electricity north west
Bringing energy to your door

Celsius
Project Progress Report

Version 1.0
9th December 2016

Celsius

VERSION HISTORY

Version	Date	Author	Status	Comments
V0.1	20/05/2016	Damien Coyle Project manager	First draft	
V0.2	17/11/2016	Damien Coyle Project manager	Second Draft	Various changes due to first review stage
V1.0	05/12/2016	Damien Coyle Project manager	Final	Finances updated

REVIEW

Name	Role	Date
Andrew Howard	Innovation programme manager	05/12/16
Paul Turner	Innovation Delivery Manager	05/12/16
Cara Blockley	Innovation bid manager & project assurance	05/12/16

APPROVAL

Name	Role	Signature & date
Steve Cox	Engineering & Technical Director	Mr Stephen Cox Digitally signed by Mr Stephen Cox DN: c=GB - UNITED KINGDOM, email=steve.cox@enwl.co.uk, o=Electricity North West Ltd, ou=Network Strategy, cn=Mr Stephen Cox Date: 2016.12.07 07:19:31 Z
Matthew Sweeney	Finance business partner	Matthew Sweeney Digitally signed by Matthew Sweeney DN: cn=Matthew Sweeney, o=ENWL, ou=Finance Business Partner, email=matthew.sweeney@enwl.co.uk, c=GB Date: 2016.12.06 16:19:04 Z

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Glossary of terms

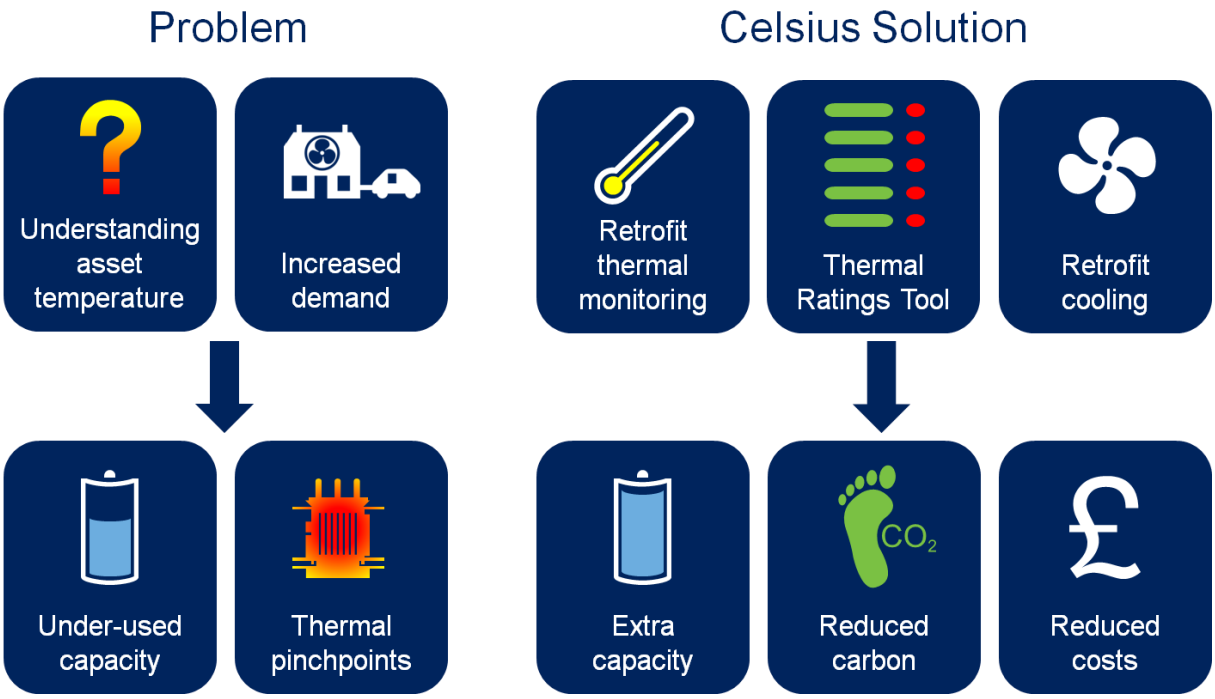
Ambient temperature	Temperature of the air surrounding a component
Cable	An underground conductor used to distribute electrical power, typically buried directly in the ground or installed in ducts or troughs
Capacity	The amount of power that can be delivered by an asset
Current	The movement of electrons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

1 EXECUTIVE SUMMARY

1.1 The Celsius project

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

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



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

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

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

1.2 Project progress

This is the second six-monthly project progress report (PPR) for the Celsius project. This report covers the period from July 2016 to December 2016.

