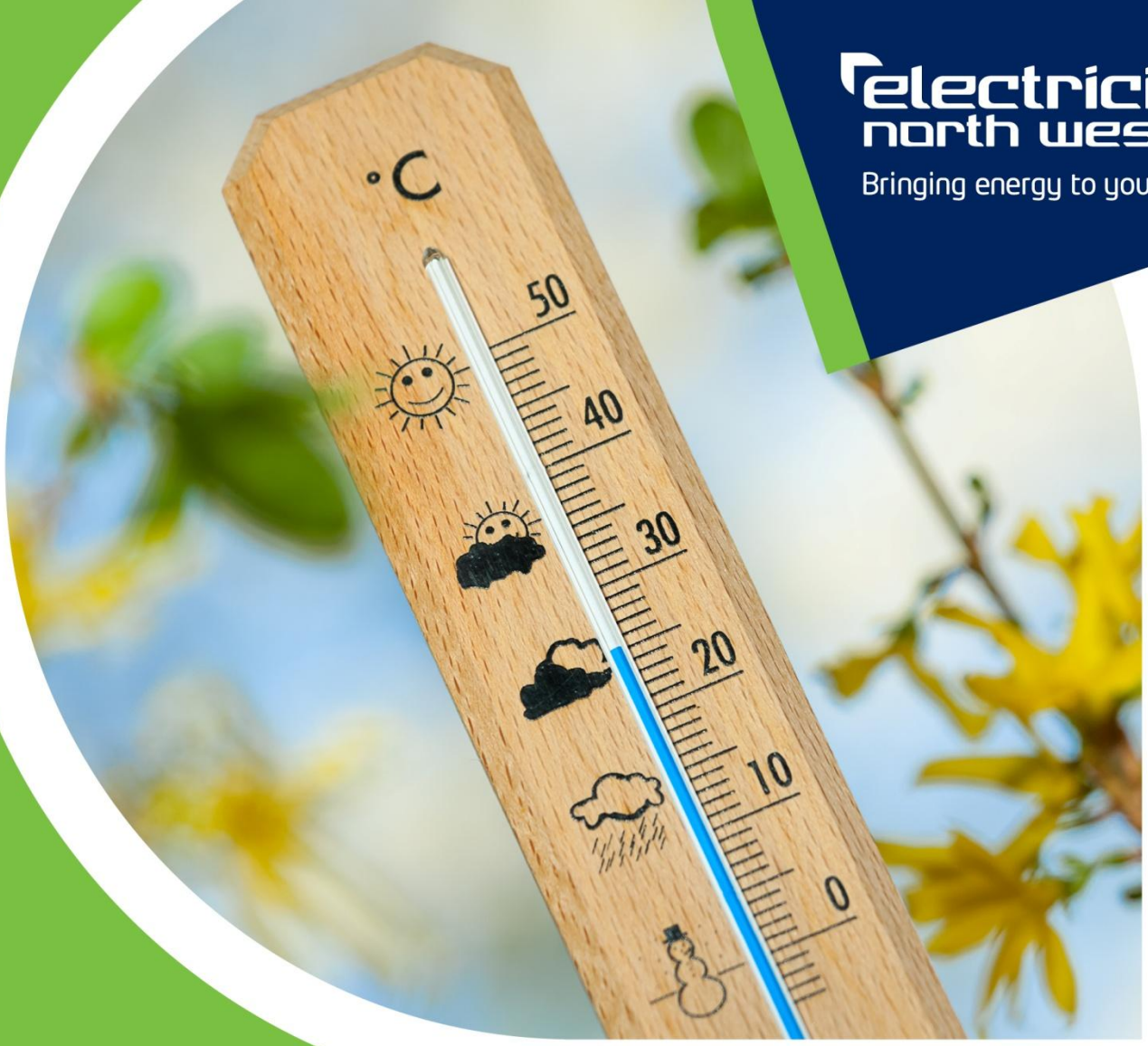
electricity north west

Bringing energy to your door



Celsius

Project Progress Report

Version 1.0
9 December 2017

VERSION HISTORY

Version	Date	Author	Status	Comments
V0.1	1 December 2017	Damien Coyle Project manager	First draft	
V1.0	7 December 2017	Damien Coyle Project manager	Final	Comments from PT & SB

REVIEW

Name	Role	Date
Paul Turner	Innovation Programme Manager	7 December 2017
Sarah Barrett	Finance Manager	7 December 2017

