Question No.	From	Proforma section	Criteria	Topic	Question	Date question asked	Date response required	Date received	Follow up to Question #	Confidential (y/n)	Attachments
1	GE	2	NA	Aims & Objectives	The fundamental idea behind this project is clear. However, there appears to be something of a discontinuity that could affect its value. On page 3 there is reference to "six times" current peak demand growth. In contrast, the case study on page 13 implies significantly less growth (i.e. 500kVA to 1000kVA). Can you resolve these positions?	25 August 2015	27 August 2015	27 August 2015		N	
2	GE	All	NA	General	No reference is made in the submission to the work of SGF WS7. As WS7 is modelling system operation at the secondary distribution level could its results be useful to the Celsius project?	25 August 2015	27 August 2015	27 August 2015		N	
3	GE	4e	e	Project Partners	Would it be possible to involve all the DNOs in the development of the site selection methodology to increase the chance of wide acceptance of the project's outcomes?	25 August 2015	27 August 2015	27 August 2015		N	
4	GE	2	NA	Aims & Objectives	On page 5 it says that the sample of substations will cover 80% of GB substations. What evidence do you have to support this? Are you confident that the other DNOs will agree?	25 August 2015	27 August 2015	27 August 2015		N	
5	GE	All	NA	General	Might it be useful to include sites outside of ENW to provide a wider range of ambient conditions? South west (warmer) & Scotland (cooler)?	25 August 2015	27 August 2015	27 August 2015		N	
6	GE	8	NA	Customer Impact	What possible impacts (e.g. noise, visual intrusion) do you think are most likely to cause customer rejection of this approach?	25 August 2015	27 August 2015	27 August 2015		N	
7	GE	2	NA	Aims & Objectives	On page 9 there is reference to a 25% loading level. Is this referring to peak loading? What proportion of secondary substations are only loaded to less than 25% of their peak rating?	25 August 2015	27 August 2015	27 August 2015		N	
8	GE	3	NA	Business Case	On page 11 it says that load diversity is lowest at that secondary distribution level. Is there good evidence that this is true across all DNOs?	25 August 2015	27 August 2015	27 August 2015		Y	
9	GE	3	NA	Business Case	Figures 3.2 and 3.3 are not like-for-like comparisons. It would be better to show this comparison on a £/kW of extra capacity basis.	25 August 2015	27 August 2015	27 August 2015		N	
10	GE	Appendix C	NA	Appendix C	The cooling technologies listed in Appendix C all seem credible but are not described in detail. Could you provide additional detail as to how cooling technologies could be applied to a PMT (for example) on the basis that they would be applied using live working methods.	25 August 2015	27 August 2015	27 August 2015		N	
11	GE	General	NA	General	Do you have good evidence that the cable backfill option can be applied in a third of the time of the cable replacement method?	25 August 2015	27 August 2015	14 September 2015		N	
12	CO	2, 3, p12	(a)	Capacity released	Changing the shape of the load profile (with the addition of LCTs to the distribution networks) will change the relationship between loading and temperature. This might have an impact on the capacity released using thermal monitoring and retrofit cooling as the uptake of LCTs (and other interventions) increases over time. It is acknowledged that this will be difficult to quantify without proceeding with the trials; however, is this something which should be considered when assessing the confidence in capacity released? Could the worst-case scenario be presented, either by means of a detailed literature review or by making worst-case assumptions?	08 September 2015	14 September 2015	14 September 2015		N	
13	CO	3, p17	(a)	Delivery time	In the comparison of delivery times to the base case, thermal monitoring has been given a 'delivery time' of 1 week. It	08 September 2015	14 September 2015	14 September 2015		N	
14	CO	3, p12	(a)	Capacity released	The CLNR lessons learned report comments that it is unclear what the capacity of a transformer is likely to be under back feeding conditions. With the increase in PV connected to distribution networks, back feed conditions may be applicable. Are back-feed conditions likely to be any different for the transformers on the ENWL network? Could the overall benefits of the scheme be reduced if back feeding conditions are taken into account?	08 September 2015	14 September 2015	14 September 2015		N	
15	CO	3, p12	(a)	Capacity released	As extra load is put through the transformer, it might be possible that there is insufficient tap range to keep the system voltage within limits. Will this be considered as part of site selection? Is it clear whether and how this might affect the number of transformers suitable to see increased load?	08 September 2015	14 September 2015	14 September 2015		N	
16	CO	Appendix B (p61-62), Appendix C; Section 4, p17	(a)	Cooling	You plan to use approximately 20 different retrofit cooling technology types in total across both transformer types and LV cables, which appears ambitious. Given that these technologies have not yet been selected (this is part of the project plan), can you provide additional confidence that the installation times are achievable?	08 September 2015	14 September 2015	14 September 2015		N	
17	CO	Page 64, Section B.1.5, and Project Plan – Appendix F	(a)	Cooling	Regarding 'Improved substation ventilation' – a retrofit cooling technique – the number, positioning and size of vents and fans can be optimised using computational fluid dynamics studies to model thermal flows in detail. This will inform future substation design for a range of standard configurations, taking into account fume, fire and sound considerations (page 64). It is not clear if this is in addition to the thermal flow study (Section B.1.5), nor is it clear in the project plan who is carrying out the CFD or whether this might be an unplanned project expense. Is this analysis in addition to the thermal flow study and has it been planned into the project?	08 September 2015	14 September 2015	14 September 2015		N	
18	CO	Appendix A.1 and submission spreadsheet	(b)	Costs	The Celsius methods cost from as little as £100. From analysis of the submission spreadsheet, these method costs do not include installation costs. It is assumed that installation costs will, therefore, also not be included in the calculation of the 'base case' costs (pg 49 – Appendix A). Would the inclusion of installation costs into the comparison of the Celsius methods with the base case would provide a more accurate picture?	08 September 2015	14 September 2015	14 September 2015		N	
19	CO		(b)	Costs	It is not considered in the submission that both a transformer and a cable may be pinch points and therefore both have to be monitored – and possibly cooled – simultaneously in order to achieve the maximum capacity release. Could this scenario increase the Celsius method costs in a significant number of substations?	08 September 2015	14 September 2015	14 September 2015		N	
20	CO	Section B.2.2 page 58 and Project Plan, Appendix F	(b)	Costs	What added value does the Parsons Brinckerhoff peer review process bring to the project?	08 September 2015	14 September 2015	14 September 2015		N	
21	CO	Appendix B.2	(b)	NIA Project	It is not clear whether and how the site selection (other aspects of the project may well also be applicable) could be aligned with some of the learning outcomes of the Distribution Asset Thermal Modelling NIA project. How will these projects be managed simultaneously to get the best value for money from both projects?	08 September 2015	14 September 2015	14 September 2015		N	
22	CO	p57 and the Risk Register-Appendix G	(c)	Rollout	One of the key outputs of this project is the functional specification to facilitate this method becoming BAU. The strategic decision to thermally improve an asset and hence postpone its replacement is a fundamental change to operating procedures. The mechanism to instruct this change has not yet been identified (page 57). For one, communication of the functional specification will be paramount. It is briefly addressed in the proposal (risk register) that attendance at learning dissemination events may be low due to the number of similar events already taking place. Have you considered any approaches to specifically to run through the technical detail of the specification and thermal ratings tool with the relevant operations teams?	08 September 2015	14 September 2015	14 September 2015		N	
23	CO		(e)	Contractual arrangements	Please provide more detail on the contractual arrangements.	08 September 2015	14 September 2015	14 September 2015		N	
24	CO		(g)	Comms	What efforts have been made to ensure a suitable low cost communication solution is available and what learning from other project has been considered?	08 September 2015	14 September 2015	14 September 2015		N	
25	CO		(g)	RTTR	Does ENWL have confidence that the solution provided by ASH is at a suitably advanced TRL, and can be delivered to time and cost?	08 September 2015	14 September 2015	14 September 2015		N	
26	CO	p58	(g)	Transformers	Transformers that are <25% loaded at peak times are not monitored: bearing in mind that these transformers may one day be subject to the Celsius method, it might be possible that this leads to an omission of a particular type of transformer in the thermal analysis. Has any investigation into the transformers that are <25% rated been performed to ensure they do not fit into a particular type?	08 September 2015	14 September 2015	14 September 2015		N	
27	CO	Appendix C	(g)	Methodology	Is five instances of each retrofit cooling technology enough to give conclusive readings that are statistically robust?	08 September 2015	14 September 2015	14 September 2015		N	
28	CO	Risk Register – Appendix G, page 76	(g)	Methodology	Data received from the substation monitoring is being continuously validated (to mitigate against lost data): there may be a cheaper and more efficient way of achieving this function autonomously if this isn't already considered. How is this monitoring of data addressed?	08 September 2015	14 September 2015	14 September 2015		N	
29	CO	Risk Register – Appendix G	(g)	Risks	There do not appear to be any risks relating to the technologies not performing as expected (i.e. the monitoring and cooling, if applicable, fail to reach near to the maximum increase in capacity (18% for PMT, 47% for GMT, and 25% for LVC – calculated from figures given in the submission)). Please explain this omission.	08 September 2015	14 September 2015	14 September 2015		N	
30	TA	Section 6	(g)	Project readiness	Please explain why you are not seeking protection from cost overruns.	10 September 2015	14 September 2015	14 September 2015		N	
31	EP		(a)	Losses	Have you considered the extent of additional losses of running a substation at a higher temperature?	17 September 2015	22 September 2015	22 September 2015		N	
32	TA	p.39	(b)	Incentives	Please explain how you have calculated the required protection from the reliability and availability incentives impact.	06 October 2015	09 October 2015	09 October 2015		Y	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	01
Question date	25/8/2015	Answer date	27/8/2015
Submission section question relates to	Section 2		
Topic	Aims & Objectives		
Question	The fundamental idea behind this project is clear. However, there appears to be something of a discontinuity that could affect its value. On page 3 there is reference to “six times” current peak demand growth. In contrast, the case study on page 13 implies significantly less growth (i.e. 500kVA to 1000kVA). Can you resolve these positions?		
Notes on question			
Answer	Figure 2.1 is illustrative and shows today’s network scaled for peak demand after diversity of approximately 2kW .The figure of “six times” peak demand growth is based on the peak demand growth of an individual customer assuming both electric vehicle and heat pump uptake and is presented to be indicative of an upper value without diversity. Uptake of low carbon technology will be geographically clustered and may also be clustered by time of the day, so customer load on specific feeders and substations may become more similar and less diverse. However, the future average after diversity value on an individual customer basis (averaged over all Electricity North West LV customers) will be somewhat lower than the figure of “six times” current peak demand growth. The case study on page 13 is for a high load growth path derived from the DECC 1 scenario for the Electricity North West area. We recognise that load growth for individual secondary assets may follow a wide range of load growth paths due to clustering of low carbon technology uptake with customers and have considered this in our business case analysis. This load growth path is representative of how the average after diversity maximum demand may increase over time due to LCT uptake. Potential benefits of Celsius have been calculated using this DECC scenario.		

