CoolDown

How Will Climate Change Impact Building Cooling?

Delroy Ainsworth

SP ENW - INNOVATION

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UK space cooling (SC) demand is expected to increase significantly

SP Electricity North West

CoolDown customer research: 20% of households are considering installing AC in the next two years.

Macro trends: IEA[1] forecasts 4% annual global SC demand growth through 2035. GB is not immune from this.

Health considerations: Up to 10,000 annual heat-related deaths by 2050 should GB insufficiently adapt to heatwaves.

Policy moves: DESNZ considering expanding BUS[2] to include heat pumps which can cool as well as heat.

[1] International Energy Agency; [2] Boiler Upgrade Scheme

CoolDown explores the impact of this increase on network planning

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CoolDown is assessing:

1. How to forecast the increase in cooling demand
2. The impact of cooling on distribution networks
3. The potential flexibility associated with it and how to harness it

1. Forecasting the increase in cooling demand

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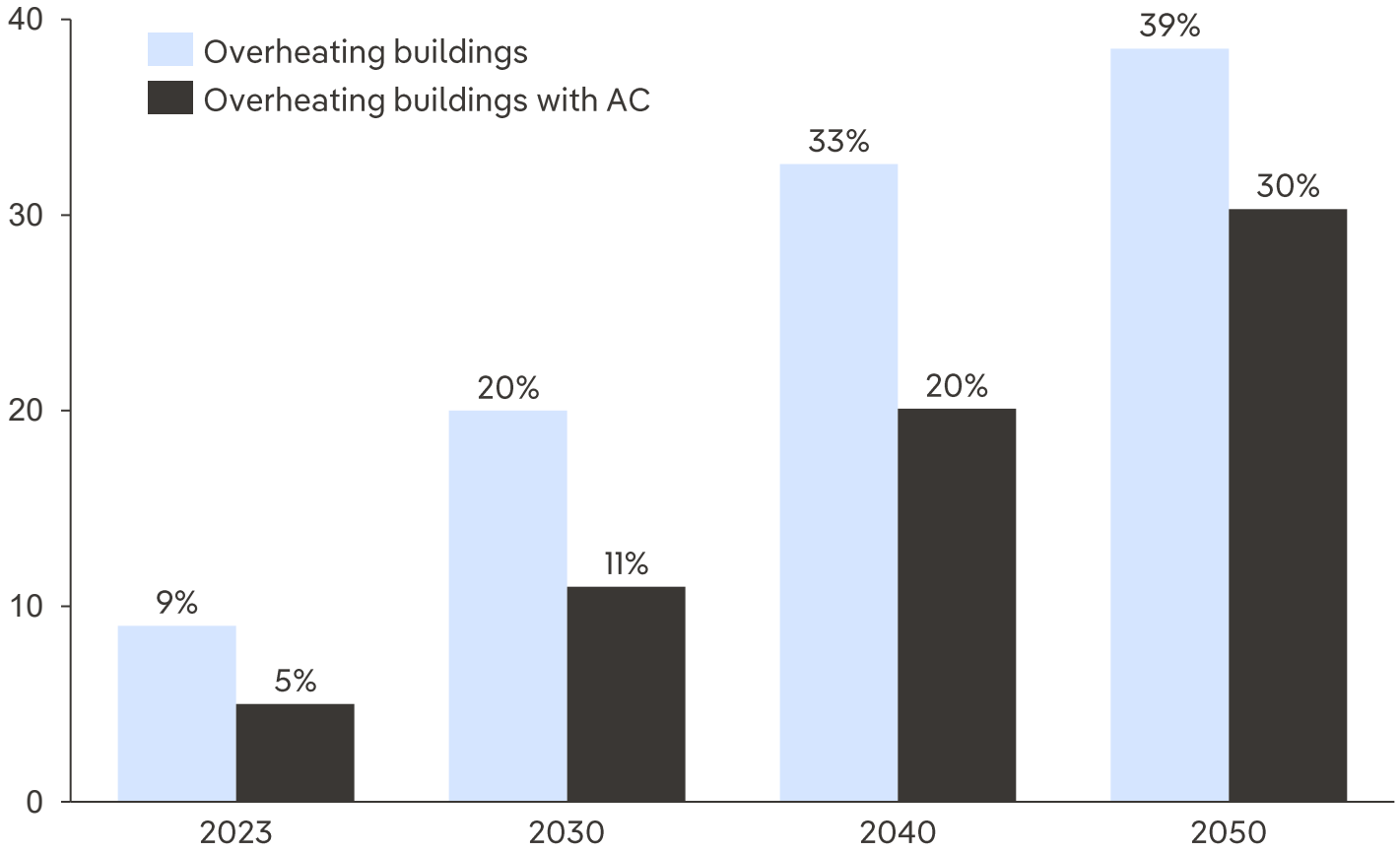
Q: How many buildings in GB will overheat by 2050?