APPROVAL

Name	Role	Date
Steve Cox	Engineering & Technical Director	8 December 2017

CONTENTS

Glossary of terms

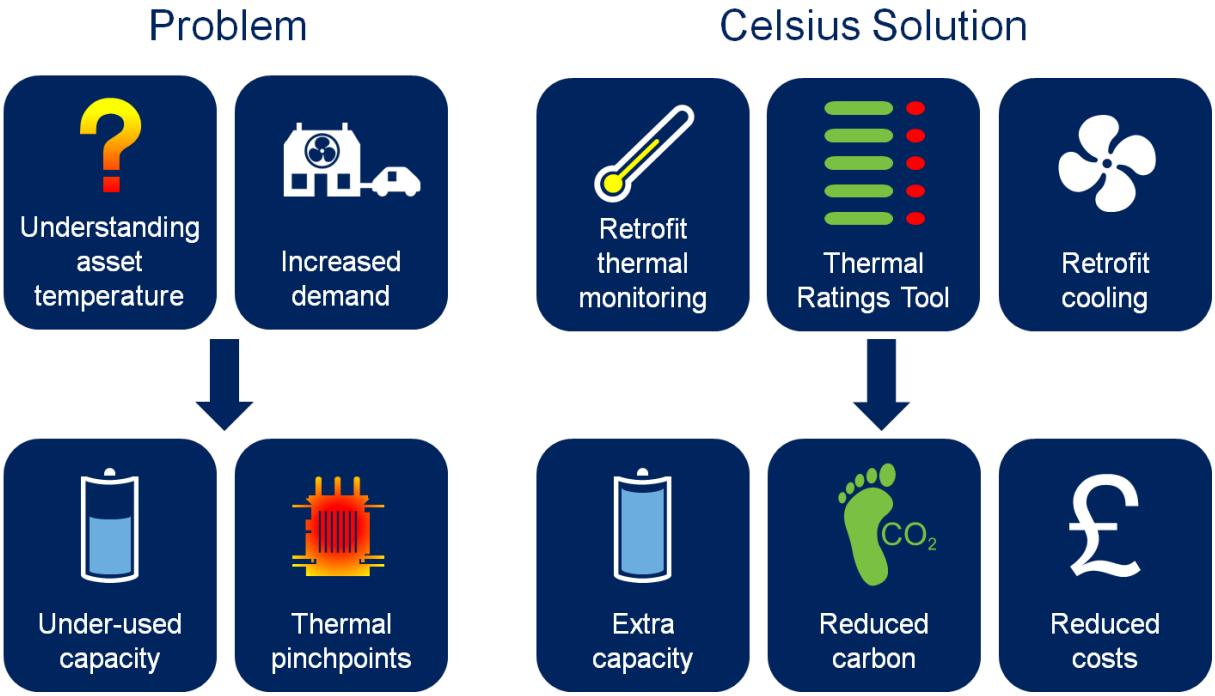
Ambient temperature	Temperature of the air surrounding a component
Cable	An underground conductor used to distribute electrical power, typically buried directly in the ground or installed in ducts or troughs
Capacity	The amount of power that can be delivered by an asset
Current	The movement of electrons 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 fourth six-monthly project progress report (PPR) for the Celsius project. This report covers the period from July 2017 to December 2017.

In the last reporting period a three-month delay to the installation plan was reported. In this reporting period a plan has been implemented to make up the lost time which has been successful in delivering the monitoring installation phase. The monitoring equipment specification and installation report was published on the Celsius website in September on time as evidence of completion of the installation phase; this was a successful delivery reward criteria (SDRC). All SDRC dependent on the monitoring installation have been delivered or are no longer at risk from the delay.

The National Physical Laboratory (NPL) completed the thermal flow study step 1 in November with findings that have highlighted changes required to Electricity North West policy in relation to louvre positions in new substations. Work on the thermal flow study step 2 that includes simulation of cooling technologies is well underway and is due to be delivered in the next reporting period. The thermal flow study step 1 full report is available on the Celsius website.

Customer focus groups were held in July, these focus groups were crucial in developing the customer engagement materials required to educate customers for use in surveys in early 2018.

The project is 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:

- Cooling technology review and selection published – *July 2017*
- Customer focus group workshops held – *July 2017*
- Electricity North West innovation knowledge sharing event held – *July 2017*
- Equipment specification and installation report published on Celsius website – *September 2017*
- Celsius advertorial publication in E&T magazine – *October 2017*
- Thermal flow study report and recommendations published – *November 2017*

The project actual cost to date is £2,491,000 and the estimated at completion cost is £4,874,000 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, a number of risks associated with the monitoring installation delay have been updated to reflect the successful completion and one new risk has been added. The most significant changes are:

R004: Monitoring equipment reliability – risk updated

There is a risk of monitoring equipment failure leading to a requirement for additional resource to attend site to fix or replace.

Update: Impact reduced to moderate due to large amount of trial data successfully gathered and alert system in place from new dashboard.

R015: Cooling technology effectiveness – new risk

There is a risk that some of the cooling technologies deployed will have little impact, resulting in reduced learning.

Control measure: Electricity North West is working with Ricardo to test a number of the cooling technologies in a lab environment prior to deploying onto the network, to ensure value for money when deploying passive and active cooling measures. Ricardo will produce a test report with recommendations for deployment.