Attachments	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	02
Question date	25/08/2015	Answer date	27/05/2015
Submission section question relates to	All		
Topic	General		
Question	No reference is made in the submission to the work of SGF WS7. As WS7 is modelling system operation at the secondary distribution level could its results be useful to the Celsius project?		
Notes on question			
Answer	The WS7 Distribution System 2030 (DS2030) project is undertaking technical studies of urban and rural networks to assess the likely effect of distributed generation and demand growth (EV and HP). WS7 looks at the use of smart solutions such as dynamic line rating, meshing and DSR to confirm the technical viability of the future distribution system and provide an understanding of its characteristics. Electricity North West and Ricardo-AEA are involved in SGF WS7 and are well placed to optimise learning in the Celsius Project. Consideration of the benefits in Section 3 uses the RIIO-ED1 business plans and specific DECC demand and generation scenarios as a base line. These scenarios have been reviewed and revised by WS7 to identify development of constraints in secondary substations as the power flows change in the future. The revised scenarios and other outputs will be considered as part of the Celsius business case analysis and carbon impact assessement. The results of the Celsius study would be a valuable input into any future smart system modelling projects. This will be supported through dissemination activities to industry and wider audiences.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	03
Question date	25/08/2015	Answer date	27/08/2015
Submission section question relates to	Section 4e		
Topic	Project Partners		
Question	Would it be possible to involve all the DNOs in the development of the site selection methodology to increase the chance of wide acceptance of the project's outcomes?		
Notes on question			
Answer	The site selection methodology for Celsius (Appendix B.2) has been devised to ensure the Project is relevant and transferrable over as much of the GB network as possible. The criteria detailed in the site selection methdology is applicable to all GB DNOs as there are limited substation enclosure options, and assets are selected from a relatively small number of large manufacturers using national specifications. The site selection methodology will be further refined in project delivery with our DNO Project Partner UK Power Networks. As UKPN and Electricity North West cover four licence areas, providing a robust cross section of network types for consideration, additional involvement from DNOs is not considered necessary.The site selection methodology will also be peer reviewed by Project Partner Ricardo-AEA to ensure that site selection is representative of the GB distribution network.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	4
Question date	25/08/2015	Answer date	27/08/2015
Submission section question relates to	2		
Topic	Aims and Objectives		
Question	On page 5 it says that the sample of substations will cover 80% of GB substations. What evidence do you have to support this? Are you confident that the other DNOs will agree?		
Notes on question			
Answer	To develop the sample size for Celsius, an analysis of the Electricity North West transformer population was carried out. The assets were split into pole mounted and ground mounted and then categorised by substation enclosure, transformer specification and transformer rating. In order to achieve 90% coverage of the Electricity North West population, 67 ground-mounted categories and 17 pole-mounted categories were included as detailed in the trial size methodology (Appendix B.3). As stated in the answer to Q3, the substation criteria detailed in the site selection methdology is applicable to all GB DNOs as there are limited substation enclosure options, and assets are selected from a relatively small number of large manufacturers using national specifications. Exceptions to the criteria will exist, but be relatively immaterial. As a result, the sample size chosen to be representative of Electricity North West was deemed to be substantially representative of the GB system.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	05
Question date	25/08/2015	Answer date	27/05/2015
Submission section question relates to	All		
Topic	General		
Question	Might it be useful to include sites outside of ENW to provide a wider range of ambient conditions? South west (warmer) & Scotland (cooler)?		
Notes on question			
Answer	In the North West region, we experience a wide range of environmental conditions: from the uplands of northern England to urban areas in the south of our licence area. The temperature ranges from an average daily high in August of 21°C, to an average daily low in Janary of 0°C. The highest and lowest recorded temperatures in the North West of England are 35°C and -22°C (data from the Met Office website). This compares to GB as a whole, with a temperature range of 24°C (daily average high in August in the south of England) to -2°C (daily average low in January in the east of Scotland), and highest and lowest recorded temperatures of 39°C and -27°C (data from the Met Office website). While expanding the Celsius trials outside of the Electricity North West area could offer a slightly wider range of ambient conditions to measure, the additional range of temperatures is relatively small, and the highest and lowest of the temperatures that could be experienced cannot be guaranteed during the live trials. Therefore, no obvious additional learning was anticipated by expanding the trial sites outside of the Electricity North West area and the increased project management and logisitcal costs and delivery risks were not considered good value for customers. The aim of Celsius is to develop the methodology to understand the thermal capacity of secondary network assets, and how this is impacted by environment and loading conditions. These conditions include the weather and ambient temperature. This understanding can then be used to gain insight on the impact of conditions outside of those recorded. Once the methdology is developed it is very easily transferable to other parts of GB		

