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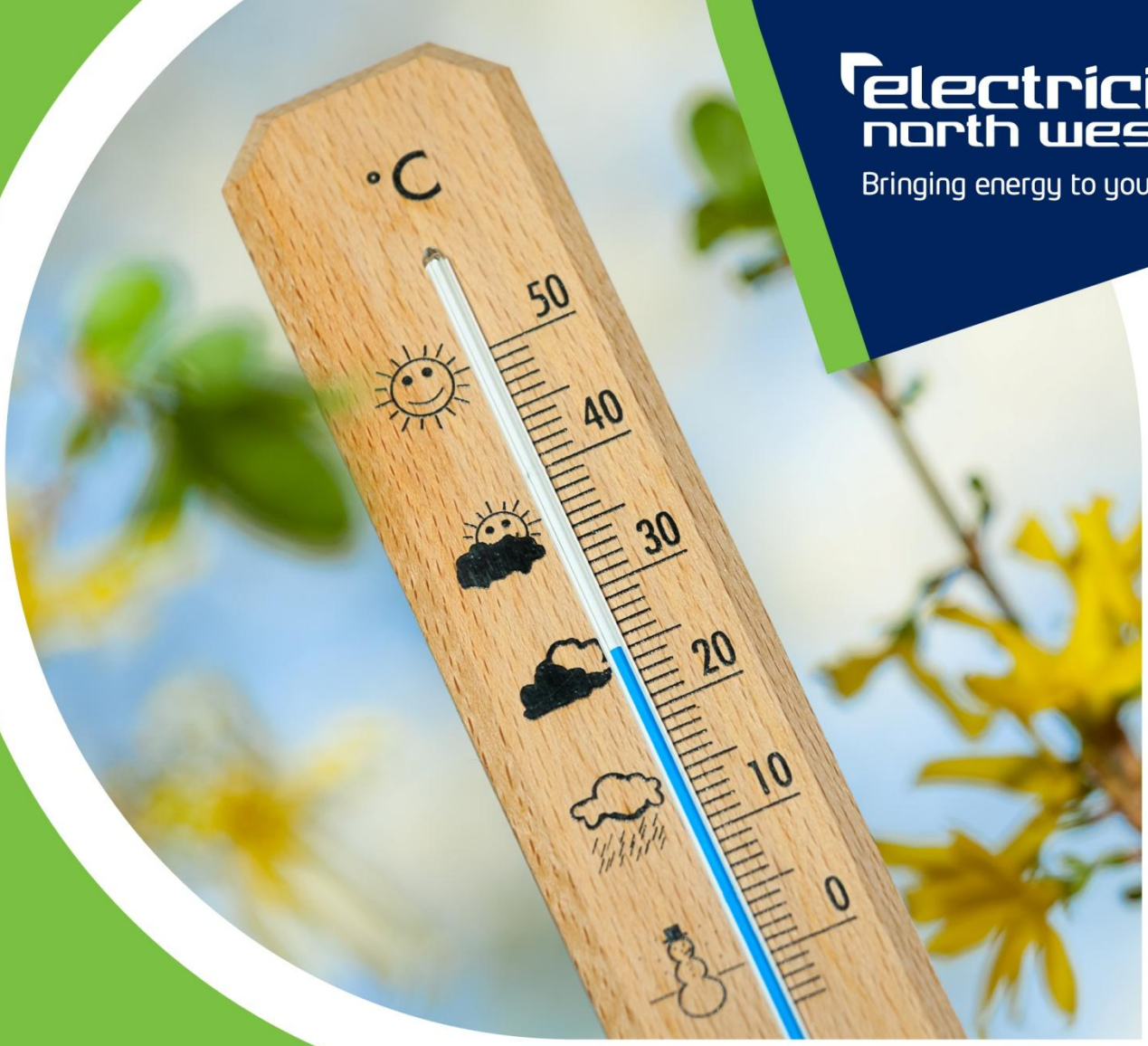


Celsius

Project Progress Report

8 June 2018

VERSION HISTORY

Version	Date	Author	Status	Comments
V0.1	15 May 2018	John Simpson Project Manager	First draft	First draft
V0.2	22 May 2018	John Simpson Project Manager	First Issue	For review
V0.3	5 June 2018	John Simpson Project Manager	Second Issue	Final review
V1.0	5 June 2018	Paul Turner Innovation Manager	Final	

REVIEW

Name	Role	Date
Paul Turner	Innovation Programme Manager	5 June 2018
Sarah Barrett	Finance Manager	6 June 2018