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:

- Innovation learning event – Jul 2017
- Industry newsletter – Aug 2017
- Advertorial – Oct 2017
- Industry newsletter – Nov 2017
- LCNI conference – Dec 2017

The Electricity North West innovation team held a learning event in Manchester in July 2017. This event covered all ongoing innovation projects and is a change to holding one-off project events. This approach is a response to feedback received from stakeholders. Holding one multi-project event enables key stakeholders in various projects to make best use of time. There is also the potential for budget savings by holding one large event rather than multiple small events.

Details of all learning and dissemination activities in this reporting period are in the communications register in Appendix F.

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.

2.2 General

This is the fourth reporting period and has been the busiest reporting period to date with nine SDRC successfully delivered. In the last reporting period a three-month delay to installation posed a risk of delaying a number of SDRC. However a successful recovery plan has been implemented that resulted in no detriment to the project or its deliverables.

Following the cooling technology workshops held in May 2017, the selection of technologies was completed and published to the project website in July. One of the key project management challenges in this reporting period has been negotiating contracts for the procurement of the cooling technologies with multiple new vendors. It is expected that all contracts will be agreed by January 2018, in time for deployment of technologies in April 2018.

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

- **Project monitoring and control:** The monitoring and control of the delivery of the Celsius project is on going.
- **Regular engagement with project partners:** The 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.
- **Cooling technology contract agreement:** As discussed above work is on-going to agree contracts with cooling technology suppliers.

2.3 Technology, trials and analysis workstreams

The key activities undertaken by the technology, trials and analysis workstream during the reporting period July to December 2017 are summarised below:

- **TW.2.2** – Review of highest scoring technologies, circulate workshop outcomes to DNOs and publish on the Celsius website by July 2017
- **TW.1** – Publish equipment specifications and installation reports by September 2017
- **TAW.2** – Publish thermal flow study report and initial recommendations for substation design on Celsius website by November 2017.

Following the cooling technologies workshop held in May 2017, a review of the highest scoring technologies was carried out in July 2017, the agreed scoring mechanism scored technologies on the following criteria:

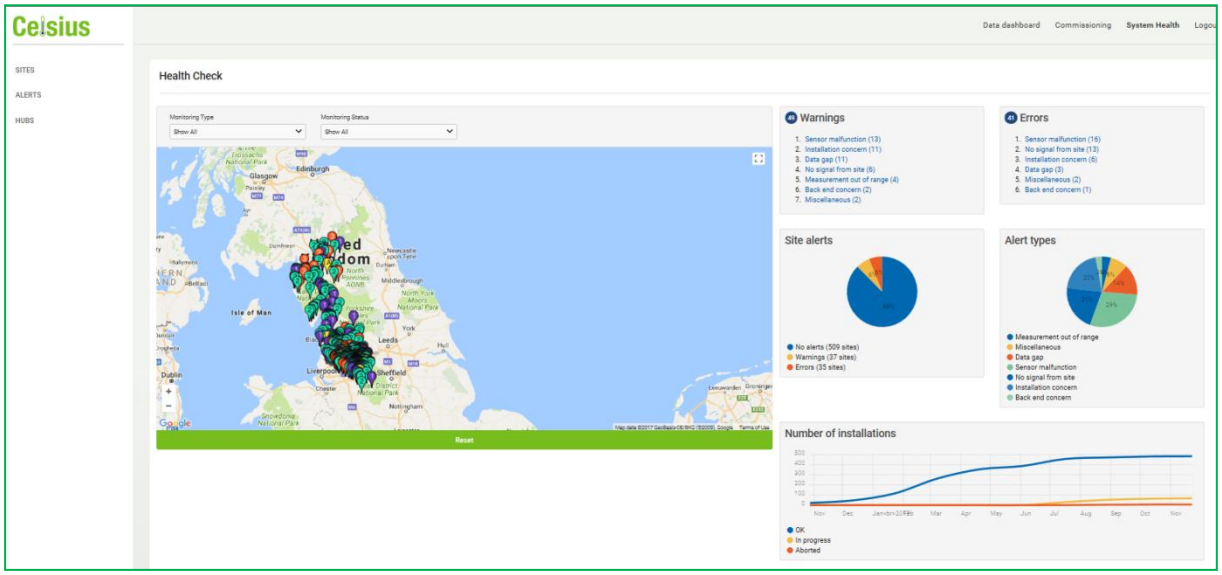
- Safety
- Purchase cost
- Technology readiness level
- Installation
- Environmental impact
- Operational
- Maintenance
- Energy use
- Customer impact.

The complete selection process can be found in the cooling technologies selection report under the library section of the Celsius website.

As previously discussed, the installation plan was delayed by three months. However due to contingency built into the plan and availability of installation teams to work weekends, the installation phase was completed on time to ensure delivery of the monitoring equipment specification and installation report.