	which may have slightly different ambient temperature ranges.
Attachments	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	06
Question date	25/08/2015	Answer date	27/08/2015
Submission section question relates to	Section 8		
Topic	Customer Impact		
Question	What possible impacts (eg noise, visual intrusion) do you think are most likely to cause customer rejection of this approach?		
Notes on question			
Answer	Testing customer acceptance of a range of cooling interventions is a key part of the Celsius trial. The addition of forced cooling interventions, such as fans, may potentially increase background noise levels at substations, which might be more noticeable to customers residing in close proximity, particularly during the night. We will ensure that cooling interventions do not breach permissible acoustic limits. Similarly, modifications to equipment such as retrofitting fins, changing the colour or fitting shades might significantly alter the appearance of equipment. We recognise that customers can be sensitive to both general disturbance associated with works at substation sites and particularly sensitive to changes that affect the long-term/permanent aesthetic of assets. These sensitivites are most likely to be observed amongst customers residing in close proximinty to the substations, particularly where the property directly overlooks the site. Engaging with customers during the design phase of the Project, educating them about the wider benefits of Celsius and testing customer acceptability of specific cooling interventions will ensure that suitable solutions are developed and deployed at appropriate sites. This research will support the future implementation of the solution more widely across Electricity North West's network and ultimately, enable Celsius to be sucessfully adopted by all GB DNOs.		

