Celsius

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## Agenda

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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

- £5.5 million investment
- Up to £583m across GB by 2050
- Financial benefits
The problem

Distribution substation

Customers’ LCTs
Step 1: Fit thermal monitoring

- **Asset**
  - Internal temperature
  - External temperature
  - Environmental factors

- **Learning**
  - Thermal coefficient

- **Deliverable**
  - Thermal Ratings Tool

- **Benefit**
  - More capacity
Step 2: Retrofit cooling

**Retrofit cooling**

- **Internal temperature**
- **External temperature**
- **Environmental factors**
- **Retrofit cooling**

**Learning**
- Retrofit cooling specifications, installation methodologies and buy order

**Deliverable**
- Enhanced Thermal Ratings Tool

**Benefit**
- Full capacity
Celsius as part of the smart future

Thermal Ratings Tool

- Celsius monitoring
- Retrofit cooling
- Reinforce

Extra capacity

Lower bills for customers
Case studies

Thermal analysis (step 1)

- Internal asset temperature
- Thermal coefficient
- External asset temperature

\[ q_{\text{core}} = q_{\text{external}} \]

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
Data to date

Measurements stored

Latest metrics

289,477 inbound requests handled
43,292,611 measurements stored
72,081 lines of code
Installation issues

- Data gaps through GPRS connection
- Data gaps caused by backend algorithm and timestamp handling
- Firmware upgrade to the KTSO1 wireless temperature sensor
- Firmware upgrade to HEX
- Firmware upgrade to HUB (OTA)
HUB OTA update

Ramillies Avenue

![Graph showing missing timestamps over time for Ramillies Avenue]

- X-axis: Timestamp
- Y-axis: Missing Timestamps (h)

- Data points indicate spikes in missing timestamps on specific days:
  - 14/04/2017
  - 19/04/2017
  - 24/04/2017
  - 29/04/2017
  - 04/05/2017

- Peaks suggest significant disruptions or delays on these dates.
Smart Tx vs Celsius: power utilization

Utilisation (%)

Apparent Power (kVA)

Stotal

Stotal Celsius

U%
Smart Tx vs Celsius: temperature

Current (A)

Temperature (°C)

Smart Hot-Spot
Celsius Top (Tank Surface Face 1)
Celsius Top (Tank Surface Face 2)
Celsius Top (Tank Surface Face 3)
Celsius Top (Tank Surface Face 4)
Smart Top
Celsius Top (Internal)

Total
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 2017
- Data capture
- Thermal flow study
- DNO cooling workshop
- Customer focus groups

July - December 2017
- Monitoring installation report
- Cooling Technologies selection
- Cooling installation plan
- Thermal flow study report

January – June 2018
- Installation of Retrofit cooling technologies
- Customer surveys

July – December 2018
- Asset health study
- Carbon Impact assessment
- Asset temperature behaviour report
- Thermal ratings tool (Step 1)

Knowledge sharing and dissemination
For more information

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