The project is currently on track to meet its aims, objectives and all successful delivery reward criteria (SDRC) as per the project plan.

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

- Customer Engagement Plan Agreed and Issued – *July 2016*
- Data Privacy Statement Agreed and Issued – *July 2016*
- Enhanced Celsius website launched – *July 2016*
- First Learning and Dissemination Webinar held – *September 2016*
- Celsius Presentation at the LCNI conference – *October 2016*
- Celsius IET advertorial – *October 2016*
- Monitoring Installation phase commenced – *October 2016*
- First DNO workshop to review Engineering Recommendations P15 & P17 - *November 2016*

The project actual costs to date is £1,260,000 and the estimated at completion costs is now £4,876,000 of a planned budget of £5,338,000 (including contingency).

1.3 Risks

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

R013 - Retrofit Monitoring Resource (New Risk) – Raised 29/9/16

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 increased costs due to premium time working.

Mitigation

Two teams have been acquired for the installation period and the technology workstream lead is 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 the risk. In addition, if premium time working is required to increase output, there is a contingency budget for this.

R014 - Monitoring Equipment Firmware updates – (New Risk) –Raised 28/10/16

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

Mitigation

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. The OTA however, does not apply to the HEX and KTS01 sensors; therefore, any software upgrade required on these devices must be updated manually. The monitoring data is being automatically validated by the back end system and any issues are reported. Additionally project partners Ricardo are providing a weekly audit during the installation period of new sites / data sets. This enables the project team to quickly identify any issues and address accordingly.

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:

- New and Improved Celsius website launched in July.
- First Celsius Webinar held in September.
- Celsius advertorial published in the IET magazine in October.
- Celsius presented at the LCNI conference in October.

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.

Celsius explores a two-step intervention approach.

Firstly, Celsius will gather data across a range of environmental, load and seasonal factors on 520 distribution substations using a range of new power and temperature monitoring equipment. The data gathered will be analysed to improve the understanding of the relationship between asset temperature, load characteristics and the surrounding environment.

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

Secondly, Celsius will apply a range of cooling techniques on 100 of the monitored distribution substations to demonstrate the increased capacity and the benefits of each technique. This will result in a 'buy order' of cooling interventions for network operators to select.

2.2 General

This is the second reporting period and progress is currently on track with plan. Electricity North West has taken delivery of 80% of the monitoring equipment from project partners ASH Wireless. The remaining 20% of equipment is due for delivery in December 2016.

Celsius is currently in the installation phase of monitoring equipment. The installation commenced in October and is due to complete in March 2017.

The back end system is now receiving data from the first installation sites. Upon early validation of the data, a software issue was identified in the KTS01 wireless sensor that caused incorrect values to be reported in some instances. This has been investigated and a resolution developed. ASH Wireless are updating the firmware in all KTS01 sensors and has issued an updated buffer stock to allow installation to continue.

The technology workstream lead has updated the installation plan to include increased working times to mitigate the risk of the installation period over running.

As part of Step 1, we will carry out detailed analysis of the heat and airflows within substations to provide evidence on the optimal configuration of indoor substations, including the location of vents and louvers. This will inform future substation design and potentially show how airflow in existing substations can be optimised. Another deliverable of the project is the Thermal Flow Study, a supplier for this piece of work has been selected and a contract is currently issued for approval.

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

- **Installation Team Recruitment and Training:** Two installation teams have been selected and trained to deliver the installation of monitoring equipment; a third team is currently being sourced.
- **Installation of monitoring equipment:** Monitoring equipment has been installed at 18 sites. Initial installations have been used to confirm installation procedures and effectiveness of the new temperature monitoring technologies.
- **Project monitoring and control:** Processes for the monitoring and control of the delivery of the Celsius project are on going. These processes build on those developed during earlier LCN Fund projects to ensure that this project progresses in a controlled manner and that the outputs are of the highest quality.
- **Regular engagement with project partners:** The Electricity North West Celsius project team hold a weekly progress update meeting with the project partners. Additionally bi annual Project Steering groups are held that include key stakeholders.

2.3 Technology, trials and analysis workstreams

The policies and procedures for the installation of monitoring equipment have been agreed and the installation phase has now commenced.

