - Publicise Celsius within Electricity North West via the Volt intranet site, email bulletins and/or Newswire company magazine by June 2016, March 2017, March 2018, March 2019 and March 2020	Mar-18	On track
LDW.6.5 - Issue project progress reports in accordance with Ofgem's June and December production cycle and publish on the Celsius website	Jun-18	On track
TAW.1.1 - Raw temperature monitoring data to be available from July 2017; and retrofit cooling monitoring data to be available from September 2018	Sep-18	On track
TAW.1.2 - Publish asset temperature behaviour analysis report on Celsius website by September 2018	Sep-18	On track
LDW.5.3 - Hold annual knowledge sharing events in September 2016, 2017, 2018 and December 2019. Provide one-to-one briefing sessions	Sep-18	On track
TAW.4.1 - Develop Thermal Ratings Tool using monitoring data to evaluate site capacity on Celsius substations by October 2018	Oct-18	On track
TAW.6 - Publish asset health study report on Celsius website by October 2018	Oct-18	On track
LDW.3.3 - Publish advertorials annually by October 2016, October 2017, October 2018 and October 2019	Oct-18	On track
TW.3 - Publish cooling equipment specifications and installation reports by November 2018	Nov-18	On track
LDW.4.3 - Participate at four annual LCNI conferences from 2016 to 2019	Nov-18	On track
LDW.6.6 - Issue project progress reports in accordance with Ofgem's June and December production cycle and publish on the Celsius website	Dec-18	On track
LDW.2.4 - Publicise Celsius within Electricity North West via the Volt intranet site, email bulletins and/or Newswire company magazine by June 2016, March 2017, March 2018,	Mar-19	On track

SDRC evidence	Planned date	Status
March 2019 and March 2020		
LDW.6.7 - Issue project progress reports in accordance with Ofgem's June and December production cycle and publish on the Celsius website	Jun-19	On track
CW.3.1 - Publish customer survey report quantifying the acceptability of innovative retrofit cooling techniques on the Celsius website by September 2019	Sep-19	On track
CW.3.2 - Publish additional customer survey analysis evaluating the change, if any, in the acceptability of innovative retrofit cooling techniques by educating customers, on the Celsius website by September 2019	Sep-19	On track
TAW.3 - Publish low cost monitoring solution specification on the Celsius website by September 2019	Sep-19	On track
LDW.3.4 - Publish advertorials annually by October 2016, October 2017, October 2018 and October 2019	Oct-19	On track
TAW.4.2 - Develop and validate Thermal Ratings Tool using retrofit cooling trial data, and publish on Celsius website by November 2019	Nov-19	On track
LDW.4.4 - Participate at four annual LCNI conferences from 2016 to 2019	Nov-19	On track
TAW.5 - Publish the cost benefit analysis and carbon impact assessment reports, Celsius business case and buy order of retrofit cooling techniques on Celsius website by December 2019	Dec-19	On track
LDW.5.4 - Hold annual knowledge sharing events in September 2016, 2017, 2018 and December 2019. Provide one-to-one briefing sessions	Dec-19	On track
TAW.4.3 - Develop and validate Thermal Ratings Tool, combining input data from the monitoring and cooling trials, and publish user guide on Celsius website by January 2020	Jan-20	On track
CI.1.1 - Produce Celsius closedown report by January 2020	Jan-20	On track
CI.3.3 - Incorporate relevant Celsius outputs into change proposal options for ER P15 and ER P17 and hold workshop with DNOs by January 2020	Jan-20	On track
LDW.2.5 - Publicise Celsius within Electricity North West via the Volt intranet site, email bulletins and/or Newswire company magazine by June 2016, March 2017, March 2018, March 2019 and March 2020	Mar-20	On track
CI.1.2 - Complete and publish peer review of Celsius closedown report by March 2020.	Mar-20	On track
CI.2 - Publish Electricity North West's approach to managing thermal constraints at distribution substations on the Celsius website by March 2020 and train planners/ operational engineers on new codes of practice	Mar-20	On track
CI.3.4 - Submit proposals for changing ER P15 and ER P17 to ENFG by March 2020	Mar-20	On track

Appendix C: Project direction budget

Project direction ref: ENWL / Celsius / 9 December 2015, Annex 1: Project budget

Cost Category	Cost (£)
Labour	1,203,362.07
Equipment	1,333,237.01
Contractors	1,764,545.12
IT	209,136.13
IPR Costs	0
Travel & Expenses	0
Payments to users	30,815.94
Contingency	537,250.86
Decommissioning	29,357.76
Other	230,089.50
Total	5,337,794.39

Labour	1,203
Labour - project management	469
Labour - general	288
Labour - installation/commissioning	446
Equipment	1,333
Equipment - Materials	349
Equipment - General	-
Equipment - Monitoring Equipment	984
Contractors	1,765
Contractor - Project management	74
Contractor - Close Out	25
Contractor - Technology	663
Contractor - Trials & Analysis	515
Contractor - Thermal Flow Study	97
Contractor - BAU Process & Tool	165
Contractor - Customer Survey	116
Contractor - Customer Engagement Activities	53
Contractor - Cost Benefit Analysis	32
Contractor - Dissemination Activities	24
IT	209
IT - Hardware	-
IT - Software	209
IPR costs	-
IPR costs	-
Travel & Expenses	-
Travel & Expenses	-
Payments to users	31
Payments to users - Customer Survey	31
Contingency	537
Contingency	537
Decommissioning	29
Decommissioning	29
Other	230
Other - Rent	57
Other - Dissemination Activities	149
Other - Other	-
Other - DNO Workshop	24
Total Project to date	5,338