APPROVAL

Name	Role	Date
Steve Cox	Engineering & Technical Director	8 June 2018

CONTENTS

GLOSSARY OF TERMS

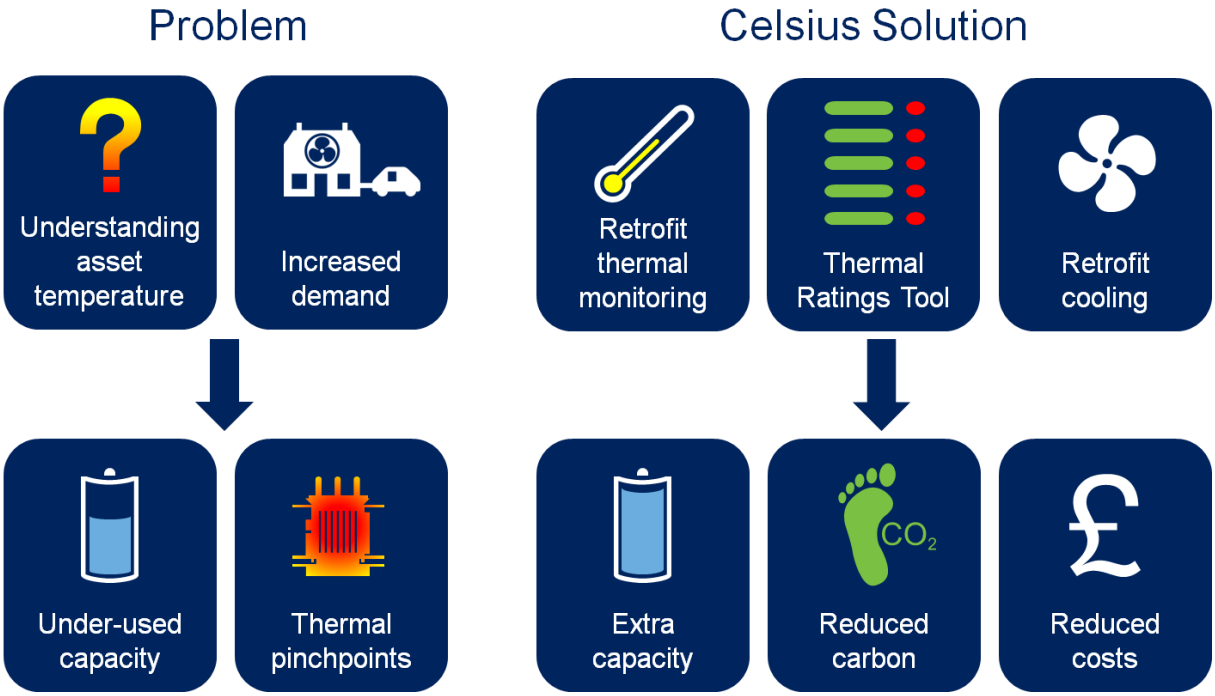
Term	Description
Ambient temperature	Temperature of the air surrounding a component
Cable	An underground conductor used to distribute electrical power, typically buried directly in the ground or installed in ducts or troughs
Capacity	The amount of power that can be delivered by an asset
Current	The movement 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 British 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 its members
High voltage (HV)	Voltages over 1kV up to, but not including, 22kV
Low Carbon Networks Fund (LCN Fund)	Funding to encourage 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 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 fifth six-monthly project progress report (PPR) for the Celsius project. This report covers the period from January 2018 to June 2018.

- No delays were reported in the last reporting period and none are reported in this period. However, three additional risks have been added (Risks: R016, Risk R017 and R018), details of which are outlined in Section 1.3 below, along with a brief summary of how they are being managed.

- Ricardo Energy & Environment completed their research and testing for a number of retrofit cooling technologies and produced a passive cooling technologies recommendations report, published in February 2018.

- The National Physical Laboratory (NPL) has produced a Specification for Phase 2 of the thermal flow modelling for the Celsius project. An informal document outlining the work required to develop these guidelines was published in March 2018. The final report was published on 31 May 2018 and provides recommendations on the work required to improve the ventilation in the various types of substations. Delay in the delivery of this report is documented as a risk (R017) in section 1.3 of this progress report.

- The Retrofit thermal monitoring analysis (temperature factors) report was produced by Ricardo and published in April 2018. These results are being discussed with Ricardo and methodologies being developed which will provide further insights into the thermal behaviour of secondary assets. Refer to risk R018 in Section 1.3.

- The Celsius data summary report was produced to plan in February 2018 and is published on the website. The purpose of the data summary document is to provide an updated report on the collection and management of data for the Celsius trial as at February 2018 and explains how the data management system receives, stores, processes, and provides access to the data from the substations.

- Final refinements were made to a customer survey along with a suite of supporting education materials and a general awareness leaflet. These were developed on the basis of feedback from an engaged customer panel (ECP) during focus group meetings, held in July 2017.

- A customer information card was developed for distribution to properties bordering substations when cooling technologies are installed; this ensured customers have contact details, should they have concerns or require further information.

- The customer contact centre (CCC) was briefed prior to commencing installation of retrofit cooling techniques and a complaints strategy was embedded. The customer worksteam has continued to liaise closely with the technical workstream and the CCC, to ensure that any issues associated with on-site installation works or the impact of the cooling techniques are captured and appropriately managed. During this reporting period, three customer enquiries concerning various aspects of the Celsius trial were received and each was resolved amicably.

- A pilot study was conducted in January 2018 to test the questionnaire and the research methodology before commencing the full baseline survey in March 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:

- Final decisions on active cooling technologies made

- All outstanding issues concerning cooling technology contracts completed and final contracts agreed
- Initial selections of best fit substations for the chosen technologies made
- Schedule of retrofit cooling installs prepared and continuously updated (for both active and passive cooling technologies)
- All selected substations surveyed and decisions made on suitability in terms of technical and safety reasons for the different cooling technologies
- Pre-contract safety work arrangements made and completed prior to installation work taking place
- All external contractors for chosen cooling technologies fully trained to enter and work in live distribution substations and issued with authorisation passes
- Safe system of work agreed with Electricity North West operations including safety documentation and personal supervision (stand-by) arrangements
- Pre-construction meeting with all interested parties with work and safety processes fully discussed. Construction and safety notes issued
- Full liaison with the external active cooling technology manufacturers/providers regarding a programme of work and details of commissioning process
- Similar arrangements made regarding the programme of work for the installation of passive cooling technologies ie reflective painting of distribution assets, solar shading of distribution assets and installation of redesigned venting arrangements
- Fourth project progress report submitted to Ofgem and published, December 2017
- Lessons learned from customer focus group report published, December 2017
- CCC briefed and complaints/enquiries process embedded, December 2017
- Industry newsletter to all stakeholders, January 2018
- Pilot customer survey completed, January 2018
- Celsius passive cooling report published, February 2018
- Celsius publicised in Electricity North West 'Connect' internal communications, weekly bulletin, March 2018
- Baseline customer survey commenced, March 2018
- Interim/informal specification for Phase 2 thermal flow model published, March 2018
- Retrofit Thermal monitoring analysis (temperature factors) report published, April 2018
- Celsius data review published, May 2018
- Industry newsletter to all stakeholders, April 2018
- Three Celsius-related complaints/enquiries received and resolved in this period.

