

electricity
north west

Bringing energy to your door



Celsius

**A new approach to managing
thermal capacity**

LCNI conference, Tuesday 16 October 2018

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Innovation Project Manager

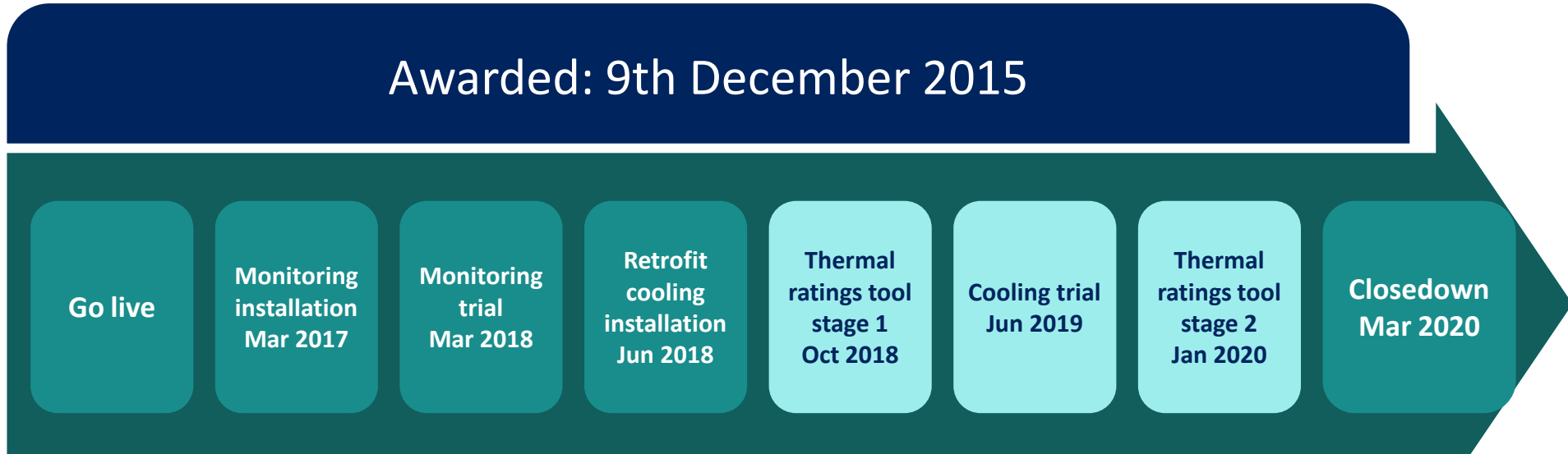
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www.enwl.co.uk



Awarded: 9th December 2015



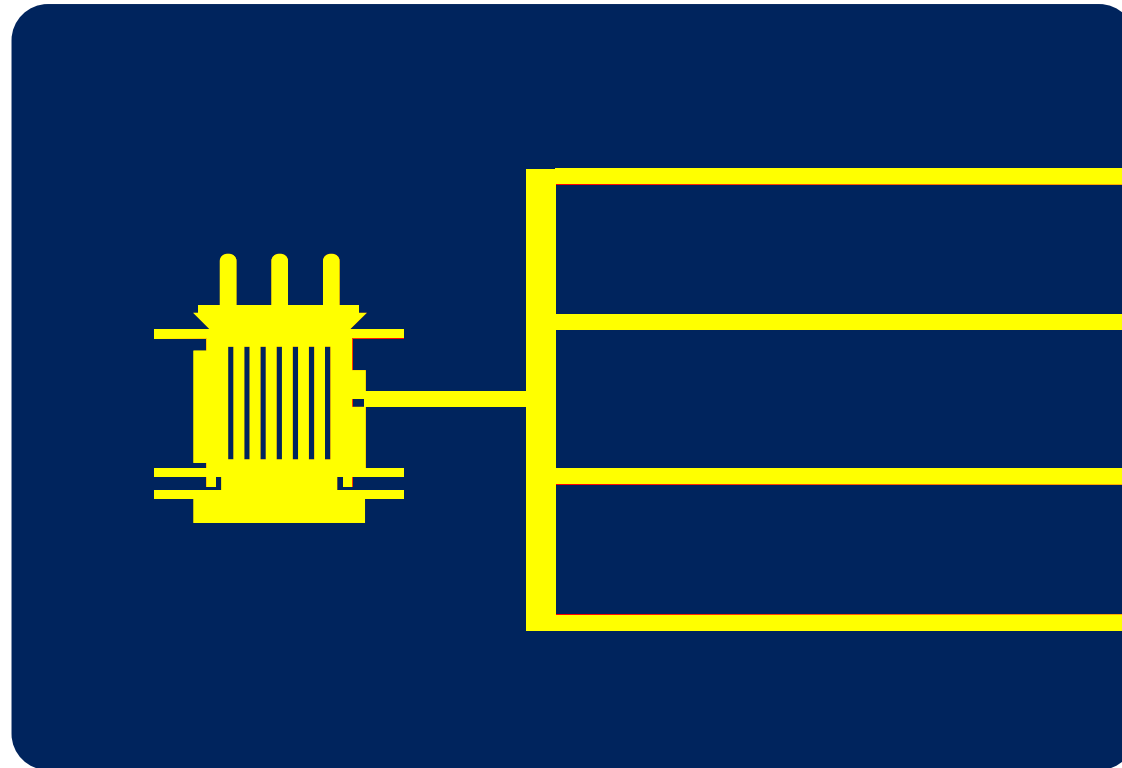
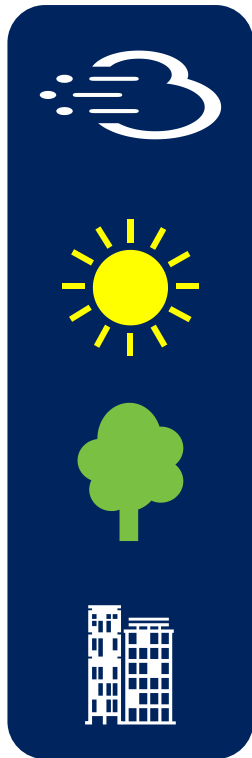
Investment

