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# Greenbanc Supports Decarbonizing Buildings and Recommends Building Energy Scorecards

*Additional submitted attachment is included below.*

greenbanc

June 27, 2018

Commissioners Andrew McAllister and David Hochschild
California Energy Commission
Docket No. 18-IEPR-09
Project Title: Decarbonizing Buildings
1516 Ninth Street
Sacramento, CA 95814-5512

RE: Comments on 2018 IEPR Workshop on Achieving Zero Emission Buildings

Dear Commissioners McAllister and Hochschild –

I'm writing to support the California Energy Commission's efforts to decarbonize buildings. Data released from the NOAA Mauna Loa Observatory indicate $CO_2$ parts per million in the global atmosphere above 410 and increasing.[1] It is imperative to move toward zero emissions, from our buildings, transportation and industry as quickly as possible to avoid catastrophic global health consequences from climate change, such as wildfires, drought, flooding, vector-borne infections, water-borne infections, migration and mental illness.[2] Continuing policies that ignore these costs and privilege buildings with carbon emissions is not sustainable nor reasonable, especially since better options exist.

Architects and builders in California know how to develop new zero energy buildings, and there is ample evidence that shows that good design can reduce building energy needs to minimal levels that can be offset by rooftop solar.

For existing buildings, there is a vast amount of work that needs to be done to retrofit enclosures and replace systems to achieve zero emissions, but I bring good news to the Commission. Greenbanc recently completed a survey of the energy performance of 100 single-family homes in the San Francisco Bay Area and discovered a tremendous opportunity for investment in energy savings from increases in airtightness and insulation that have a simple payback for homeowners in under 10 years.

The methodology for collecting the data was the Department of Energy's Home Energy Score, and the enabling policy was the City of Berkeley's Building Energy Savings Ordinance that requires owners to get a Home Energy Score for single-family homes at time-of-sale. The average cost of the energy assessments per home was $222.

[1] NOAA 2018: Recent Monthly Average Mauna Loa $CO_2$. https://www.esrl.noaa.gov/gmd/ccgg/trends/
[2] USGCRP 2016: The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, Washington, DC, 312 pp. http://dx.doi.org/10.7930/J0R49NQX

The aggregate annual carbon dioxide emissions from the 100 homes is 472 tons, or an average of 4.7 tons per home per year. The first and least expensive step toward reducing those emissions is increasing airtightness and insulation to prevent heating and cooling waste from air infiltration.

Of the 100 homes, 27 have no attic insulation. For the 27 homes with no attic insulation, the Home Energy Score calculated energy savings, assuming a 30-year expected life, of $218k. Based on pricing from local contractors and the attic square footage, Greenbanc calculated the cost of those improvements at $72k, representing a return of more than 10% per year, offering a simple payback under 10 years, and if fully implemented, annual carbon reductions of 56 tons. An additional 60 homes have attic insulation that is lower than the recommended level of R-30. While it is slightly more expensive to remove old insulation prior to adding new insulation, the payback on those improvements is still attractive. In total, 87% of homes have less attic insulation than the recommended level of R-30.

Similarly, wall insulation is rare to find among the 100 Bay Area homes and 67 had no wall insulation. Wall insulation is more difficult to price in aggregate because often the work requires painting and cosmetic repairs. The best time to get wall insulation is during a change in residency when furniture has been removed and walls are going to be re-painted anyway for a new owner or occupant.

Floor insulation is uncommon, and 80 homes of the 100 surveyed have no floor insulation. Nearly all the homes had adequate access under the floor to add insulation. In addition to increases in airtightness, there are a host of other benefits for the home occupants from having a strong vapor barrier below the floor.

