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Economic Data in Support of All-Electric Buildings

Additional submitted attachment is included below.



November 10, 2020

California Energy Commission
Docket Office, MS-4
1516 Ninth Street MS-4
Sacramento, CA 95814-5512

**Re: Economic Data in Support of All-Electric Buildings, Docket #19-BSTD-03
(2022 Energy Code Pre-Rulemaking)**

Dear Commissioners and Staff:

In this letter, Rocky Mountain Institute (RMI) is providing additional data that supports an all-electric Title 24 building code, particularly from a first cost standpoint. Adopting an all-electric Title 24 code in this code cycle is a significant step that the California Energy Commission (CEC) can take towards achieving California's emissions reduction targets; moreover, it is a cost-effective pathway that is ready for mass implementation today.

Analysis undertaken by Energy and Environmental Economics (E3) and validated by RMI's own analyses has proven that building electrification in residential new construction across all California climate zones is cost effective relative to a dual-fuel building. This is due to the construction of an all-electric single-family home or low-rise multifamily building requiring less installation time and fewer components overall. For example, a standard dual-fuel building will need: a stove, an air conditioning unit, a furnace, a water heater, and natural gas plumbing and pipeline connections. In comparison, an all-electric building will need only a stove, a heat pump and heat pump water heater.

The following analyses by E3 and RMI compare first costs for all-electric new construction to standard mixed-fuel new construction and find that an all-electric Title 24 code would be cost effective statewide.

Supporting Analyses

E3's 2019 study, *Residential Building Electrification in California*,¹ finds that across six different climate zones in California, the capital costs for all-electric single-family

¹ E3, *Residential Building Electrification in California*, at viii-xi. August 15, 2019, <https://www.ethree.com/e3-quantifies-the-consumer-and-emissions-impacts-of-electrifying-california-homes/>

and low-rise multifamily buildings are cheaper than their natural gas alternatives. This pivotal finding, reached after extensive costing analysis in partnership with the engineering company AECOM, can be attributed to 1) fewer appliances needing to be installed in all-electric buildings and 2) elimination of a roughly \$2,000-6,000 natural gas infrastructure connection cost.

The only instance in which building an all-electric building might present slightly higher upfront costs is for low-rise multifamily buildings in Climate Zone 3 (San Francisco Bay area), where it was assumed that an air conditioner unit would not be needed, thereby diminishing the benefits of using a single heat pump for both space heating and cooling. However, the majority of new buildings constructed in California include air conditioners² and rising temperatures in the Bay Area will likely lead exacerbate this trend³ leading to this scenario also being lower cost than its natural gas counterpart.

The full set of results is summarized in Figures 1 and 2 below.

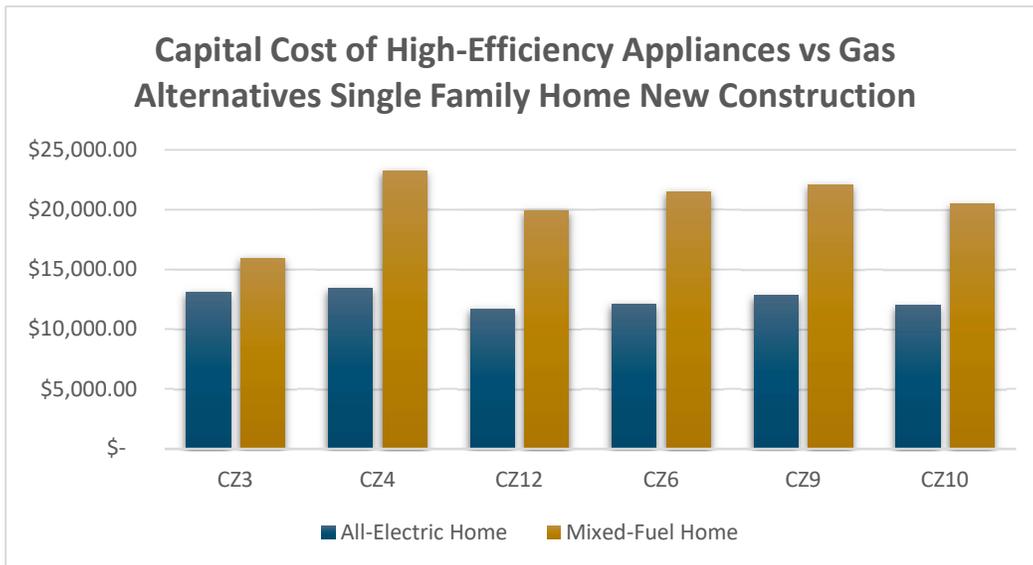


Figure 1: Capital Cost of High-Efficiency Appliances versus Gas Alternatives Single Family Home New Construction (source: E3, *Residential Building Electrification in California*)