The project actual cost-to-date is £3,054,000 and the estimated at-completion cost is £4,870,000 of a planned budget of £5,338,000 (including contingency).

1.3 Risks

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.

There have been a number of changes to the risk log since the last reporting period and three new risks have been added; these are outlined below and have been added to Appendix A.

Risk R016*: There is a risk that operational resources may not be available to supervise the cooling installation contractors working in live substations*. This would have the effect of delaying the retrofit active cooling work beyond the intended deadline of June 2018. However by negotiating a new contract with an outside agency and agreeing the programme of work this risk should be eliminated.

Risk R017*: There is a risk that the NPL will not complete the thermal flow study step 2 ('Thermal flow modelling work phase 2') which was due by 31 May 2018.* While this is not an SDRC it is an important project commitment and could potentially delay the retrofit of passive

cooling work at 20 substations beyond the intended deadline of end of June 2018. A commitment was made by the NPL to issue a section of the work earlier (this was published on 30 March 2018). By making use of additional resources, to implement the passive cooling work, this risk should be eliminated.

This risk was updated on 31 May 2018. NPL have issued the thermal flow study step 2 and so this risk is closed.

Risk R018: The Retrofit thermal monitoring analysis (secondary network asset temperature factors) report, published on 30 April 2018, does not currently allow us to understand the thermal behaviour of substation assets (in particular LV cables and transformers) under different asset environment conditions. This introduces a risk to the project and is the subject of ongoing discussions between Electricity North West and Ricardo so that strategies may be developed to overcome this problem.

Two risks have been closed:

R007*: Availability of technology providers* – providers have now been appointed and contracts are in place. Risk closed.

R008*: Installation delay of cooling technologies* – The lead time to appoint technology providers has been managed and the installations have commenced to plan. Risk closed.

1.4 Learning and dissemination

The Celsius project manager held a one-day project steering group meeting with the following objectives:

- For new partners to meet the team
- To review project progress to date
- To discuss the next six months deliverables and plan
- For partners to share learning and progress.

Of particular note was:

- An update to the monitoring plan, ie monitoring the results produced by energy and thermal sensors installed in electrical distribution plant in 550 substations
- A customer engagement update
- A presentation by the NPL of their thermal flow study paper
- The proposed Trial 2 cooling installation plan.

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 continue to 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 fifth reporting period in which we have been busy planning the reactive cooling technology and the passive cooling technology installations in specifically chosen positions, dependent upon the cooling technology to be used

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 ongoing.
- **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 with key stakeholders.
- **Cooling technology contract agreement:** As discussed above work is completed and contracts are agreed with the cooling technology suppliers.
- **Cooling technology plan/installations:** The plan was fully developed for the active and passive cooling technology contractors and implemented. It is expected that the planned implementation of all the cooling technologies will be completed by 30 June 2018. The work is currently ongoing.

2.3 Technology, trials and analysis workstreams

The key activities that were undertaken by the technology, trials and analysis workstream during the reporting period January to June 2018 are summarised below:

Passive cooling technology recommendations report

Ricardo Energy & Environment have completed research and testing for a number of retrofit cooling technologies, and produced a passive cooling technologies recommendations report (dated 24 January 2018, published on the Celsius website on 1 February 2018). This work was undertaken as a control measure to address risk R015 (cooling technology effectiveness), in view of concerns that some of the proposed cooling technologies deployed could have little impact, which might result in reduced learning.

This report focused on the passive approaches (as opposed to active cooling with fans or pumps) and presented advice and recommendations on the suitability of the retrofit cooling technologies for inclusion in the Celsius trials. This included potential benefits, limitations, procurement options and recommendations. The document also provides a site selection for the demonstration trial sites for those technologies recommended for inclusion, as follows:

- **Section 2: Technology investigation: colour change of assets and substations**: A description of research and testing of the impact of changing the colour of assets, including test apparatus, methodologies, results and recommendations.
- **Section 3: Technology investigation: pole-mounted transformer shade**: A description of testing the effectiveness of pole-mounted transformer shades using the same apparatus as the colour shades, including test methodologies, results and recommendations. Because of operational difficulties and the need to disconnect customers while pole-mounted shading was installed, it was decided to concentrate on the shading of ground-mounted transformers.
- **Section 4: Technology investigation: ground-mounted shade**: Reporting the results of research and investigation, including requirements, limitations, characteristics and suppliers.

- **Section 5: Technology investigation: improved substation ventilation**: Reporting the results of research and investigation, including requirements, limitations and approach.

- **Section 6: Passive cooling technology site selection:** site selection methodology and results.

Specification for Phase 2 thermal flow model

SDRC TAW.2 (to produce a Thermal flow study report and initial recommendations for substation design) was achieved and this document was published on the Celsius website in November 2017. The report documents the initial modelling of heat and air flow within substations and identifies a set of recommendations from the results of that modelling, based on six various types of substations, under various conditions.

After some consultation, Electricity North West accepted this specification but requested that a similar set of recommendations were developed to guide best practice in new build transformer substations. The NPL subsequently produced a specification Phase 2 of the thermal flow modelling. An informal document outlining the work required to develop these guidelines was delivered in March 2018. This supported the retrofitting work conducted between April and July 2018.

The final report was published on 31 May 2018 and fully specifies all models and assumptions. This deadline was imposed to ensure that recommendations could be followed during the retrofitting campaign and that the delivered results were focused on developing recommendations for new build and applying them to non-standard buildings. The final document, published on the Celsius website, also makes recommendations on the work required to improve ventilation in the various types of substations included in the Celsius project. Refer to risk R017.

