Policy brief

Residential temperature settings

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Behavioural choices shape US indoor temperatures more than technology

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Households that manually manage thermostats keep homes warmer in winter and cooler in summer than those using automated smart thermostat features, leading to increased energy use and costs. Expanding equitable access to smart thermostats and supporting behavioural engagement could improve indoor thermal comfort, reduce energy costs, and narrow disparities in thermal safety.

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The policy problem

Maintaining safe indoor temperatures is critical for preventing heat- and cold-related illness, yet millions of US households struggle to keep their homes thermally safe. National and international health agencies provide guidance on indoor temperature ranges, but many households cannot meet these standards due to energy costs, housing quality, or limited control over systems (for example, landlord-controlled thermostats). These challenges reflect broader energy insecurity, which affects approximately 34 million households and can force residents to reduce the energy used for heating or cooling to unsafe levels, placing them at an elevated health risk (for example, pipes freezing or heat stroke). More than half of residential energy use is tied to indoor temperature regulation; therefore, thermostat technologies and temperature control behaviours play a central role in shaping energy expenditures. Yet, evidence on how households regulate indoor temperatures remains limited, making it difficult to identify how technology or behavioural strategies impact thermal safety.

The findings

We find thermostat management behaviour plays a stronger role in shaping indoor temperature settings than thermostat technology alone. As illustrated in Fig. 1, households setting a single fixed temperature or manually adjusting their thermostats maintain winter heating setpoints up to 2.3 °F (1.3 °C) warmer (Fig. 1a) and summer cooling setpoints up to 2.2 °F (1.2 °C) cooler (Fig. 1b) than households using WiFi-connected features that automatically adjust temperatures based on occupancy and schedule. Such behavioural patterns can increase household energy use and energy costs. We also find racial disparities in thermostat settings, even after accounting for income, housing quality, and climate. Black households report keeping homes up to 2.2 °F (1.2 °C) higher in winter and 1.4 °F (0.78 °C) lower in summer than white households, potentially reflecting different approaches to managing indoor comfort or challenges with housing quality. These results are associative, and future research should investigate the household-level mechanisms that shape temperature regulation decisions.

The study

Our analysis employs the US Energy Information Administration's 2020 Residential Energy Consumption Survey (RECS), a nationally representative dataset reflecting household-level information for over 123.5 million US occupied housing units. RECS captured household energy behaviours, technologies, and socioeconomic and sociodemographic characteristics between September 2020 to April 2021. We examine self-reported thermostat settings (in degrees Fahrenheit) in winter and summer, focusing on how thermostat type, temperature management behaviours, and coping strategies, such as keeping homes at unsafe temperatures or forgoing essentials to pay energy bills, shape indoor thermostat settings. Using survey-weighted regression models, we assess differences in thermostat settings while controlling for respondent characteristics, including housing quality and climate. The RECS provides a unique opportunity to understand how technology and behaviour affect thermal comfort and energy use, and how these relationships differ across income, race, and tenure groups in a large, nationally representative sample of American households.

Messages for policy

- Thermostat management has a stronger effect on energy use than technology alone, meaning behaviour-focused energy interventions are essential.
- Smart thermostat roll-out programmes should pair device access with user education on automated scheduling and efficient use.
- Expanding access to smart thermostats and ensuring residents have control over indoor temperatures can improve comfort and safety.
- Policies should address seasonal differences in coping behaviours, supporting winter heating and summer cooling needs separately, including providing energy assistance in both seasons.
- Black households keep homes 2.2 °F (1.2 °C) warmer in winter and 1.4 °F (0.78 °C) cooler in summer than white households, highlighting the need for policymakers to consider racial disparities in thermostat settings when establishing and implementing policy.