£5.5 million

Up to £583m across GB by 2050

Financial benefits

The problem



Distribution
substation

Customers'
LCTs

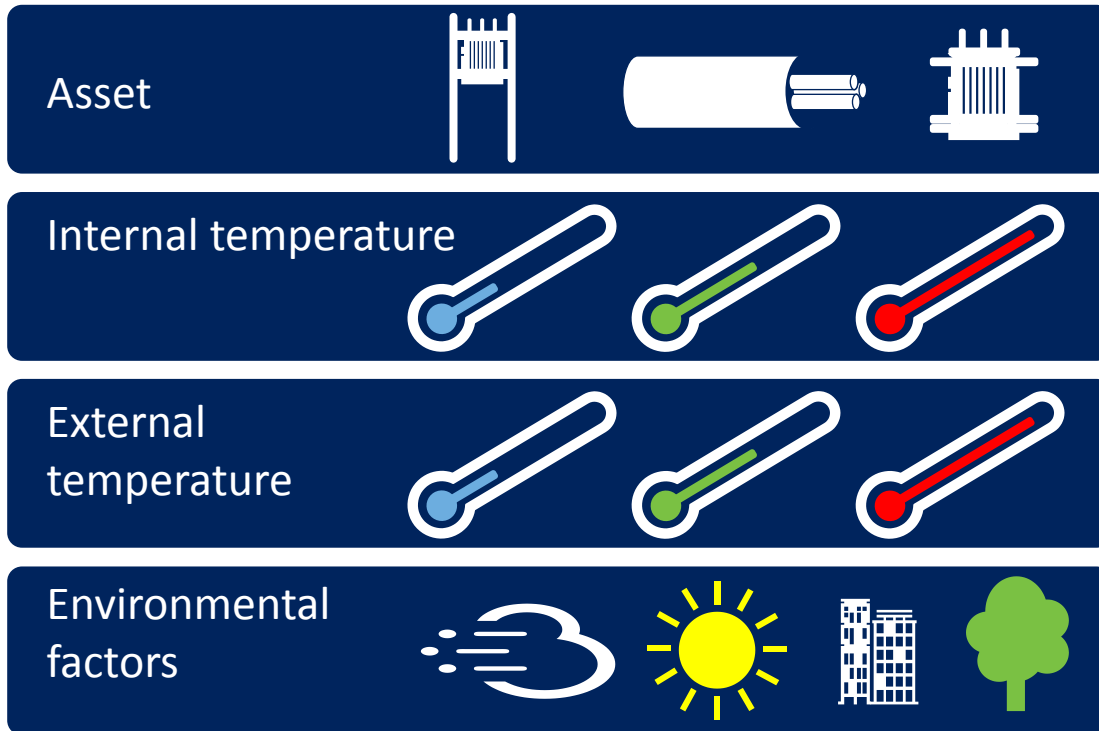
Step 1: Fit thermal monitoring



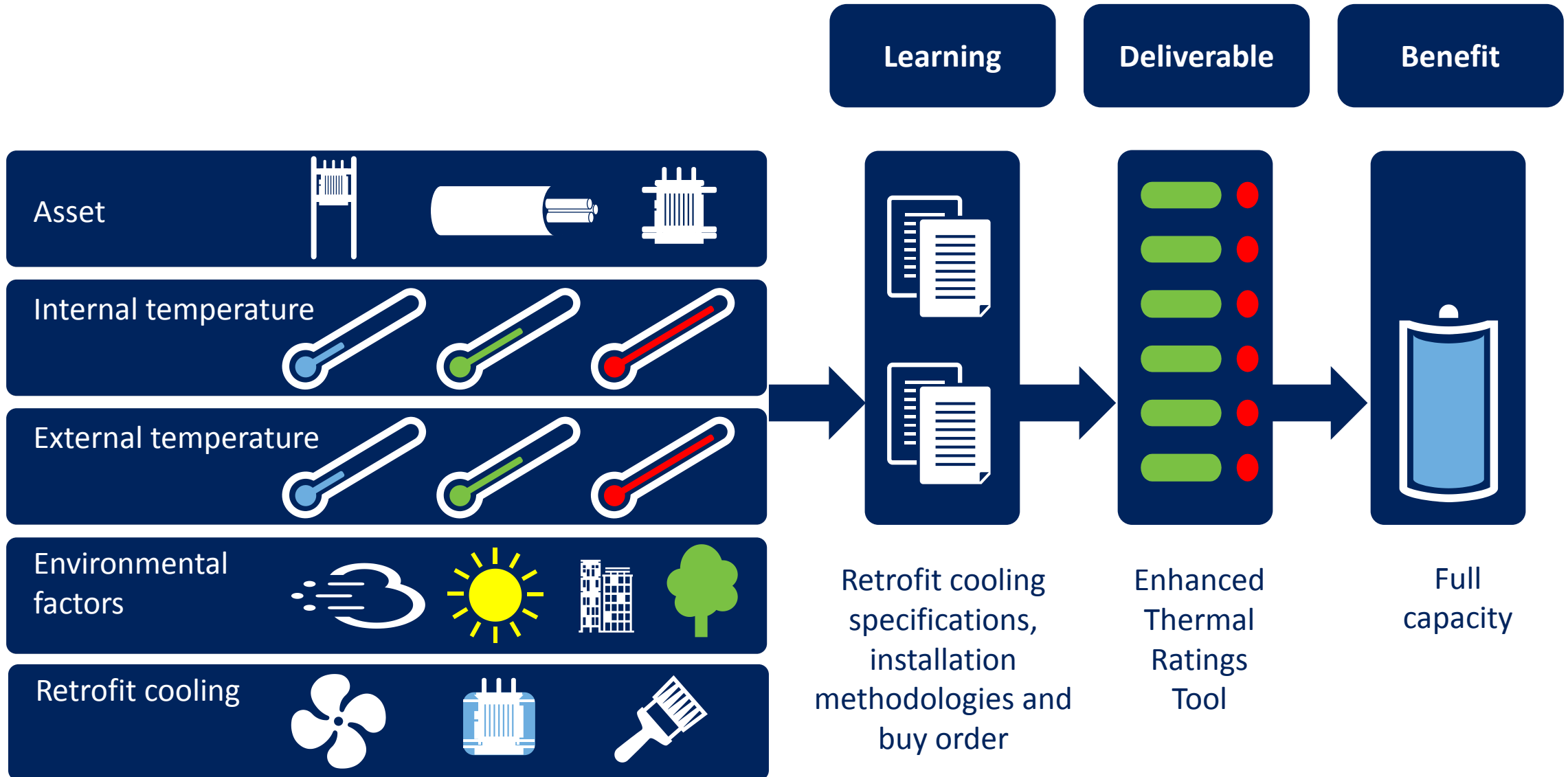
Learning

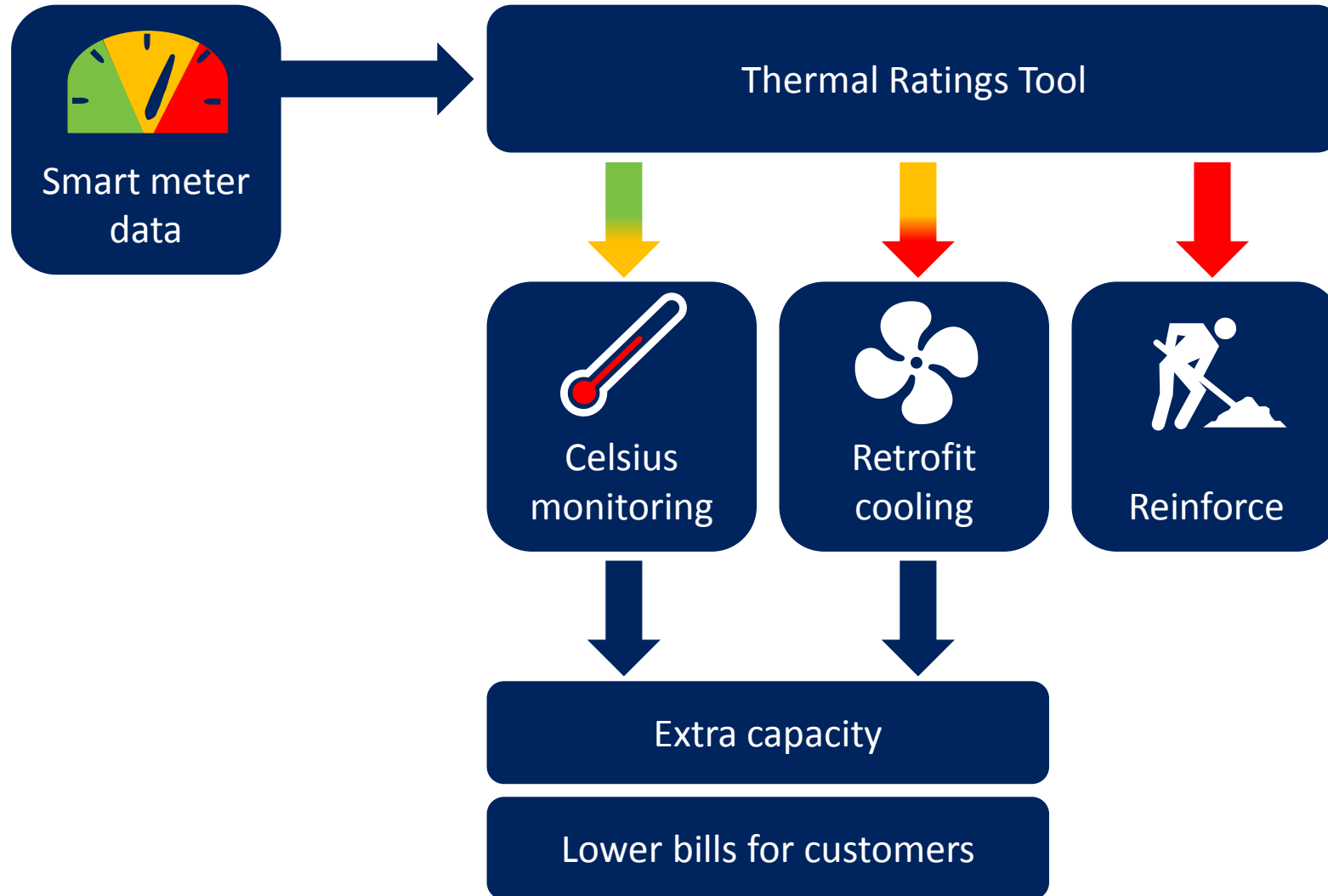
Deliverable

Benefit

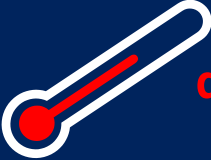
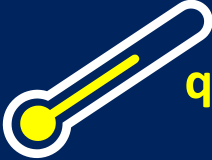
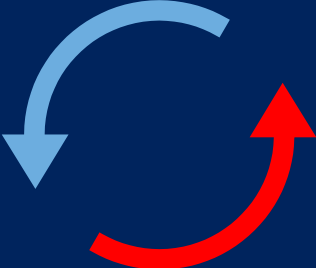



Step 2: Retrofit cooling







Thermal analysis	 q_{core} Internal asset temperature = Thermal coefficient \times External asset temperature  q_{external}
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



