electricity north west

Bringing energy to your door

Innovation Learning Event

Wednesday 4 July 2018

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Celsius

Project update

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Celsius

Awarded: 9th December 2015

- Go live
- Monitoring installation Mar 2017
- Monitoring trial Mar 2018
- Retrofit cooling installation Jun 2018
- Thermal ratings tool stage 1 Oct 2018
- Cooling trial Jun 2019
- Thermal ratings tool stage 2 Jan 2020
- Closedown Mar 2020

Investment

£5.5 million

Up to £583m across GB by 2050

Financial benefits

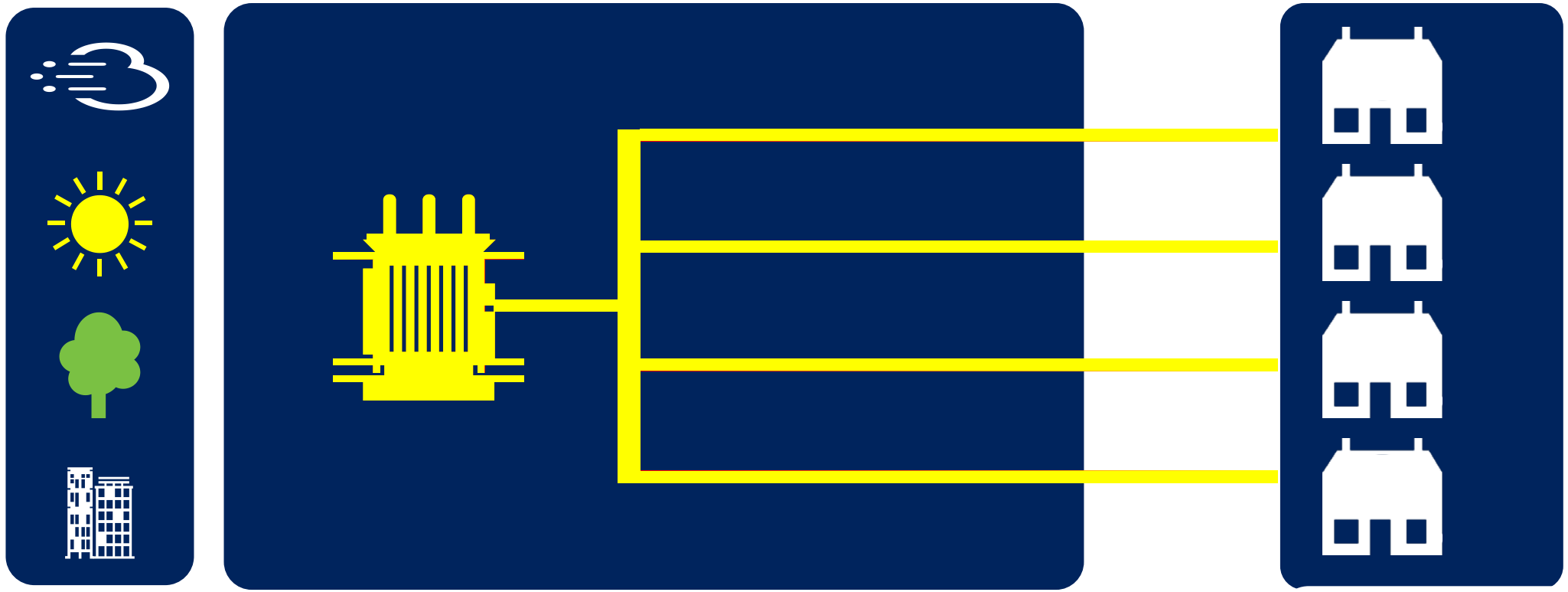
RICARDO-AEA

ASH CREATIVE WIRELESS ELECTRONICS

Impact Research

UK Power Networks Delivering your electricity

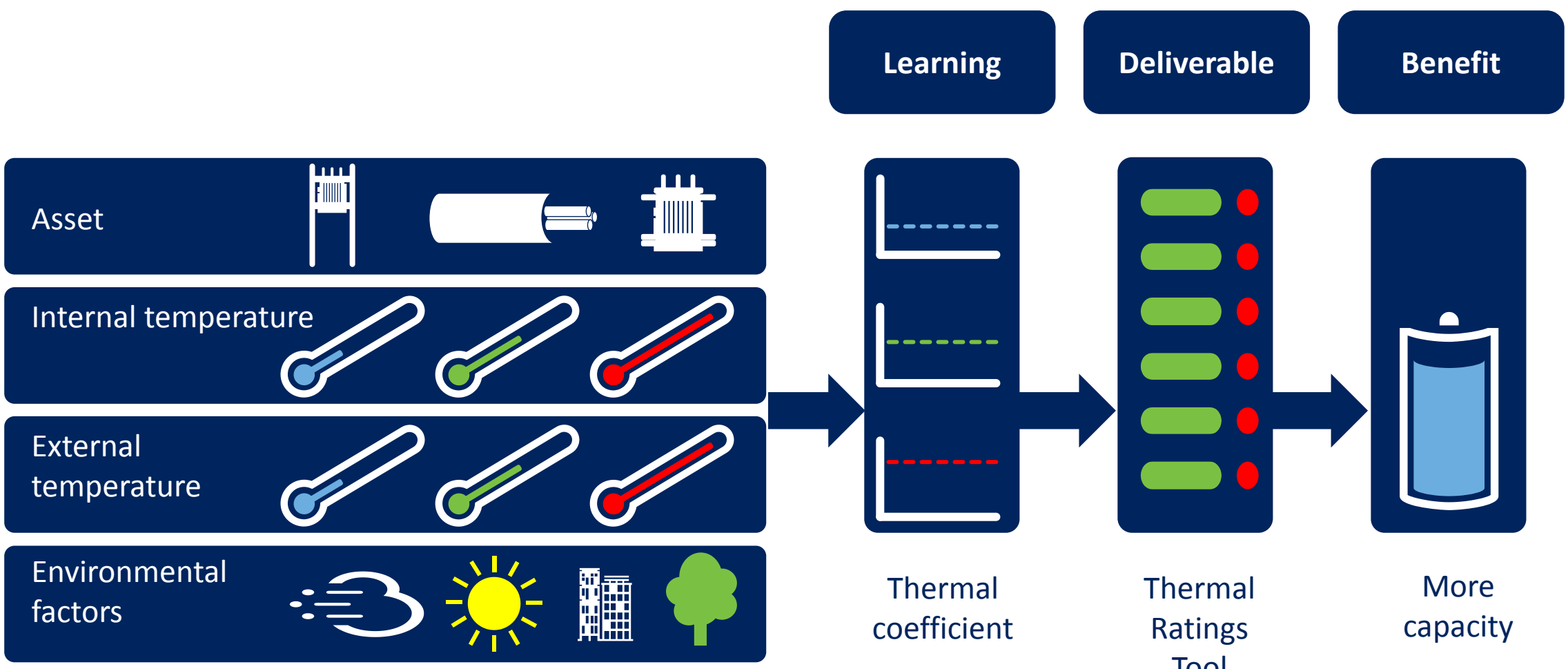
The problem



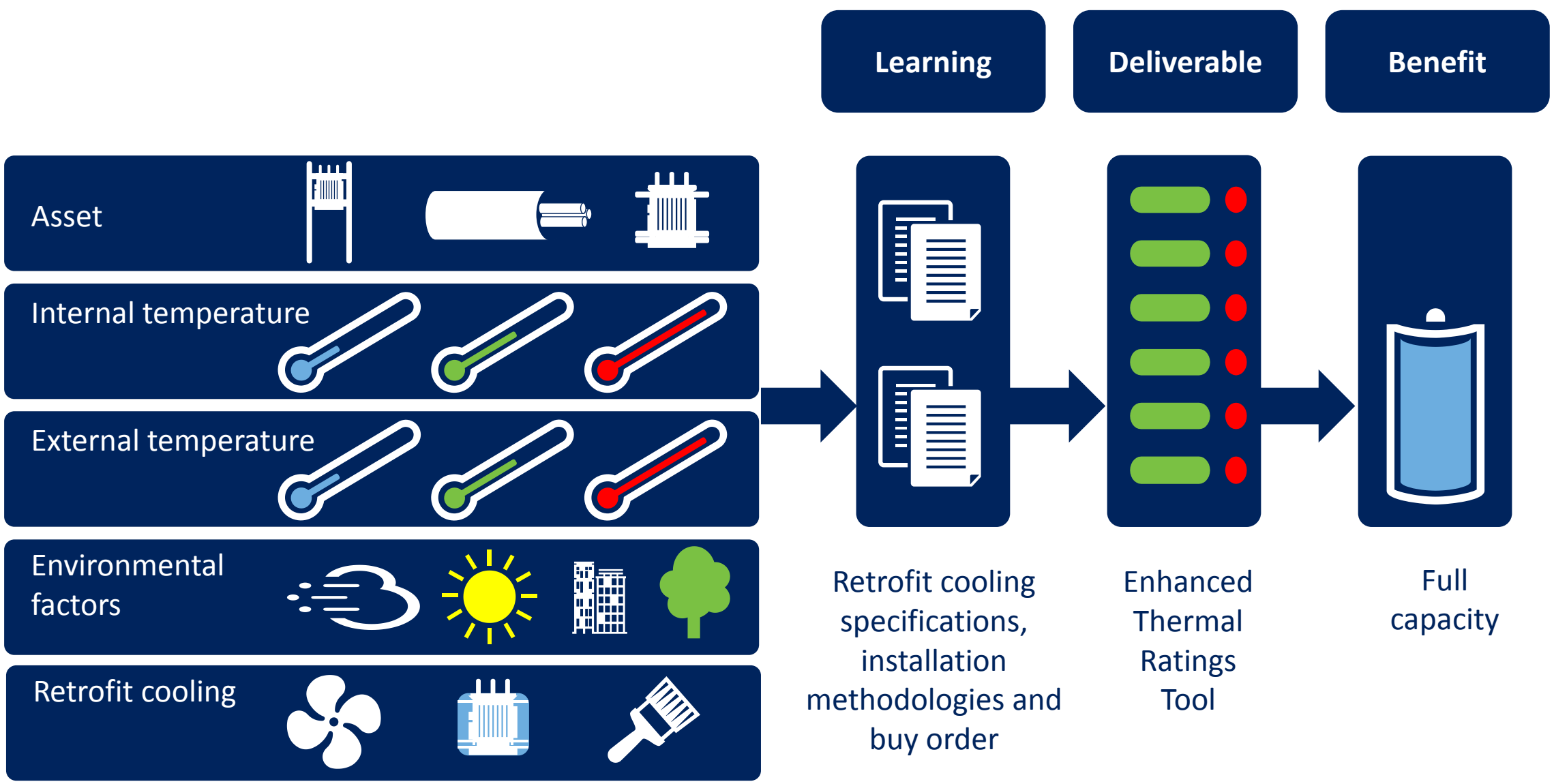
Distribution substation

Customers' LCTs

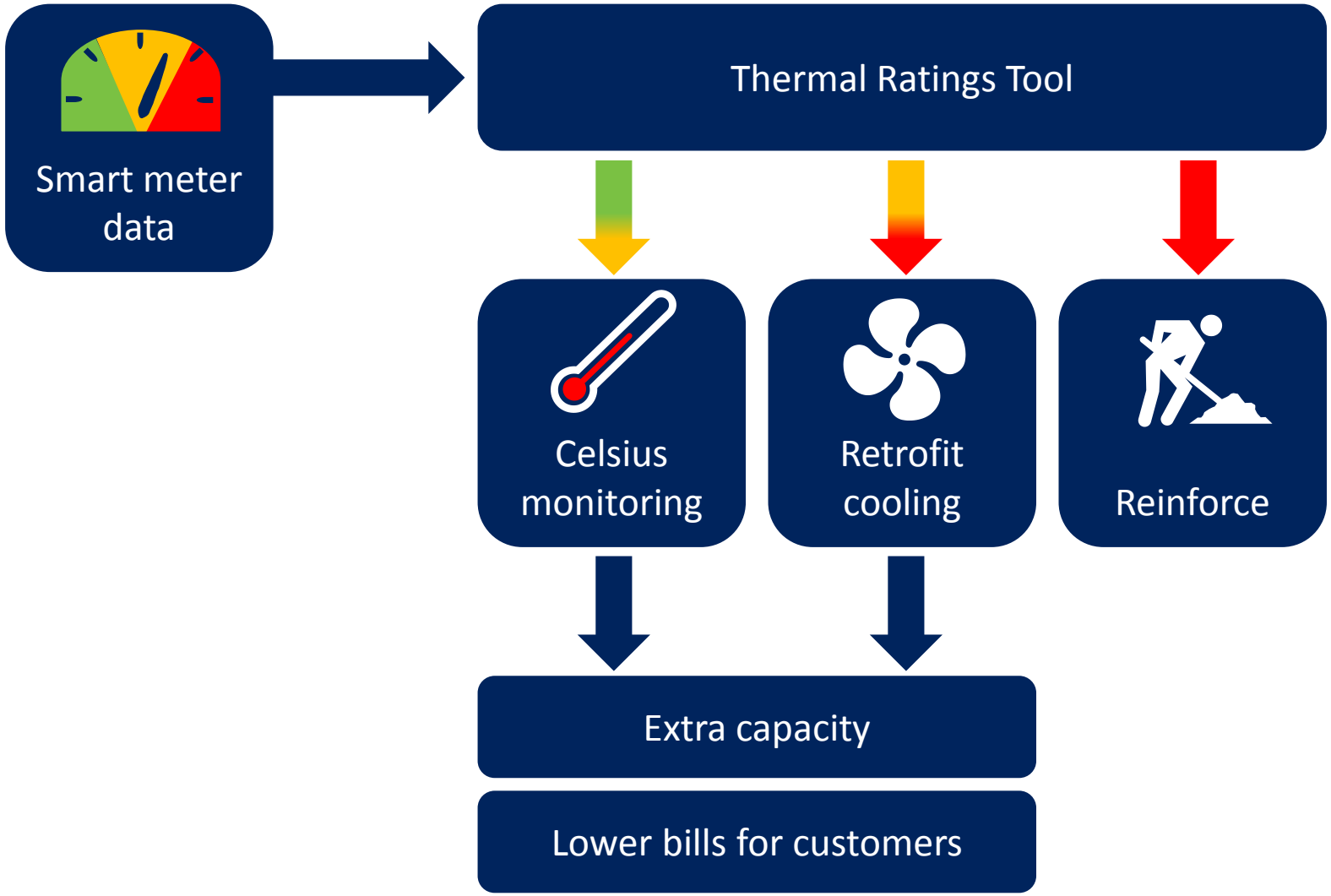
Step 1: Fit thermal monitoring



Step 2: Retrofit cooling



Celsius as part of the smart future

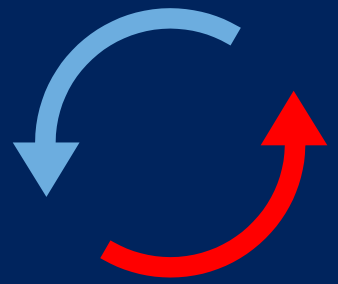


Case studies

Thermal analysis

Internal asset temperature = Thermal coefficient × External asset temperature

Thermal flow study



Research into heat and air flows for optimal substation design

Asset health study

Examines effects of increased load and cooling techniques on assets

System health dashboard

Allows tracking of installation progress and data quality across all sites, including overview, site summaries, and issue tracking