	We have well established procedures in place to assess noise disturbance and deal with customer concerns around the visual amenity of assets. Any customer enquiry/complaint of noise disturbance or detriment to visual amenity resulting from the installation of a cooling intervention will be investigated on an individual basis to attain an acceptable resolution.
Attachments	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	07
Question date	25/08/2015	Answer date	27/08/2015
Submission section question relates to	Section 2		
Topic	Aims and Objectives		
Question	On page 9 there is reference to a 25% loading level. Is this referring to peak loading? What proportion of secondary substations are only loaded to less than 25% of their peak rating?		
Notes on question			
Answer	The threshold of 25% loading represents the peak loading of the assets, below which the asset is considered too lightly loaded in order to be included in the trial. Celsius is concerned with assets which are thermally loaded and constrained. Though it is not a requirement of the site selection to select sites that are themselves thermally constrained, the sites should be adequately loaded to permit a useful trial. The preliminary work carried out by project partners Ricardo-AEA shows that where assets are very lightly loaded (ie < 25%), the operating temperature is much less impacted by loading conditions. This is because there is not enough energy passing through the asset to significantly alter its temperature. The proportion of secondary substations loaded to less than 25% of their peak rating in Electricity North West is currently around a third of the population.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	08
Question date	25/8/2015	Answer date	27/8/2015
Submission section question relates to	Section 3		
Topic	Business Case		
Question	On page 11 it says that load diversity is lowest at that secondary distribution level. Is there good evidence that this is true across all DNOs?		
Notes on question			
Answer	As a distribution substation is a single demand point, it faces a defined demand profile, the result of diversity below it. In this introductory comment, low load diversity at the secondary distribution transformer was meant to express that the combined peak effect of customer load on the secondary networks can be the result of customers behaving in similar, non-diverse ways, as there is less potential for averaging out amongst customers, relative to HV and EHV assets serving a larger number of customers. This is common to all DNOs. In general, as we meant it, load diversity can be lowest at secondary substation level. Customer load connections at LV are often of a similar nature eg residential, and similar socio-economic groups, thus customer load tends to be clustered temporally. The connection of low carbon technology will exacerbate this further, as there may be little difference (diversity) in the load profiles of a group of heat pumps in a geographical cluster and operating at a similar time of day. At higher voltage levels, different types of load profiles, eg residental, commercial and industrial, different socio-economic groups, combine to increase diversity and loading is comparatively reduced. This may not hold true in specific instances due to the connection of large commercial or industrial customers at 11kV or 33kV reducing load diversity. However, this is the exception rather than the norm. We appreciate that using low/ high ‘load diversity’ to express whether		

	customers are acting similarly (non-diversely) or differently (diversely) may have been confusing. Load diversity is sometimes expressed in different ways eg as the sum of the peak loads for individual customers (or assets) relative to either the combined peak load or to the average load. In this sense we may think of limited diversity in customer behaviour at LV as having a high effect on average load relative to possible peak load, expressed as an after-diversity value.
Attachments	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

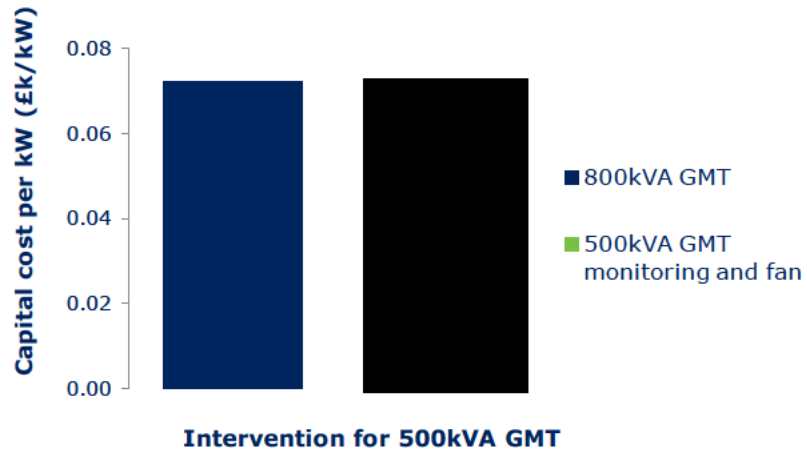
Project: Celsius

Tick if this answer has been provided verbally: ☐

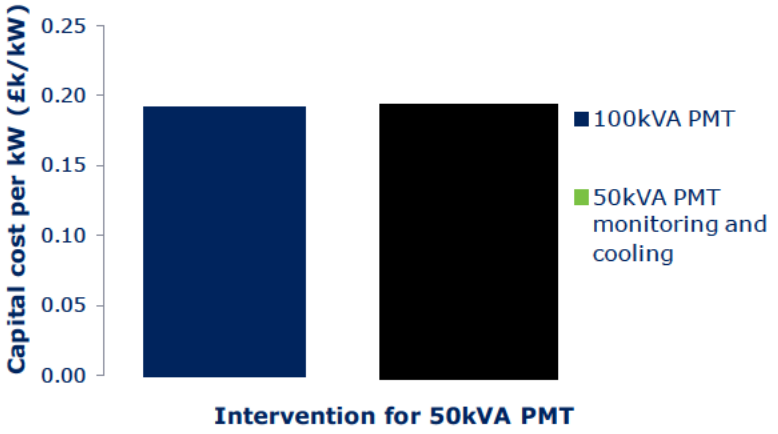
Project code	ENWEN 01	Question Number	09
Question date	25/8/2015	Answer date	27/8/2015
Submission section question relates to	Section 3		
Topic	Business Case		
Question	Figures 3.2 and 3.3 are not like-for-like comparisons. It would be better to show this comparison on a £/kW of extra capacity basis.		
Notes on question			
Answer	Figures 3-2 and 3-3 present capital costs for traditional reinforcement and for Celsius for representative PMT, GMT and LV cable first leg out assets. We recognise that presenting in terms of a capital £/kW metric for each representative asset class would also be helpful for comparison. We have provided this comparison in the tables below. This supports our business case by showing that Celsius offers additional thermal capacity at value for money whilst reducing the risk of stranded assets.		

Attachments	

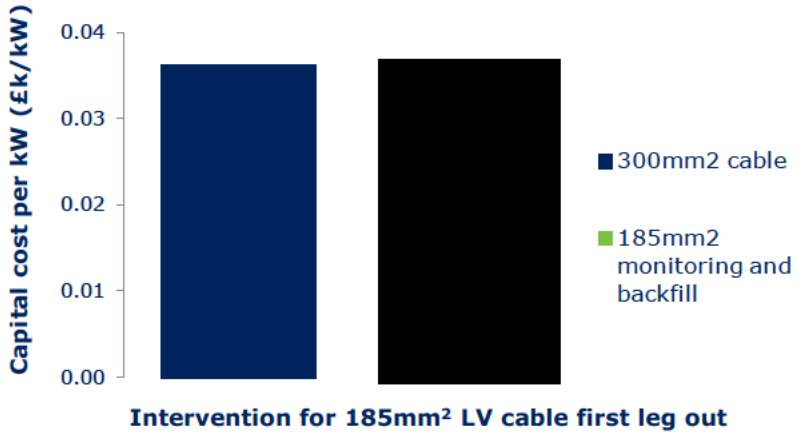
Capital £/kW of intervention for 500kVA GMT



