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Session 5.1
Thermal Monitoring and Dynamic Ratings

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Network Performance & Innovation Manager

LCNI Conference
Thursday 13 October 2016

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Agenda

Celsius

Enhanced Real-Time Cable Temperature Monitoring

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SP ENERGY NETWORKS

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Senior Project Consultants

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Innovation Project Manager

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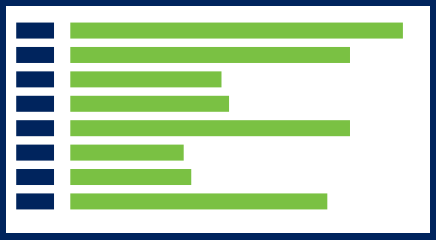
Agenda

Celsius



Introduction

Project overview

Progress and next steps

Questions & answers

Our smart grid development

Leading work on developing smart solutions

Deliver value from existing assets

Customer choice

LCN Fund Low Carbon Networks

Five flagship products (second tier/NIC) £42 million

C2C

SMART STREET

Celsius

CLASS

RESPOND

Celsius

Awarded: 9th December 2015

- Go live
- Monitoring installation Mar 2017
- Monitoring trial Mar 2018
- Thermal ratings tool stage 1 Oct 2018
- Retrofit cooling installation Jun 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

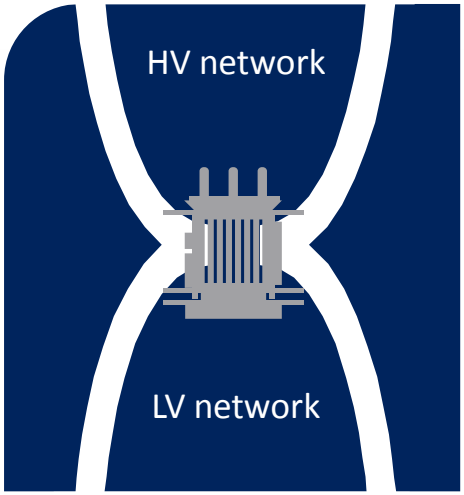
Impact Research

UK Power Networks Delivering your electricity

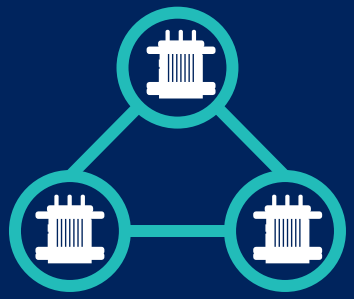
Partners and roles on project

ASH – Creative Wireless Electronics	Ricardo-AEA	UK Power Networks – Delivering your electricity	Impact Research	University of Southampton
Supply complete retrofit monitoring solution Provide ongoing support throughout installation, commissioning and operation of the retrofit thermal monitoring workstream	Analyse trial data Develop methodologies to understand relationship between asset temperature, load characteristics and surrounding environment Determine impact of cooling technologies Develop tool and spec for low cost temperature sensor Recommendations for BAU rollout	Work with ASH, Ricardo-AEA and Electricity North West to develop retrofit thermal monitoring solution Participate in evaluation and selection of retrofit cooling techniques	Facilitate customer focus groups Develop customer communication materials Lead the customer survey engagement	Peer review of the analysis methodology of the retrofit temperature sensor part of the project An investigative study on the impact of Celsius on the lifetime health of network assets

The problem



Objective is to maximise power through transformer



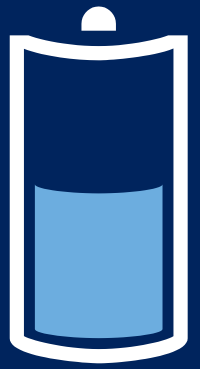
Assets have nominal thermal rating

Ratings = ^{O}C

Ratings **K** amps

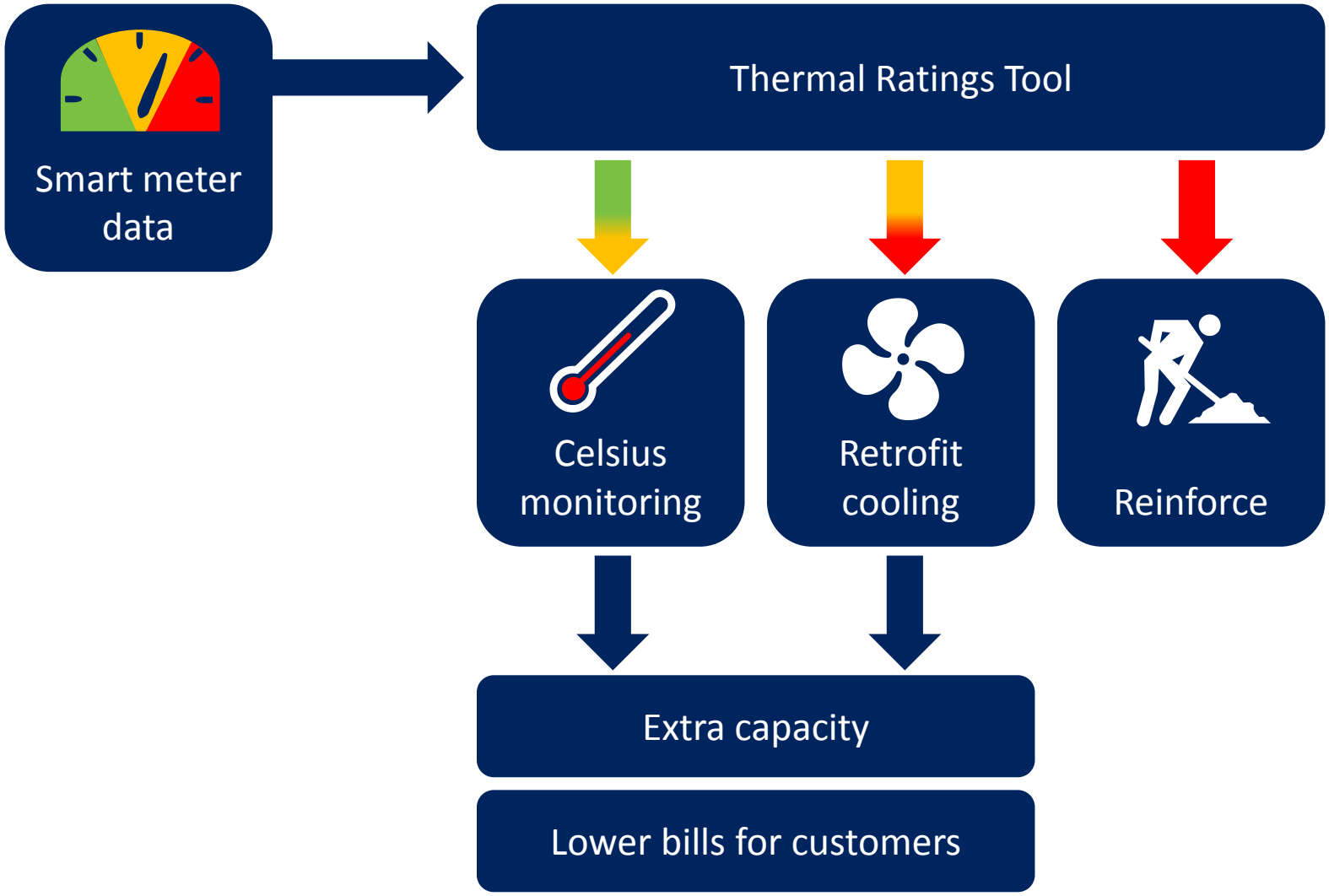
Diverse range of environments

Small changes in environmental factors can result in very different actual ratings