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SITES

ALERTS

HUBS

Site	Code	Type	Status	Hubs	Sensor Positions	Measurements
ALBRIGHTON EST	415402	2	OK	C3E4B5B7319		85 % coverage
ALBRIGHTON RD	415599	2	OK	2045AC6E8B60		100 % coverage
ALDER AVE	212304	2	OK	10172469DA63		100 % coverage
ALEXANDRA RD S	171051	2	OK	2218AF88E894		98 % coverage
ALLITHWAITE	618166	1	OK	1E0882561604		100 % coverage
ALTRINCHAM FOOTBALL	171011	2	OK	14165694CF3F		100 % coverage

Data dashboard

Allows visualisation and download of retrofit monitoring data across any site, sensor position and timescale

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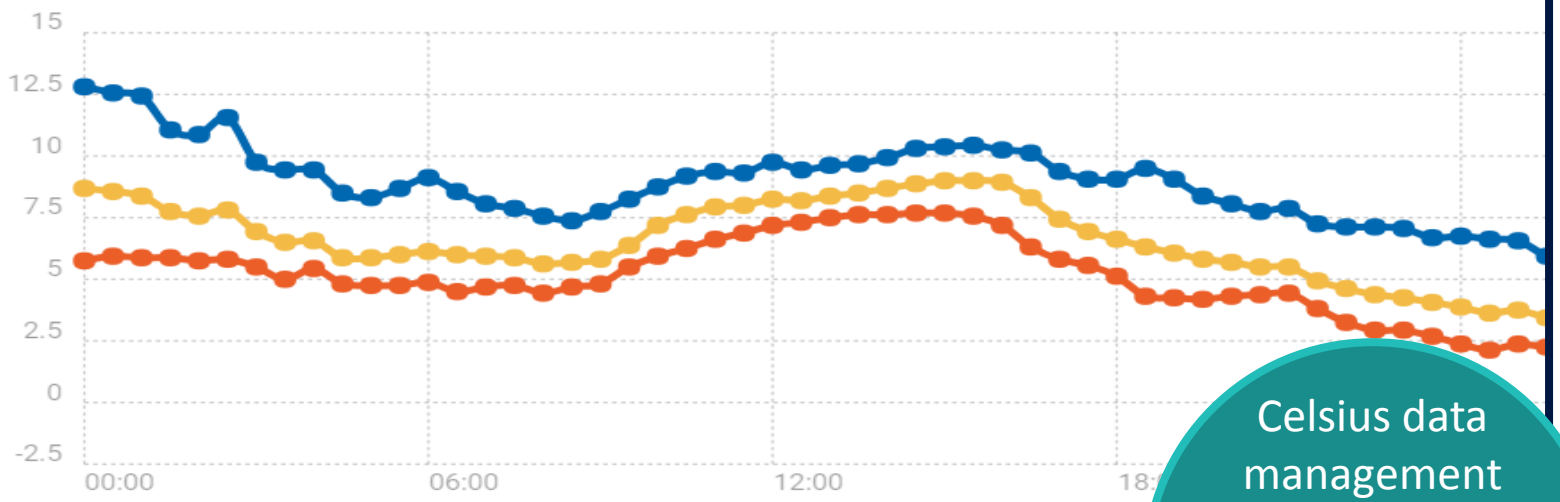
LATEST DATA

