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Need to Address Climate Resilience and Adaptation to Mitigate Health, Carbon, and Cost Impacts

Additional submitted attachment is included below.

TO: California Energy Commission, 2022 Title 24 Rulemaking

FROM: Thomas J. Phillips, Healthy Building Research, Davis, CA

DATE: February 11, 2021

SUBJECT: Health, Productivity, and Economic Impacts of Building Energy Standards, Rulemaking Docket No. 21-BSTD-01

The extensive work of CEC staff to address various issues and include carbon emission metrics in updating the Title 24 building standards is greatly appreciated. However, for the sake of due diligence and public and worker health and safety, building standards must be developed with full consideration of ongoing climate change, and significant non-energy benefits on climate change adaptation on Human Health and Productivity should be considered. The recommended approaches and examples to address the climate change risks for overheating and increased energy costs, GHG emissions, and peak power demands were summarized in my pre-rulemaking comments on Feb. 11, 2021.

In short, we cannot afford to lock in maladapted building design and to reduce GHG emissions by waiting to address these issues. Even if CEC lacks staffing and funding to address these issues adequately, it can at least provide guidance for builders and designers who can address these issues now -- by including guidance in CalGreen, in the Title 24 Manuals, and in collaborations with state building and other sustainability programs. If we fail to plan, we will plan to fail (Ben Franklin).

Other major institutions have recently prioritized the urgent need to address overheating, peak demand reduction, and carbon emissions now (IEA, 2021; UK Committee on Climate Change, 2021, Independent Assessment of UK Climate Risk). California should follow their example.

In addition, please consider the **additional information** below in developing and assessing the **costs and benefits climate adaptation** in the 2022 Title 24 standards, and in developing guidance to mitigate the health, safety, grid, and climate impacts.

1. Modeling study of US health risks from overheated buildings during power outages.

Stone et al., April 2021. **Compound Climate and Infrastructure Events: How Electrical Grid Failure Alters Heat Wave Risk.**
Environ Sci Technol 2021 Apr 30.
doi: 10.1021/acs.est.1c00024. Online ahead of print.

https://pubmed.ncbi.nlm.nih.gov/33930272/
"...Study results find simulated compound heat wave and grid failure events of recent intensity and duration to expose between 68 and 100% of the urban population to an elevated risk of heat exhaustion and/or heat stroke."

Comment: Under conservative climate projections (RCP 4.5), Phoenix homes had **indoor temperatures averaging about 37-42 C for SFam and MFam over 5 days.** Much of inland California will experience climate similar to that of present day Phoenix by mid century, based on Cal-Adapt RCP 8.5 projections.

2. I shared the following information on the **benefits & business case for climate adapted/future proof buildings** with CEC staff in April 2021 via email, and with DGS Sustainability staff who are updating the State building Climate Resilience policy.

RDH, 2019. Designing Climate Resilient Multifamily Buildings. Prepared for U. of British Columbia.
Analyses of several types of MFam in BC under future climate conditions.
Includes recommendations for mitigating overheating, by building type.
Caveat: the ASHRAE 55 Thermal Comfort standard and its 80% acceptability limit for thermal comfort was used as benchmark, but this is not appropriate for residential settings, schools, care facilities, etc. and is not very health-protective.

ASBEC & Climate Works Australia, 2018 (AU). Final Report. Built to Perform: An industry led pathway to a zero carbon ready building code.
https://www.monash.edu/__data/assets/pdf_file/0011/1602758/180703_asbec_cwa_built_to_perform_-_zero_carbon_ready_building_code_-_web.pdf. The report outlines a set of energy performance targets for different building types across different climates, based on societal cost-benefit analysis of energy efficiency and on-site renewable energy opportunities. The goal of the analysis is to assess the contribution that the Code could make towards achieving GHG emissions reductions in line with overarching zero carbon targets.