Our model finds that 40% of buildings will overheat by 2050, up from 10% today. 30% of those will install active cooling

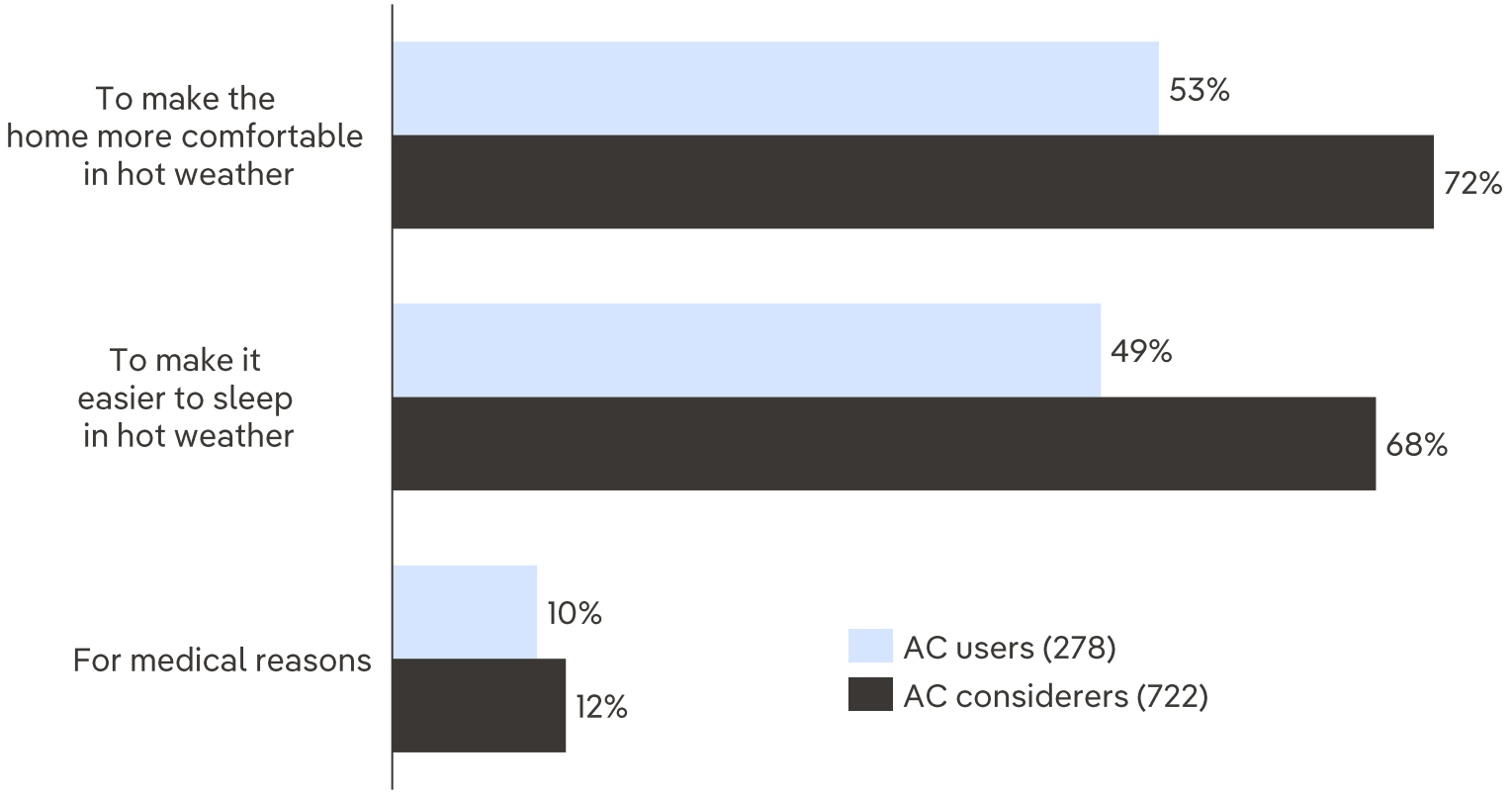
Proportion of overheated buildings and buildings with AC installed across 2,438 modelled SP ENW substations