SNAPSHOTS

Data | Graphs



Over **750,000** inbound requests handled

Nearly **130 million** measurements taken

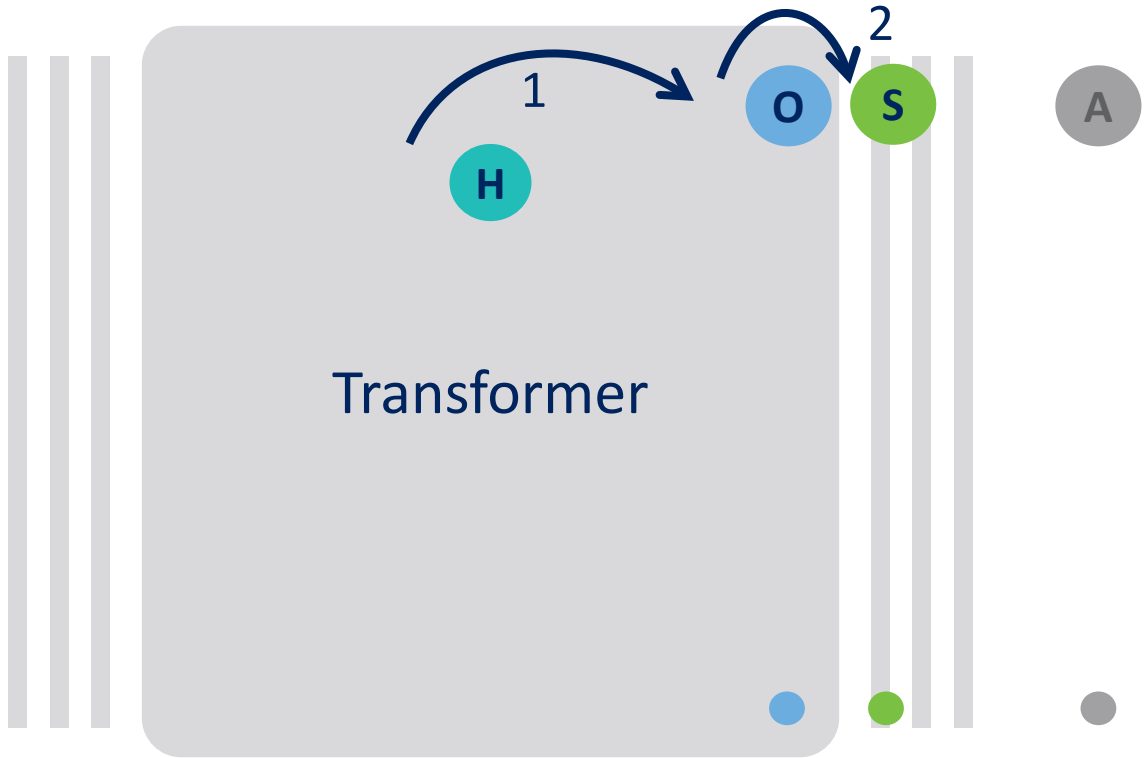
Celsius data management system consists of over **86,000** lines of code

Transformer hotspot assessment

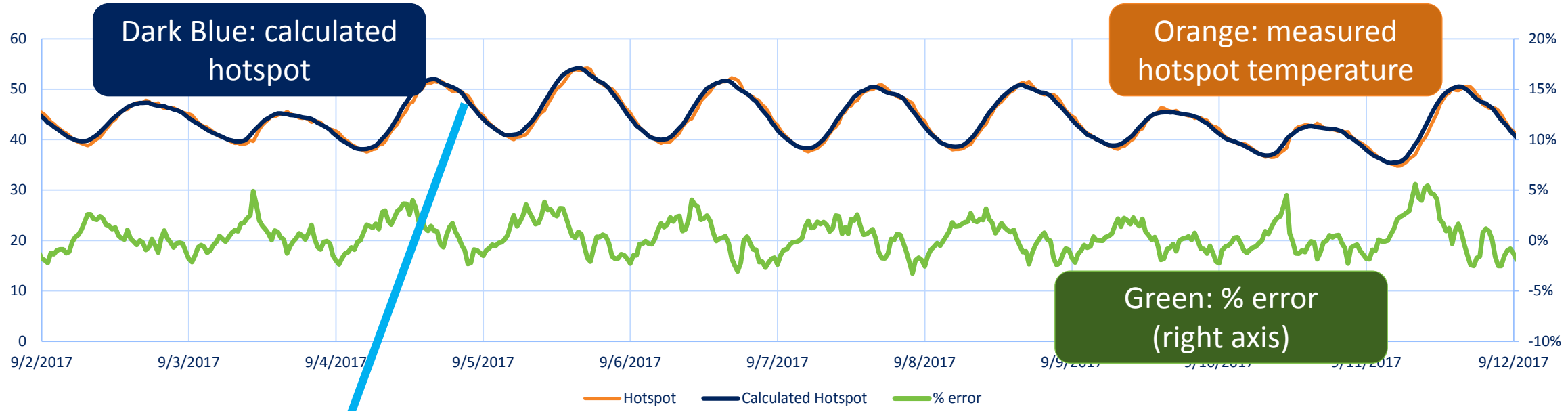
Goal: To know the hotspot temperature from one external sensor

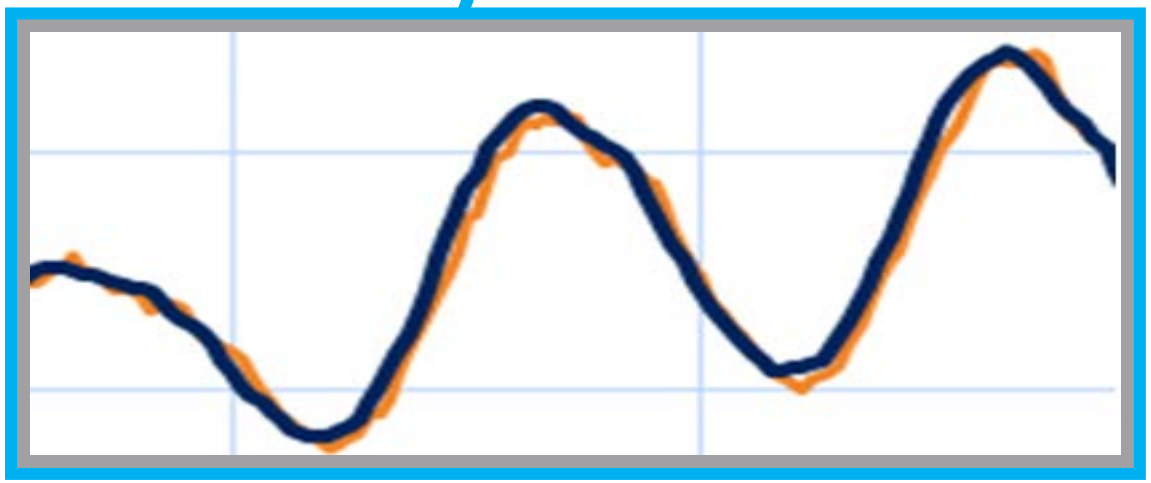
1. **Use 'Smart' transformer data** to understand link between hotspot and internal oil
2. **Use oil measurements** to link between internal oil and surface measurements
3. **Develop a method to use surface measurements to estimate hotspot**

