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Building stock and overheating modeling needed to identify biggest health risks, energy savings, and carbon emission reductions

Additional submitted attachment is included below.

DATE: August 20, 2026

TO: CEC IEPR Energy Equity, Docket # 26-IEPR-05

FROM: Tom Phillps, Healthy Building Research, Davis, CA.
Technical Advisor, Collaborative for High Performance Schools

SUBJECT: Building stock and overheating modeling needed to identify biggest health risks, energy savings, and carbon emission reductions

Per CEC staff's request, I am submitting my comments emailed previously in response to the latest workshop and additional information. The groups cited below that are working on modeling of building stocks for overheating and health risks, energy use, and carbon emissions should be able to provide you with useful insights and advice on targeting energy poverty and indoor overheating risks in current and future climates.

JULY 15, 2026 EMAIL TO MARTIN FLORES, CEC

"Re: prioritizing CEC efforts to reduce inequity, carbon emissions, and health impacts:

In case I did not mention this in your earlier workshops, modeling of CA home building stock should also be done to identify homes most at risk for overheating and high cooling costs, and to target the best opportunities for reducing energy burdens, adverse health impacts, and carbon emissions. For example:

Massachusetts: home energy use was modeled for the entire state, and an interactive retrofit tool was developed. This approach can also be used in other states.
MIT Sustainable Design Lab and the Commonwealth of Massachusetts Launch New Collaboration on Home Energy Efficiency (MIT, 5/2/25).
https://climate.mit.edu/posts/mit-sustainable-design-lab-and-commonwealth massachusetts-launch-new-collaboration home?utm_source=MIT+Climate+Newsletter&utm_campaign=c35077cfcd

Austin, TX: researchers modeled existing homes during a power outage under a future climate and urban heat (Lin et al., 2026)
https://www.sciencedirect.com/science/article/pii/S0360132325015367?via=ihub
When blackouts occur during heat waves, Austin homes pose major risk, 2/10/26 & journal paper.
https://phys.org/news/2026-02-blackouts-austin-homes-pose-major.html
A new study led by researchers at the University of Texas at Austin is the first US study to assess the indoor heat vulnerability from both climate change and urban heat for

each single-family home in an entire city. The research used Austin as its test bed, but the approach can be applied to most cities in the U.S.

France: researchers modeled national residential building stock (single and multi family) for overheating risks in future climates (Merlet et al., 2025)
https://hal.science/hal-04960739v2/file/CLIMA2025-ISB_DH%20Review.pdf

Australia: researchers modeled residential building stock for energy use, overheating, and carbon emissions up to 2050.
Development of an on-line Australian residential building stock model (Chen et al. 2025)
https://www.sciencedirect.com/science/article/pii/S0378778823005637.
Austria's building stock was modeled for energy use and the effect of passive cooling measures up to 2050 by Mayrhofer et al., 2023.
https://www.sciencedirect.com/science/article/pii/S0378778823005637

More Information

Socially fair decarbonization pathways for housing and mobility –
Insights from a multi-model analysis for Austria.
C. Kettner et al.
Energy Economics, Volume 157, May 2026
https://www.sciencedirect.com/science/article/pii/S014098832600160X

Passive measures for reducing space cooling demand in the EU-27: Potentials and costs
A. Malla, L. Kranzl, A. Muller
Energy and Buildings, Volume 356, April 2026
https://www.sciencedirect.com/science/article/pii/S0378778826001064

Thank you for considering these comments.

Tom Phillips

MORE INFORMATION, CONTD. August 20, 2026

Ji et al., 2023. Evaluating and Mapping Indoor Thermal Risk on Older People in Long Term Care Buildings Under Urban Microclimate Impacts..
This study explored the spatial variability of the thermal conditions and physiological various locations in Montreal, Canada, by modeling an extreme heat event in 2018.
DOI:10.1007/978-981-19-9822-5_99

The Keep Bristol Cool mapping tool.
https://www.bristol.gov.uk/council/policies-plans-and-strategies/energy-and-environment/the-keep-bristol-cool-mapping-tool.
Bristol UK mapping of housing stock and vulnerable populations for indoor overheating risks for current and future climates.

Cooler Homes Programme, Healthy Home Hub, 2026. Overheating risks are assessed for housing stock in England and Wales, and retrofit strategies are recommended. “(the) programme… will provide participating social landlords a heat risk score for every home in their portfolio, a validated digital intervention tool that generates property-specific mitigation options based on home archetype, orientation, and local environment, and a board-ready evidence for RSH compliance.”
See also: Housing Climate Risk, Livv Housing Group and UK Housing Associations worked with Map Impact to use satellite data to add urban heat factors and climate change to their net zero strategy for building upgrades and green energy improvements. https://www.mapimpact.io/case-studies/housing-climate-risk/

DEFRA, 2024. Overheating in Houses. A tool is available to explore the impact of climate change on future temperatures inside UK homes and model how different adaptations change internal temperatures.
https://environment.data.gov.uk/dataset/ca55be10-b513-4dc2-bd2c-cc7c15bd23f6.

Schunemann et al., 2023.
Spatially resolved indoor overheating evaluation using microscale meteorological simulation as input for building simulation opportunities and limitations.
https://doi.org/10.1016/j.cacint.2023.100122
They applied a 3D urban climate model (ENVI-met) and a 1D boundary layer model (HIRVAC) for two urban districts in Germany as meteorological input for an indoor thermal comfort and evaluation of two representative buildings, and for assessing passive cooling measures to achieve overheating resilience.

ARCC Network, ca. 2016. Modeling of housing stock and occupant health vulnerability in Teeside Valley (not available; see me for details).

Thermal justice could make urban heat adaptation fairer as cities grow hotter.
Bioengineer, Aug. 19, 2026 news.
https://bioengineer.org/thermal-justice-could-make-urban-heat-adaptation-fairer-as-cities-grow-hotter/.
A new framework developed by researchers at ETH Zurich, the Swiss Federal Institute of Aquatic Science and Technology, and partner institutions argues that heat adaptation must be judged not only by how much it lowers temperatures, but also by who benefits, who remains exposed and where the risks go next.
Paper: Gobatti et al., “Thermal justice in urban climate change adaptation,” Nature

Climate Change, DOI: 10.1038/s41558-026-02727-5

NOTE: I did not check on recent R&D in China and other Asian regions, but Chinese researchers are very active now in modeling building stock performance and climate adaptation and mitigation. Earlier work on Asian buildings was conducted by Short et al., 2018 (China), LoH Cool Project, University of Cambridge, https://www.arcc-network.org.uk/lohcool/,
and by Schunemann et al., Leibniz Inst (Korea).