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

Celsius

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



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

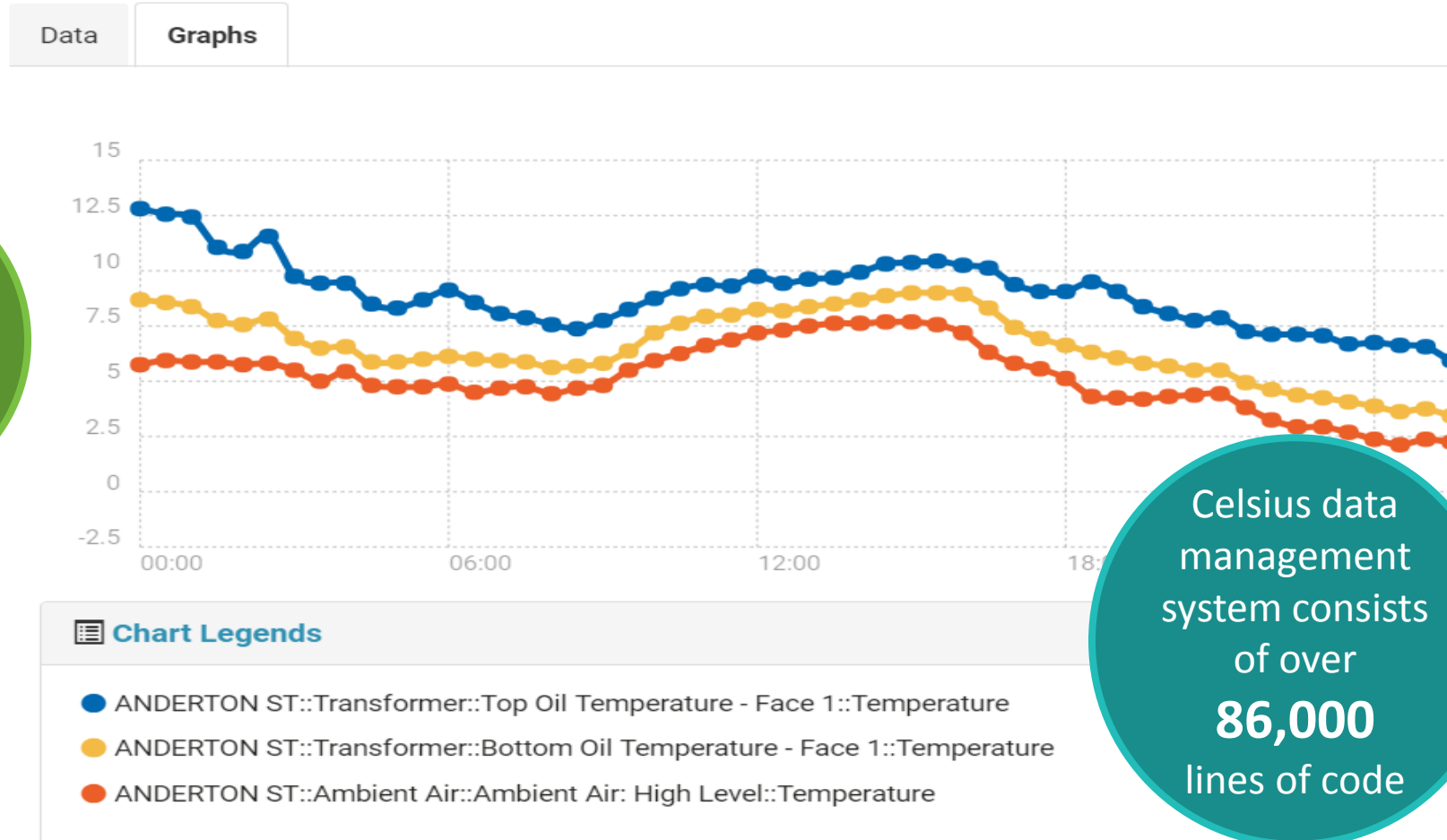
Celsius

LATEST DATA

SNAPSHOTS

Over **750,000** inbound requests handled

Nearly **130 million** measurements taken



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



Goal: To know the hotspot temperature from one external sensor

1

Use 'Smart' transformer data to understand link between hotspot and internal oil

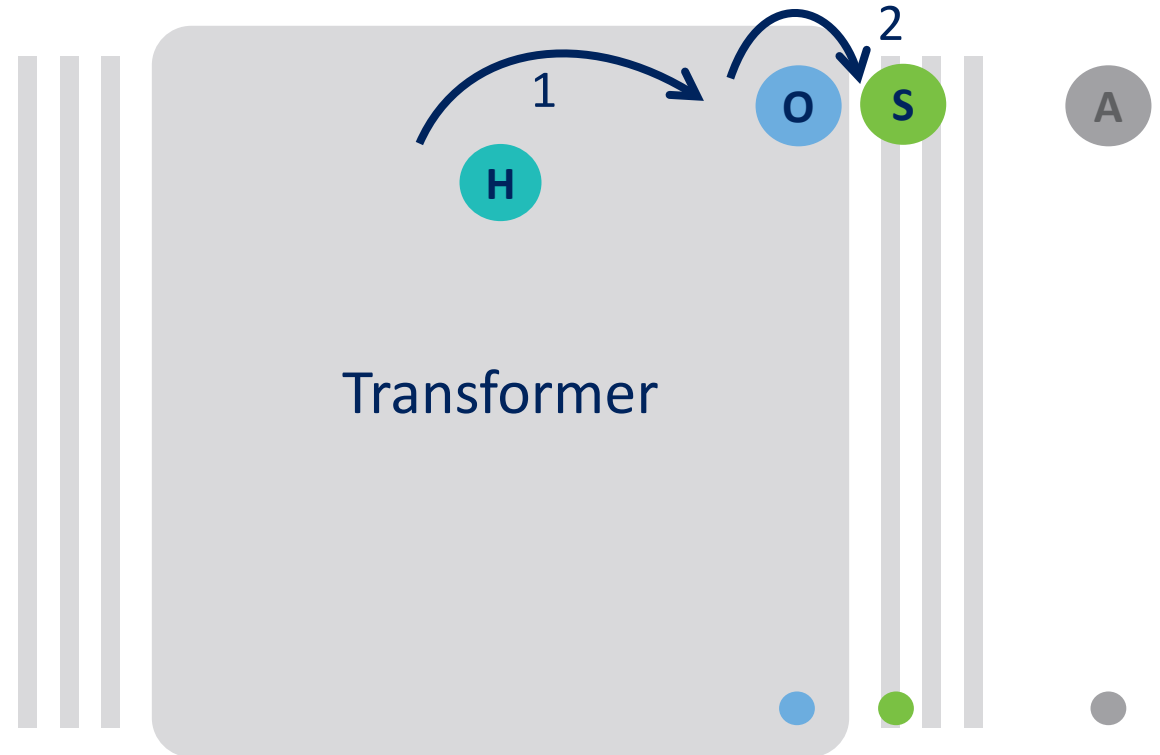
2