Taking into account ambient conditions and characteristics of the transformer



Transformer hotspot calculation





Analysis supports the case for single sensor hotspot calculation that could be rapidly deployed to BAU and at low-cost

Thermal flow study

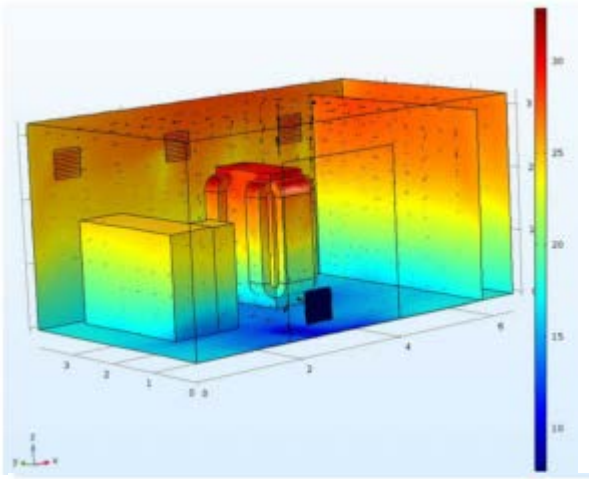
Six trial substations modelled

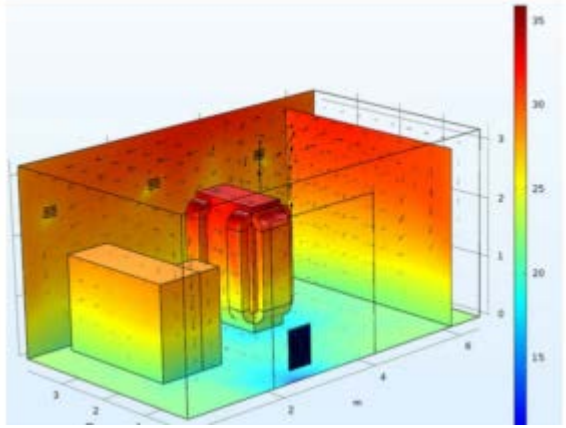
Validated with monitoring data

Changes to ENW Substation Policy

Application of cooling to models underway

NPL National Physical Laboratory



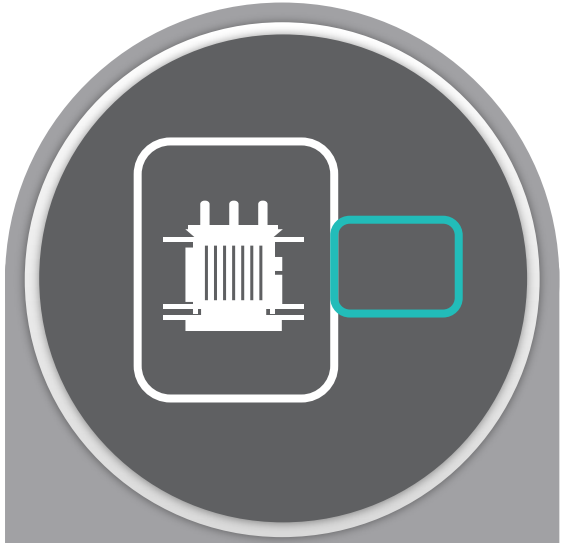


Cooling site selection

Subset of monitored sites (100 out of 520)

Appropriate mix of outdoor, GRP, brick building, etc

Operating temperatures at the site from monitoring data



Physical requirements of the cooling technology

Active cooling

Powered technologies which can be used to push or pull the hot air from the building