Capital £/kW of intervention for 50kVA PMT



Capital £/kW of intervention for 185mm² LV cable first leg out



Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	10
Question date	25/08/2015	Answer date	27/08/2015
Submission section question relates to	Appendix C		
Topic	Appendix C		
Question	The cooling technologies listed in Appendix C all seem credible but are not described in detail. Could you provide additional detail as to how cooling technologies could be applied to a PMT (for example) on the basis that they would be applied using live working methods.		
Notes on question			
Answer	An important part of the Celsius project will be the identification, installation and demonstration of retrofit cooling techniques which will be used to cool substations and their assets, thereby releasing thermal capacity. During the Celsius bid development, potential example cooling technologies have been identified (Appendix C), including information gathered through a call for innovation. The cooling techniques to be demonstrated in the Celsius trials have not yet been selected. During the Celsius project, we will investigate potential options and review these with other DNOs. Ease of installation will be considered and it is expected that the majority of the cooling technologies could be installed on live assets and without the need for shutdowns. Installation methodologies will be defined as part of the trial. In Appendix B.2 we recognise that some technologies will only be suitable for certain applications and this will be considered when selecting both the technologies to be used and the sites they will be used at. At this stage we do not anticipate fitting the cooling technology using live line techniques on pole-mounted substations. Methods for on-load application of cooling techniques, for example using live line teams and lifting equipment, or hot-stick type apparatus to install from the ground will be explored. However, it may also be concluded that for the small numbers		

	of cooling installations to be carried out within the project, and considering that these are innovative technologies, that the installations may be performed with generator support for customers. If results show significant advantages, then further work may be done to understand the potential of live installation. These tasks are not currently within the scope of works of Celsius.
Attachments	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	11
Question date	25 August 2015	Answer date	27 August 2015
Submission section question relates to	General		
Topic	General		
Question	Do you have good evidence that the cable backfill option can be applied in a third of the time of the cable replacement method?		
Notes on question			
Answer	The overall timeframefor the Celsius cable backfill option has been assessed by experienced engineers and planners against traditional cable replacement techniques typically used on reinforcement projects. Traditional reinforcement of the LV cable “first leg” out of a substation requires replacement of the constrained cable with a higher rated asset. The installation process includes time taken from the original identification of the requirement through planning, shutdown notification and the scheduling and deployment of skilled jointing resource to final reinstatement. This technique involves customer interruptions and would usually take a minimum of 12 weeks. For the Celsius cable backfill option, the existing cable is retained hence cable jointing is not required. There are also no associated shutdowns requiring a notification period and no customer interruptions. The majority of the work would be undertaken by our excavate and lay contractors and is estimated to take around four weeks. Taking into account the ease of the Celsius cable backfill option compared to cable replacement, it is evident that Celsius can significantly reduce the time taken to intervene on a constrained cable section compared to traditional reinforcement options.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	12
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to	Section 2 & 3 pg 12		
Topic	Capacity released		
Question	Changing the shape of the load profile (with the addition of LCTs to the distribution networks) will change the relationship between loading and temperature. This might have an impact on the capacity released using thermal monitoring and retrofit cooling as the uptake of LCTs (and other interventions) increases over time. It is acknowledged that this will be difficult to quantify without proceeding with the trials; however, is this something which should be considered when assessing the confidence in capacity released? Could the worst-case scenario be presented, either by means of a detailed literature review or by making worst-case assumptions?		
Notes on question			
Answer	The capacity released for Celsius as presented in the bid is simply based on comparison of hotspot temperature for a flat load profile which is a conservative assumption already. It was felt that this would provide a good baseline for identifying potential capacity release and is consistent with planned integration into business as usual as an enhanced rating. We recognise that there is significant uncertainty regarding the impact of low carbon technology uptake on future LV network load profiles. Measuring the dynamic thermal behaviour of the assets during the Celsius project should enable an improved thermal characterisation and understanding of aging to be developed, including the impact of rapid changes in loading and sustained loading. This could potentially lead to hotspot temperature overshoot, however, this would be considered in the context of the probability of such rapid load increases with changing load profiles and the corresponding risk which may be minimal. In general therefore we consider that whilst load shape does affect temperature it is not as material when		