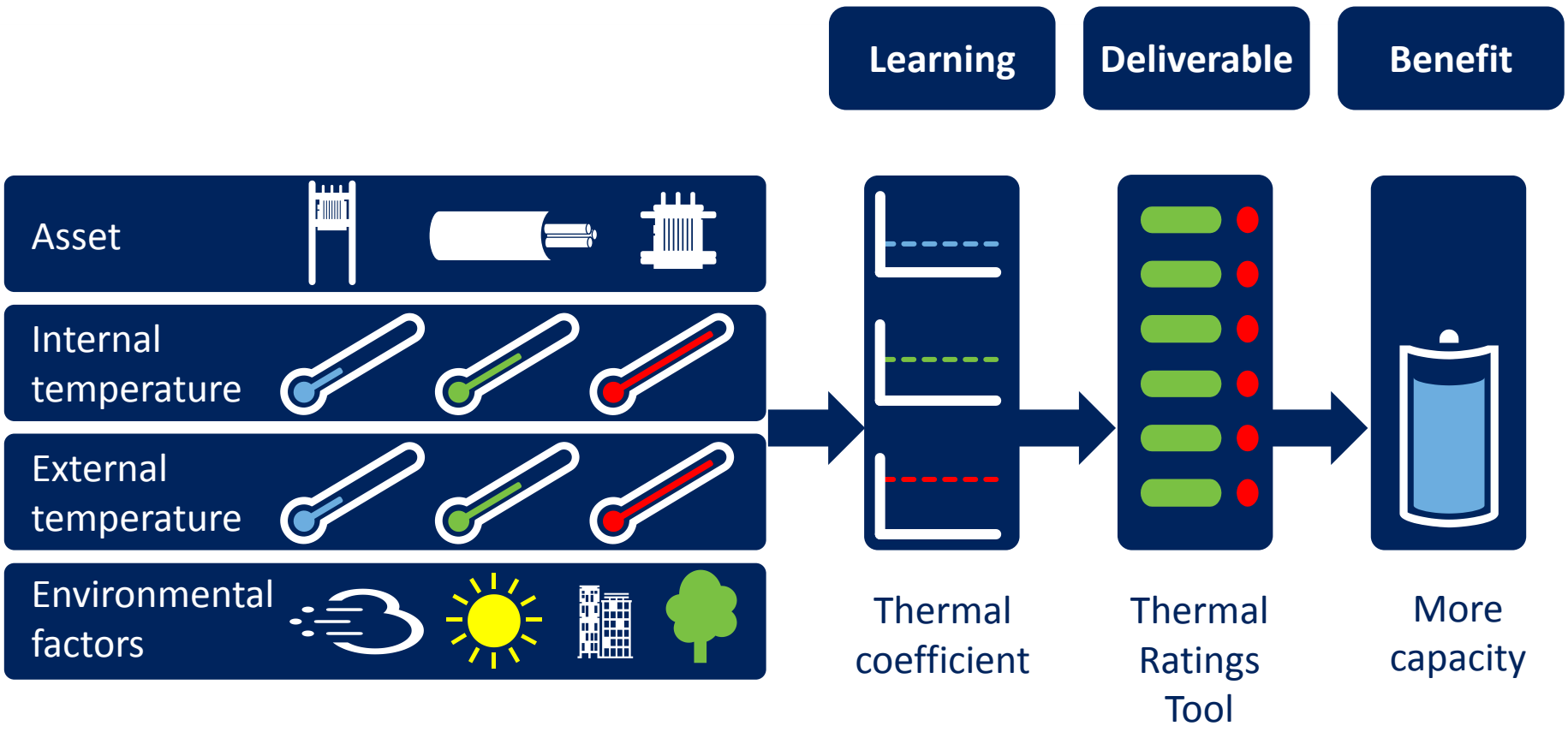


Assumed thermal ratings can lead to capacity being under-utilised or unnecessary risk