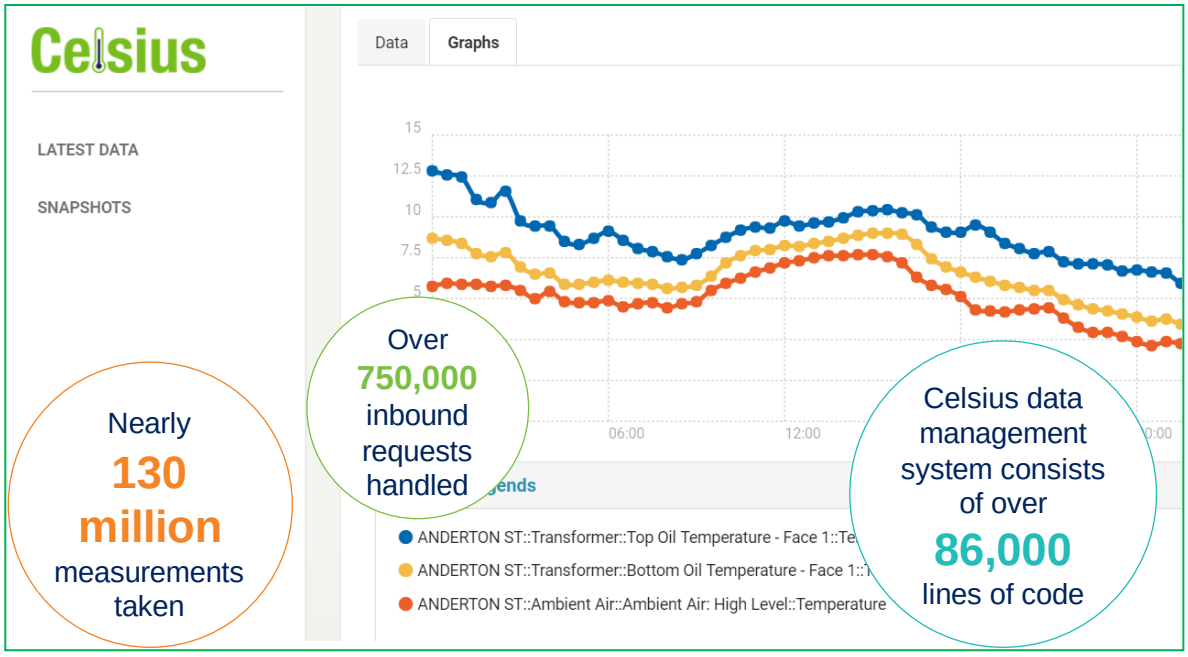
Installation and tracking of progress is made quick and effective by using the Celsius installation application in conjunction with the Celsius dashboards developed by project partners Ricardo. The project team use the dashboards to analyse data, they are also utilised to identify any suspected faults or issues on trial sites. Any issues identified at a Celsius site is flagged up as an alert and assigned to the relevant team member for further investigation. This has proved a very useful and efficient tool for managing the trial sites. See Figure 2.1 below for the system health dashboard display.

Figure 2.1: Celsius dashboard



Included in the Celsius dashboards is the data dashboard that allows visualisation and download of retrofit monitoring data across any site, sensor position and timescale. To date on the project nearly 130 million measurements have been taken and all temperature data is available on the Celsius website. Figure 2.2 shows some data statistics regarding the dashboards.

Figure 2.2: Dashboard statistics



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

- Retrofit cooling technology site selection: 100 sites will be identified using monitoring data for installation of suitable cooling technologies
- Retrofit cooling technology installation plan: installation plan to be agreed with various suppliers of cooling technologies
- Development of policies to support cooling technology installation
- Commence deployment of cooling technologies.

2.4 Customer workstream

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

- Mobile application software has been successful in capturing customer specific data
- An engaged customer panel (ECP) was convened to test initial reactions to the various retrofit cooling techniques and evaluate stimulus materials intended to support the forthcoming customer survey
- A customer survey instrument, supportive educational materials and a customer leaflet have been developed, guided by focus group feedback
- A strategy for administering the customer survey has been developed
- Ongoing liaison has continued with the technical workstream and customer contact centre (CCC) colleagues, to ensure that issues associated with on site monitoring work are captured and appropriately managed.

Mobile application software has been utilised to successfully capture an accurate visual assessment of each site, which includes details of the nearest customer to each substation and the customer type, during the monitoring installation phase. This information will be used in conjunction with customer data collected during the survey to assess overall customer perception of existing distribution assets in benchmarking research. It will then assist in the evaluation of changes in perception, after retrofit cooling technologies have been installed.

Work has been completed to finalise a suite of stimulus materials, which were subsequently used to introduce Celsius to a representative panel of Electricity North West customers at two focus groups, held in Manchester in July 2017. The ECP was comprised of ten individuals representing a broad domestic customer demographic.