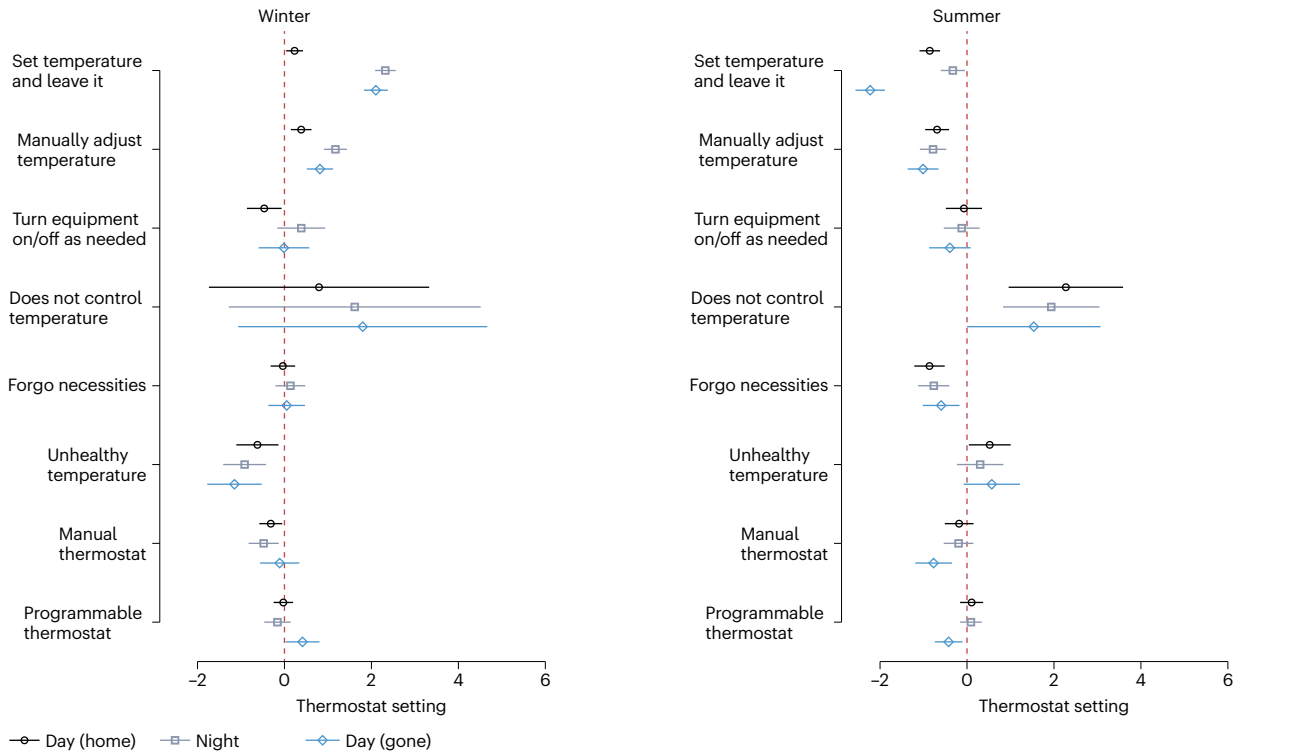

Fig. 1 | Factors driving thermostat settings in winter and summer. The figure presents thermostat settings in degrees Fahrenheit from linear regression coefficient estimates. Black circles, at home during the day; grey squares, at night; blue diamonds, not at home during the day. The error bars indicate the 95% confidence intervals. All models include a sample of $n = 14{,}608$ observations, or survey responses, representing over 96.3 million US occupied housing units after replicate survey weights are applied. Left: thermostat control behaviour and thermostat type coefficient estimates in winter. Right: thermostat control behaviour and thermostat type coefficient estimates in summer. Models also include socioeconomic and sociodemographic measures as well as housing, geographic, and cost covariates. For variance and standard error estimation, we employ the jackknife method with 60 iterations per the Energy Information Administration's recommendation. Figure adapted from Graff, M. & Nock, D. *Nat. Energy* https://doi.org/10.1038/s41560-025-01948-w (2026).

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Further reading

1. Carley, S., Graff, M., Konisky, D. M. & Memmott, T. Behavioral and financial coping strategies among energy-insecure households. *Proc. Natl Acad. Sci.* **119**, e2205356119 (2022).
This article evaluates the prevalence of energy-related coping strategies, showing over half of low-income households used at least one strategy, especially those with vulnerable members or deficient housing conditions.
2. Kwon, M. et al. Forgone summertime comfort as a function of avoided electricity use. *Energy Policy* **183**, 113813 (2023).
This article quantifies the amount of electricity households forgo over the cooling season, finding that households earning under US$15,000 reduce cooling use by about 1.03 kWh per 1 °F increase compared to higher-income households.
3. Peffer, T., Pritoni, M., Meier, A., Aragon, C. & Perry, D. How people use thermostats in homes: A review. *Build. Environ.* **46**, 2529–2541 (2011).
This article provides a review of residential thermostat technologies, usage patterns, and design challenges to assess their effectiveness.
4. Pritoni, M., Meier, A. K., Aragon, C., Perry, D. & Peffer, T. Energy efficiency and the misuse of programmable thermostats: The effectiveness of crowdsourcing for understanding household behavior. *Energy Res. Soc. Sci.* **8**, 190–197 (2015).
This article examines how households use programmable thermostats, revealing limited use of programming features and widespread misconceptions about thermostat operation and energy use.
5. Stopps, H. & Touchie, M. F. Residential smart thermostat use: An exploration of thermostat programming, environmental attitudes, and the influence of smart controls on energy savings. *Energy Build* **238**, 110834 (2021).
This article characterizes smart thermostat programming behaviours, finding that while most participants made no setpoint adjustments across heating and cooling seasons, a small subset made hundreds of changes.

Competing interests

The authors declare no competing interests.