Benefits & Cost, p. 8 +, p. 19; health discussed re: underestimate of costs.
Cost estimate for passive measures by building types and climate zones: p. 20+
Note: Australia has some climate zones similar to those in CA, but their building stock is somewhat different than ours.
The CRC for Low Carbon Living has undertaken work to investigate inclusion of comfort metrics in the NatHERS framework through its 'Advanced Comfort Index for Residential Homes' project, assuming a **70 year lifetime for homes.**

Technology Strategy Board, 2014 (UK). The business case for adapting buildings to climate change: Niche or mainstream? Summary report: The business case for adapting buildings to climate change: Niche or mainstream?
Aimed at building designers, construction professions, policy makers, regulators,

etc., the report is based on various case studies and interviews with experts, and questionnaires. Slides at https://www.slideshare.net/SustEast/building-a-resilient-environment-morning-session.

Note: since then CIBSE building design standards for addressing overheating and urban heat island impacts have been more widely used, e.g. various projects, the London Plan, and t**he 2021 draft UK building energy standards.**

4. I also shared this info re: **guidelines and standards for building overheating in other jurisdictions**

BC Housing, 2019. Overheating and AQ Design Guidelines Supplement. BC Energy Step Code Design Guide & Supplemental. Summary at Builder Insight 19: Modelling the Future Climate for Passive Cooled Buildings.

RCP 8.5 climate scenario is recommended. Morphed future weather files have their limitations, but "...using the weather files described in this Builder Insight is a good first step toward improving building resilience…"

Note: Based on recent discussions at weekly Passive House Accelerator webinars, many designers have already run into overheating problems in new Canadian & US homes, mainly due to poorly controlled solar heat gain. Some are starting to use lower SHGC windows and solar window films, and better external shading. Almost all are using HSPHs so they can do some mechanical cooling too and still meet or approach Passive House energy, carbon, and thermal comfort standards. Some are doing overheating assessments, with future weather files.

Toronto Atmospheric Fund, TowerWise project: various case studies and IEQ & overheating studies of deep MFam retrofits, by Touche & Siegel at U. Toronto. Future overheating impacts were assessed. **10 buildings completed so far.**

National Research Council Canada: Preventing Overheating (2019)**.**
The project aims to produce decision support tools, including codes, guides and models for the design of new climate resilient buildings and infrastructure.
A risk analysis framework was published in 2019. They have recently published articles on reference weather files for Canada, and a health based evaluation method. They plan to publish national guidance for overheating risk assessment in April 2021 publication.

Draft 2021 UK Future Homes Standard and Building Regulations are in the consultation phase until mid April. They include low carbon and ventilation measures. Also, in response to earlier comments from a public health commission, architects, etc., they have included an **overheating assessment method and requirement.**

News: https://www.architecture.com/knowledge-and-resources/knowledge-landing-page/the-future-homes-standard-explained
Draft standards: https://www.gov.uk/government/consultations/the-future-buildings-standard
The overheating part is based on the CIBSE TM 59 standard, which has been around for several years.
An independent health commission recommended last year and previously that the UK standards address the overheating issue in current and future climates, and various demonstration projects have been done in the UK using future climate projections.

5. Recent Harvard modeling **study of energy and non-energy benefits** SFam retrofits in 10 US cities under current climate.

Williams et al. 2020. Health and Climate Benefits of Heat Adaptation Strategies in Single-Family Residential Buildings

- October 2020
- Frontiers in Sustainable Cities 2(47):561828
- DOI: 10.3389/frsc.2020.561828

"… Under light and deep retrofit scenarios, respectively, we estimate that the simulated heat adaptation retrofits in this subset of relatively new buildings have the potential to yield $1.10 or $1.57 billion in direct utilities savings. There is an additional $462.9 million ($301.3–$909.9 million) or $692.8 million ($442.6 million–$1.385 billion) in climate and health benefits, due to avoided GHG and AP emissions. **Put simply, the climate and health benefits may account for an additional 42–44% of the direct utility savings, on average. Climate and health benefits were generally highest for adaptations simulated in hot climates (Dallas, TX and Houston, TX)** or in areas with dirtier fuel mixes (Chicago, IL and Philadelphia, PA). **When climate and health savings are included, the payback periods of these interventions can decrease by nearly half.** We also discuss the **potential additional health benefits of reducing indoor temperatures during extreme heat. These significant savings from avoided climate and public health damages should be factored into climate change adaptation decision making by stakeholders and policymakers."**

Comment: Lesser but significant benefits would be expected from including such damage estimates for new building design in California, especially when hotter future climates are considered over a 60-100 year life cycle.

Thank you in advance,
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