The panel was convened to evaluate the content of proposed communication materials that will educate a proportion of survey participants in the baseline phase of Celsius customer research. The panel guided refinements to these materials, ensuring they are understood by previously unengaged individuals in the survey/fieldwork phase of Celsius customer research, early next year. The ECP discussion guide and stimulus materials have been published on the project webpage.

The panel was also tasked with testing initial reaction to potential retrofit cooling techniques and the ECP's feedback provided initial insight into likely customer perception of a range of proposed technologies and critically, whether application of these interventions is likely to be as acceptable to customers as traditional reinforcement.

Constructive ECP feedback was instrumental in informing the development of the survey instrument, the content of the supportive educational material to be incorporated into the survey and the manner in which this information will be presented to participants. The survey instrument and the supplementary materials have been designed to capture a robust baseline measure of existing customer perception of distribution assets, specifically those near to the respondents' homes/places of work.

ECP consultation was successful in ensuring that materials, which will be introduced to the educated sample of respondents, clearly and effectively communicate the problem that Celsius seeks to address, traditional solutions and the proposed trial interventions. A glossy leaflet, capturing all the information that customers are likely to require about the Celsius project, has been produced as a direct result of ECP consultation. This will be issued to all respondents in the educated sample and can be found on the Celsius website.

The customer workstream continues to liaise regularly with the technical delivery team to ensure that any customer facing issues that might arise as a result of the monitoring installation works are identified and resolved. No such issues have yet occurred or are

anticipated. This procedure will continue throughout the installation of retrofit cooling technologies until project closedown.

A robust enquiries/complaints process has been embedded to ensure that issues that might arise relating to any aspect of Celsius are identified, recorded and resolved effectively and in line with Electricity North West's complaints and enquiries procedures.

Innovation roadshows, regular electronic newsletters and briefings ensure that all Electricity North West colleagues are regularly updated about the progress of the Celsius project; however, more detailed engagement with CCC colleagues is scheduled to take place before survey fieldwork and any onsite works to install retrofit technologies begin.

In the next reporting period the customer workstream's most significant activities are as follows:

- **Conduct the Celsius baseline customer survey:** The survey methodology and instrument will be subject to peer review by an external third party before being piloted among a previously unengaged group of customers. This will ensure it is understood by respondents, can be easily administered and is able to elicit robust results, sufficient to achieve the required outcomes. Any final enhancements will be made to the survey before its rollout. This activity is expected to start in January 2018. The initial research phase will involve 600 benchmarking interviews with customers on trial networks, to provide a baseline measurement before retrofit cooling techniques are applied. Of these, 300 interviews will be conducted with customers who have been exposed to the additional educational materials, providing a mechanism to evaluate the hypothesis linking an investment in education to the increased acceptability of Celsius.
- The next reporting period will also see the start of the final 600 test surveys, following the installation of the cooling technologies. Of these, 450 respondents will be completely new to the research, having received no prior education or any form of engagement about the Celsius project. This final survey will elicit changes in perception from the baseline study and test the hypothesis around education. Our project partner, Impact Research, will be responsible for the recruitment of all survey participants and analysis of the results.
- A series of presentations and briefing materials will be delivered to CCC colleagues about Celsius in the New Year, to ensure the team is fully equipped to respond to any enquiries that might be generated by the baseline survey or the installation of retrofit cooling technologies.

To mitigate potential customer impact associated with the Celsius fieldwork and to ensure there is no ambiguity about the legitimacy of the survey, all participants approached to take part will first be issued with detailed information providing the credentials of the market research company, the nature of the research and contact details for Electricity North West.

2.5 Learning and dissemination workstream

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

- Hold annual knowledge sharing event – July 2017
- Publish Celsius advertorial. – October 2017
- Participate at the annual LCNI conference – December 2017.

This year the innovation team held an innovation event day to promote and share learning from our portfolio of innovation projects to external stakeholders. This event proved popular with stakeholders and it is envisaged that this will be the format of future learning events.

Throughout each reporting period the project team engage with Electricity North West colleagues through various channels including newsletters, company intranet and site briefings.

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

- Publicise Celsius within Electricity North West via the Volt intranet site, email bulletins and/or Newswire company magazine
- Issue project progress reports in accordance with Ofgem's June production cycle
- Hold innovation roadshows for internal stakeholders: in the previous reporting period, the innovation team held innovation roadshows at area depots to raise awareness and promote participation for all colleagues. These were well received and positive feedback has led the team to make this an annual event.

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

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.

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 Figure 5.1 below. The report includes expenditure up to and including 30 November 2017. It is noted that the project is currently performing favourably relative to budget. Project expenditure as at the end of November 2017 was £2,491,000 compared to a cost baseline of £3,280,000 including contingency.

