

A new approach to managing thermal capacity



The first solution of its kind in Great Britain, the **Celsius project** will deliver a co-ordinated approach to managing the temperature of electrical assets in distribution substations. The £5.5 million project will release additional capacity, reduce long-term costs for customers and avoid early asset replacement.

Electricity North West is leading the way in developing smart solutions to meet the UK's future energy demands. As the regional electricity operator, the company is responsible for keeping the lights on for five million people in the North West of England. It's also their job to plan for the future and look at smarter ways of meeting the expected increase in electricity demand as we start to reduce our reliance on fossil fuels.

Why do we need Celsius?

To meet the decarbonisation challenge laid down by the Government, customers are being encouraged to adopt new low carbon technologies such as electric vehicles and heat pumps. Government forecasts suggest that there may be up to a 60% increase in total electricity demand in Great Britain (GB) by 2050. This increase in load means an increase in the current flowing on the network. The greater the amount of current flowing, the greater the heat generated and the hotter an asset becomes.

The expected increase in electrical load from low carbon technologies will lead to thermal 'pinch points' at distribution substations. The expected increase in electrical load from low carbon technologies will lead to thermal 'pinch points' at distribution substations, where load is causing equipment to operate close to its maximum operating temperature.

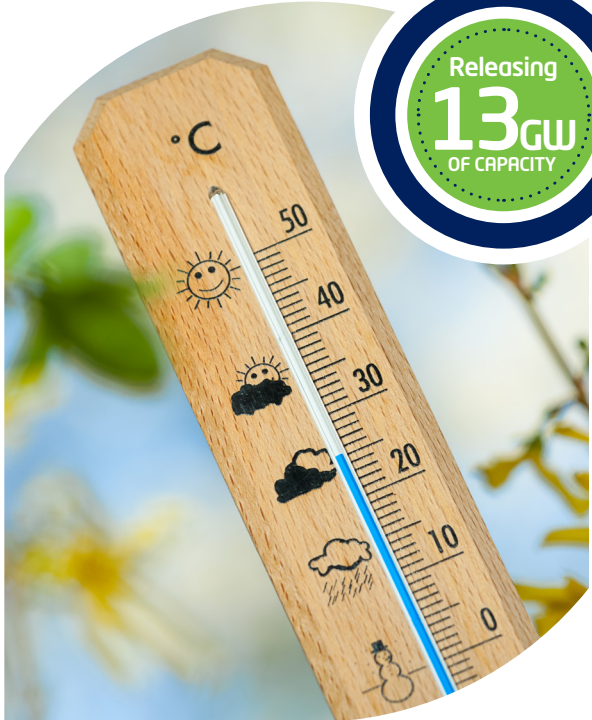
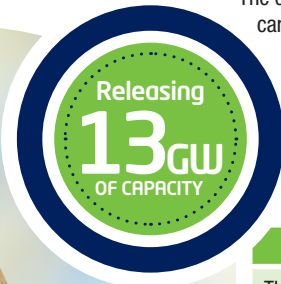
What is Celsius?

Celsius is a four year trial of a co-ordinated approach to managing the temperature of electrical assets in distribution substations in GB. A two-step structured approach will gather data to increase understanding of thermal behaviour and release capacity to customers.

With greater knowledge of the behaviour of these assets, network operators will be able to support the connection of increasing numbers of low carbon technologies more quickly and at lower cost than deploying traditional solutions.

Celsius will enable the release of capacity at a fraction of the cost of traditional reinforcement, reducing costs for GB customers by around £0.6 billion by 2050 and releasing 13GW of thermal capacity.

Celsius is funded by Ofgem's Network Innovation Competition. The project started in January 2016 and will run until March 2020.



Stage 1 - Thermal monitoring	Stage 2 - Retrofit cooling techniques
<p>The first stage of the project will be to record temperature and load measurements from 520 distribution substations to evaluate the available capacity margins at each site. This work will include a functional specification for a low cost monitoring solution which can be deployed at scale.</p> <p>To evaluate the capacity margins, the maximum operating temperature (or hot spot) which is at the core of the asset needs to be measured. As it is impractical and cost prohibitive to measure directly at scale using retrofit means, the project will develop a methodology to allow the internal hot spot temperatures to be calculated from the measured external temperature and other known information.</p> <p>The output of this work will be a 'Thermal Ratings Tool', which needs minimal inputs such as temperature and environment to quantify available capacity. This tool is likely to be a Microsoft Excel look-up table or similar, which is easily transferable and will be made available for use by other network operators.</p>	<p>To release further capacity, retrofit cooling techniques for cables and transformers will be evaluated and deployed on 100 of the initial 520 trial sites.</p> <p>Celsius will identify and evaluate a range of potential techniques and technologies which may be used to cool or thermally manage assets. For example, passive techniques such as painting transformers with reflective paint, new backfill material for cables and active techniques such as fans on transformers.</p> <p>Electricity North West will then work in collaboration with other network operators to select a number of appropriate techniques to be trialled.</p> <p>Once the cooling technologies are installed, the benefits will be quantified via an extended period of monitoring for a minimum period of 12 months. This will allow thermal behaviour to be contrasted against the measurements taken in the initial monitoring trial.</p> <p>The learning from this work will be captured as an enhancement to the Thermal Ratings Tool. The tool will automate the evaluation of the potential gain in capacity of each technique for different applications and environments.</p> <p>The cooling techniques will be deployed at substations close to where customers live and work, so a programme of customer engagement will be carried out to understand if customers find the proposed cooling solutions acceptable compared to traditional solutions.</p>

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