	using actual temperatures rather than forecast temperatures as defined in present rating tables. These of course being based on a statistical approach under assumed peak conditions and assumed load duration curves.
Attachments	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	13
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to	Section 3 pg 17		
Topic	Delivery time		
Question	In the comparison of delivery times to the base case, thermal monitoring has been given a 'delivery time' of 1 week. It is assumed that this is for installation only and does not take into account the monitoring period required to determine the capacity release of the asset. Should the monitoring period be taken into account for a better comparison?		
Notes on question			
Answer	Thermal monitoring delivery time of one week is for Celsius as business as usual. The decision to deploy the monitoring in a BAU scenario will be based on the assessment of smart meter data and instigated at a threshold below the current mandated intervention point. The low cost sensors will be attached magnetically reducing installation costs. The metering data has already indicated the load curve and hence potential times when existing capacity may be exceeded. Therefore we envisage that the monitoring may only be needed for a short time to determine that asset's peak temperature and hence available capacity. The Thermal Ratings Tool, one of the Celsius deliverables, will then quickly translate the external temperature measurement to hotspot temperature and determine the capacity release. It will also highlight whether a further cooling intervention is required at that point.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	14
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to	Section 3 pg 12		
Topic	Capacity released		
Question	The CLNR lessons learned report comments that it is unclear what the capacity of a transformer is likely to be under back feeding conditions. With the increase in PV connected to distribution networks, back feed conditions may be applicable. Are back-feed conditions likely to be any different for the transformers on the ENWL network? Could the overall benefits of the scheme be reduced if back feeding conditions are taken into account?		
Notes on question			
Answer	During preparation of our bid submission, we discussed the CLNR project outputs with colleagues from Northern PowerGrid and how learning might be incorporated into Celsius. The CLNR report suggests that in areas of high PV, there will be points on the load curve where generation exceeds demand and “back feed” or “reverse power flow” conditions may exist. The “reverse power flow” conditions seen on the Northern PowerGrid network will be the same for Electricity North West and all other DNOs. As these conditions would tend to occur in the middle of a summer’s day when loads are low the benefits of Celsius would not be reduced. Celsius will monitor temperature so the effects of reverse power flow will be seen and the capacity available from the thermal effects of PV can be assessed.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	15
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to	Section 3 pg 12		
Topic	Capacity released		
Question	As extra load is put through the transformer, it might be possible that there is insufficient tap range to keep the system voltage within limits. Will this be considered as part of site selection? Is it clear whether and how this might affect the number of transformers suitable to see increased load?		
Notes on question			
Answer	It is possible that increases in load may cause issues with system voltages at the end of LV feeders; as this does occur with traditional reinforcement. We have recognised this issue and are trialling and demonstrating innovative solutions to system voltage in our second tier project Smart Street. Celsius seeks to solve thermal constraints and complements the Smart Street solution enabling increase in transformer load. If this were not the case, then traditional solutions to increase transformer load would also be subject to the same issue. We note that issues with LV voltage limits are caused primarily on feeders not at LV busbars.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	16
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to	Appendix B (p61-62), Appendix C; Section 4, p17		
Topic	Cooling		
Question	You plan to use approximately 20 different retrofit cooling technology types in total across both transformer types and LV cables, which appears ambitious. Given that these technologies have not yet been selected (this is part of the project plan), can you provide additional confidence that the installation times are achievable?		
Notes on question			
Answer	In preparation for the Celsius bid submission we undertook analysis of cooling technology options with operational colleagues, consultants and a call for innovation through the Energy Innovation Centre. The list of options identified can be found in Appendix C. Retrofit cooling technologies to be demonstrated during Celsius will be considered against a range of criteria listed in Section B.1.4 on page 55. Evaluation criteria will include installation processes and requirements. It is intended to identify around 20 examples for trial. This may include multiple versions or configurations of one technology type (for example, two different types of cable duct backfill material from different manufacturers, or two different configurations of ventilation fans). Some of the techniques, such as fans, are already used in other industries and at higher voltage levels and installation procedures are well known. Other cooling techniques are less well understood and there is the potential that installations will be more complex. In consideration of this, the time allocated for installation of retrofit cooling includes two months to define the installation plan followed by a six month installation programme.		

Attachments	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	17
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to	Pg 64, Section B.1.5, and Project Plan – Appendix F		
Topic	Cooling		
Question	Regarding 'Improved substation ventilation' – a retrofit cooling technique – the number, positioning and size of vents and fans can be optimised using computational fluid dynamics studies to model thermal flows in detail. This will inform future substation design for a range of standard configurations, taking into account fume, fire and sound considerations (page 64). It is not clear if this is in addition to the thermal flow study (Section B.1.5), nor is it clear in the project plan who is carrying out the CFD or whether this might be an unplanned project expense. Is this analysis in addition to the thermal flow study and has it been planned into the project?		
Notes on question			
Answer	Investigations into the optimisation of substation ventilation using CFD will be undertaken as part of the thermal flow study activities. The thermal flow study will be divided into two parts: Phase 1 – Investigating the configurations and ventilation within existing substations. The outcome of this phase will be a set of recommendations for business as usual new build substation design, and potentially recommendations for retrofit changes for existing ventilation, particularly where there are existing thermal issues. Phase 2 – Using the methods and models developed in phase 1 to investigate the more suitable retrofit cooling techniques. In order to promote value for money within Celsius, the thermal flow study will be competitively tendered within the project. Therefore the provider of these activities has not been defined. The development of the preliminary scope and budget allocation was carried out during consultation with two		

	potential providers (Ricardo UK and the University of Surrey); to ensure that they are a reasonable representation of what is realistically achievable.
Attachments	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	18
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to	Appendix A.1 and submission spreadsheet		
Topic	Costs		
Question	The Celsius methods cost from as little as £100. From analysis of the submission spreadsheet, these method costs do not include installation costs. It is assumed that installation costs will, therefore, also not be included in the calculation of the 'base case' costs (pg 49 – Appendix A). Would the inclusion of installation costs into the comparison of the Celsius methods with the base case would provide a more accurate picture?		
Notes on question			
Answer	The costs for installation of retrofit thermal monitoring will be less than would be required for installing a monitor before proceeding with conventional reinforcement. As these costs occur in both the Celsius Method and the Base Cases, they have been disregarded. The difference in installation cost is not expected to have a material effect on the business case when reviewed in the context of the timing and magnitude of capital costs for Celsius and the Base Case.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	19
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to			
Topic	Costs		
Question	It is not considered in the submission that both a transformer and a cable may be pinch points and therefore both have to be monitored – and possibly cooled – simultaneously in order to achieve the maximum capacity release. Could this scenario increase the Celsius method costs in a significant number of substations?		
Notes on question			
Answer	Celsius costs and benefits are based on the number of interventions not where they occur. The Celsius method for transformers and for LV cables first leg out is analysed independently in the business case. There may actually be opportunity for some cost savings if retrofitting of cooling interventions is undertaken at thermally constrained assets in the same substation concurrently and this would increase potential benefits. It may also be the case that all LV feeders out of a distribution transformer are heavily loaded and applying the Celsius method to both the transformer and the LV cables still results in the transformer constraining the LV cables from carrying full potential capacity. However, based on our analysis of the DECC 1 scenario for Electricity North West, there were a very limited number of LV cables in the same substations that were simultaneously overloaded so this seems a low probability scenario.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	20
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to	Section B.2.2 pg 58 and Project Plan, Appendix F		
Topic	Costs		
Question	What added value does the Parsons Brinckerhoff peer review process bring to the project?		
Notes on question			
Answer	Following a discussion with Tim Aldridge, we understand this question to be related to the peer review referred to on line 23 of our project plan. This work will be undertaken by our Project Partner Ricardo-AEA. Parsons Brinckerhoff will have no involvement in the delivery of Celsius. Ricardo-AEA is an engineering consultancy with significant experience and expertise in the fields of thermal modelling and asset temperature analysis. The peer review ensures and confirms that the selected sites enable effective performance of the monitoring and analysis by including the necessary categories of assets. The site selection methodology will be written by Electricity North West as this was judged to deliver the best value for money. Ricardo-AEA will investigate and identify links between asset hot spot temperature and external asset temperature. This will validate the work carried out and provide a second level of confidence.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	21
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to	Appendix B.2		
Topic	NIA Project		
Question	It is not clear whether and how the site selection (other aspects of the project may well also be applicable) could be aligned with some of the learning outcomes of the Distribution Asset Thermal Modelling NIA project. How will these projects be managed simultaneously to get the best value for money from both projects?		
Notes on question			
Answer	Our NIA project, Distribution Asset Thermal Modelling, due to finish in January 2017, concludes work undertaken in the IFI project detailed in Appendix D. Learning from this project will be utilised as part of the work to develop the Celsius thermal coefficients. Deliverables of this NIA project are a planning tool for cables that will allow us to model low carbon technology uptake, future loads and their effect on LV cables, and a thermal failure tool for transformers. This tool will produce an estimation of transformer life remaining based on loading. The calculations that are used for the failure tool and the planning tool may be relevant in development of the Thermal Ratings Tool to support investment decisions for deployment of Celsius.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	22
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to	pg57 and the Risk Register- Appendix G		
Topic	Rollout		
Question	One of the key outputs of this project is the functional specification to facilitate this method becoming BAU. The strategic decision to thermally improve an asset and hence postpone its replacement is a fundamental change to operating procedures. The mechanism to instruct this change has not yet been identified (page 57). For one, communication of the functional specification will be paramount. It is briefly addressed in the proposal (risk register) that attendance at learning dissemination events may be low due to the number of similar events already taking place. Have you considered any approaches to specifically to run through the technical detail of the specification and thermal ratings tool with the relevant operations teams?		
Notes on question			