Use oil measurements to link between internal oil and surface measurements

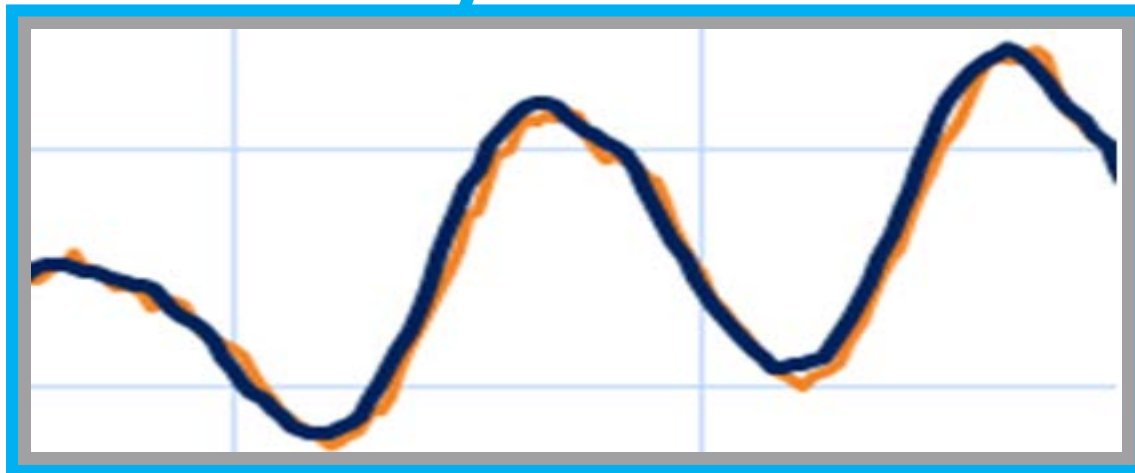
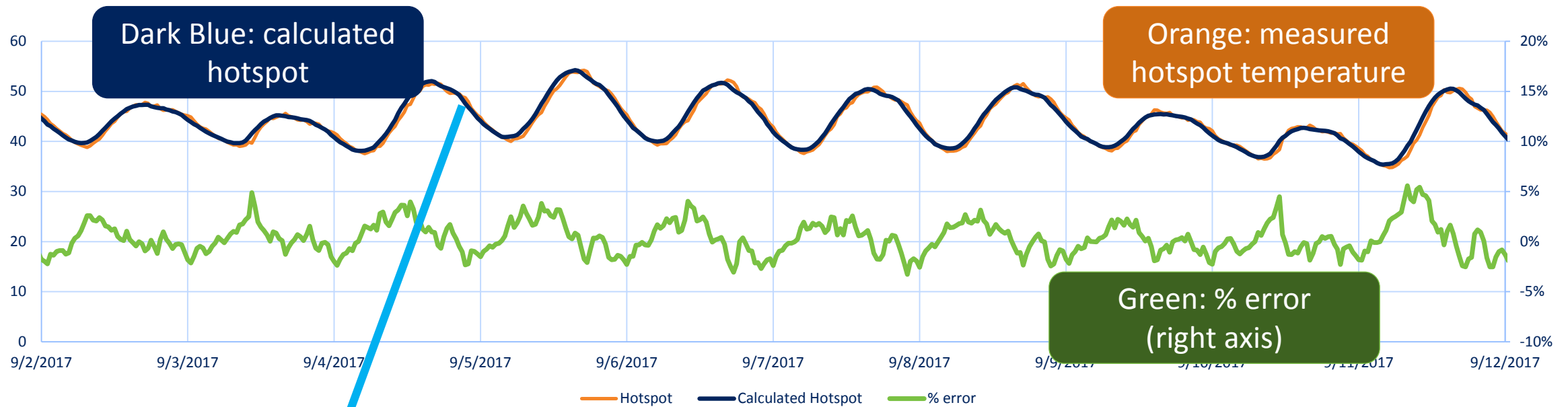
3

Develop a method to use surface measurements to estimate hotspot

Taking into account ambient conditions and characteristics of the transformer



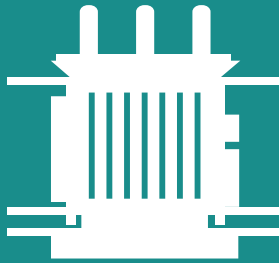
Transformer hotspot calculation



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



Six trial substations
modelled



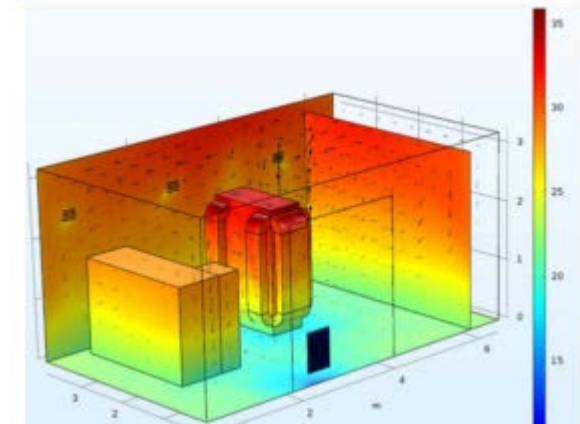
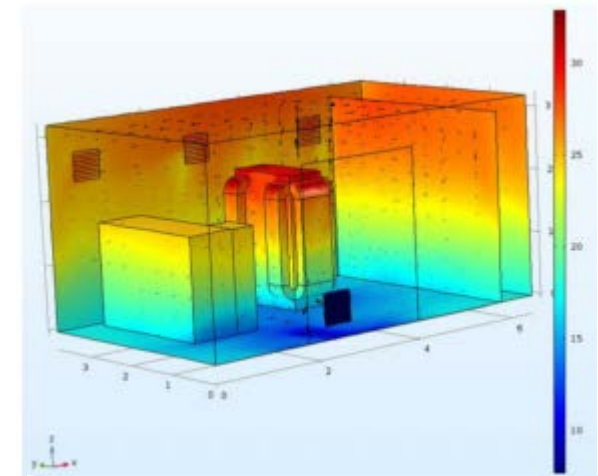
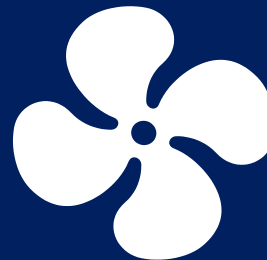
Validated with
monitoring data