The technical workstream is considering if additional work is required after the retrofitting has been completed, to assess the validity of the models used.

Retrofit thermal monitoring analysis (temperature factors) report

This interim document was published on the project website on 30 April 2018. It will inform SDRC (TAW.6 – publication of asset health study report) which is due to be published on the Celsius website by October 2018. The expected output of the monitoring trial analysis is a detailed understanding of the thermal behaviour of substation assets (in particular LV cables and transformers) under different asset environments.

This interim report makes it clear that the results produced, although informative, are not conclusive and there are key limitations. In particular, limitations to the loading of plant and equipment and data quality were prevalent. These results are being discussed with Ricardo and methodologies are being developed, which will provide further insights into the thermal behaviour of secondary assets (refer to Risk R018).

Celsius data summary report

This report was published on the project website dated 27 February 2018. The purpose of the data summary document was to provide an updated report on the collection and management of data for the Celsius trial as at February 2018. This comprehensive document explains how the data management system receives, stores, processes and provides access to the data from the substations. This has considerable functionality which has been developed and improved over the Celsius project, including the receiver, databases, automatic validation, web interface and application.

Some further functionality and improvements are still being developed and added, including performance improvements, tightening automatic validation rules and bringing in weather data. As issues are discovered, solutions are deployed as quickly as possible.

A small amount of additional functionality is likely to be needed to support the next stage of the Celsius trials: the retrofit cooling technology trial. While the required changes are likely to be simple and achievable, it is recommended that they are scoped and understood as soon as possible to ensure they are in place in time for the installation of these trials, planned for April 2018. This work is already partially achieved.

Installation of retrofit cooling techniques

- The retrofit of cooling technologies at 100 of the Celsius trial sites has commenced. Additional monitoring and data associated with some of these technologies, requiring minor feature changes to the installation app and data management system, have taken place.

- The data management system receives, stores, processes and provides access to the Celsius data. The latest metrics (as of early 2018) are:

    - Over 750,000 inbound requests handled
    - Over 190 million measurements stored
    - Over 86,000 lines of code in the data management system.

- All of the Celsius sites have monitors installed, these will remain in place until the end of the monitoring trial, and the cooling sites will then be monitored for a further year. Therefore, the amount of data handled by this system will continue to grow substantially.

Key activities from January to June 2018 have been:

- While the data management site is largely complete, there are updates and improvements that are being made on an ongoing basis. These include updates to automatic alerts (alerts are generated automatically according to a set of rules). This enables large amount of data coming in to be processed to search for potential data or site issues. The rule settings must be considered carefully to prevent either a large number of alerts raised when they are not needed, or issues not being flagged.

- Peer review of hotspot temperature calculation has been carried out and points of issue are being discussed.

- Analysis of temperature factors has been completed and is under discussion and the asset temperature behaviour analysis report is expected to be published on schedule.

- Development and validation of the Thermal Ratings Tool will take place over summer 2018.

- Capacity evaluation methodology will be developed over summer 2018, and the evaluation will then be carried out for all Celsius sites. The asset temperature behaviour analysis report is expected to be published on schedule.

The retrofit cooling technology trial is the next stage of the Celsius project. Installation of cooling technologies is well underway and will culminate in cooling interventions at 100 of the Celsius trial sites. Technologies have been identified, selected and specified for these sites.

- Retrofit cooling technology deployment has commenced and will be completed to plan although there may be minor adjustments made to cooling settings and minor installation modifications to accommodate improved data and customer satisfaction. The cooling equipment specifications and installation reports will be written over summer 2018.

- Collection of retrofit cooling monitoring data has commenced and will continue for a period of 12 months. Assessment of cooling technology costs and benefits will be

produced as a result of the cooling trial, which will include a performance analysis of each technology.

2.4 Customer workstream

The key activities undertaken by the customer workstream, during the reporting period January to June 2018, are summarised below:

- Lessons learned from the customer focus groups and all supporting material published
- Customer contact centre briefed
- Complaints/enquiries process embedded
- Final refinements made to the customer survey instrument and education materials
- Pilot survey completed
- Baseline customer survey commenced
- Customer information card developed for local distribution
- Three Celsius-related complaints/enquiries received and amicably resolved.

Customer contact centre briefing

The CCC was briefed about Celsius prior to any survey field work taking place and before commencing installation of the retrofit cooling techniques. Agents were furnished with appropriate project materials and details of the cooling intervention sites to ensure that all issues relating to any aspect of Celsius are captured, reported and colleagues have sufficient knowledge to answer general enquiries about the project.

A complaints process has been embedded, managed centrally by designated members of the project team, to ensure that more detailed enquiries or complaints, which might arise over the life of the project, are handled swiftly and appropriately.

Celsius pilot survey

Final refinements were made to a customer survey instrument, in addition to a suite of supporting education materials and a general awareness leaflet. These were developed on the basis of feedback from an engaged customer panel (ECP) during focus group meetings held in July 2017. Key learning from this phase of customer engagement, along with the materials developed, are included in the Customer focus groups lessons learned report, published on the project website on 21 December 2017.

These materials were used to administer a pilot study in January 2018, to test the survey instrument and the research approach (face-to-face, door step interviews), before launching the full baseline survey.

The pilot involved interviews with 34 customers residing or working in close proximity to four substations, selected to have a cooling technique applied.

The pilot survey sample comprised 26 domestic and eight business customers, representing small to medium enterprises (SME). Of these, 19 individuals were educated with communication materials, which provided an overview of the Celsius project. The remaining 15 respondents were not shown any stimulus materials to test the hypothesis that customers will be more accepting of interventions at substations if they have had some prior education about the project and the challenges facing DNOs in a low carbon future.