Ekkosense

Uses a fan to pull air over the transformer, and expel it through the top vent

Air is directed by using screens to create negative pressure inside the building

Warm air is directed through trunking to an exit vent

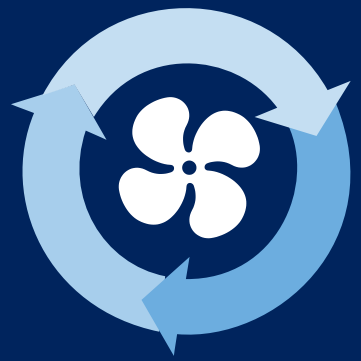
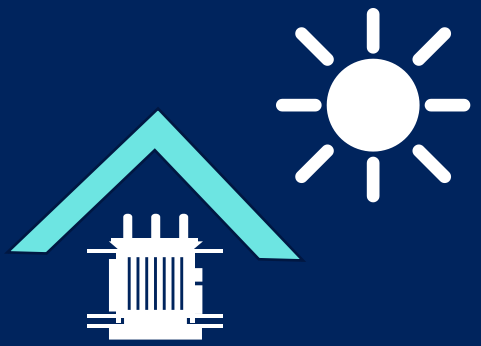
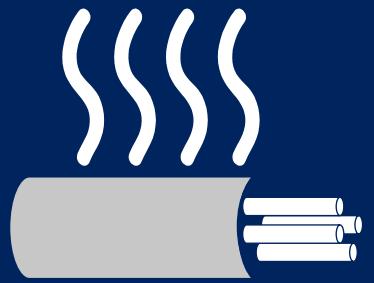
Active cooling

Powered technologies which can be used to push or pull the hot air from the building

Passcomm

Uses equipment to force air from outside through the lower vent, which creates positive pressure inside which expels through a high exit vent

Passive cooling

Improving ventilation	Painting outdoor transformers	Shading outdoor transformers	Cable backfill
			
Supported by the Thermal Flow Study results, which will provide guidance about the best ventilation arrangements	White paint will be used to reflect solar heating of the asset	To protect from solar radiation	Backfilling cable ducts with a material with beneficial thermal properties, to allow heat to escape from cables more effectively

Customer engagement

Customers in the Celsius trial areas will find the implementation of innovative retrofit cooling techniques as acceptable as traditional reinforcement

Customers who are educated as to the need for and benefits of Celsius are significantly more likely to find it acceptable

Perception and acceptability of cooling techniques

600 baseline surveys

Prior to installation of cooling techniques

April 2018

300 uneducated about Celsius

300 educated

Test

- Awareness of Electricity North West
- Satisfaction with Electricity North West
- General perception of substations
- Awareness of existing asset location, appearance, size, noise level etc

600 test surveys

Following installation of cooling techniques

Winter 2018

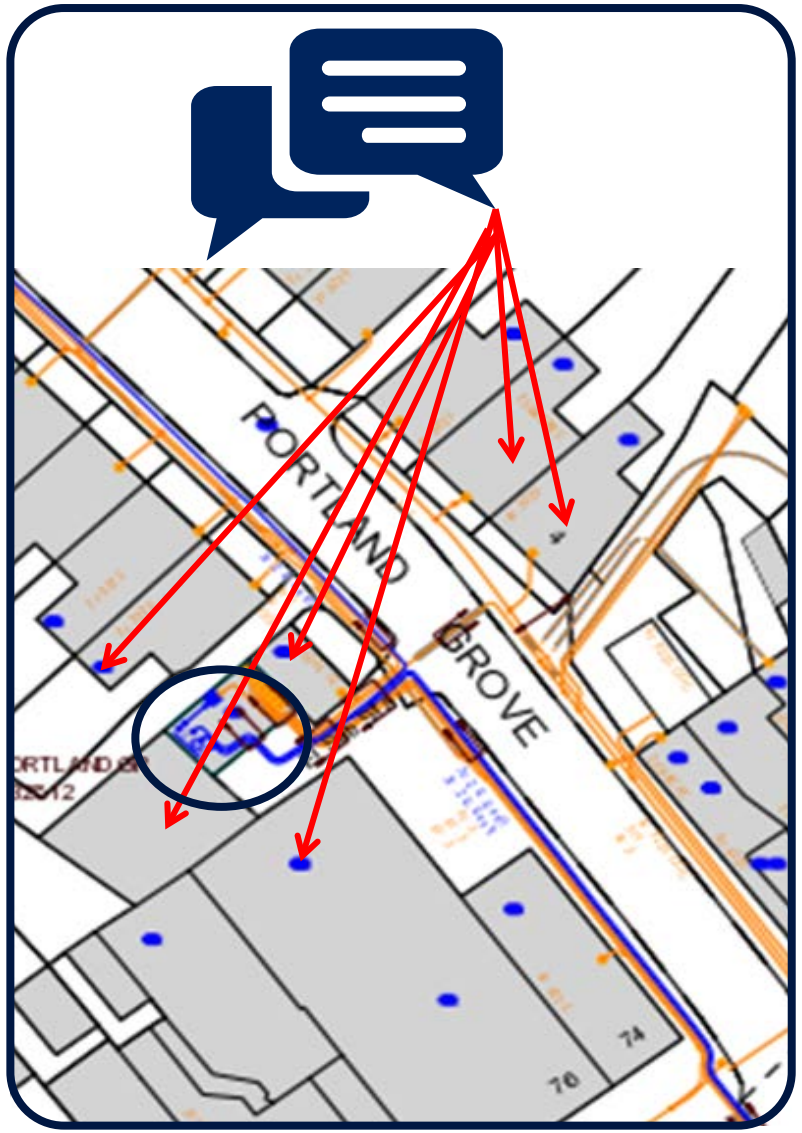
150 previously educated

450 new no prior education about Celsius

Test

- Changes in overall satisfaction
- Notice of any changes
- Attitude/acceptance of any change in asset location, appearance, size, noise level
- Design features/barriers