Changes to ENW
Substation Policy



Application of cooling
models underway





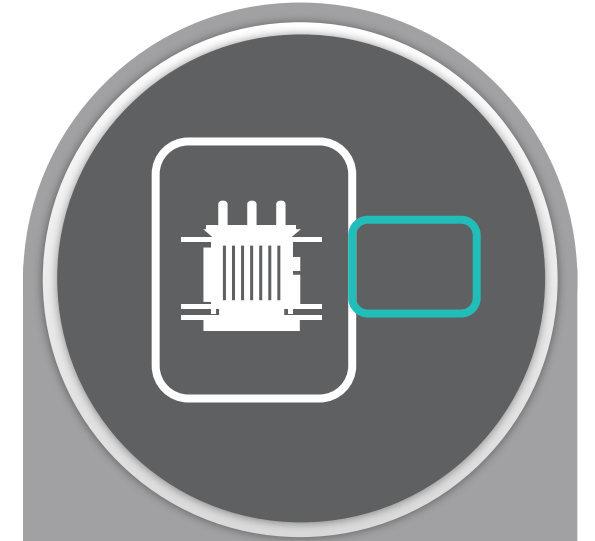
Subset of
monitored sites



Appropriate mix of
outdoor, GRP,
brick building, etc



Operating
temperatures at
the site from
monitoring data



Physical
requirements of
the cooling
technology



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



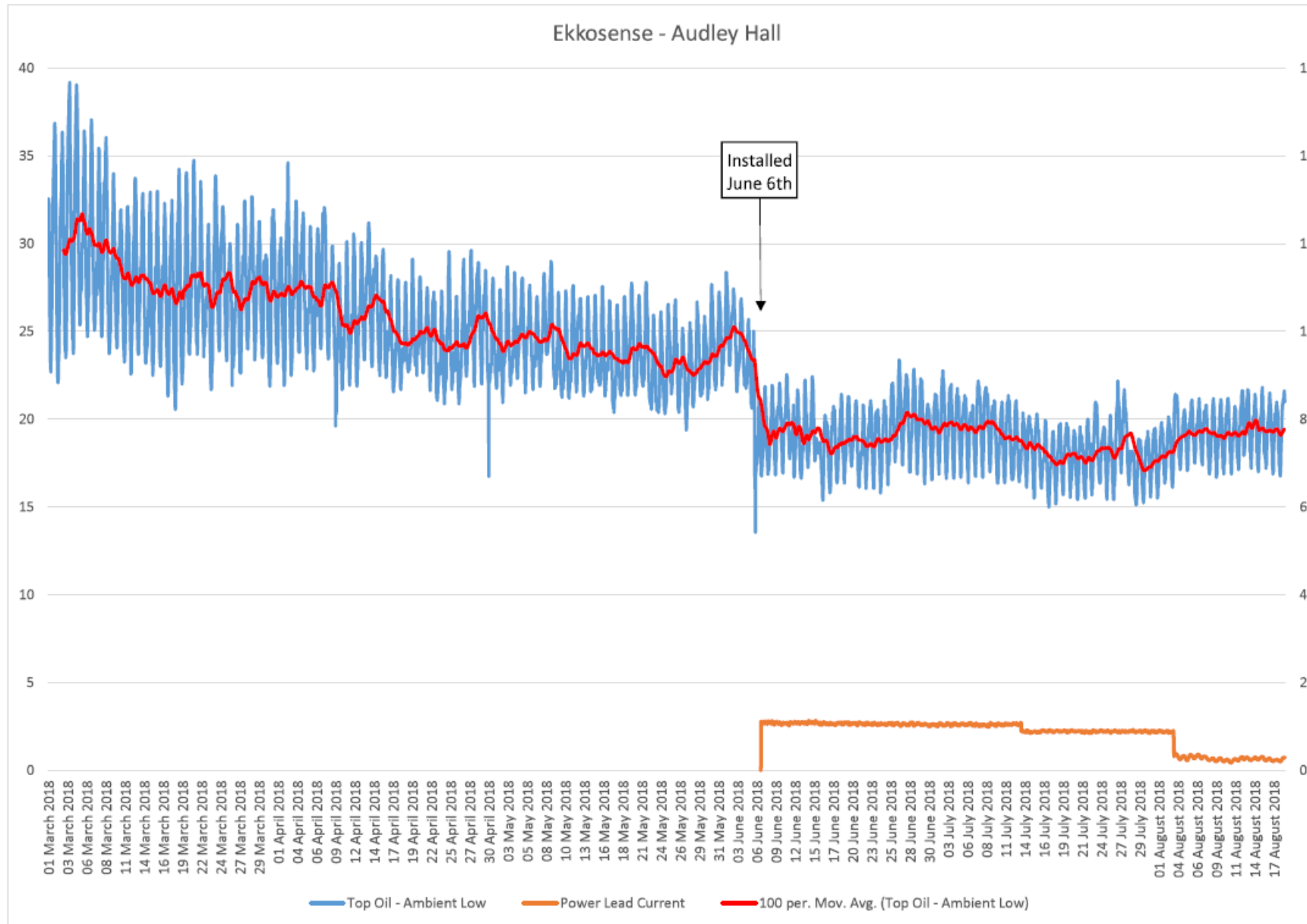
Ekkosense

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







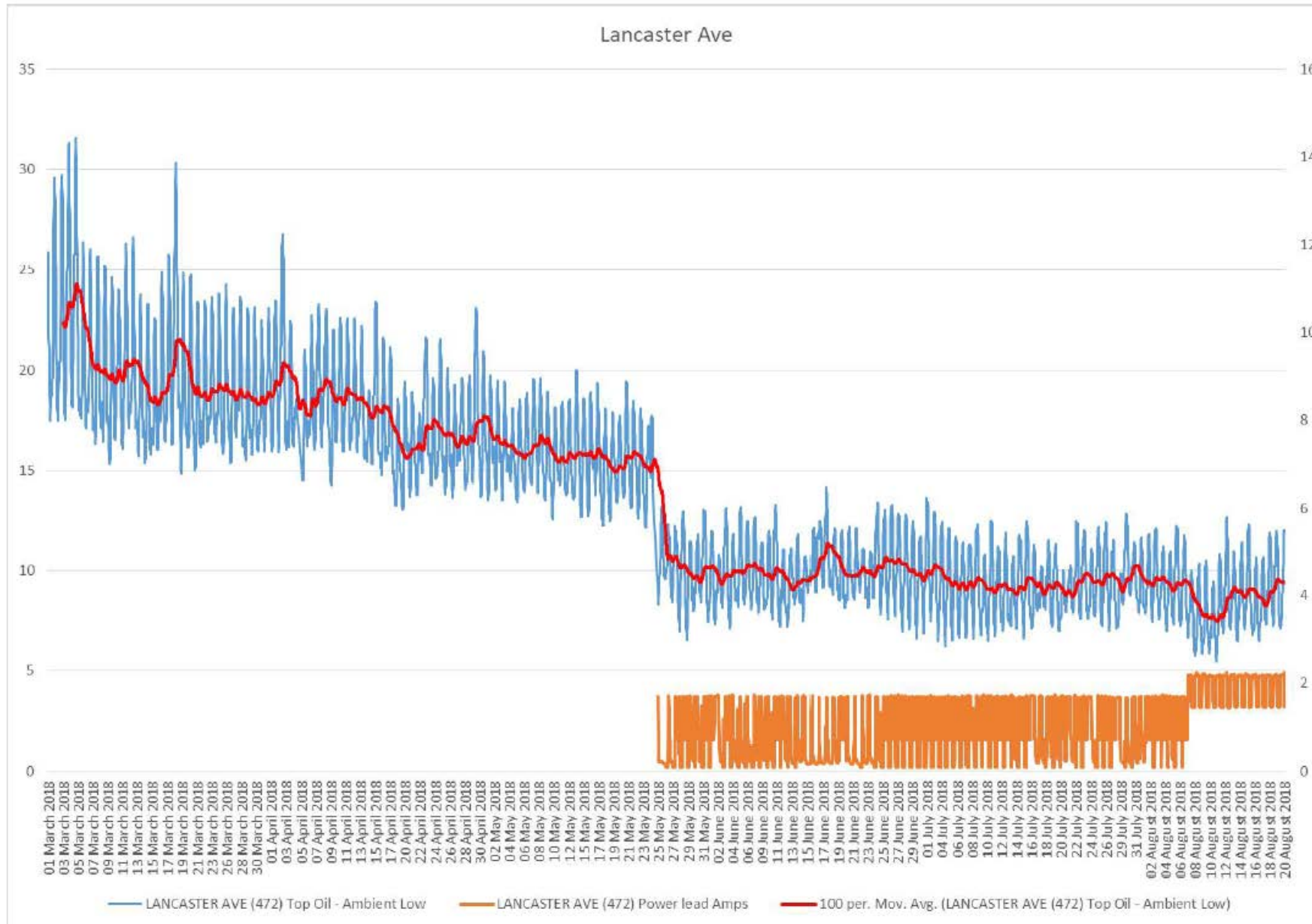
Powered technologies which can be used to push or pull the hot air from the building