Prior to the interview, participants were given the opportunity to read a letter from Electricity North West, designed to reassure respondents of the authenticity of the research and compliance with the Market Research Society code of conduct. It also aided interviewers in explaining their role in the research. In addition, the letter set out the criteria for receiving the associated incentive and outlined that participants might be approached to take part in a subsequent survey. This letter was produced on the basis of learning from previous customer

facing projects, which had generated a limited amount of feedback from individuals concerned about the genuine nature of the research.

The overall survey methodology and instrument were expected to have been peer reviewed by an external third party before the baseline survey was launched. However, the project team have struggled to re-engage with the academic who agreed to conduct this activity at the outset of the project. Work is ongoing to secure the services of another expert in this field, to complete academic critique. For this reason, on the basis of a successful pilot and considering the positive feedback from the ECP, it was considered an acceptable risk to proceed with the baseline, to negate delays to the survey and mitigate any detrimental impact on the overall research methodology.

Celsius baseline customer survey

It was originally anticipated that this activity would have been completed by October 2017. However, the issues finalising the site selection (as specified in the technology trials and analysis update) delayed the baseline survey which commenced in March 2018. This phase of research involved 600 benchmarking interviews with customers living or working in close proximity to trial substations, to provide a baseline measurement before retrofit cooling techniques were applied. Half of these interviews were conducted with customers who were exposed to the additional educational materials, providing a mechanism to evaluate the hypothesis linking an investment in education to the increased acceptability of Celsius.

Impact Research was provided with substation location data for the purpose of identifying appropriate customers to take part in the survey. This information was provided in the form of an aerial map, displaying the substation and identifying addresses in the immediate proximity. The mapping information was obtained from Electricity North West's GIS database. No personal or sensitive customer information was supplied for survey recruitment, which was achieved using a door-to door, cold calling approach.

Customer enquiries/complaint resolved

In this reporting period three customer enquiries were received concerning Celsius. All were from domestic customers and two were generated from the baseline survey. Of these:

- The first was a general expression of concern from a customer, who having read the leaflet handed to the educated sample, expressed resistance to any form of cooling technique that had potential to impinge either audibly or visually on members of her household. The matter was resolved on confirmation that the cooling technique intended for a substation in the locality would have no direct impact.

- The second expression of concern was raised after a customer had completed a baseline survey, and as a result of a misunderstanding, had assumed that electricity supply to the local area would be interrupted. At project initiation, Electricity North West thought that, in a small number of cases, there may have been the need to turn off electricity supplies for a short period, to install some of the cooling technologies. This would only have occurred where there was absolutely no alternative and in these instances, all affected customers would have received prior notice in compliance with the Celsius customer engagement plan and Electricity North West's Guaranteed Standards of Performance. To ensure that customers were made aware of all potential impacts, this possibility was referenced in a leaflet, handed to the educated sample of customers taking part in the baseline survey. The complaint was resolved when it was explained that it will now be possible to install all cooling techniques without the need to interrupt any customer supplies. As a direct result of this complaint and to prevent further misunderstanding, interviewers were directed to instruct all survey participants that Celsius will have no impact on supplies.

- The third complaint was associated with noise disturbance, following the installation of a Passcomm cooling system. A site visit was conducted immediately by a project

engineer, who extended the night mode settings on the main control unit, in addition to reducing both the day and night time fan speeds. This had the effect of significantly reducing the noise emitted from the unit. The situation was monitored by the customer over a number of days and a series of follow-up visits were conducted by the project team to monitor the effectiveness of the modification. It became apparent after a few days of monitoring that while noise levels were significantly reduced, the customer continued to experience some noise disturbance. The manufacturer was consulted and an alternative solution to remedy the problem was implemented. The project team remain in dialogue with the customer and are continuing to monitor the situation. Further remedial measures will be deployed, if necessary, to negate any ongoing noise disturbance. This may ultimately involve disconnecting and removing the cooling system. Learning outcomes arising from this situation are documented separately in Section 8 of this report.

Customer information card

In early 2018 Electricity North West introduced a new initiative to improve customer service for residents and businesses neighbouring substations, when on-site works are carried out. This simply involves hand delivering a card to properties bordering substations, which briefly outlines the nature of the activity conducted. Importantly, it also includes contact details, should customers have any concerns or wish to provide either positive or negative feedback.

This simple initiative not only improves service to customers but reduces associated calls to the contact centre. In light of the potential customer impacts associated with the cooling interventions, it was considered inappropriate to seek a derogation to exempt Celsius intervention works from this policy.

As such, there was overlap in some customers both receiving the information card and being approached to participate in a baseline survey. This was unavoidable, as the target survey population are those living and working closest to substations because these individuals are most likely to notice/be impacted by the cooling interventions.

This overlap could have a bearing on the hypothesis that *'Customers who are educated on the need for and benefits of Celsius are significantly more likely to find it acceptable'.* The act of delivering the information card, in itself, provides a basic level of education which reduces the pool of respondents in the completely uneducated sample.

The project specific 'customer information card', developed for distribution as cooling technologies are being installed, was published on the project website in March 2018.

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:

- Celsius project steering group, March 2018

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:

- Hold annual knowledge sharing event, July 2018
- Attend the LCNI annual conference, October 2018
- Publicise Celsius progress and learning in advertorial 3, July 2018
- Publicise Celsius within Electricity North West via the Volt intranet site, email bulletins and/or Newswire company magazine

- Issue project progress report in accordance with Ofgem's December production cycle.

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 31 May 2018. It is noted that the project is currently performing favourably relative to budget. Project expenditure as at the end of May 2018 was £3,054,000 compared to a cost baseline of £4,038,000 including contingency.

In the previous reporting period the variance minus contingency was £496,000. This has now increased to £544,000; this is for the most part due to the phased payments to project partners (contractors). The variance in contractor payments is £267,000. The overall contractor forecast is still within budget with a forecast under spend of £6,000 by the end of the project.