Assessing customer impact

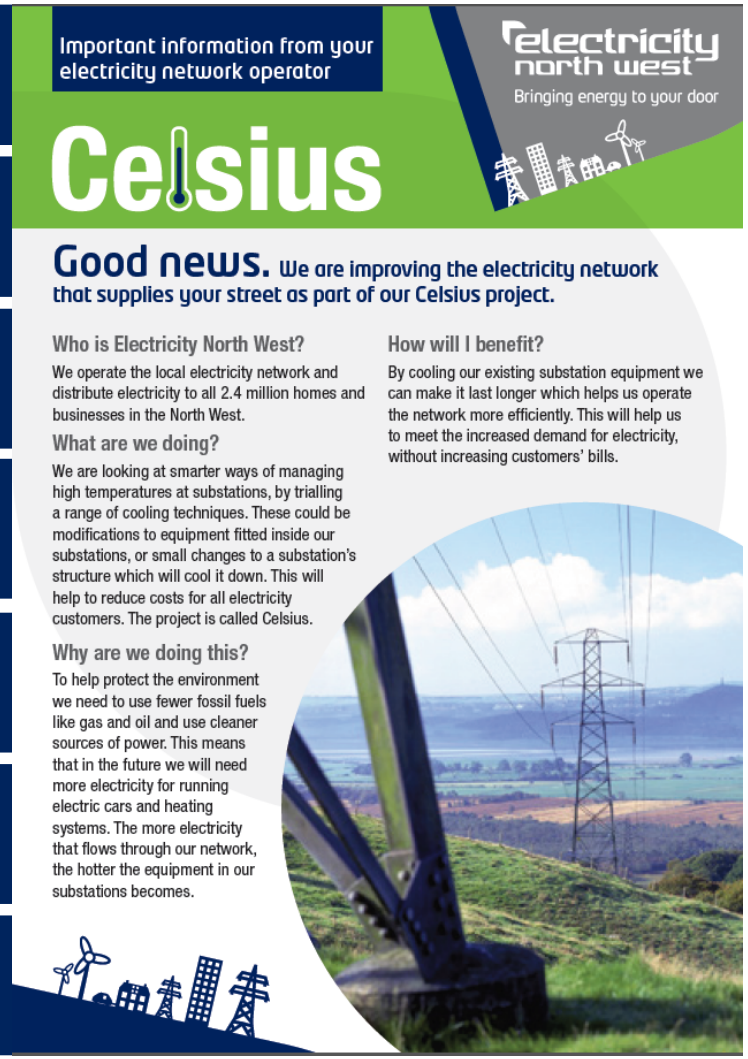


- Surveys of those nearest substation and most likely to be impacted
- Survey carried out on doorstep
- Repeat visits to interview customers neighbouring substations
- Cash incentive for completing baseline
- Dissatisfaction from customers not surveyed because no payment

Progress so far

Customers educated about the need and benefits of Celsius are more likely to find it acceptable

- Engaged customer panel to develop comms materials
- Project leaflet for all educated survey participants
- Survey developed
- Baseline survey complete
- Embedded process to capture complaints / enquiries
- Feedback via customer contact centre, website and SMS
- Materials and findings published on project website


Important information from your electricity network operator

electricity north west
Bringing energy to your door

Celsius

Good news. We are improving the electricity network that supplies your street as part of our Celsius project.

Who is Electricity North West?

We operate the local electricity network and distribute electricity to all 2.4 million homes and businesses in the North West.

What are we doing?

We are looking at smarter ways of managing high temperatures at substations, by trialling a range of cooling techniques. These could be modifications to equipment fitted inside our substations, or small changes to a substation's structure which will cool it down. This will help to reduce costs for all electricity customers. The project is called Celsius.

Why are we doing this?

To help protect the environment we need to use fewer fossil fuels like gas and oil and use cleaner sources of power. This means that in the future we will need more electricity for running electric cars and heating systems. The more electricity that flows through our network, the hotter the equipment in our substations becomes.

How will I benefit?

By cooling our existing substation equipment we can make it last longer which helps us operate the network more efficiently. This will help us to meet the increased demand for electricity, without increasing customers' bills.

Assessing customer impact

Embedded complaints process to capture/manage customer issues arising from installation

3 noise complaints from 19 sites

High density urban substations close to domestic dwellings

Settings reduced to lower noise emissions

Reduction on cooling potential

Technical solution may be viable but need to consider customer impact in some environments

Progress and next steps

January – June 2018	July – December 2018	January – June 2019	July – December 2019
Baseline customer survey	Asset temperature behaviour report	Cooling trial	Thermal Ratings Tool step 2
Thermal flow study part 2	Asset health study report	Trial customer survey	Monitoring specification
Cooling technology installation	Thermal Ratings Tool step 1		Customer survey report

Knowledge sharing and dissemination

For more information

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	**@ElecNW_News**
	**linkedin.com/company/electricity-north-west**
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Thank you for your time and attention