Passcomm

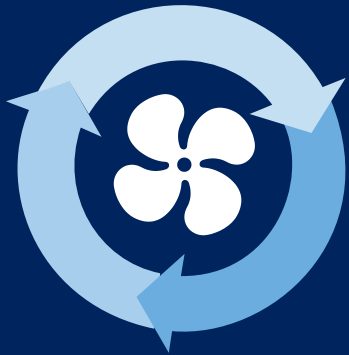
Uses equipment to force air from outside through the lower vent, which creates positive pressure inside which expels through a high exit vent







Improving ventilation



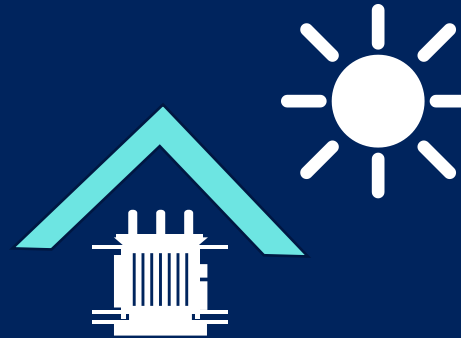
Supported by the Thermal Flow Study results, which will provide guidance about the best ventilation arrangements

Painting outdoor transformers



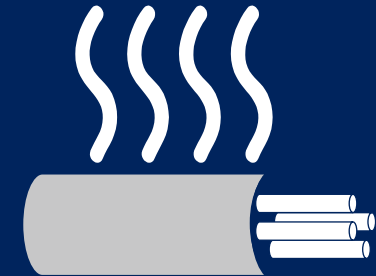
White paint will be used to reflect solar heating of the asset

Shading outdoor transformers



To protect from solar radiation

Cable backfill



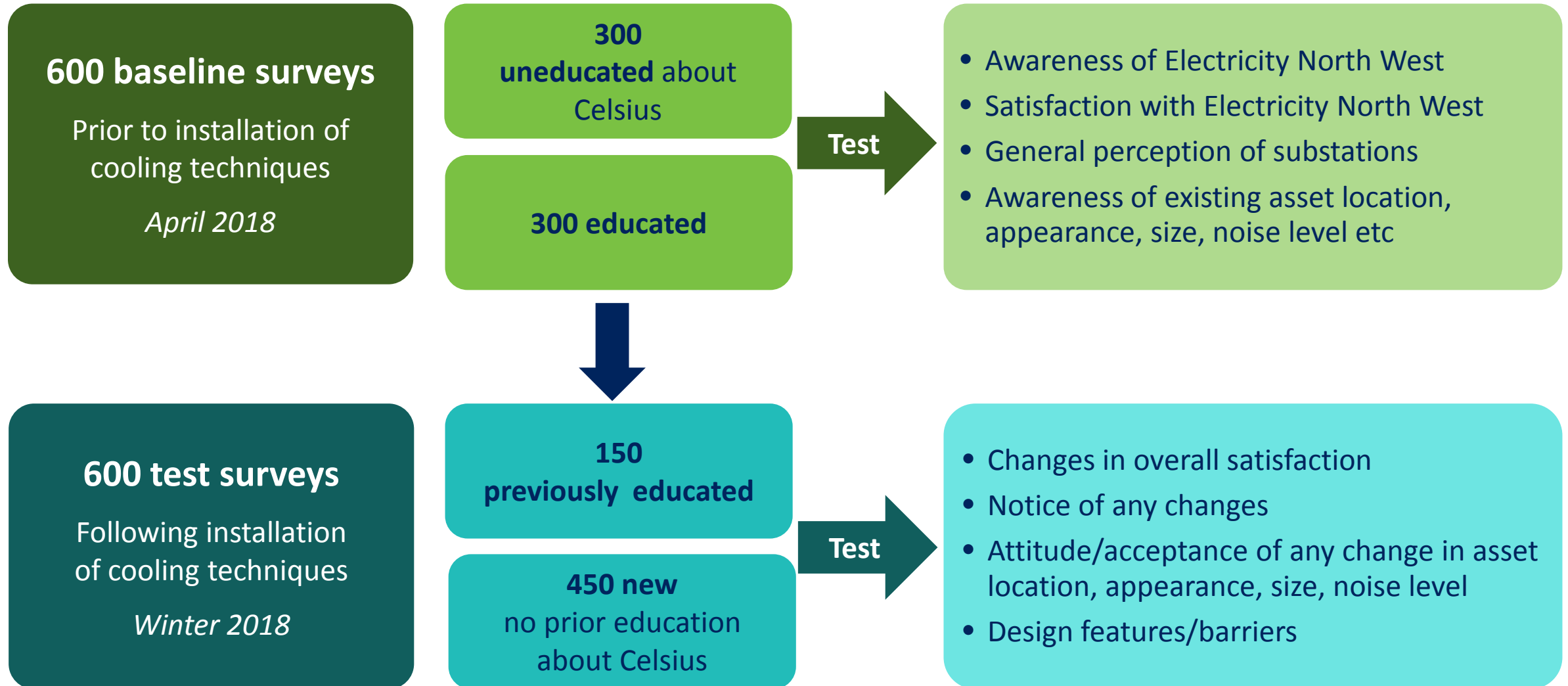
Backfilling cable ducts with a material with beneficial thermal properties, to allow heat to escape from cables more effectively

