CoolDown

Project Show and Tell

3rd June 2024

Presenters:

- Electricity North-West Limited – Delroy Ainsworth
- Guidehouse – Callum Coghlan
- UCL Consultants – Olly Smith

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Context: We aimed to better understand cooling demand and flexibility for distribution networks

10%
UK electricity already attributed to air conditioning (AC).

65%
Of office spaces and 30% of retail spaces have air conditioning currently.

>30%
Of English homes are at risk of overheating in future.

Up to 7GW
Increase in UK-wide summer peak loads in a 32% AC adoption rate scenario.

Lack of clarity on the impact of increasing SC on networks

- ✓ As the UK warms, it is important to assess the impact of space cooling and the potential flexibility associated with it, particularly in areas with summer-peaking substations.
- ✓ It is unclear how much network flexibility space cooling can provide in practice, and what is needed to unlock demand response (DR).

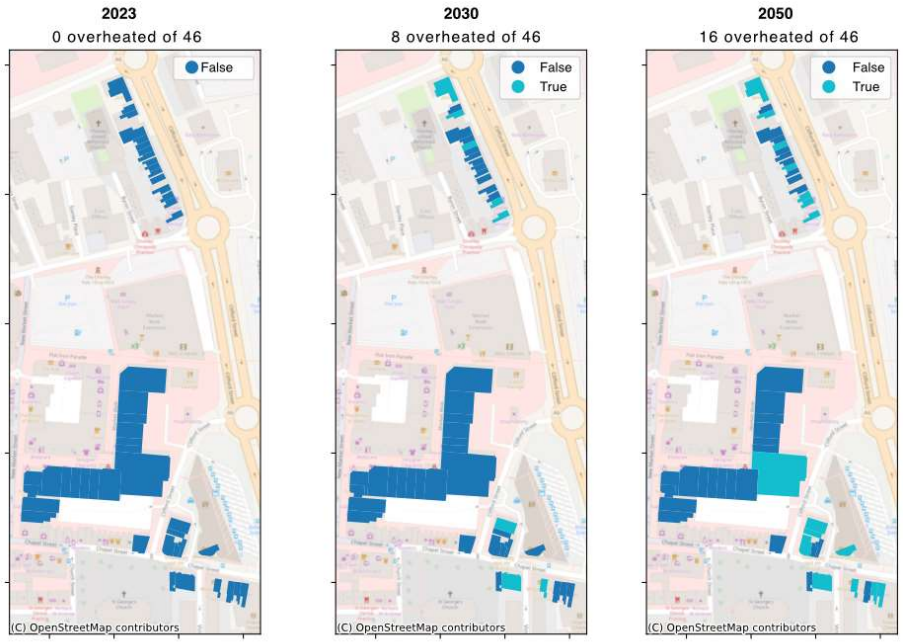
1. **Modelled future cooling uptake** — UCLC
2. **Explored cooling impact on network** — electricity north west
3. **Performed cost benefit analysis** — Guidehouse
4. **Evaluated cooling DR** — Guidehouse
5. **Longlist DR commercial models** — Guidehouse

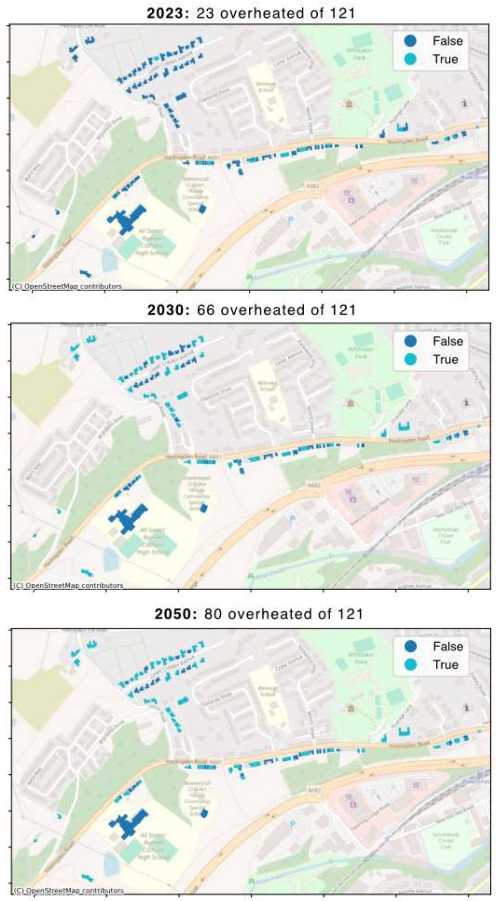
For both substations modelled, overheating is expected to increase significantly between now and 2050

Key takeaways

- Initial overheating simulations for both ENWL substations assume no additional cooling uptake from 2023 levels.
- The simulations indicate that by 2050, **16 out of 46 buildings served by the Cattle Market substation** are projected to experience overheating.
- Adding to the 13 existing non-domestic buildings with heating, this means 29/46 buildings are cooled by 2050.
- **80 out of 121 buildings served by the Union Rd substation** are expected to face overheating.