Since the last reporting period the contractor under-spend decreased from £317,000 to £267,000 which is a clear indicator that the project costs are aligning with the budget.

The labour under-spend variance increased from £84,000 to £95,000 due to phasing of budget plan aligning with phasing of milestones payments.

Equipment variance increased to £230,000; this is largely due to costs associated with the installation of cooling equipment not yet being complete.

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

Summary Ofgem Cost Category (excluding partner funding)	Spend to date (£'000s)			Total Project		
	Actual	Budget	Variance	Forecast	Budget	Variance
Labour	657	752	95	1,203	1,203	1
Equipment	1,103	1,333	230	1,334	1,333	(1)
Contractors	933	1,199	267	1,758	1,765	6
IT	191	131	(60)	209	209	0
IPR costs	0	0	0	0	0	0
Travel & expenses	0	0	0	0	0	0
Payments to users	15	0	(15)	30	31	0
Contingency	77	516	440	77	537	461
Decommissioning	0	0	0	29	29	0
Other	78	105	27	230	230	0
Total costs	**3,054**	**4,038**	**984**	**4,870**	**5,338**	**467**

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 two SDRC due in this reporting period, both 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
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	Delivered
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	Delivered

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 dominated by the appointment and mobilisation of the retrofit cooling technology partners. With these have come some key learning points:

- The need to consider each cooling technology in relation to practical installation issues, to ensure best fit to individual substation type, eg the ability to fit different designs of kit into a specific substation's internal space.
- The value of substation surveys accompanied by a representative of the cooling technology provider, to validate site selection.
- The value of having reserve sites already chosen so that if sites are aborted, as unsuitable for a specific intervention, they are easily replaced, eg older large volume substations where the proposed cooling technologies would have been ineffective.
- The need to consider substation type and unexpected difficulties from ownership of buildings, eg Grade 2 protected buildings.
- Learning from the NPL thermal flow study recommendations including positioning of new wall vents with respect to transformer position when installing cooling technologies; particularly, the preliminary recommendations for significantly improved ventilation arrangements in GRP substations.
- Customer reactions to cooling technology install. The appropriate management of customer enquiries and solutions to noise queries is an ongoing feature of the installation work. Different frequency noises are absorbed differently by the environment in which they are placed. The customer's perception of sound can be different and time of day also affects how easily customers perceive the sounds created by the cooling equipment eg night time. The technical team are experimenting with the positioning of the cooling equipment, sound absorbing measures and different fan speeds at different times of the day.

A flexible approach to the cooling technology installation plan was initiated to mitigate the risk of the retrofit passive cooling recommendations not being available in compliance with the project plan; a draft has been issued which covers the extra louvers required in glass reinforced plastic (GRP) type substations only. This has allowed the retrofit work to proceed in line with the installation plan. The specification covering brick built substations of various types was made available at the end of May 2018, whereupon additional resources were appointed to ensure the installations are completed as planned.

To initiate further learning of the design of substation buildings, Electricity North West's civil team is reviewing the thermal flow study and updating the policy as appropriate. Further learning is expected to be generated from the retrofit cooling development and deployment.

The retrofit monitoring trial analysis has made significant progress. It has shown that it is possible to estimate the hotspot temperature of transformers and cables using surface and ambient temperatures. The findings and learning from the temperature factors study are under discussion and additional work is needed to finalise this.

Customer impact and complaint resolution

Background: To ensure that any customer enquiries are addressed quickly, efficiently and sensitively, an enquiry/complaints process was been embedded to support the CCC. Any queries or concerns that cannot be addressed immediately by a CCC agent are referred to a designated member of the Celsius customer workstream.

Lessons learned: Learning from previous innovation projects, most notably Smart Street, had demonstrated that this proactive customer strategy provides the most effective means of ensuring that issues are addressed quickly, appropriately and consistently. This maintains good customer relationships with individuals who are most directly impacted by new technologies and the associated installation work. It was essential that the CCC was made fully aware of the project and the correct process, to avoid any handling delays or the delivery of inconsistent information, which might result in greater customer dissatisfaction and ultimately decreases the chances of reaching a satisfactory resolution. However, learning attained in this reporting period demonstrates the value of having a designated customer expert within the project team, empowered to make appropriate decisions, to attain a swift, mutually agreeable, appropriate and amicable resolution to disputes.

Background: The retrofit cooling installations will have no impact on power quality for customers on trial networks. However, it was originally thought that a small number of customers might have been impacted by brief, planned supply interruptions to install certain cooling technologies.

Lessons learned: To ensure that customers were made aware of all potential impacts, this possibility was referenced in the leaflet, handed to the educated sample of customers taking part in the baseline survey. This resulted in a complaint, demonstrating that customers struggle to accept planned supply interruptions unless the long-term benefit of even a short planned interruption is fully understood. All Celsius cooling techniques have been installed without the need to interrupt any supplies and all customers subsequently taking part in the survey were verbally reassured that the project would have no impact on supplies. Educational material for future projects should be designed with this sensitivity in mind.

Background: A small number of customers, with properties in close proximity to assets where retrofit cooling techniques have been deployed at substations could potentially be impacted by a visual or audible effect. Surveys will elicit perceived audible and/or visual changes, as will the capture of any associated customer enquiries from individuals whose views may or may not have been recorded in the survey.

The project team received a report of noise disturbance from a property adjacent to a substation where this technology had been deployed. A project engineer immediately attended and extended the night mode settings on the main control unit in addition to reducing the day and night time fan speeds. The situation was monitored over the subsequent days and the action taken was confirmed to have been effective in reducing noise levels, but had not fully resolved the problem. As such, an acoustic foam buffer was installed to further reduce noise emissions. The project team is continuing to monitor the situation and has maintained dialogue with the customer affected, who has been reassured that further remedial measures will be undertaken to resolve the situation if necessary.