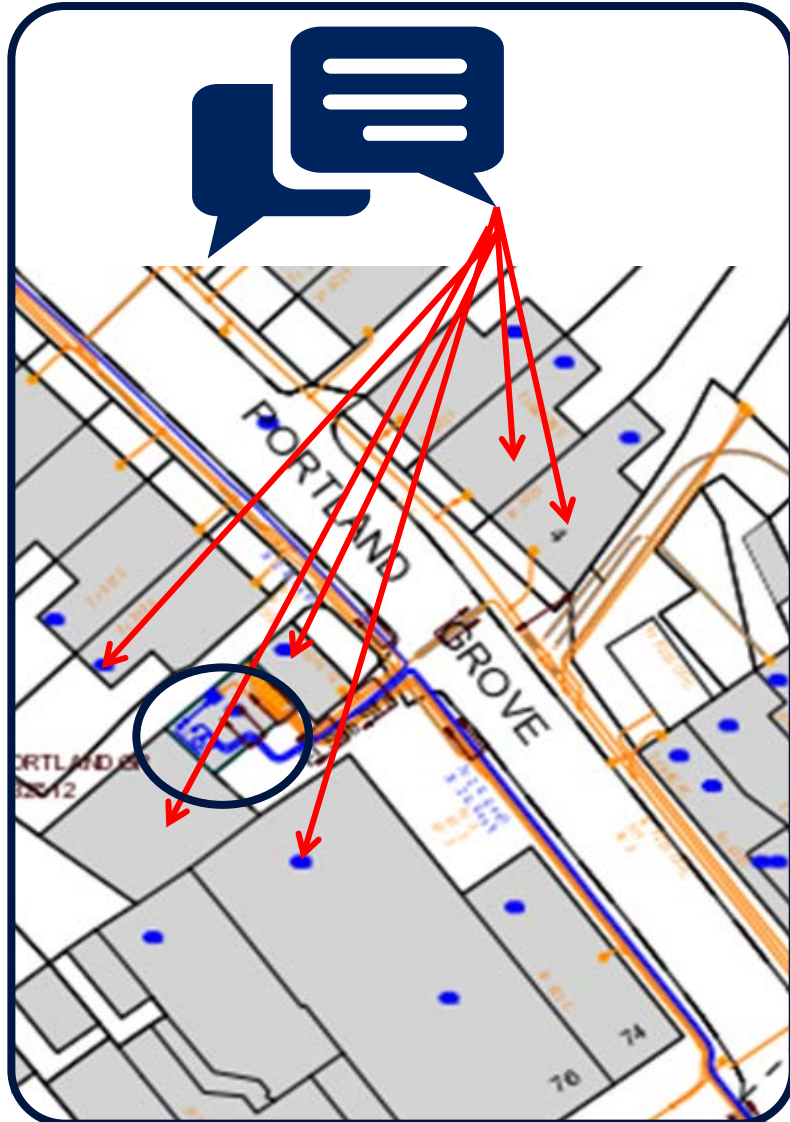


Customers in the Celsius trial areas will find the implementation of innovative retrofit cooling techniques as acceptable as traditional reinforcement

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





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



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.





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



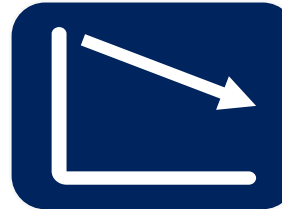
3 noise complaints from 19 sites



High density urban substations close to domestic dwellings



Settings reduced to lower noise emissions

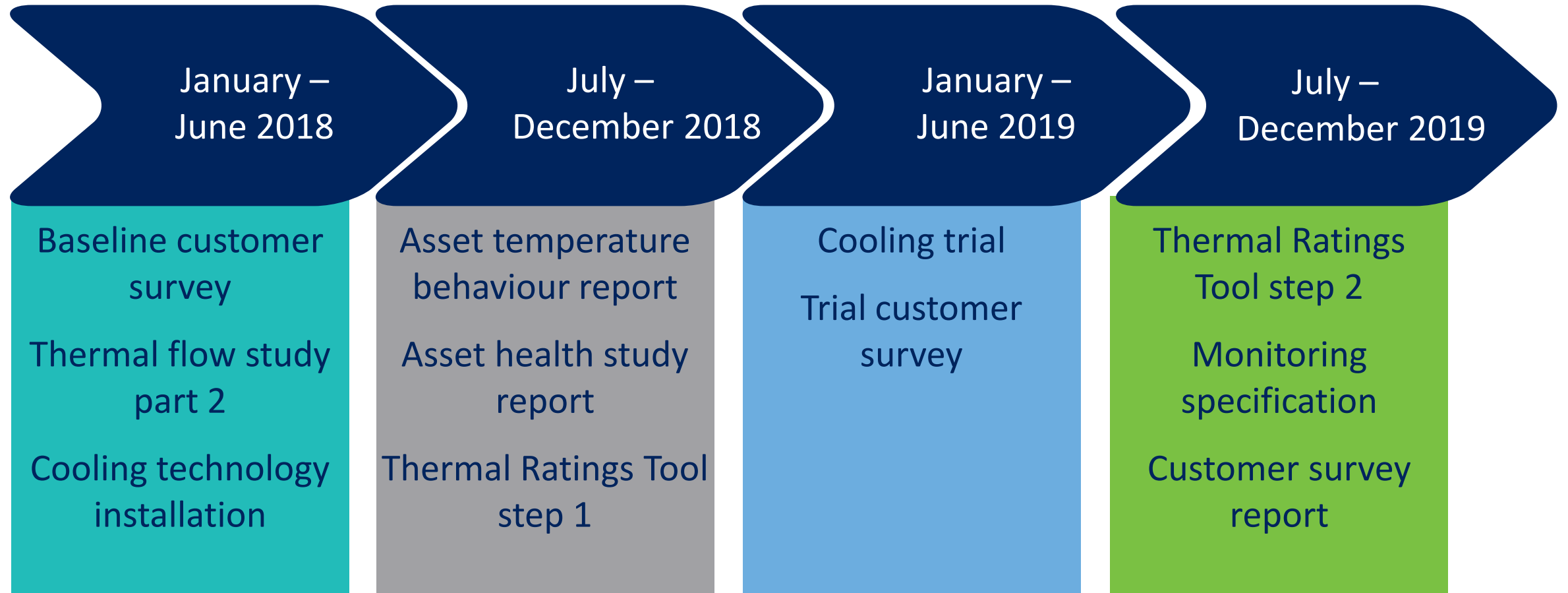


Reduction on cooling potential



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

Progress and next steps



Knowledge sharing and dissemination

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QUESTIONS & ANSWERS

Stay connected...



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