To support the installation project partners ASH Wireless and Ricardo worked with Electricity North West to develop a smart phone application to enable the install teams to safely, easily and quickly install the kit. This has proved to be a benefit to the project, as this allows not only for efficiencies to be made in the install process but also for the project team to track installations live in real time.

The installation of monitoring equipment has now commenced and the back end system is now receiving data from the first installation sites.

The key activities undertaken by the technology, trials and analysis workstreams during the reporting period are summarised below:

- Monitoring Installation plan agreed and issued.
- Commissioning application developed to support, manage and monitor installation phase.
- Back end data management system online and receiving data.
- Thermal Flow Study specification and delivery contractor agreed.
- Testing of internal transformer monitor prototype has commenced.

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

- Complete the installation of retrofit monitoring.
- Commence investigation into potential cooling technologies.
- Analysis - hotspot temperature calculation.
- Commence Thermal Flow study

2.4 Customer workstream

The key activities undertaken by the customer workstream during the reporting period July to December 2016 are summarised below.

- A customer engagement plan was submitted to Ofgem on 30 June 2016 for approval.
- A data privacy statement was submitted to Ofgem on 30 June 2016 for approval.

The customer workstream have been working closely with Ricardo on the development of a template for capturing important site information during the installation of monitoring equipment. Mobile application software has been designed allowing the technical workstream to conveniently record substation data remotely. This data includes a visual and audio assessment of each site. This will be important in helping to establish customer awareness and perception of existing assets and any perceived changes in the assets following installation of retrofit cooling techniques.

In the next reporting period, the customer engagement workstream will undertake the following activities:

- Preparation of engagement materials for customer focus group workshops, due to be delivered in July 2017.

2.5 Learning and dissemination workstream

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

- New and Improved Celsius website launched in July 2016.
- First Celsius Webinar held in September 2016.
- Celsius advertorial published in the IET magazine in October 2016.
- Celsius presented at the LCNI conference in October 2016.

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

One key learning point from this reporting period is the benefits of using smart applications to manage and control the installation process. As discussed in Section 2.3 a smart application has been developed originally to act as guide for the installation teams but was enhanced further to provide real time feedback and can track progress.

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

- Publicise Celsius on the company intranet and in the internal email bulletin

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.

Progress against the project plan as outlined in the full submission and is currently on track with no substantial issues raised that are expected to affect the project plan.

5 PROGRESS AGAINST BUDGET

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

Actual spend to date compared to project budget is summarised in Table 5.1 below. The report includes expenditure up to and including 30 November 2016. It is noted that the project is currently performing favourably relative to budget. Project expenditure as at the end of November 2016 was £1,260,000 compared to a cost baseline of £2,381,000. This variance is due to milestone payments agreed with project partners for the monitoring phase of the project and these milestones do not match the original anticipated spend profile. This is also the reason for the IT and other categories being slightly ahead of the budget spend profile. Once the monitoring phase has reached completion it is expected the forecast spend profile will align with the project actual costs.

The variance in IT cost is due to early completion of project milestones, for example, the back end data system is online and receiving data ahead of plan. This variance will readjust in the next reporting period.

Table 5.1: Summary of project expenditure

£'000s Excluding Partner Funding Ofgem Cost Category	Spend to date			Total Project		
	Actual	Plan	Variance	Forecast	Plan	Variance
Labour	168	335	167	1,204	1,203	(1)
Equipment	659	999	340	1,335	1,333	(2)
Contractors	237	679	442	1,764	1,765	0
IT	74	28	(46)	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	72	288	216	72	537	465
Decommissioning	0	0	0	29	29	0
Other	50	52	2	231	230	(1)
Total	**1,260**	**2,381**	**1,121**	**4,876**	**5,338**	**462**

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 2016.

7 SUCCESSFUL DELIVERY REWARD CRITERIA (SDRC)

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

Table 7.1: Celsius SDRC due in this reporting period

SDRC evidence	Planned date	Status
CW.1 - Send customer engagement plan and data privacy	Jun-16	Delivered

SDRC evidence	Planned date	Status
statement to Ofgem by June 2016.		
LDW.2.1 - Publicise Celsius within Electricity North West via the Volt intranet site, email bulletins and/or Newswire company magazine by June 2016.	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.	Sep-16	Delivered
LDW.3.1 - Publish advertorials annually by October 2016.	Oct-16	Delivered
LDW.4.1 - Participate at four annual LCNI conferences from 2016.	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

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

Table 7.2: Celsius SDRC due in the next reporting period

SDRC evidence	Planned date	Forecast date
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	On track
LDW.2.2 - Publicise Celsius within Electricity North West via the Volt intranet site, email bulletins and/or Newswire company magazine by March 2017.	Mar-17	On track
TW.2.1 - Hold retrofit cooling workshop by May 2017	May-17	On track
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	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	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

As this is Electricity North West's fifth LCN Fund Tier 2/NIC project, the project team has been able to review and apply lessons learnt from previous projects when commencing a new project. During this reporting period much of the work has evolved around planning and execution of the installation of the monitoring technology

There has been one learning outcome discussed in Section 2.5 (learning and dissemination workstream) regarding the benefits of using smart applications to manage the installation process.