Lessons learned: As a result of this enquiry the project team conducted further investigations to understand the correlation between fan settings and noise emission. It is notable that simple decibel measurements alone fail to adequately determine the potential noise impact on customers in the vicinity. Different frequency noises are absorbed differently by the environments in which they are placed. The customer's perception of sound can be different and time of day also affects how easily customers perceive the sounds created by the cooling equipment eg at night time there is little ambient background noise. The technical team are experimenting with sound-absorbing measures and different fan speeds at different times of the day.

This learning demonstrates that while this type of cooling technology may potentially provide an effective solution to cooling assets, it may not necessarily be appropriate to install such a system in close proximity to domestic dwellings, without deploying additional mitigation against noise disturbance. This could involve:

- Mounting the unit internally; however, this may not be possible or appropriate at all sites

- Use of acoustic foam inside the unit to act as a baffle
- Reduction of the fan speed – while this option could yield the required reduction in noise output to satisfy local customers, it could also affect the overall effectiveness of the system and its cooling performance
- Utilising different settings of the equipment at different times of the day.

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 period:

R007: Availability of technology providers

There is a risk that there may be a lack of suitable retrofit cooling technology suppliers.

Update: Retrofit cooling suppliers have now been appointed and this risk is closed.

R08: Installation delay of cooling technologies

There is a risk that the lead time to appoint retrofit cooling suppliers may delay the start of the monitoring trial.

Update: This risk is closed as the retrofit cooling suppliers have been appointed in line with the project plan.

R016: Availability of operational resources

There is a risk that operational resources may not be available to supervise the cooling installation contractors.

A contract has now been negotiated with a provider of operational resources and they are now available. The risk is closed.

R017: Completion of the thermal flow study by NPL

There is a risk that the NPL will not complete the thermal flow study step 2 to plan and delay the retrofit cooling plan.

By issuing a draft of the work earlier and by making use of additional resources to implement the passive cooling work, this risk is mitigated.

The thermal flow study step 2 was completed and this risk closed.

R018: Temperature factors report

There is a risk that the Secondary network asset temperature factors report will not provide a detailed understanding of the thermal behaviour of substation assets.

This risk to the project is the subject of ongoing discussions between Electricity North West and Ricardo so that strategies may be developed to overcome this problem.

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
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 plan. Commitment to additional operational resource should any delays occur to the installation, testing and commissioning programme.	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
						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.*			
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**	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	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
			successfully gathered			through data validation. *Contingency: Budget for additional resource.*			
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 comm-unications 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	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
						been defined and agreed at an early stage. *Contingency: Select sites without signal issues. Where 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.* *Risk now closed – Invitations to tender led to sufficient providers being selected to install suitable cooling technologies.*	2	3	Closed
R008	Installation delay of	Technology	There is a risk that the lead-time for the retrofit cooling	3	4	During technology selection, each technology will be	3	4	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
	cooling technologies		techniques may lead to a delay in the installation of this technology and delay the start of the monitoring trial.			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.* *Retrofit cooling technology companies appointed and scheduled for installation to be complete to plan.*			
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*	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
						networks where the risk of an adverse customer impact, specific to the customer/network/asset/ 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
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

Risk register ID	Risk title	Project phase/ workstream	Description	Probability score	Impact score	Mitigating action/contingency action	Revised probability score	Revised impact score	Status
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
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	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
						been tried and tested successfully.			
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. *A report documenting the findings and passive cooling technologies recommendations (dated 24 January 2018) is published on the Celsius website.*	2	4	Open
R016	Availability of operational resources.	Technology / Trials & Analysis /Learning & Dissemination	There is a risk that operational resources may not be available to supervise the cooling installation contractors working in live substations. This would have the effect of delaying the retrofit active cooling work beyond the intended deadline of June 2018	2	4	By negotiating a new contract with an outside agency and agreeing the programme of work this risk should be mitigated. The contract has now been negotiated and operational resource is now available. The risk remains open until the work is complete.	1	4	Open
R017	Completion of the thermal flow study by NPL	Technology / Trials & Analysis /Learning & Dissemination	There is a risk that the National Physical Laboratory will not complete the thermal flow study step 2 ('Thermal Flow Modelling Work Phase 2') by end May	4	2	By issuing a section of the work earlier and by making use of additional resources to implement the passive cooling work this risk should	4	2	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
			2018. This has the effect of potentially delaying the retrofit passive cooling work at twenty substations beyond the intended deadline of end of June 2018			be mitigated. NPL have now issued the final report on the 31 May 2018. Risk closed.			
R018	Temperature factors report data will not provide sufficient understanding of thermal behaviour.	Technology / Trials & Analysis /Learning & Dissemination	There is a risk that the Secondary Network Asset Temperature Factors Report will not provide a detailed understanding of the thermal behaviour of substation assets (in particular LV cables and transformers) under different asset environment conditions.	4	4	This risk to the project is the subject of ongoing discussions between ENW and Ricardo so that strategies may be developed to overcome this problem.	4	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
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
LDW.3.1 – Publish advertorials annually by October 2016, October 2017, October 2018 and October 2019	Oct-16	Delivered
LDW.4.1 – Participate at four annual LCNI conferences from 2016 to 2019	Nov-16	Delivered
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
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
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
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 one-to-one briefing sessions	Sep-17	Delivered

SDRC evidence	Planned date	Status
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	Delivered
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	Delivered
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, March 2019 and March 2020	Mar-19	On track