In the previous reporting period the variance minus contingency was £644,000. This has now reduced to £496,000; this is for the most part due to the phased payments to project partners (contractors). The variance in contractor payments is £317,000. The overall contractor forecast is still within budget with a forecast underspend of £6,000 by the end of the project.

Since the last reporting period the contractor underspend decreased from £517,000 to £317,000, which is a clear indicator that the project costs are aligning with the budget.

Similarly, the labour underspend variance reduced from £164,000 to £84,000 due to phasing of budget plan aligning with phasing of milestones payments.

Equipment variance increased to £110,000 this is largely due to costs associated with the procurement of cooling equipment not yet being realised.

As reported in the previous reporting period IT costs associated with the development of the data management system and user interface have been completed ahead of plan therefore milestone payments have been paid ahead of the budget plan.

These costs are expected to align after installation of the cooling technologies has been completed this time next year.

Figure 5.1: Summary of project expenditure

£'000s Excluding Partner Funding Ofgem Cost Category	Spend to date			Total Project		
	Actual	Budget	Variance	Forecast	Budget	Variance
Summary						
Labour	503	587	84	1,203	1,203	1
Equipment	1,025	1,136	110	1,333	1,333	(0)
Contractors	673	990	317	1,758	1,765	6
IT	138	97	(41)	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	370	294	78	537	460
Decommissioning	0	0	0	29	29	0
Other	75	101	26	233	230	(3)
Total Costs	**2,491**	**3,280**	**790**	**4,874**	**5,338**	**464**

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 November 2017.

7 SUCCESSFUL DELIVERY REWARD CRITERIA (SDRC)

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

Figure 7.1: Celsius SDRC due in this 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	Delivered
CW.2.1 – Deliver customer focus group workshop by July 2017	Jul-17	Delivered
TW.1 – Publish equipment specifications and installation reports by September 2017	Sep-17	Delivered
LDW.5.2 – Hold annual knowledge sharing events in September 2016, 2017, 2018 and December 2019. Provide one-to-one briefing sessions	Sep-17	Delivered
LDW.3.2 – Publish advertorials annually by October 2016, October 2017, October 2018 and October 2019	Oct-17	Delivered
TAW.2 – Publish thermal flow study report and initial recommendations for substation design on Celsius website by November 2017	Nov-17	Delivered
LDW.4.2 – Participate at four annual LCNI conferences from 2016 to 2019	Nov-17	Delivered
CW.2.2 – Publish lessons learned from testing customer communication materials on Celsius website by December 2017	Dec-17	Delivered
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	Delivered

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

Figure 7.2: Celsius SDRC due in the next reporting period

SDRC evidence	Planned date	Forecast date
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

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

This reporting period has been one of the busiest six months in terms of SDRC. With this have come some key learning points:

- Benefits of automated data validation
- Customer data capture during installation
- Thermal flow study recommendations.

The data dashboard developed by Ricardo and Electricity North West has demonstrated the benefits of automated data validation. A number of automated checks performed by the system will auto generate system alerts where data falls outside the expected pre defined parameters. This saves time for the trials and analysis team and instils confidence that the data they are using has been processed and checked prior to analysis.

The Celsius commissioning application has proved invaluable for managing the monitoring installation plan quickly, efficiently and recovering lost time due to equipment delays. The application also allowed the technology team and the customer team to capture important information from site that may add value or reduce work to the customer workstream at a later stage in the project.

Information identified by the team is:

- Nearest customer type (commercial/domestic)
- Substation distance from nearest customer
- A number of external pictures to help with future customer enquiries.

The thermal flow study step 1 is now complete and has highlighted a number of recommendations for improved airflows within substations and improved ventilation. One of the main learning points from this study has revealed Electricity North West's existing substation design policy requires updating. In its current format the policy recommends new substations to have two large louvres installed on the same wall, one high and one low. The thermal flow study revealed this can work for cooling the substation assets provided there is no prevailing wind acting upon the wall containing the louvres, therefore it is beneficial to have louvres on more than one wall both high and low.

The company's civil team is reviewing the thermal flow study and updating the policy as appropriate. Further learning is expected from the thermal flow study step 2 in the next reporting period. Additionally learning is expected to be generated from the retrofit cooling development and deployment.

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 LCN Fund and NIC 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:

R004: Monitoring equipment reliability

There is a risk of monitoring equipment failure leading to a requirement for additional resource to attend site to fix or replace.

Update: Impact reduced to moderate due to large amount of trial data successfully gathered.

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 : This risk is closed as the monitoring installation is now complete.

R015: Cooling technology effectiveness (new)

There is a risk that some of the cooling technologies deployed will have little impact, resulting in reduced learning.

Control measure: Electricity North West is working with Ricardo to test a number of the cooling technologies in a lab environment prior to deploying onto the network. Ricardo will produce a test report with recommendations for effectiveness and deployment.