In the next reporting period, it is expected further learning will be generated after the development of the monitoring equipment has been fully approved and the installation phase commences. In addition, there will be a large piece of work involving IT testing and development that is expected to generate further learning.

9 INTELLECTUAL PROPERTY RIGHTS (IPR)

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

10 RISK MANAGEMENT

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

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.

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.

With the agreement of partner contracts and the commencement of installation of monitoring equipment, the mobilisation risk is now closed.

80% of monitoring equipment purchase orders has now been received; therefore, the risk of delayed installation is now closed.

The use of existing monitoring equipment will not take place due to an issue raised by project partner Ricardo. The cost and effort required to redeploy existing monitoring equipment and implement this into the data handling system has been investigated and evaluated against deployment of new equipment. The outcome of which is that the cost and timescales associated with redeployment will put the project delivery at risk, therefore new monitoring equipment has been ordered for the affected sites. This has been budgeted for in the contingency and has not negatively affected the project delivery. This risk is now closed.

Changes to date are:

- Project partners have mobilised, and this risk is now closed.
- 80% of thermal sensors have been delivered, this risk is now closed.
- Use of existing monitoring equipment has been evaluated and ruled out, with mitigation strategy deployed. This risk is now closed.

11 CONSISTENCY WITH FULL SUBMISSION

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

12 ACCURACY ASSURANCE STATEMENT

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

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

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

13 APPENDICES

Appendix A: Status of all risks

Risk Register ID	Risk Title	Project phase/ workstream	Description	Probability score	Impact score	Mitigating action/contingency action	Revised probability score	Revised impact score	Status
R001	Project partner Mobilisation	Mobilisation	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.	1	4	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 (Change from 1)	0 (Change from 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
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.	2	5	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 (Change from 2)	0 (Change from 5)	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.	4 (Change from 3)	1 (Change from 4)	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 (Change from 4)	0 (Change from 1)	Closed
R004	Monitoring Equipment Reliability	Technology	Probability reduced Sept 2016 due to successful verification test. There is a risk of monitoring equipment failure leading to a requirement for additional resource to attend site to fix or replace.	2 (Change from 3)	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	4	Open

Risk Register ID	Risk Title	Project phase/ workstream	Description	Probability score	Impact score	Mitigating action/contingency action	Revised probability score	Revised impact score	Status
R005	Project Installation impact on BAU	Technology	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.	2	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.*	2	5	Open
R006	Poor Communications signal coverage	Technology	Probability/Impact reduced Aug 2016 due to use of roaming sim cards and availability of backup sites from site selection. 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 (Change from 3)	2 (Change from 4)	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.	2	4	A call for innovation in Celsius development showed that products are available from a number of vendors. A thorough market search will identify as many options as possible. *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	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
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	New Risk There is a risk that the financial reporting contained in the 6 monthly Project Progress Report (PPR) may be inaccurate due to the requirement to submit the document on the 9th of each reporting month. ENWL's finance system compiles project costs on the fifth working day of the subsequent month. This results in a small window for internal approval before release to OFGEM.	3	4	The risk has been highlighted to the ENW finance team and the approval managers, and a delivery plan is agreed for each reporting period however there is still a risk that all finances are not up to date for the last month of the reporting period. This has been brought to the attention of OFGEM.	3	4	Open

Risk Register ID	Risk Title	Project phase/ workstream	Description	Probability score	Impact score	Mitigating action/contingency action	Revised probability score	Revised impact score	Status
R013	Retrofit Monitoring Resource	Project Management	New Risk 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.	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	Open
R014	Monitoring Equipment Firmware updates	Technology	New Risk There is a risk that the monitoring equipment software will need updating due to unforeseen bugs arising during the monitoring trial.	3	4	To reduce the impact of this risk, project partners ASH increased the functionality of the HUB monitoring device to allow for over the air (OTA) software upgrades. This has been tried and tested successfully.	3	4	Open