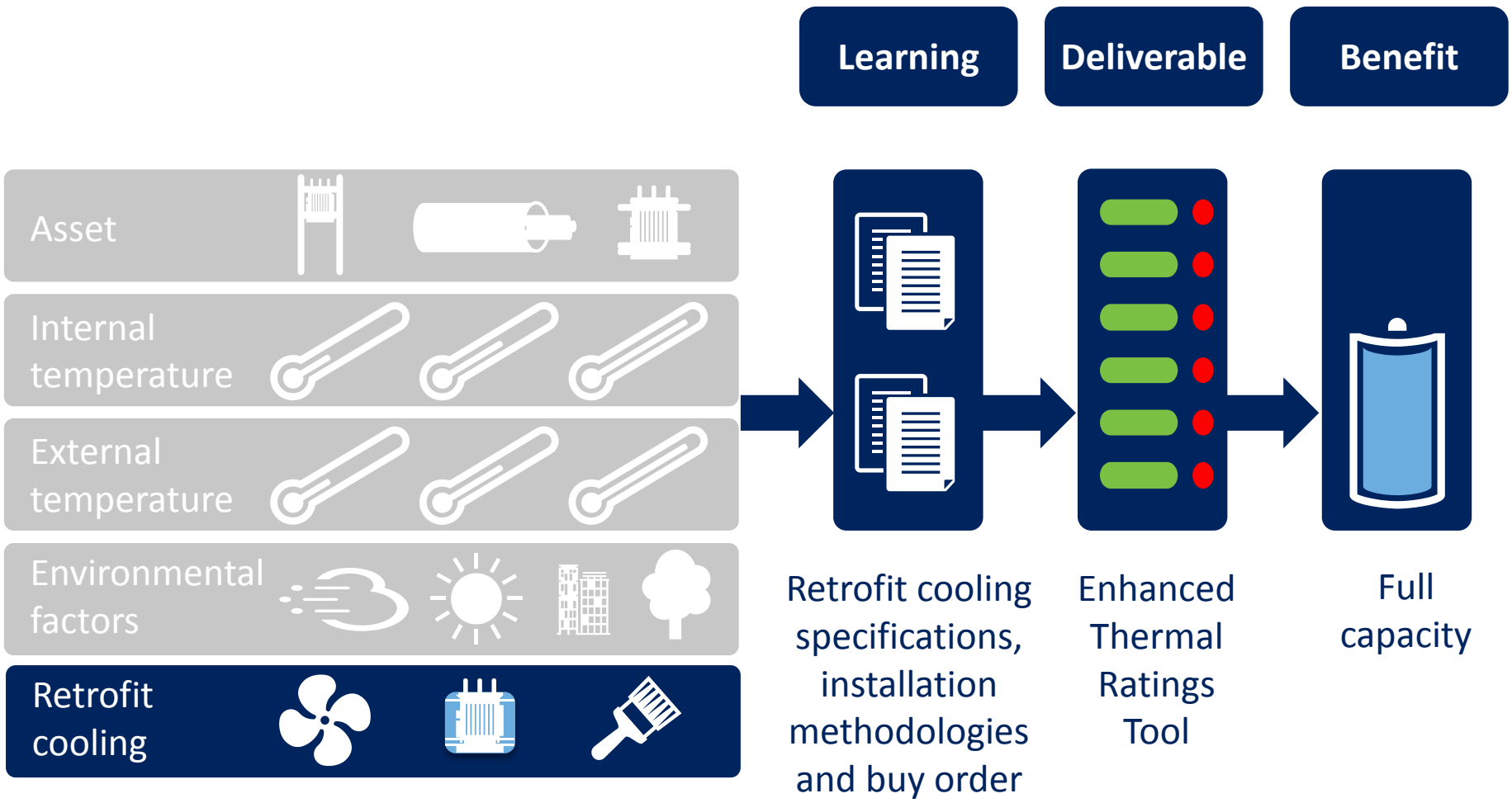
Celsius as part of the smart future



Step 1: Fit thermal monitoring



Step 2: Retrofit cooling

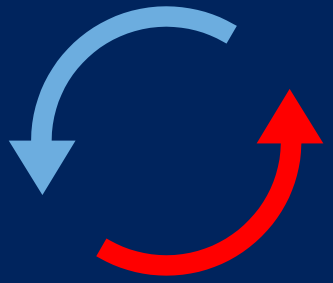


Celsius studies

Thermal analysis (step 1)

Internal asset temperature = Thermal coefficient × External asset temperature

Thermal flow study (steps 1 & 2)



Research into heat and air flows for optimal substation design

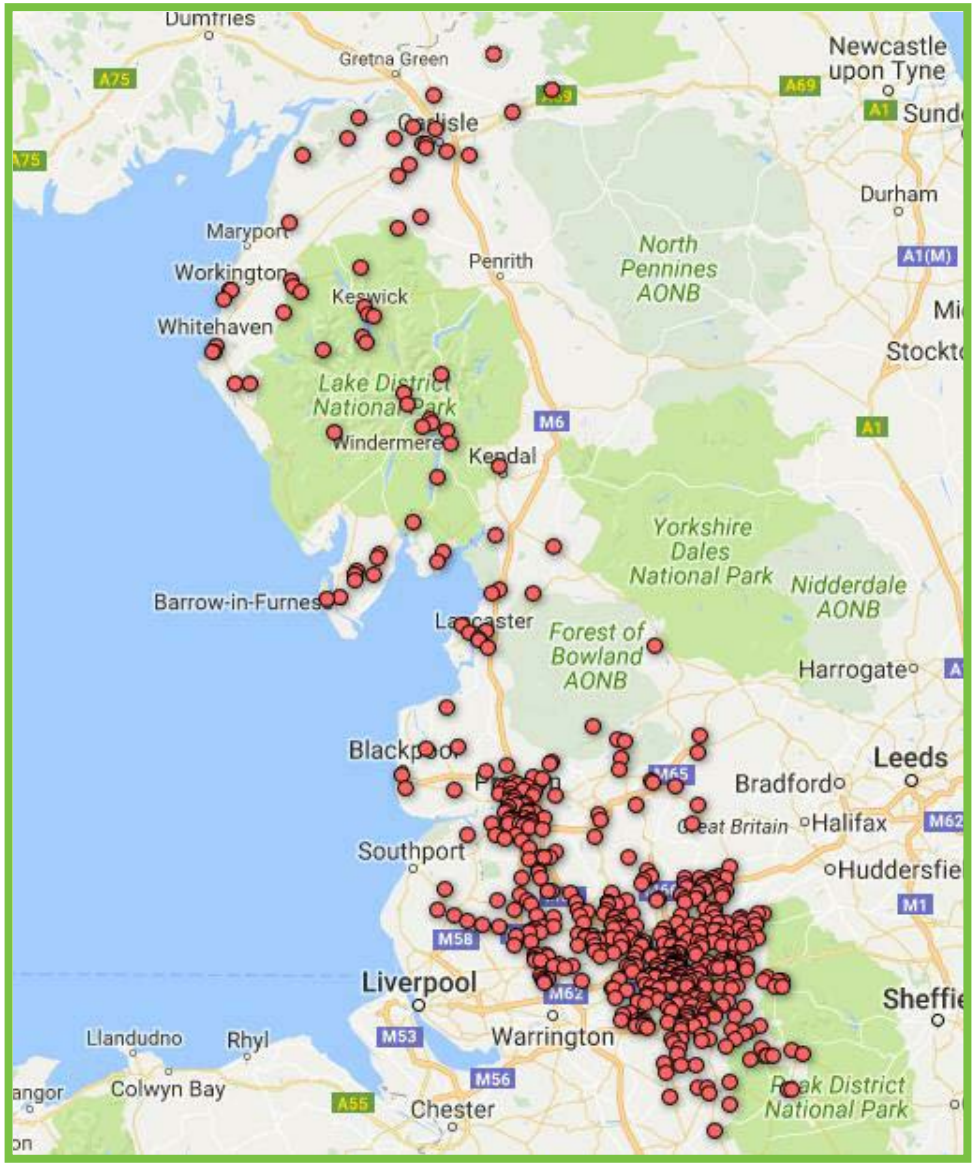
Asset health study (steps 1 & 2)

Examines effects of increased load and cooling techniques on assets

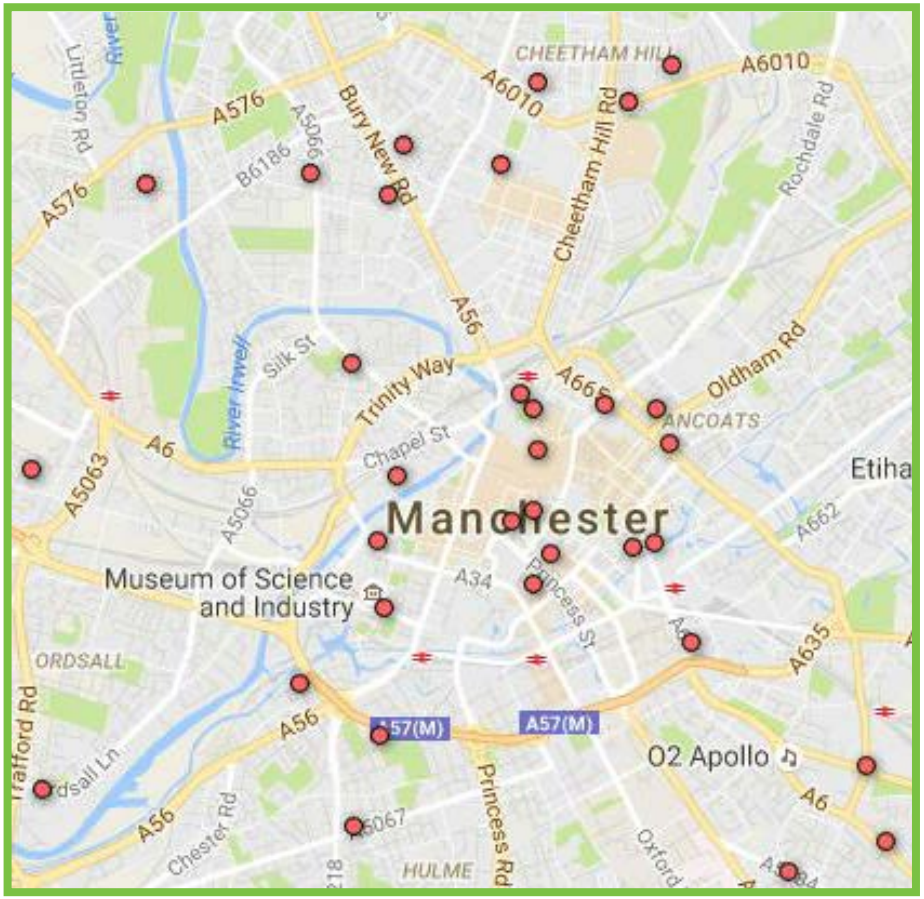
Monitoring site selection and timescales