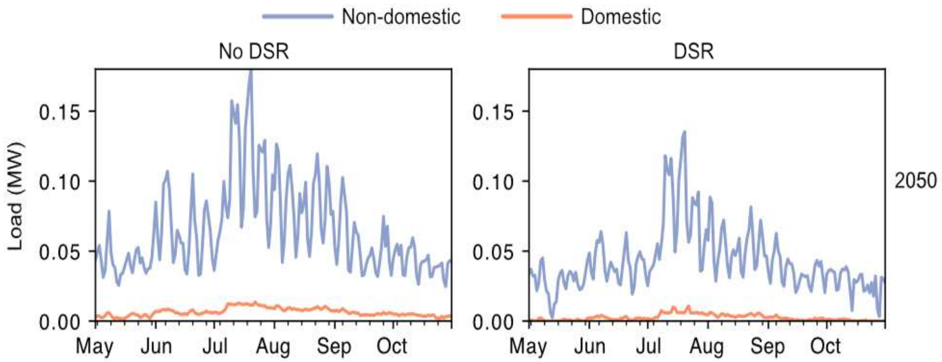
Illustration of overheating in Substation 1: Cattle Market (left) and 2: Union Road (right)





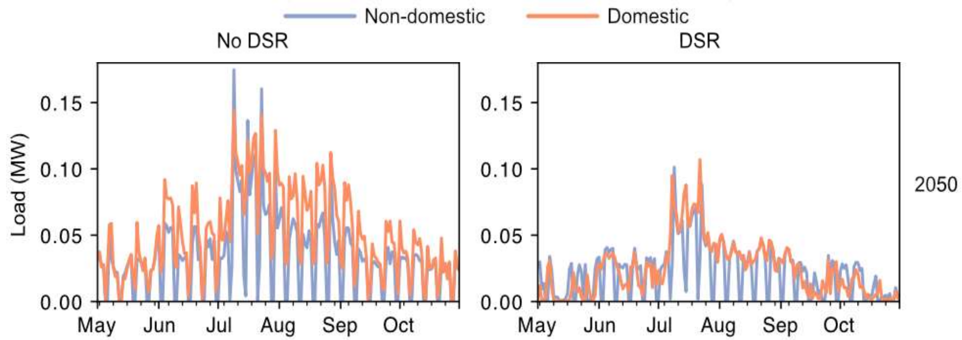
Cooling DR can significantly reduce peak cooling load without resulting in overheating buildings

Simulated cooling load profiles for Substation 1: Cattle Market with and without DR