Appendix B: Summary of project SDRC

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

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

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

Appendix C: Project direction budget

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

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

£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	**168**	**335**	**167**	**1,204**	**1,203**	**(1)**	
Labour - project management	64	77	14	469	469	0	
Labour - general	36	66	30	288	288	0	
Labour - installation/commissioning	68	191	123	448	446	(1)	
Equipment	**659**	**999**	**340**	**1,335**	**1,333**	**(2)**	
Equipment - Materials	23	18	(5)	349	349	(0)	
Equipment - General	0	0	0	0	0	0	
Equipment - Monitoring Equipment	636	981	345	986	984	(2)	Spend profile (plan) varies from delivery of equipment.
Contractors	**237**	**679**	**442**	**1,764**	**1,765**	**0**	
Contractor - Project management	15	6	(9)	74	74	(0)	
Contractor - Close Out	0	2	2	25	25	0	
Contractor - Technology	139	512	374	663	663	0	Spend profile varies from contractor milestone payments.
Contractor - Trials & Analysis	50	90	40	515	515	0	
Contractor - Thermal Flow Study	0	16	16	97	97	0	Thermal Flow study first payment due Jan 2017
Contractor - BAU Process & Tool	12	23	11	165	165	(0)	
Contractor - Customer Survey	10	4	(6)	116	116	(0)	
Contractor - Customer Engagement Activities	11	21	9	53	53	0	
Contractor - Cost Benefit Analysis	0	3	3	32	32	0	
Contractor - Dissemination Activities	0	2	2	24	24	(0)	
IT	**74**	**28**	**-46**	**209**	**209**	**(0)**	
IT - Hardware	0	0	0	0	0	0	
IT - Software	74	28	(46)	209	209	(0)	Variance due to early delivery of back end system.
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	**72**	**288**	**216**	**72**	**537**	**465**	
Contingency	72	288	216	72	537	465	Spend due to LV Monitoring solution contingency
Decommissioning	**0**	**0**	**0**	**29**	**29**	**0**	
Decommissioning	0	0	0	29	29	0	
Other	**50**	**52**	**2**	**231**	**230**	**(1)**	
Other - Rent	5	0	(5)	57	57	0	
Other - Dissemination Activities	45	45	(1)	150	149	(1)	
Other - Other	0	0	0	0	0	0	
Other - DNO Workshop	0	8	8	24	24	0	
Total	**1,260**	**2,381**	**1,121**	**4,876**	**5,338**	**462**	

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 November 2016 month end reporting period.