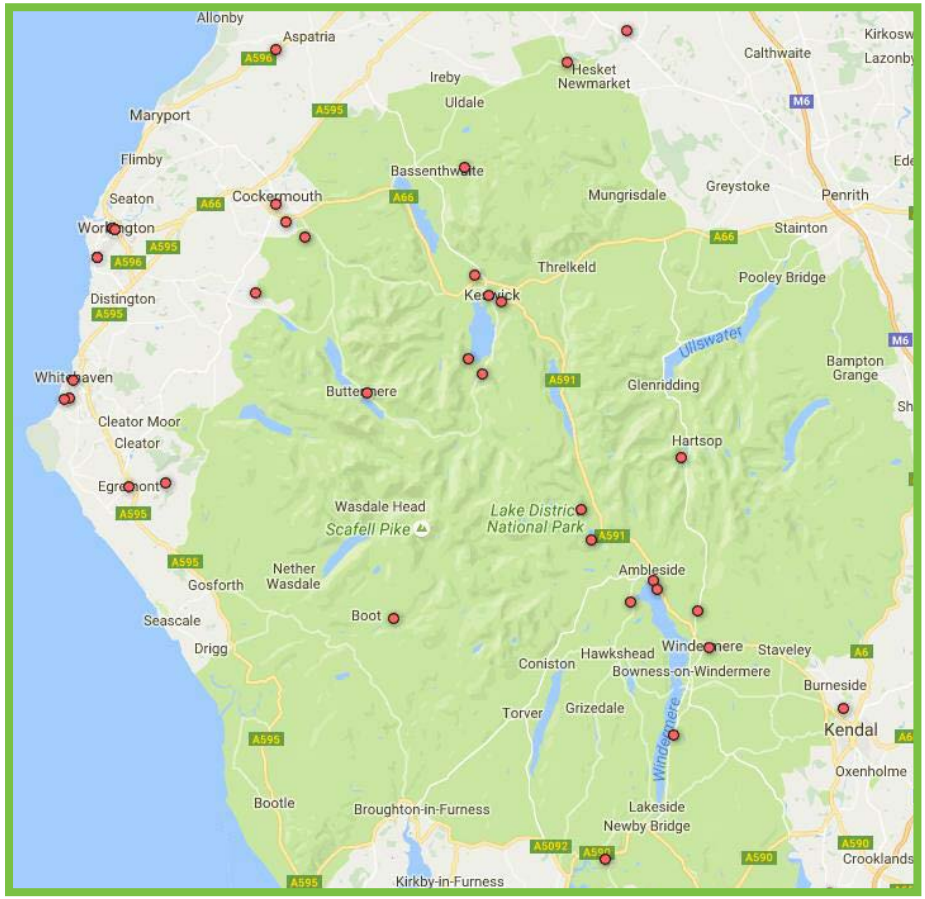
		
520 substations	100 cooling technique sites	Four year project
Enough substations to represent 80% of GB substation population	Subset of 520 substations – enough sites to adequately trial all techniques	To enable trials to take place during all seasons and to trial all cooling techniques