We used a building-level model to characterise >2,000 substations into 20 archetypes using monitored load data. We modelled baseline and forecast cooling uptake for each archetype and scaled up across SP ENW's license area

20% of households plan to purchase AC in the next two years, largely to improve general comfort and ability to sleep in heat

Most cited reasons for domestic AC installations according to surveyed customers



We found that 8% of households already have AC,

20% are considering installing it in the next two years.

2. Cooling impact on distribution networks

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Q: How many substations could need earlier reinforcement GB-wide due to cooling?

Cooling growth triggers more reinforcements via peak summer load instead of the peak winter load currently driving planning

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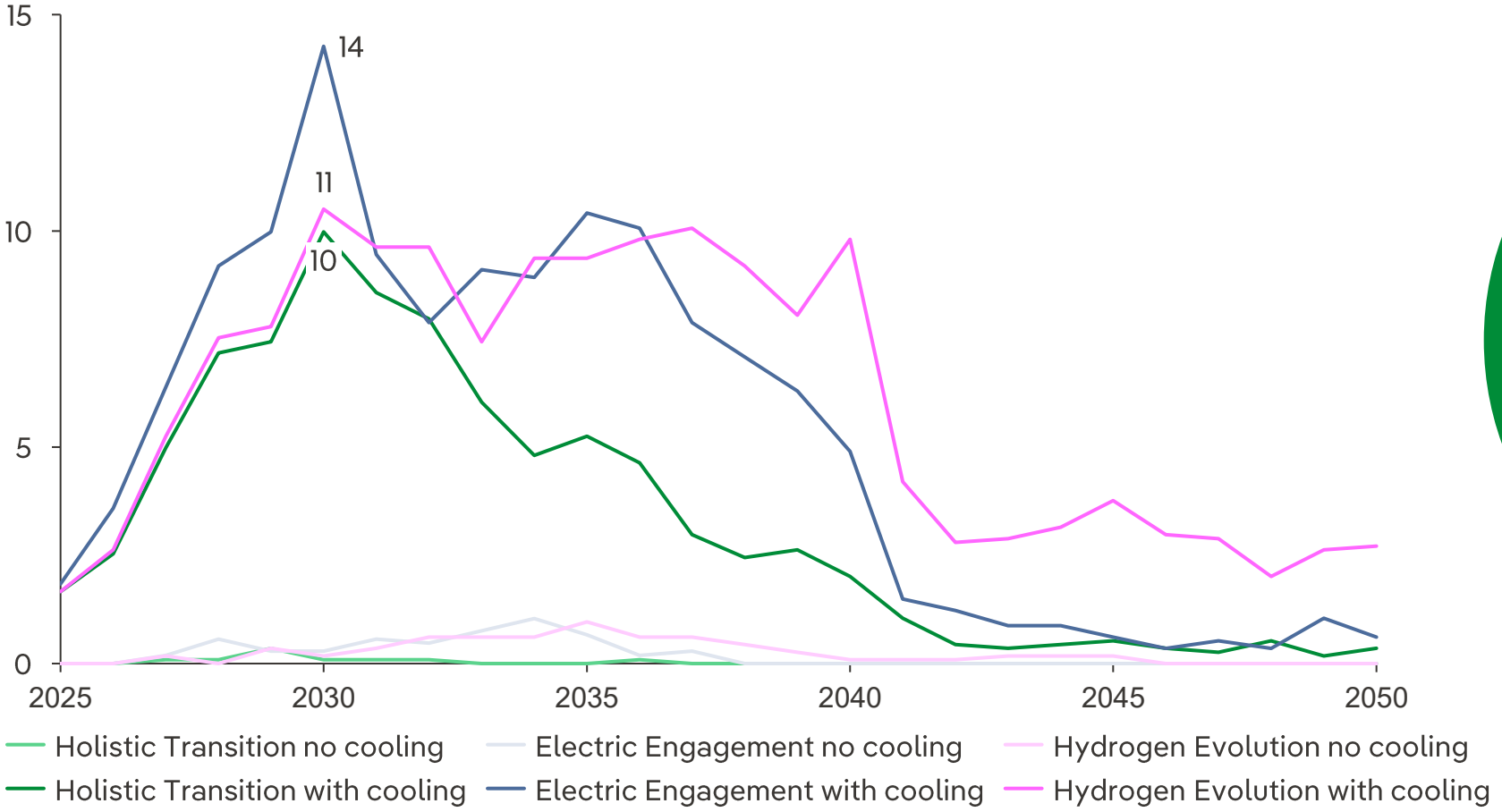
Number of summer reinforcements GB-wide (thousands) with and without forecast cooling load