DR reduced peak cooling load by 26%

Simulated cooling load profiles for substation 2: Union Road with and without DR

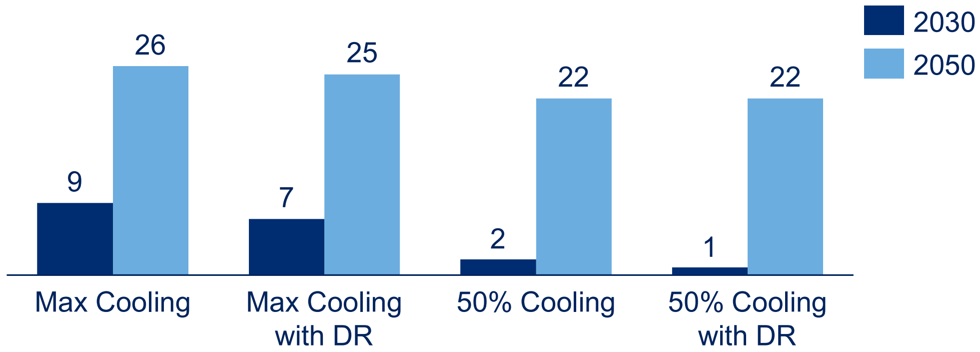


DR reduced peak cooling load by 45%

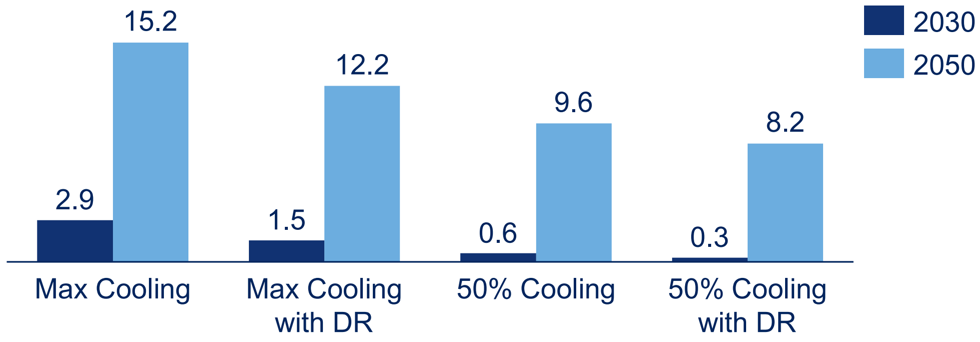
Key takeaway - Both substations show that implementing DR by raising cooling setpoints reduces cooling load.

Cooling DR defers substation reinforcement, particularly in early years

Quantity of substations exceeding firm capacity



Demand exceedance (MW)



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Substation reinforcements deferred by 2050 if scaled across 17,000 ENW distribution substations

Up to

1.4GW

Reduction in cooling load by 2050 if DR is scaled across 17,000 ENW distribution substations

Benefits accrue most clearly for early years of CBA due to spate of deferred reinforcement

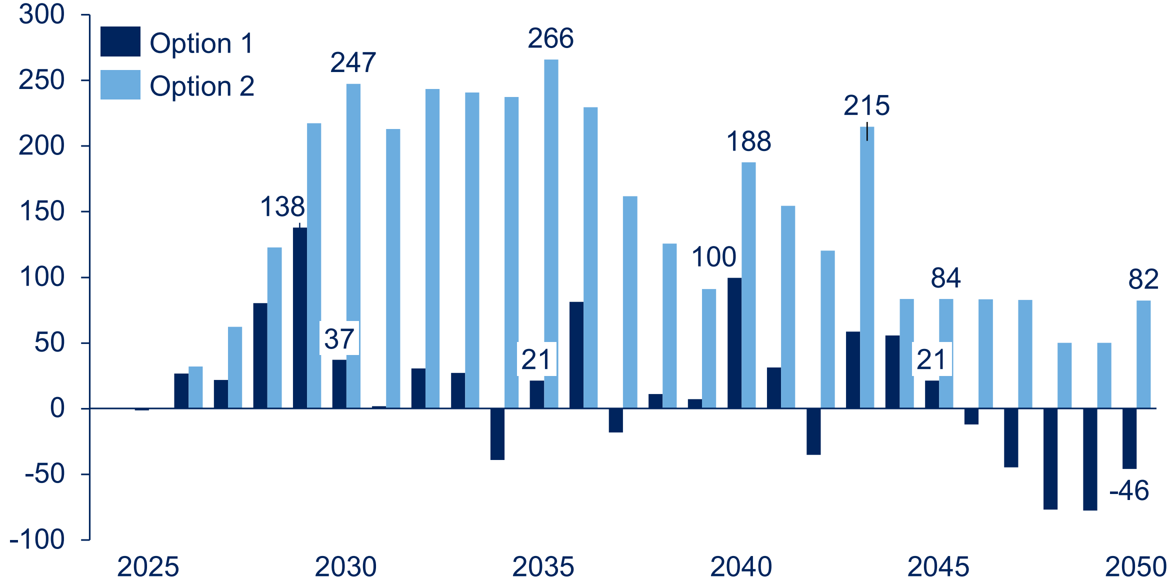
Both options with DR provide financial benefits through to 2030, largely due to deferred substation reinforcement.