Site selection map

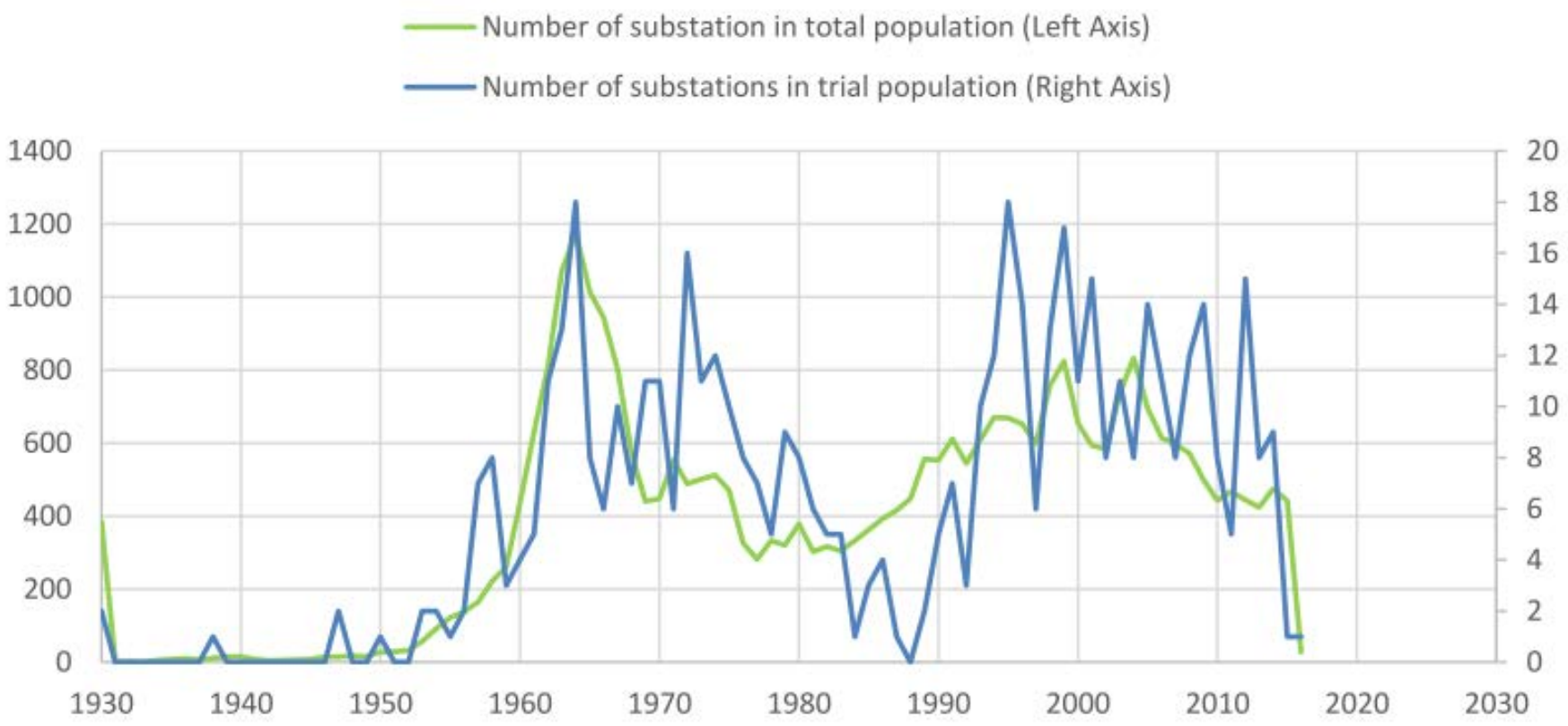


Site selection – rural and urban

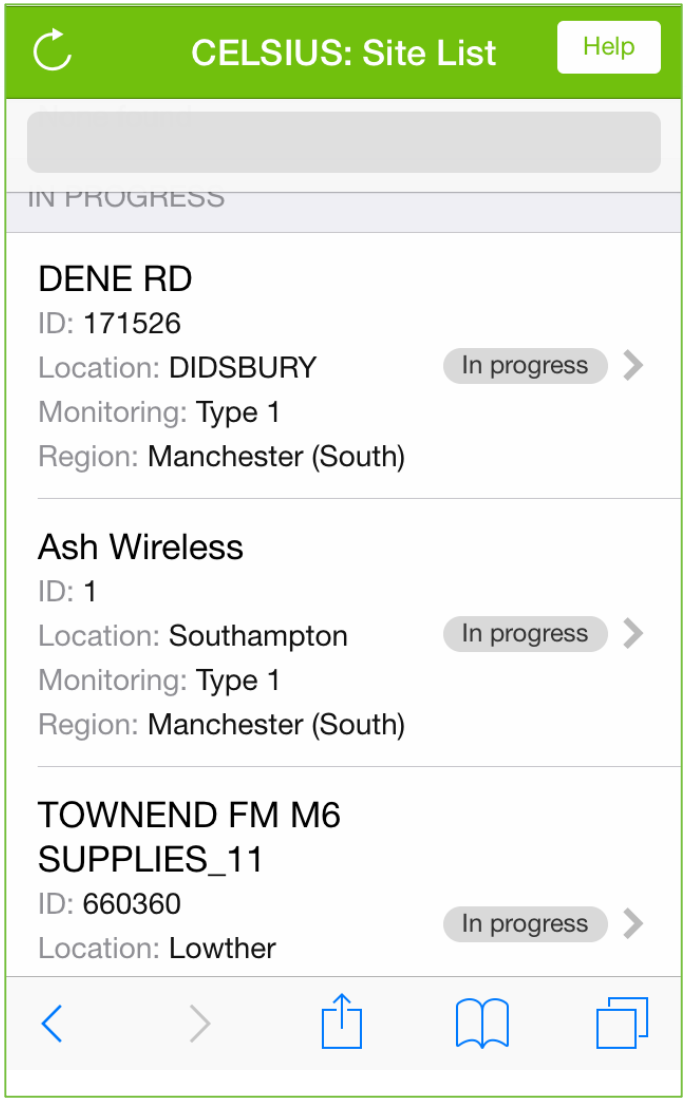


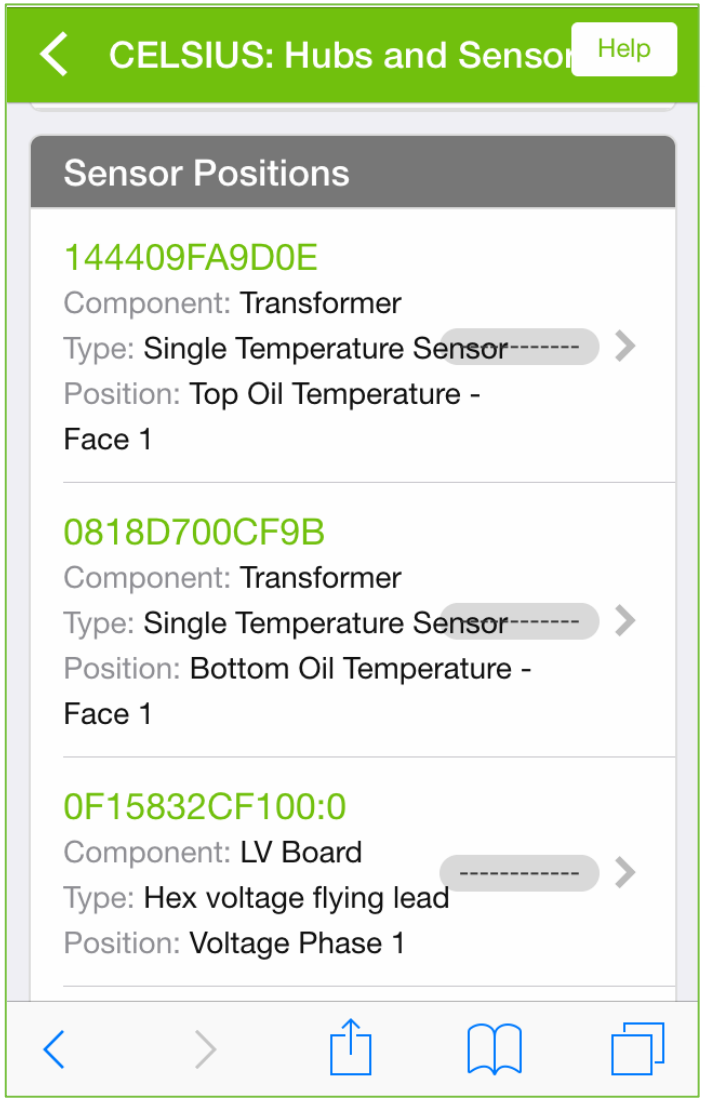


Site selection



Commissioning app

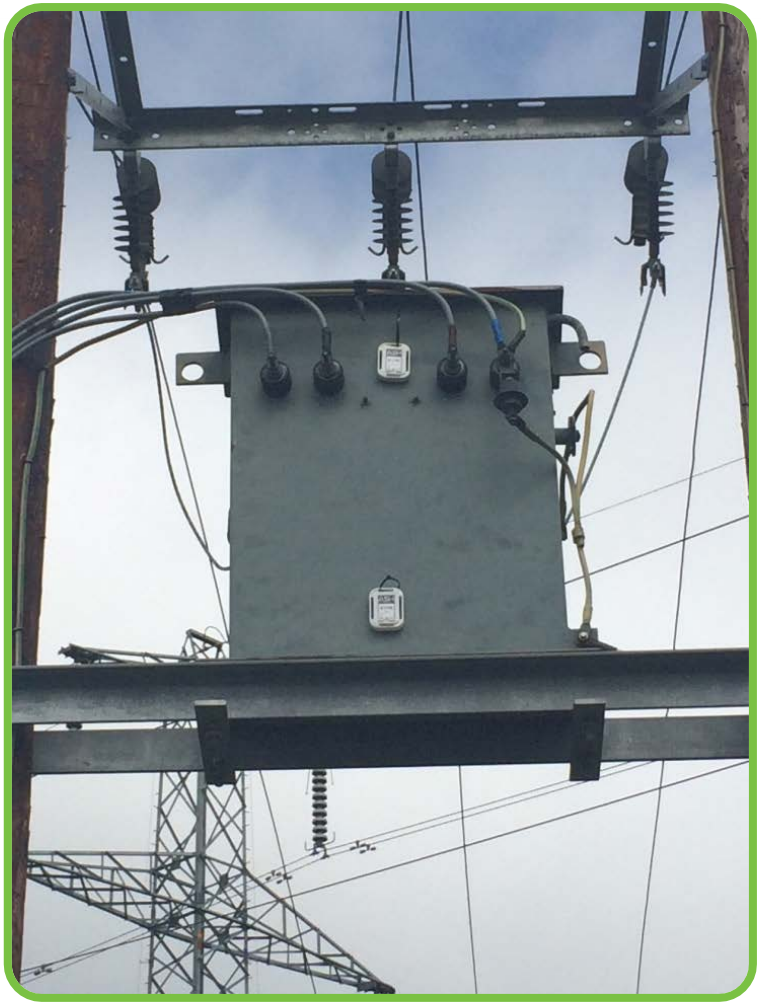




Celsius technology

Hub

Wireless sensor

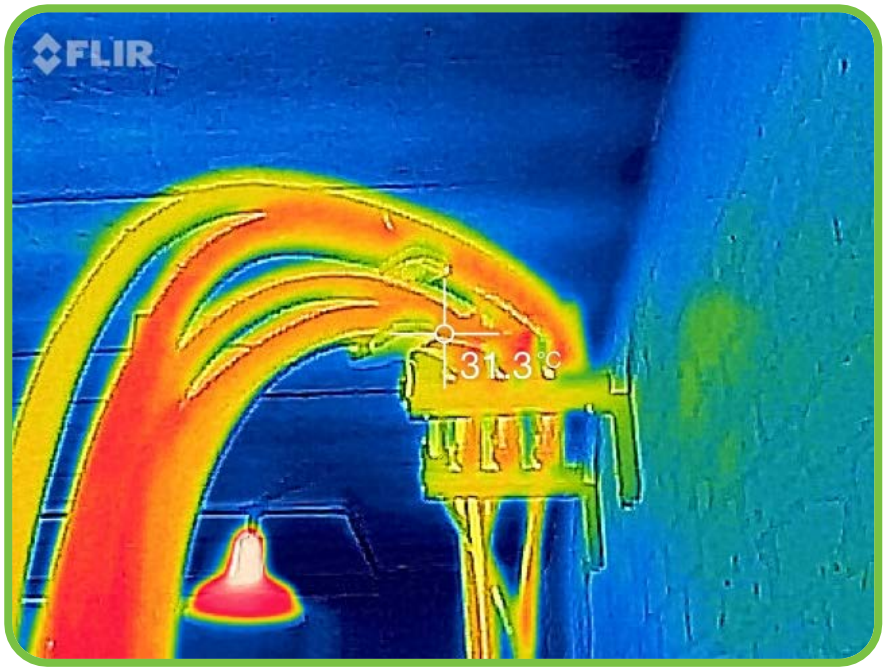


Celsius technology – trial fit

LV board with three sensors

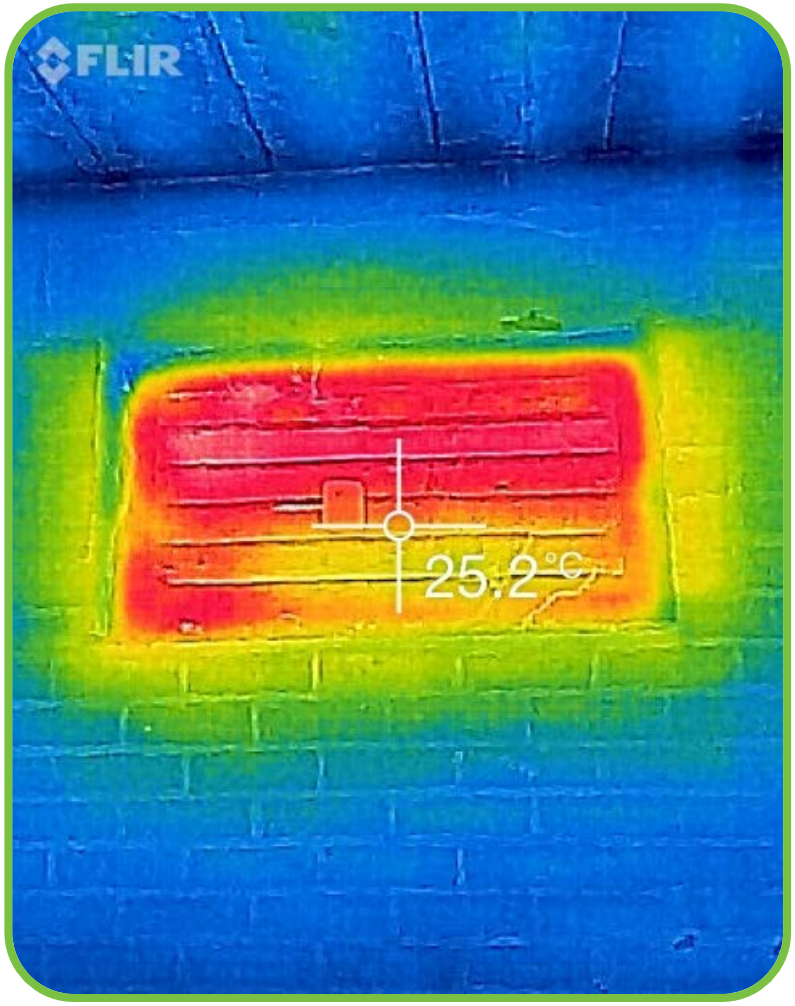
Celsius technology – trial fit

Transformer singles



Celsius technology – trial fit