Lloyds Bank — **Statements and Balances**

Yesterday's Statement — **N397926**

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

Date	Type	Narrative	Value Date	Payments	Receipts	Balance
01JUN16		Opening Ledger Balance				1,324,418.74 Cr
03JUN16	DR	TO A/C TFR 02749020 300002		114,305.33		1,210,113.41 Cr
03JUN16	DR	TO A/C TFR 02749020 300002		50,000.00		1,160,113.41 Cr
03JUN16	DR	TO A/C TFR 02749020 300002		293,387.06		866,726.35 Cr
03JUN16	DR	TO A/C TFR 02749020 300002		75,787.50		790,938.85 Cr
15JUN16	BGC	NO 3 PAYMENTS BGC NIC FUND 3RD DUE			395,319.46	1,186,258.31 Cr
15JUL16	BGC	NO 3 PAYMENTS BGC FUND 15TH JULY2016			395,319.46	1,581,577.77 Cr
09AUG16	CR	INTEREST (GROSS)			547.05	1,582,124.82 Cr
11AUG16	CR	REFUND DEBIT INT			1,022.61	1,583,147.43 Cr
15AUG16	BGC	NO 3 PAYMENTS BGC NIC FUND AUG2016			395,319.46	1,978,466.89 Cr
18AUG16	CR	FROM A/C TFR 02749020 300002			0.01	1,978,466.90 Cr
22AUG16	DR	TO A/C TFR 02749020 300002		0.01		1,978,466.89 Cr
06SEP16	DR	TO A/C TFR 02749020 300002		114,305.33		1,864,161.56 Cr
06SEP16	DR	TO A/C TFR 02749020 300002		293,387.06		1,570,774.50 Cr
06SEP16	DR	TO A/C TFR 02749020 300002		78,640.70		1,492,133.80 Cr
06SEP16	DR	TO A/C TFR 02749020 300002		44,875.75		1,447,258.05 Cr
06SEP16	DR	TO A/C TFR 02749020 300002		75,787.50		1,371,470.55 Cr
09SEP16	CR	INTEREST (GROSS)			389.91	1,371,860.46 Cr
15SEP16	BGC	NO 3 PAYMENTS BGC NIC FUND 15/09/16			395,319.46	1,767,179.92 Cr
16SEP16	CR	FROM A/C TFR 02749020 300002			0.01	1,767,179.93 Cr
19SEP16	DR	TO A/C TFR 02749020 300002		0.01		1,767,179.92 Cr
26SEP16	CR	FROM A/C TFR 02749020 300002			0.01	1,767,179.93 Cr
27SEP16	DR	TO A/C TFR 02749020 300002		0.01		1,767,179.92 Cr
10OCT16	CR	INTEREST (GROSS)			361.68	1,767,541.60 Cr
17OCT16	BGC	NO 3 PAYMENTS BGC NIC FUND 17OCT2016			395,319.46	2,162,861.06 Cr
31OCT16	CR	FROM A/C TFR 02749020 300002			17,317.36	2,180,178.42 Cr
09NOV16	CR	FROM A/C TFR 02749020 300002			75,787.50	2,255,965.92 Cr
09NOV16	CR	FROM A/C TFR 02749020 300002			293,387.06	2,549,352.98 Cr
09NOV16	CR	FROM A/C TFR 02749020 300002			114,405.33	2,663,758.31 Cr
09NOV16	CR	INTEREST (GROSS)			428.67	2,664,186.98 Cr
09NOV16	DR	TO A/C TFR 02749020 300002		237,392.82		2,426,794.16 Cr
09NOV16	DR	TO A/C TFR 02749020 300002		347,040.08		2,079,754.08 Cr
15NOV16	BGC	NO 3 PAYMENTS BGC NIC FUND 15TH NOV			395,319.46	2,475,073.54 Cr
02DEC16	DR	TO A/C TFR 02749020 300002		35,323.73		2,439,749.81 Cr
02DEC16		Value of Credits (18)			2,875,563.96	
02DEC16		Value of Debits (15)		1,760,232.89		
02DEC16		Closing Ledger Balance				2,439,749.81 Cr
02DEC16		Closing Cleared Balance				2,439,749.81 Cr

*** End of Report ***

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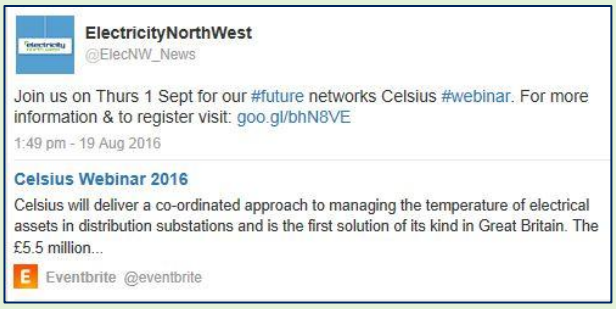
Notes:

A number of 1 penny transfers are shown which are test movements performed by ENWL finance team.

There was a double entry payment error of £114,305.33, £293,387.06 and £75,787.50 on the 06 September that was subsequently corrected on the 09 November.

Appendix F: Celsius communications register

Date	Activity	Audience	Evidence
Jun 2016	Article in Connect bulletin	All employees	
Jul 2016	Yammer update	All employees	
Jul 2016	Website	All stakeholders	www.enwl.co.uk/celsius
Jul 2016	Industry newsletter	All stakeholders	Newsletter page
Jul 2016	Website promoted on Yammer	All employees	
Aug 2016	Webinar promoted on Linked In	All stakeholders	

Date	Activity	Audience	Evidence
Aug 2016	Webinar promoted on Twitter	All stakeholders	
Sep 2016	Webinar	All stakeholders	Webinar recording Webinar slides and feedback
Sep 2016	Webinar recording promoted on Linked In	All stakeholders	
Sep 2016	Webinar recording promoted on Twitter	All stakeholders	
Sep 2016	Webinar promoted internally in Connect bulletin	All employees	
Oct 2016	Advertorial	Industry stakeholders	Advertorial
Oct 2016	LCNI conference	Industry stakeholders	Slide presentation
Oct 2016	Industry newsletter	All stakeholders	Newsletter page

Date	Activity	Audience	Evidence
Oct 2016	Promotion of LCNI conference in internal magazine and Connect e-bulletin	All employees