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 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	Risk closed Dec 16 – following successful mobilisation 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.	0	0	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. A project initiation document will be issued to the project partners to ensure that all parties are ready. *Contingency: Electricity North West will seek new partners should existing partners fail to mobilise.*	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	Risk Closed October 2016 – Commenced Installation 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.	0	0	Project plan specifies that a purchase order will be raised to procure the sensors allowing the partner to begin manufacture. Regular meetings/reports to track progress against the plan. Commitment to additional operational resource should any delays occur to the installation, testing and commissioning programme. *Contingency: Flexibility is built into the installation programme; phased installation plan starts in autumn 2016 to be completed by spring 2017.* *A full year's data for comparison with the cooling trial could be gained by overlapping these tasks more than planned.*	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	Risk Closed Dec 16 – existing load monitoring units were found to be unsuitable and planned contingency was initiated 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.	0	0	Allowance in budget and plans to move some existing load monitors if necessary. Communications with manufacturers of existing equipment to identify solutions early. Allowance in budget and plans to carry out updates. *Contingency: New power monitoring units, supplied by project partner Ash Wireless will be installed where this is deemed most cost-effective.*	0	0	Closed
R004	Monitoring Equipment Reliability	Technology	There is a risk of monitoring equipment failure leading to a requirement for additional resource to attend site to fix or replace. **Update: Impact reduced to moderate due to large amount of trial data successfully gathered**	2	4	Phased rollout of equipment to ensure systems are working properly before all sites are installed. Some remote monitoring and diagnostics will be possible, for example of performance of the communications and through data validation. . *Contingency: Budget for additional resource.*	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
R005	Project Installation impact on BAU	Technology	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. Probability is rare (1) due to successful testing and roll out.	1	5	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. *Contingency*: *If any issues occur, then the technology will be removed and made good at the earliest signs.*	1	5	Open
R006	Poor Communications signal coverage	Technology	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.	2	2	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. Data will be sent once a day, any failures to send data will be identified automatically and corrected. Data being received will be continuously validated to identify missing or unrealistic data, so issues will be identified quickly. Battery life requirements have been defined and agreed at an early stage. *Contingency: Select sites without signal issues. Where*	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
						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.*			
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. Impact set to moderate (3) due to good response from call for innovation**.**	2	3	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. *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.*	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	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. *Contingency: Flexibility is built into the installation programme with a phased installation plan starting in winter 2018 and to be completed by summer 2018. 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.*	3	4	Open
R009	Customer Impact of Retro fit technology	Customer	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. This risk might result in a breakdown in customer relationship and reputation.	3	4	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. *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/*	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
						environment type, from a particular technique, is considered excessively high.			
R010	Attendance at Project Events	Learning dissemination	There is a risk that attendance at events may be low due to the number of projects and knowledge dissemination events already taking place. Learning may be inhibited due to stakeholders having different interests and learning styles	2	3	Electricity North West will try where possible to merge dissemination events and choose dissemination channels optimised to achieve maximum reach and coverage. Dissemination will be carried out through multiple communication channels including 121 briefings *Contingency: Interested parties are able to contact the project team for any queries and request additional information.*	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. *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.*	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 ENWL 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: Closed due to completion of monitoring installation.**	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	4	Closed
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.	2	4	Open
R015	Cooling Technology effectiveness	Technology / Trials & Analysis /Learning & Dissemination	There is a risk that some of the cooling technologies deployed will have little impact, resulting in reduced learning.	2	4	Electricity North West is working with Ricardo to test a number of the cooling technologies in lab environment prior to deploying onto the network. Ricardo will produce a test report with recommendations for deployment.	2	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
TW.2.2 – Review of highest scoring technologies, circulate workshop outcomes to DNOs and publish on the Celsius website by July 2017	Jul-17	Delivered
CW.2.1 – Deliver customer focus group workshop by July 2017	Jul-17	Delivered
TW.1 – Publish equipment specifications and installation reports by September 2017	Sep-17	Delivered
LDW.5.2 – Hold annual knowledge sharing events in September 2016, 2017, 2018 and December 2019. Provide	Sep-17	Delivered

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	Delivered
TAW.2 – Publish thermal flow study report and initial recommendations for substation design on Celsius website by November 2017	Nov-17	Delivered
LDW.4.2 – Participate at four annual LCNI conferences from 2016 to 2019	Nov-17	Delivered
CW.2.2 – Publish lessons learned from testing customer communication materials on Celsius website by December 2017	Dec-17	Delivered
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	Delivered
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**