Cooling growth GB-wide triggers large-scale reinforcement that DNOs should consider when planning their networks. Absence of early reinforcement and/or flexibility procurement planning could exacerbate network constraints.

3. Flexibility potential for cooling and how to harness it

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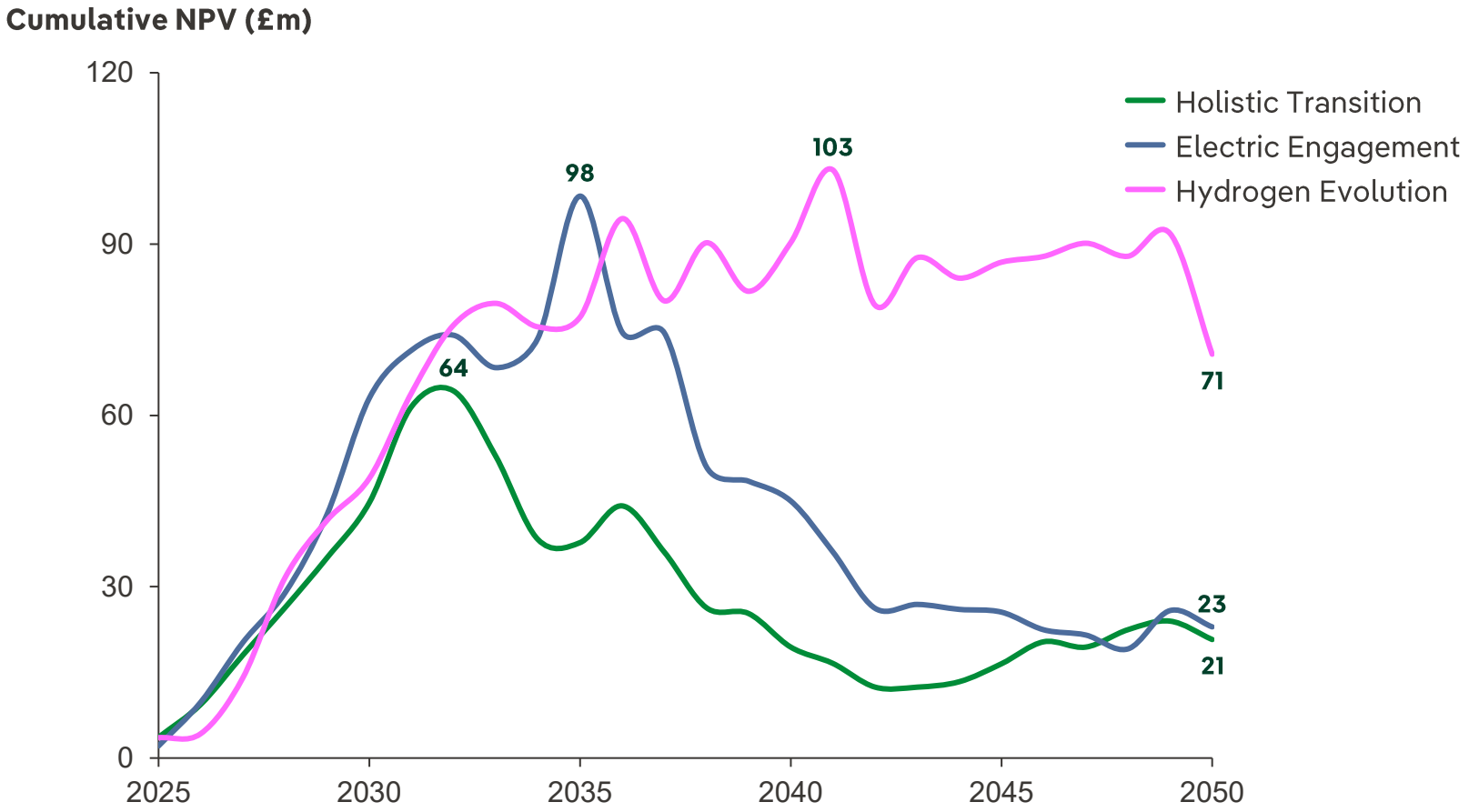
Q: What proportion of domestic AC users told us they would be willing to flex their asset