SDRC evidence	Planned date	Status
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	**657**	**752**	**95**	**1,203**	**1,203**	**1**	
Labour - project management	226	251	25	468	469	1	
Labour - general	117	124	7	288	288	0	Underspend variance reduced from £17k in last reporting period to £7k this reporting period and is expected to further align after roll out of cooling technologies is completed in June.
Labour - installation/commissioning	313	377	63	446	446	0	Underspend variance increased from £48k in last reporting period to £63k in this reporting period and is expected to align after roll out of cooling technologies.
Equipment	**1,103**	**1,333**	**230**	**1,334**	**1,333**	**(1)**	
Equipment - Materials	118	349	231	349	349	0	Underspend variance to date varies due to budget (plan) phasing of retrofit cooling purchase and installation
Equipment - General	0	0	0	0	0	0	
Equipment - Monitoring Equipment	986	984	(1)	986	984	(1)	
Contractors	**933**	**1,199**	**267**	**1,758**	**1,765**	**6**	
Contractor - Project management	42	25	(16)	74	74	0	
Contractor - Close Out	0	2	2	25	25	0	
Contractor - Technology	581	626	45	663	663	0	Underspend variance reduced from £158k in last reporting period to £45k in this reporting period. It is expected to further align after roll out of cooling technologies are completed in June 2018.
Contractor - Trials & Analysis	171	341	169	515	515	0	Phasing of Project milestone payments are at a slight variance to budget phasing.
Contractor - Thermal Flow Study	47	97	50	91	97	6	Thermal Flow forecast is lower than budgeted.
Contractor - BAU Process & Tool	12	25	13	165	165	(0)	
Contractor - Customer Survey	49	25	(24)	116	116	(0)	
Contractor - Customer Engagement Activities	31	45	14	53	53	0	Underspend variance due to budget (plan) phasing, variance reduced from £15k in last reporting period to £14k in this reporting period.
Contractor - Cost Benefit Analysis	0	3	3	32	32	0	
Contractor - Dissemination Activities	0	11	10	24	24	(0)	
IT	**191**	**131**	**-60**	**209**	**209**	**0**	
IT - Hardware	0	0	0	0	0	0	
IT - Software	191	131	(60)	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	**15**	**0**	**-15**	**30**	**31**	**0**	
Payments to users - Customer Survey	15	0	(15)	30	31	0	
Contingency	**77**	**516**	**440**	**77**	**537**	**461**	
Contingency	77	516	440	77	537	461	No changes to contingency spending since last reporting window.
Decommissioning	**0**	**0**	**0**	**29**	**29**	**0**	
Decommissioning	0	0	0	29	29	0	
Other	**78**	**105**	**27**	**230**	**230**	**0**	
Other - Rent	5	0	(5)	57	57	0	
Other - Dissemination Activities	66	90	24	149	149	0	
Other - Other	0	0	0	0	0	0	
Other - DNO Workshop	8	16	8	24	24	0	
Total	**3,054**	**4,038**	**984**	**4,870**	**5,338**	**467**	

£'000s Excluding Partner Funding Ofgem Cost Category	Spend to date			Total Project		
	Actual	Plan	Variance	Forecast	Plan	Variance
Labour	657	752	95	1,203	1,203	1
Equipment	1,103	1,333	230	1,334	1,333	(1)
Contractors	933	1,199	267	1,758	1,765	6
IT	191	131	(60)	209	209	0
IPR Costs	0	0	0	0	0	0
Travel & Expenses	0	0	0	0	0	0
Payments to Users	15	0	(15)	30	31	0
Contingency	77	516	440	77	537	461
Decommissioning	0	0	0	29	29	0
Other	78	105	27	230	230	0
Total	**3,054**	**4,038**	**984**	**4,870**	**5,338**	**467**

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 2018 month end reporting period.

Lloyds Bank
Statements and Balances

Custom Report **N397802**

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

Date	Type	Narrative	Value Date	Payments	Receipts	Balance
06DEC17		Opening Ledger Balance				2,931,108.88 Cr
07DEC17	DR	TO A/C TFR 02749020 300002		133,793.96		2,797,314.92 Cr
11DEC17	CR	INTEREST (GROSS)			1,148.14	2,798,463.06 Cr
09JAN18	CR	INTEREST (GROSS)			1,000.55	2,799,463.61 Cr
09FEB18	CR	INTEREST (GROSS)			1,069.93	2,800,533.54 Cr
09MAR18	CR	INTEREST (GROSS)			966.76	2,801,500.30 Cr
09APR18	CR	INTEREST (GROSS)			1,070.71	2,802,571.01 Cr
09MAY18	CR	INTEREST (GROSS)			1,036.57	2,803,607.58 Cr
07JUN18	CR	FROM A/C TFR 01676933 300002			395.55	2,804,003.13 Cr
07JUN18	DR	TO A/C TFR 02749020 300002		163,275.25		2,640,727.88 Cr
07JUN18	DR	TO A/C TFR 02749020 300002		40,739.38		2,599,988.50 Cr
07JUN18	DR	TO A/C TFR 02749020 300002		109,196.24		2,490,792.26 Cr
07JUN18	DR	TO A/C TFR 02749020 300002		28,674.04		2,462,118.22 Cr
07JUN18	DR	TO A/C TFR 02749020 300002		67,099.52		2,395,018.70 Cr
07JUN18	DR	TO A/C TFR 02749020 300002		154,270.42		2,240,748.28 Cr
07JUN18		Value of Credits (7)			6,688.21	
07JUN18		Value of Debits (7)		697,048.81		
07JUN18		Closing Ledger Balance				2,240,748.28 Cr
07JUN18		Closing Cleared Balance				2,240,748.28 Cr

*** End of Report ***

Appendix F: Celsius communications register

The below updates have been added to the Celsius communications register for the reporting period up to May 2018.

Date	Activity	Audience	Evidence
Jan 2018	Industry newsletter	All stakeholders	Newsletter page
Mar 2018	Internal comms	Mar 2018	
Apr 2018	Industry newsletter	All stakeholders	Newsletter page