Answer	The business as usual process and associated tool will form a code of practice for internal business use. This code of practice will be rolled out across the business using the change control procedures currently in place. Electricity North West has a great track record with holding successful dissemination events which are generally well attended. The dissemination channels and methods will be tailored to the needs of the specific stakeholder. Where there may be a need to hold events specifically aimed at distribution network operators' representatives we will offer technical workshops on a one-to-one basis. This will allow for focussed learning dissemination and facilitate specific training and coaching on the application of Celsius and the Thermal Ratings Tool.
Attachments	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	23
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to			
Topic	Contractual arrangements		
Question	Please provide more detail on the contractual arrangements.		
Notes on question			
Answer	In consideration of the obligations on ourselves and Partner organisations when delivering a Network Innovation Competition (NIC) funded project, we have adapted our business as usual terms and conditions for delivery of Celsius. These have been drafted by our solicitor to ensure compliance with the Network Innovation Competition Governance Document. Partner and supplier contracts include a defined term for Regulatory Projects (meaning a project funded or part funded through the innovation competition). This highlights that there will be a focus on working in partnership throughout the project to promote the objectives of Celsius. Default NIC IPR arrangements apply. Contract schedules reflect the agreed roles, responsibilities and budget for the services, and include the project plan and timescales for achievement of project deliverables. Learning experienced throughout project delivery may require adapting the scope or plan to maximise knowledge generated from Celsius. To enable a robust approach to this, the Schedules also set out a prescribed change control procedure. Whilst every endeavour is made to ensure that contracts run smoothly, on occasion contractual disputes can occur. A process for dispute resolution is defined. In line with internal governance processes, all of the Partner Agreements for Celsius will be signed off by a statutory director.		

Attachments	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	24
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to			
Topic	Comms		
Question	What efforts have been made to ensure a suitable low cost communication solution is available and what learning from other project has been considered?		
Notes on question			
Answer	During the build up of the project costs, quotes for communications and data handling were obtained and potential Partner opportunities explored. The solution proposed was judged to be the most cost effective option for the Celsius project's requirements. Based on experiences with previous projects we have found the 3G mobile network suitable for the transfer of large amounts of data. However, signal coverage varies across the UK and so there can be issues with only using one mobile phone network provider. To address this, and reduce data loss due to signal constraints, Celsius will use roaming SIMS to give the best network choice for the location.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	25
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to			
Topic	RTTR		
Question	Does ENWL have confidence that the solution provided by ASH is at a suitably advanced TRL, and can be delivered to time and cost?		
Notes on question			
Answer	For all of the key technical elements of the proposed monitoring solution, ASH have demonstrable experience of: • remote telemetry reporting backhaul via mobile phone networks (in production) • low power battery operated radio networks for temperature sensing (prototype tested in intended environment) • magnetic mounting of sensing and measurement equipment (in production) • complex power measurement by non-intrusive means (in production). Therefore the technical elements are regarded as low risk. The timescale risk associated with getting from demonstrated prototype to a manufactured/integrated solution for install will be mitigated by the early release of funds in the Celsius program, to enable work to start on this once the Project Direction has been signed.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	26
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to	Pg58		
Topic	Transformers		
Question	Transformers that are <25% loaded at peak times are not monitored: bearing in mind that these transformers may one day be subject to the Celsius method, it might be possible that this leads to an omission of a particular type of transformer in the thermal analysis. Has any investigation into the transformers that are <25% rated been performed to ensure they do not fit into a particular type?		
Notes on question			
Answer	The preliminary work carried out by Ricardo-AEA showed that at lower levels of utilisation, the load has no significant impact on the temperature of the transformer. This is because the heat generated does not cause the mass of the transformer to rise above ambient temperature. Above this level the heating is broadly linear and therefore, the project will only include transformers that are at least 25% utilised within the project. The substation/transformer types included in the trials have been determined using the whole transformer population. There are sufficient units of each type so that no type will be omitted based on utilisation. The smallest categories have been checked for the levels of utilisation, and they all have at least 14 examples of sites where utilisation is above 25%. As the trial will monitor seven examples from each category, and utilisation is the major condition that they will need to meet, we consider this to be sufficient to allow the trial to run successfully.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	27
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to	Appendix C		
Topic	Methodology		
Question	Is five instances of each retrofit cooling technology enough to give conclusive readings that are statistically robust?		
Notes on question			
Answer	The methodology described in the submission document is a representative outline approach only; the chosen approach for project delivery will depend on the characteristics of the technologies themselves and the number of technologies selected to be trialled. In the proposed outline methodology, it was assumed that there would be approximately 20 technologies selected for trial, and that each of these would be trialled at five substations. It is noted that the technologies will be installed and operational in these five sites over a year, and the data will be collected over the whole of this duration. It should be noted that the technologies selected may include more than one configuration or application of the same technology enabling more than one aspect of the same technology to be trialled. In this way, it is considered that a year's data in five separate sites is adequate to draw statistically robust conclusions.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	28
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to	Risk Register – Appendix G, pg76		
Topic	Methodology		
Question	Data received from the substation monitoring is being continuously validated (to mitigate against lost data): there may be a cheaper and more efficient way of achieving this function autonomously if this isn't already considered. How is this monitoring of data addressed?		
Notes on question			
Answer	The data handling system will be provided by Ricardo-AEA, taking advantage of existing expertise and systems that have been developed as part of other major data collection and management projects. This system is capable of autonomously validating the data, including identifying instances of lost data, and also determining if data falls within reasonable ranges. The project team can be notified of the results of this validation via email alerts and reports. The resource associated with the validation activities is firstly a small amount of set-up time, in order to define the suitable conditions and ranges. There will then be resource associated with reacting to the information brought about by the validation activities, i.e. investigating issues in monitoring or communication, and finding solutions.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	29
Question date	08 September 2015	Answer date	14 September 2015
Submission section question relates to	Risk Register – Appendix G		
Topic	Risks		
Question	There do not appear to be any risks relating to the technologies not performing as expected (i.e. the monitoring and cooling, if applicable, fail to reach near to the maximum increase in capacity (18% for PMT, 47% for GMT, and 25% for LVC – calculated from figures given in the submission)). Please explain this omission.		
Notes on question			
Answer	In our high level risks and issues register found in Appendix G, we include risks for performance of monitoring and cooling technologies. These risks are: • Monitoring equipment failure • Internal monitoring and retrofit cooling methods having an impact on the distribution network potentially leading to disruption. Mitigating actions for the technologies not performing as expected in these areas are also described. The estimates for capacity released are based on the analysis of known temperature effects used in existing codes of practice and known effectiveness of a proven retrofit cooling solution at higher voltage levels. In the Celsius trials, a range of cooling interventions will be demonstrated. Some of these are anticipated to achieve at least the increase in capacity used for the business case analysis, whilst others may achieve a lower capacity release. Celsius will generate real data from deploying these methods on a live network. This will determine the benefits that could be delivered against differing capacity release outcomes across a wide range of		