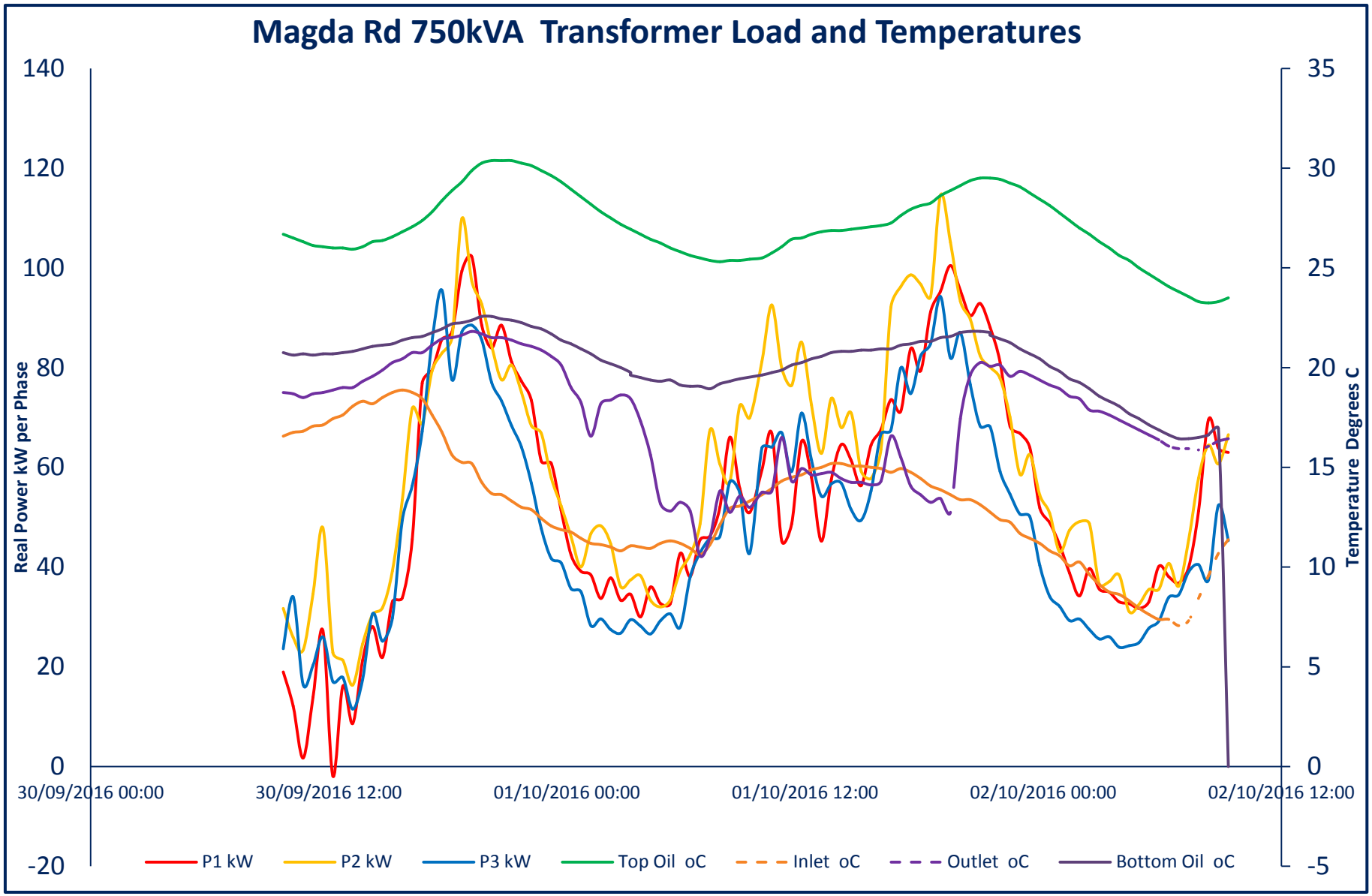
Ventilation



Celsius technology – trial fit

Transformer

Trial site data



Traditional reinforcement v Celsius

	Traditional	Celsius
	Traditional replacement of ground-mounted transformer is expensive	Low cost options to release capacity as and when required
	Complex and time-consuming	Simple and quick to deploy
	Highly disruptive	Minimal or no disruption to customers

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

Customer engagement plan

Baseline survey

Test survey

Focus groups

Website

Video/ podcasts

Customer mailing

Social media

Progress and next steps

January – June 2016	July - December 2016	January – June 2017	July – December 2017
Project mobilised	Monitoring site selection	Data capture	Monitoring installation report
Partner contracts awarded	Commissioning tool	Thermal flow study	Cooling installation plan
Customer engagement plan	Monitoring installation	ENA cooling workshop	Thermal flow study report
Data privacy statement	ENA ER P15 & P17 workshop	Customer focus groups	