£000's Excluding Partner Funding Ofgem Cost Category	
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	**503**	**587**	**84**	**1,203**	**1,203**	**1**	
Labour - project management	170	189	19	468	469	0	
Labour - general	83	100	17	288	288	0	Underspend variance reduced from £42k in last reporting period and is expected to align after roll out of Cooling technologies.
Labour - installation/commissioning	249	297	48	446	446	0	Underspend variance reduced from £116k in last reporting period and is expected to align after roll out of Cooling technologies.
Equipment	**1,025**	**1,136**	**110**	**1,333**	**1,333**	**(0)**	
Equipment - Materials	40	151	112	348	349	1	Undespend variance to date varies due to budget (plan) phasing of retrofit cooling purchase.
Equipment - General	0	0	0	0	0	0	
Equipment - Monitoring Equipment	986	984	(1)	986	984	(1)	
Contractors	**673**	**990**	**317**	**1,758**	**1,765**	**6**	
Contractor - Project management	15	13	(2)	74	74	(0)	
Contractor - Close Out	0	2	1	25	25	0	
Contractor - Technology	447	606	158	663	663	0	Underspend variance reduced from £298k in last reporting period an is expected to align after cooling technology roll out.
Contractor - Trials & Analysis	146	183	36	515	515	0	Phasing of Project milestone payments are at a slight variance to budget phasing.Variance reduced from £75k since last reporting period.
Contractor - Thermal Flow Study	0	97	97	91	97	6	Thermal Flow Study stage 1 payment due to hit December 17 in line with SDRC.
Contractor - BAU Process & Tool	12	25	13	165	165	(0)	
Contractor - Customer Survey	22	9	(13)	116	116	(0)	
Contractor - Customer Engagement Activities	30	45	15	53	53	0	Underspend variance due to budget (plan) phasing, variance reduced from £33k in last reporting period.
Contractor - Cost Benefit Analysis	0	3	3	32	32	0	
Contractor - Dissemination Activities	0	8	7	24	24	(0)	
IT	**138**	**97**	**-41**	**209**	**209**	**(0)**	
IT - Hardware	0	0	0	0	0	0	
IT - Software	138	97	(41)	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**	**370**	**294**	**78**	**537**	**460**	
Contingency	77	370	294	78	537	460	No change to contingency spending since last reporting period.
Decommissioning	**0**	**0**	**0**	**29**	**29**	**0**	
Decommissioning	0	0	0	29	29	0	
Other	**75**	**101**	**26**	**233**	**230**	**(3)**	
Other - Rent	5	0	(5)	57	57	0	
Other - Dissemination Activities	62	85	23	152	149	(3)	Variance due to savings in ENW shared dissemination event & LCNI costs in December not applied yet.
Other - Other	0	0	0	0	0	0	
Other - DNO Workshop	8	16	8	24	24	0	
Total	**2,491**	**3,280**	**790**	**4,874**	**5,338**	**464**	

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 December 2017 month end reporting period.

Lloyds Bank — **Statements and Balances** — **Yesterday's Statement** — **391353**

308012-13292060
ELECTRICITY NWL NO.15 (CELSIUS) (GBP)

Date	Type	Narrative	Value Date	Payments	Receipts	Balance
30JUN17		Opening Ledger Balance				3,286,361.87 Cr
10JUL17	CR	INTEREST (GROSS)			697.79	3,287,059.66 Cr
03AUG17	DR	TO A/C TFR 02749020 300002		152,435.19		3,134,624.47 Cr
09AUG17	CR	INTEREST (GROSS)			561.51	3,135,185.98 Cr
31AUG17	DR	TO A/C TFR 02749020 300002		79,749.09		3,055,436.89 Cr
11SEP17	CR	INTEREST (GROSS)			561.67	3,055,998.56 Cr
28SEP17	DR	TO A/C TFR 02749020 300002		52,068.75		3,003,929.81 Cr
09OCT17	CR	INTEREST (GROSS)			465.44	3,004,395.25 Cr
09NOV17	CR	INTEREST (GROSS)			674.51	3,005,069.76 Cr
09NOV17	DR	TO A/C TFR 02749020 300002		36,245.67		2,968,824.09 Cr
10NOV17	DR	TO A/C TFR 02749020 300002		37,715.21		2,931,108.88 Cr
07DEC17	DR	TO A/C TFR 02749020 300002		133,793.96		2,797,314.92 Cr
07DEC17		Value of Credits (5)			2,960.92	
07DEC17		Value of Debits (6)		492,007.87		
07DEC17		Closing Ledger Balance				2,797,314.92 Cr
07DEC17		Closing Cleared Balance				2,797,314.92 Cr

*** End of Report ***

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Appendix F: Celsius communications register

The below updates have been added to the Celsius communications register for the reporting period up to December 2017.

Date	Activity	Audience	Evidence
Jul 2017	Innovation learning event on social media	All stakeholders	
Jul 2017	Innovation learning event on social media	All stakeholders	
Jul 2017	Innovation learning event	All stakeholders	Slide presentation and survey results
Aug 2017	Industry newsletter	All stakeholders	Newsletter page
Oct 2017	Advertorial	All stakeholders	Advertorial
Nov 2017	Industry newsletter	All stakeholders	Newsletter page
Dec 2017	LCNI conference	Industry stakeholders	Slide presentation