	substation environments.
Attachments	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	30
Question date	10 September 2015	Answer date	14 September 2015
Submission section question relates to	Section 6		
Topic	Project readiness		
Question	Please explain why you are not seeking protection from cost overruns.		
Notes on question			
Answer	In developing the Celsius project, we undertook significant preparatory work prior to the bid submission to create a robust budget. The resource and costs are challenged and agreed with a range of stakeholders and subject to internal audit. A critical element of establishing project costs includes identifying any risks and issues associated with project delivery and defining actions to mitigate those risks. Within the overall cost calculation, we have included 8% contingency for any potential cost impacts that result from a realised risk as the Celsius project progresses. When delivering projects of this scale and type, our focus is on ensuring the key deliverables are achieved and the project managed within the budget included as part of the full submission. We have confidence in our budget setting process and protection from cost overruns is not sought.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	31
Question date	17 September 2015	Answer date	22 September 2015
Submission section question relates to			
Topic	Losses		
Question	Have you considered the extent of additional losses of running a substation at a higher temperature?		
Notes on question			
Answer	The Celsius Method, which maximises utilisation of available asset thermal capacity, will operate well within the asset's maximum designed operating temperature. Where retrofit cooling is also deployed, heat will be taken away from the asset to allow even more current to pass through for use by customers. When undertaking the Celsius business case analysis, we considered the extent of potential additional losses as a result of the higher currents that Celsius will facilitate as a sensitivity. Given the significant uncertainty as to the impact of low carbon technology uptake on future LV networks, specifically the load profile which directly impacts on losses experienced, the magnitude of losses is also uncertain. This is because future loading profiles experienced at a distribution substation throughout the course of a day, and cumulatively over a year, may depend on technology, market and regulatory factors relating to low carbon technology. In the sensitivity case, we assumed a scaling of today's "representative" load profile which is quite conservative. We can confirm that inclusion of monetised losses results in a small reduction in the net benefits in the business case, based on a conservative linear scaling of the load profile with peak load. The net benefit for the Celsius Method remains strongly positive.		

	The impact of future load profiles on losses will be assessed in further detail during the Celsius project.
Attachments	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Celsius

Tick if this answer has been provided verbally: ☐

Project code	ENWEN 01	Question Number	32
Question date	06 October 2015	Answer date	09 October 2015
Submission section question relates to	Page 39		
Topic	Incentives		
Question	Please explain how you have calculated the required protection from the reliability and availability incentives impact.		
Notes on question			

Answer

Within Celsius, we will explore all possible alternatives to planned supply interruptions during both installation and decommissioning of retrofit thermal monitoring and retrofit cooling equipment.

We have sought protection based on the following assumptions:

1) All external retrofit thermal monitoring on ground mounted transformers can be installed with no shutdown due to ease of installation of the Klik-Fit sensor;
2) All cable monitoring and cooling can be installed with no shutdown;
3) Of the remaining Celsius installation activities, it is expected that a high proportion of trial sites can use either back-feed from another transformer or temporary generation for the duration of any installation or decommissioning activities;
4) Where a planned interruptions (PI) is anticipated the expected duration anticipated has been advised by our operational engineers. The table below shows these assumptions.

Equipment	Quantity	PI (hours)	% backfeed or generation	Cost of PI penalties
Internal monitoring	20	5	80	[redacted]
Monitoring (PMT)	51	1	50	[redacted]
Retrofit cooling (PMT)	15	4	50	[redacted]
Retrofit cooling (GMT)	30	4	90	[redacted]

Note: Cost of PI penalties has been established using the following Planned Interruptions values (2015/2016 prices) and average number of customers connected to pole mounted and ground mounted transformers.

	[redacted]
Attachments	