We modelled three scenarios

1. **Baseline[1] - Traditional substation reinforcement**
2. **Option 1 - Maximum cooling with DR**
3. **Option 2[3] - 50% cooling with DR**

Cumulative benefits when DR is implemented vs no DR implementation[2]

Cumulative annual benefits compared to baseline scenario for each cooling DR option, £k

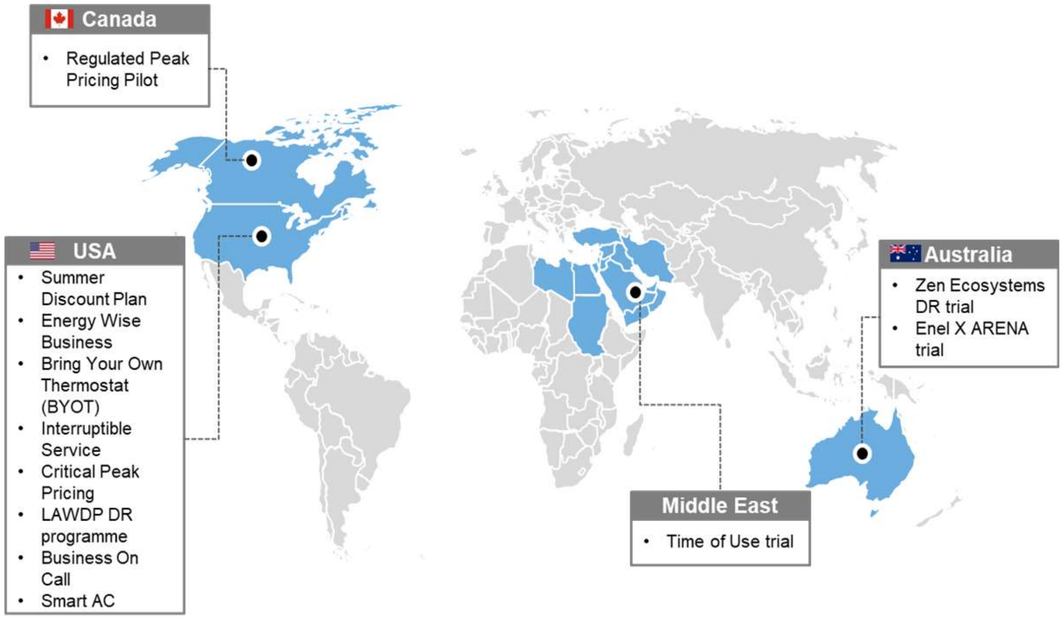


Up to
£38 m
Cumulative benefit by 2050 if option 2 scaled across 17,000 ENW distribution substations

[1] Baseline scenario assumes 100% of buildings modelled as overheated via WP2 methodology install cooling to be used on peak summer day; [2] For 36 ENW distribution substations connected to 2 primary substations. [3] This DR option is based on a second baseline (Baseline 2) that assumes traditional reinforcement of distribution substations to accommodate increased cooling demand when 50% of buildings that overheat install cooling.

We categorised cooling DR benchmark learnings across programme design, customer offerings and preference

Cooling DR programmes are most prevalent in North America and Australia.



We grouped key learnings and best practices from the benchmarked programmes into three categories.

Programme design

How trials and programmes are designed and undertaken.

Customer offerings and recruitment

How to achieve a compelling proposition and maximize participation.

Customer preference

How to meet participant needs.

We narrowed a longlist of nine potential programme designs to the five most promising for future exploration

Peak time rebates for commercial customers using an availability and utilisation payment with a notice period of 15 minutes.

Direct load control for commercial customers using a utilisation payment with a notice period of either 2 mins,15 mins or week ahead.

Direct load control for commercial customers using an availability and utilisation payment with a day ahead notice period.

Time of Use Tariff for commercial and residential customers; Notice period is at sign up.

Peak time rebates for residential customers using an availability and utilisation payment with a 2-hour notice period.

Technology agnostic

Central ACs

2025

2035

Event length: 1-6 hours for all arrangements

We have identified three themes of further work to build on Discovery findings

1

Explore impact on wider network by expanding modelling

- Model cooling uptake and network impacts in more detail across more substations and property types with more localised weather simulations.
- Explore more deeply the network business case for cooling flexibility, incorporating elements like interaction with distributed solar PV.

2

Conduct feasibility study on shortlisted programme designs

- Conduct market research on awareness of SC solutions and appetite for cooling DR focused on commercial and residential sectors.
- Assess feasibility of different shortlisted programme designs.
- Model network impacts of specific designs and quantify costs and benefits.

3

Engage additional players to design a cooling DR trial

- Onboard flexibility aggregators with domestic and non-domestic portfolios to plan a trial of the most promising programme designs.
- Engage with property management firms and energy suppliers to survey customer views and inform trial design.

QUESTIONS & ANSWERS

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