Appendix D: Detailed project expenditure

£'000s Excluding Partner Funding Ofgem Cost Category	Spend to date			Total Project			Comments
	Actual	Plan	Variance	Forecast	Plan	Variance	
Labour	307	471	164	1,205	1,203	(1)	
Labour - project management	128	133	5	468	469	0	
Labour - general	36	78	42	288	288	0	Underspend variance to date due to delay in installation.
Labour - installation/commissioning	143	260	116	448	446	(1)	Underspend variance to date due to delay in installation.
Equipment	1,027	1,070	43	1,335	1,333	(1)	
Equipment - Materials	40	86	46	348	349	1	Underspend variance to date varies due to budget (plan) phasing of retrofit cooling purchase.
Equipment - General	0	0	0	0	0	0	
Equipment - Monitoring Equipment	987	984	(3)	987	984	(3)	
Contractors	376	893	517	1,760	1,765	5	
Contractor - Project management	15	10	(5)	74	74	(0)	
Contractor - Close Out	0	2	2	25	25	0	
Contractor - Technology	278	576	298	664	663	(1)	Underspend variance due to excavation activity associated with delay in installation.
Contractor - Trials & Analysis	50	125	75	515	515	0	Phasing of Project milestone payments are at a slight variance to budget phasing, £100k payment due in June 17
Contractor - Thermal Flow Study	0	97	97	91	97	6	Thermal Flow forecast does not match delivery milestone payments, due in June 17 and Oct 17.
Contractor - BAU Process & Tool	12	25	13	165	165	(0)	
Contractor - Customer Survey	10	6	(3)	116	116	(0)	
Contractor - Customer Engagement Activities	11	45	33	53	53	0	Underspend variance due to budget (plan) phasing, costs expected to realign in next reporting window.
Contractor - Cost Benefit Analysis	0	3	3	32	32	0	
Contractor - Dissemination Activities	0	4	4	24	24	(0)	
IT	138	62	-76	209	209	(0)	
IT - Hardware	0	0	0	0	0	0	
IT - Software	138	62	(76)	209	209	(0)	Overspend variance due to early delivery of back end system milestone payments against budget (Plan) phasing.
IPR costs	0	0	0	0	0	0	
IPR costs	0	0	0	0	0	0	
Travel & Expenses	0	0	0	0	0	0	
Travel & Expenses	0	0	0	0	0	0	
Payments to users	0	0	0	30	31	0	
Payments to users - Customer Survey	0	0	0	30	31	0	
Contingency	77	353	277	78	537	460	
Contingency	77	353	277	78	537	460	Increased by £5k due to additional equipment spend (CT leads, batteries plus general materials).
Decommissioning	0	0	0	29	29	0	
Decommissioning	0	0	0	29	29	0	
Other	75	71	-4	233	230	(3)	
Other - Rent	5	0	(5)	57	57	0	
Other - Dissemination Activities	62	55	(7)	152	149	(3)	
Other - Other	0	0	0	0	0	0	
Other - DNO Workshop	8	16	8	24	24	0	
Total	1,999	2,920	921	4,878	5,338	459	

Appendix E: Project bank account

The bank statement below details all transactions relevant to the project in this reporting period. This includes all receipts and payments associated with the project effective up to the May 2017 month end reporting period.

 Lloyds Bank		Yesterday's Statement				N397926
Statements and Balances						
308012-13292060						
ELECTRICITY NWL NO.15 (CELSIUS) (GBP)						
Date	Type	Narrative	Value Date	Payments	Receipts	Balance
03JAN17		Opening Ledger Balance				2,835,562.37 Cr
09JAN17	CR	INTEREST (GROSS)			588.53	2,836,150.90 Cr
16JAN17	BGC	NO 3 PAYMENTS BGC			395,319.46	3,231,470.36 Cr
16JAN17	DR	NIC FUND 16TH JAN TO A/C TFR 02749020 300002		378,278.14		2,853,192.22 Cr
09FEB17	CR	INTEREST (GROSS)			605.11	2,853,797.33 Cr
15FEB17	BGC	NO 3 PAYMENTS BGC			395,319.46	3,249,116.79 Cr
28FEB17	DR	NIC FUND 15TH FEB TO A/C TFR 02749020 300002		90,274.92		3,158,841.87 Cr
09MAR17	CR	INTEREST (GROSS)			603.40	3,159,445.27 Cr
15MAR17	BGC	NO 3 PAYMENTS BGC			395,319.46	3,554,764.73 Cr
15MAR17	DR	NIC FUND 15MARC17 TO A/C TFR 02749020 300002		73,589.70		3,481,175.03 Cr
10APR17	CR	INTEREST (GROSS)			751.98	3,481,927.01 Cr
20APR17	DR	TO A/C TFR 02749020 300002		97,732.92		3,384,194.09 Cr
09MAY17	CR	INTEREST (GROSS)			678.23	3,384,872.32 Cr
25MAY17	DR	TO A/C TFR 02749020 300002		43,188.79		3,341,683.53 Cr
08JUN17	DR	TO A/C TFR 02749020 300002		56,034.87		3,285,648.66 Cr
08JUN17		Value of Credits (8)			1,189,185.63	
08JUN17		Value of Debits (6)		739,099.34		
08JUN17		Closing Ledger Balance				3,285,648.66 Cr
08JUN17		Closing Cleared Balance				3,285,648.66 Cr
*** End of Report ***						
Version : 3,16,1,516		This report is confidential and for the intended recipient only. If you are not the intended recipient please destroy this page immediately.				09/06/17 09:04.30 Page 1

Appendix F: Celsius communications register

Date	Activity	Audience	Evidence
Feb 2017	Innovation Road show	All Employees	
March 2017	Connect Weekly Bulletin	All Employees	
May 2017	Cooling Workshop	DNO's & project team	