Cooling demand response could reduce substation and network level peak demand, deferring reinforcement in many cases

Cumulative discounted net present value (NPV) of cooling demand response rollout GB wide

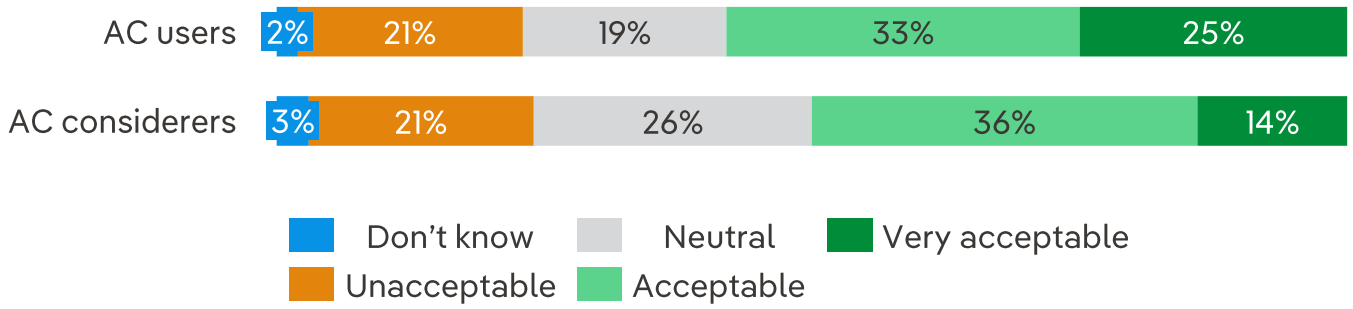


Cooling demand response decreases peak load in by >10% by 2050 in over half of the substations modelled

This reduces the number of substations reinforcing throughout the 2030s and 2040s due to a summer trigger

Most domestic survey respondents were amenable to flexing their cooling demand to help the network

Acceptability of being asked to change the way AC is used on hot days to help the network



Event duration: 1-2 hours most acceptable.

Event frequency: Typically 1-2 events per day.

Notice: 24-hour minimum notice desired.

Participants preferred event-based flexibility to tariff-based flexibility

But there may be limits to event-based flexibility - AC users told us they already only use AC when they really need to due to 'AC guilt' and cost concerns

Next steps: Moving from modelling to hard data

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CoolDown Beta | We will conduct live trials of cooling demand response and design a space cooling forecasting tool for DNOs

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In CoolDown Beta, we will:

1. Conduct live trials of cooling demand response in both domestic and commercial buildings to explore willingness to flex cooling assets and the limits of flexibility

2. Iterate and improve demand response programme design using knowledge gathered on customer behaviour from live trials.

3. Develop a cooling forecasting tool for DNOs to feed into network planning.

4. Iterate our CBA using live field data to ascertain the net cumulative benefits from cooling demand response DNOs.

5. Build the evidence base to support the rollout of cooling demand response in BaU


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