Knowledge sharing and dissemination

Installation of monitoring equipment…

Installation of temperature and power monitoring equipment at

520 LV substations

Monitoring can be installed

quickly, safely, and easily,

without outages

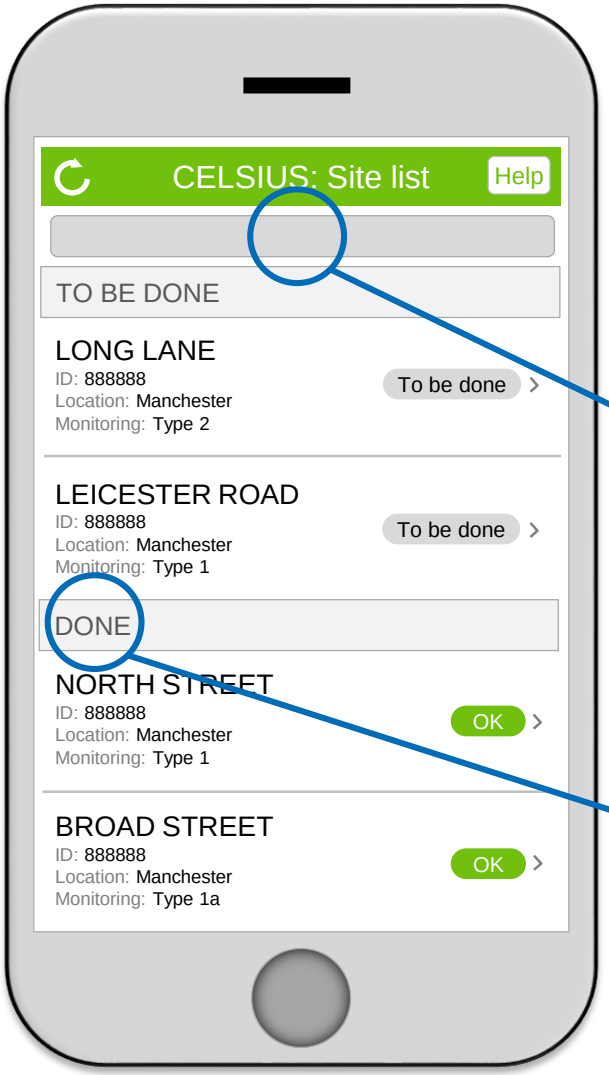
and commissioned with the help of a

mobile phone app

Celsius

Installation of monitoring equipment…

mobile phone app



Sites are

selected on the app

to begin commissioning

Search

for the right site

Listed by

installation progress

Celsius

Installation of monitoring equipment…

mobile phone app

RICARDO

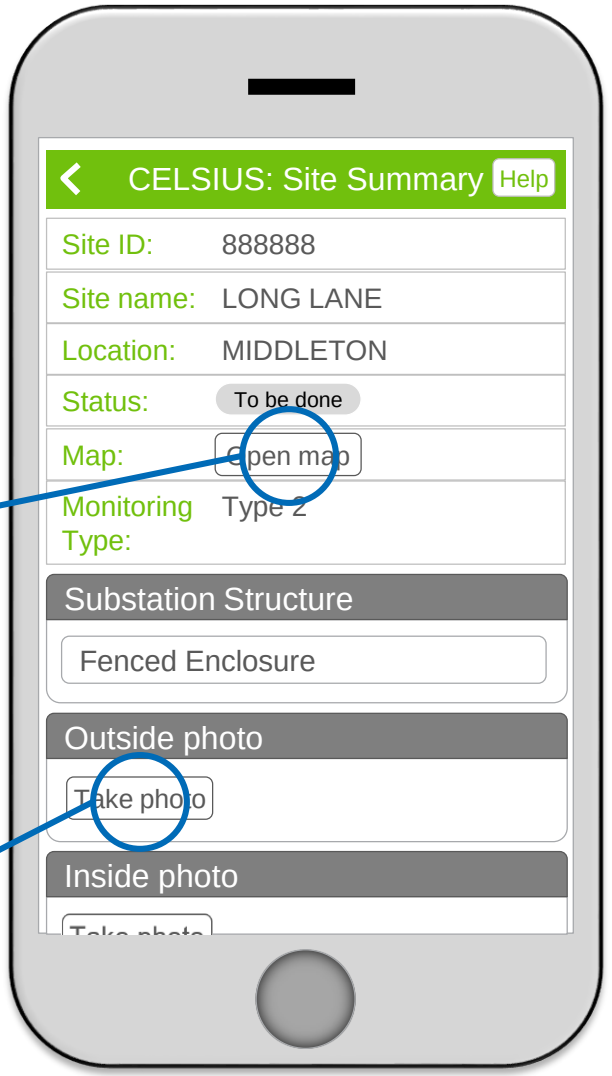
Site information

is entered and checked

Map of site location

to help navigation

Site photographs and thermal images are taken

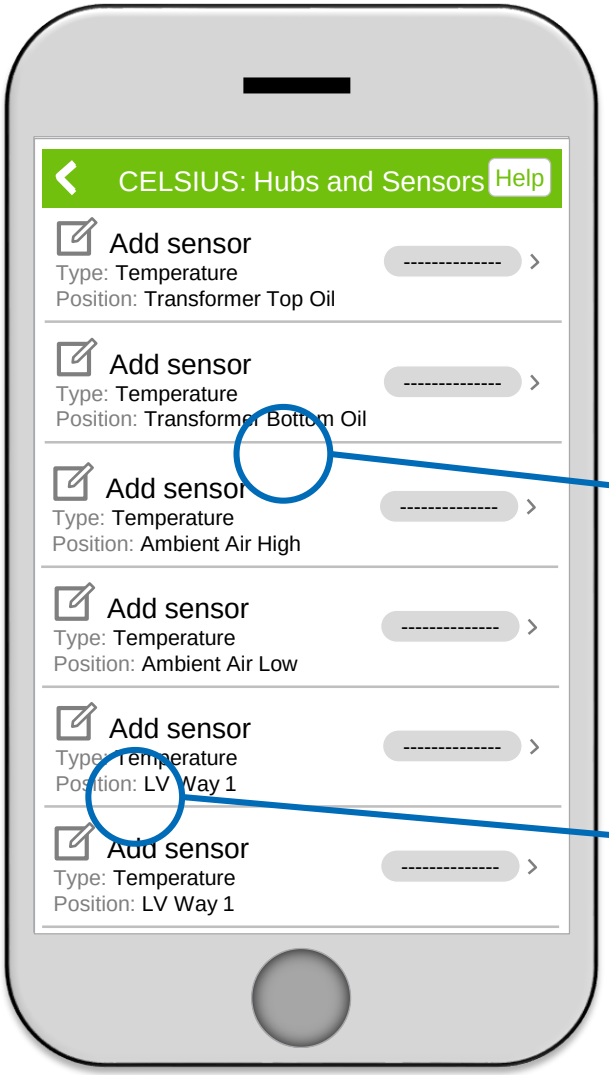


Celsius

Installation of monitoring equipment…

mobile phone app

RICARDO



Monitoring equipment can be installed and commissioned

List of required Equipment and sensor positions

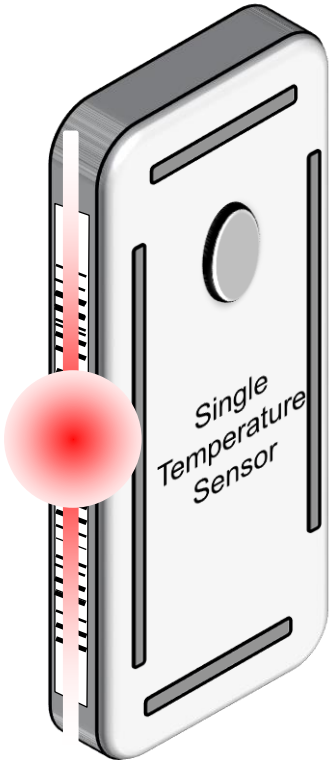
Each position is selected to install the equipment

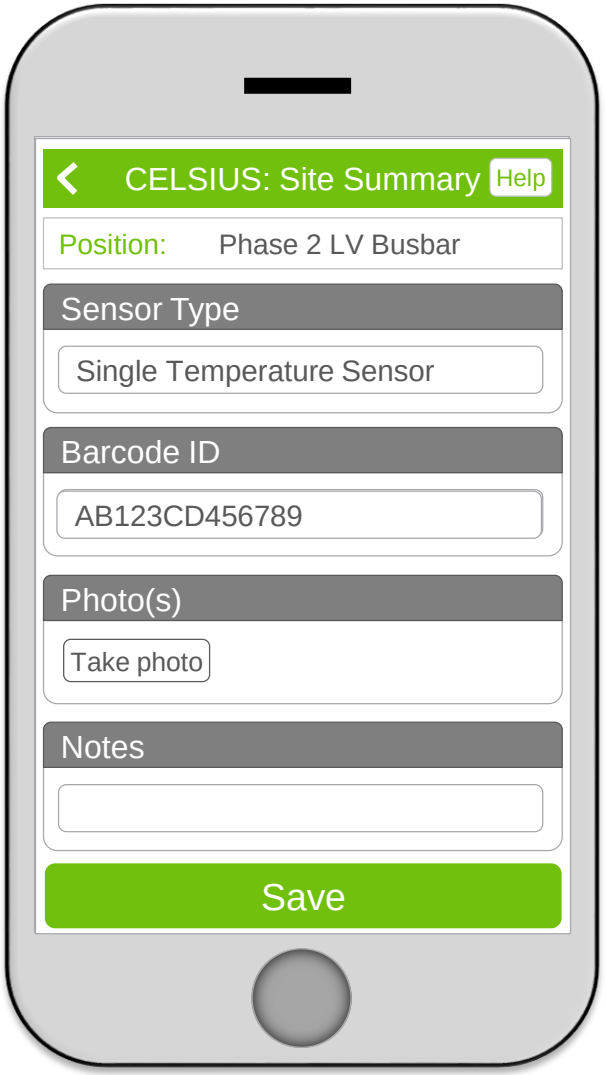
Celsius

Installation of monitoring equipment…

mobile phone app

Sensors are added by entering details, and scanning the barcode



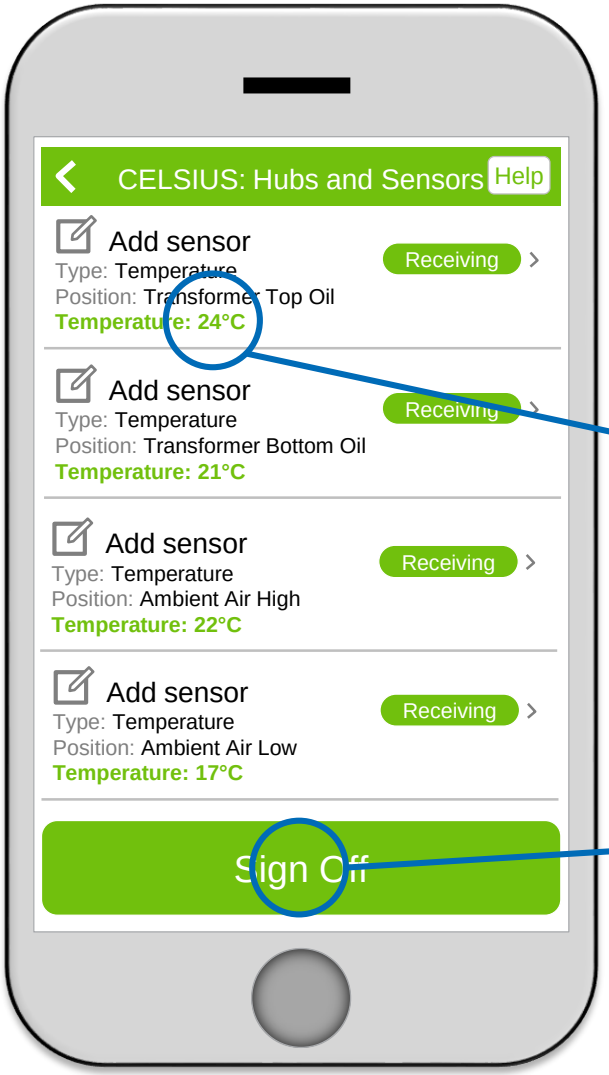


Celsius

Installation of monitoring equipment…

mobile phone app

RICARDO



Working sensors

are indicated in the list

Initial sensor readings

can be checked

Sign off

the installation

For more information

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	**futurenetworks@enwl.co.uk**
	**0800 195 4141**
	**@ElecNW_News**
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