For the 100 homes, Greenbanc's recommended measures to increase airtightness and insulation in total were expected to cost $340k and save $437k in energy costs over 30 years, mostly from reduced gas usage for heating. On a per home basis, the average cost is $3.4k per home and the energy savings is $4.4k, without rebates. The estimated carbon impact of these improvements is a reduction of 112 tons. Of the 472 annual tons of carbon from the 100 homes, 112 tons, or 24%, can be reduced cost-effectively with investments that are attractive for the building owners. Importantly, the recommended measures are an essential step to preparing homes for decarbonization by replacing furnaces with heat pumps, since heat pumps produce hot air at a lower temperature than furnaces.

For mechanical systems, despite the Bay Area's mild climate and abundant solar resources, gas is dominant. All 100 homes utilized gas for space heating and 99 were dependent on gas for water heating. Nearly half the equipment was due to be replaced soon. 43% of the furnaces exceeded a 15-year expected life, and 44% of water heaters exceeded a 10-year expected life. Solar power was installed at 9 homes, however, those homes have undersized solar power systems, because the space heating and water heating needs are dependent on gas. (Notably, very few, only 2, of the homeowners had electric vehicles.)

Switching from gas systems to electric systems for existing single-family homes in the Bay Area is still expensive, and there is unfortunately no policy support for it, however, for homeowners who already have solar or intend to get solar, the economics of heat pump water heaters are on the cusp of having some market acceptance. Leading contractors have

said that heating system replacements, when included in a retrofit, are now split approximately 50/50 between heat pumps and gas furnaces.

While I was shocked not to find a single heat pump among existing homes in the Bay Area (far less than I found in Vermont, a cold climate), what was worse was the lack of awareness among building owners about the carbon impact of the buildings they own, and the lack of knowledge about common sense measures, like air sealing, that cost little to implement and can have a big impact. This ignorance is costly. It is the primary cause of neglect of building energy improvements that are financially attractive for the owners and potential sources of carbon emission reductions for the state.

If California is going to achieve its carbon emission reduction goals, its citizens must be better educated about the carbon emissions from buildings, building science and the roadmap for decarbonization. The work Greenbanc did in the Bay Area was made possible by the City of Berkeley's ordinance requiring building energy scorecards. While the policy in Berkeley is far from perfect, it is at least a beginning for a more forceful and comprehensive building energy scorecard policy that successfully drives improvements for the worst performing buildings, which is where the greatest opportunities are.

Building energy scorecards provide an education to citizens about energy performance that is essential to achieve increases in energy efficiency. That is why they have been adopted by all 28 Member States of the European Union. In 2016, the European Commission concluded that building energy scorecards – energy performance certificates – will "directly contribute" to the EU's proposed target of a 30% increase in energy efficiency by 2030, and that "certification of the energy performance of building is delivering a demand-driven market signal for energy efficient buildings and is achieving its aim of encouraging consumers to buy or rent more energy efficient buildings."[3]

Elsewhere in the United States, Portland, Oregon has adopted a strong Home Energy Score program[4] and Massachusetts has proposed a statewide building energy scorecard policy.[5] California must similarly mandate building energy scorecards to achieve a meaningful number of retrofits and zero emission buildings.

Additionally, the data collected for a scorecard program is valuable for crafting and marketing incentives. When the East Bay Energy Watch received funding for 10 x $1500 incentives for heat pump water heaters, I was able to search through my database of over 100 homes, identify homes with old gas storage water heaters that were ripe for replacement, and send targeted messages about the incentives to those homeowners.

While the Commission contemplates its carbon emission policies, building energy scorecards need to be seriously considered and supported to catalyze investments in energy efficiency and renewable energy that will change buildings to achieve zero emissions.

North Lennox
Managing Member
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[3] European Commission 2016. https://ec.europa.eu/energy/sites/ener/files/documents/1_en_act_part1_v10.pdf
[4] City of Portland Home Energy Score 2018. https://www.pdxhes.com/
[5] Mass.gov 2018: "Baker-Polito admin files legislation to improve residents' access to home energy info." https://www.mass.gov/news/baker-polito-administration-files-legislation-to-improve-residents-access-to-home-energy