² 2009 Residential Appliance Saturation Survey; 2018 American Housing Survey % of Housing Units with Air Conditioning

³ D.J. Sailor, A.A. Pavlova, "Air conditioning market saturation and long-term response of residential cooling energy demand to climate change." Science Direct, 2001.

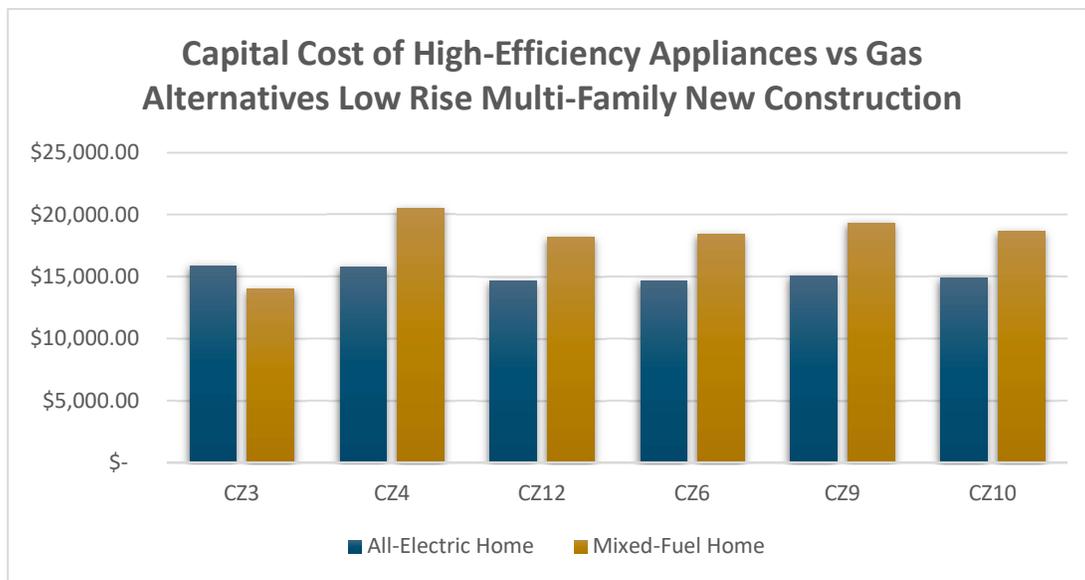


Figure 2: Capital Cost of High-Efficiency Appliances versus Gas Alternatives Low Rise Multi-Family New Construction (source: E3, *Residential Building Electrification in California*)

In addition to the E3 findings, RMI has also conducted extensive analysis about the economics of electrifying single-family homes in a variety of different cities across the United States, confirming E3’s findings in California. In the 2019 report, *The Economics of Electrifying Buildings*, RMI found that it was less expensive to construct an all-electric single-family home than a mixed-fuel home in four different geographic regions.⁴ Specific to California, *The Economics of Electrifying Buildings* found that in Oakland it cost \$2,700 less to construct an all-electric single-family home than a mixed-fuel home. The insight brief, *The New Economics of Electrifying Buildings*,⁵ expanded this research to seven additional geographic regions and concluded that a mixed-fuel home has a higher upfront cost than an all-electric home, which uses the heat pump system for both heating and cooling.

Similar to the findings from other reports, while heat pump water heaters (HPWHs) remain more expensive than gas storage water heaters, a report from RMI on HPWHs finds that when the cost of gas infrastructure in new residential developments is accounted for, HPWHs can cost less than their gas alternatives in new residential buildings.⁶ Incorporating HPWHs into new construction projects can eliminate the cost associated with gas infrastructure to make them the most cost-competitive option for new residential homes.

⁴ Rocky Mountain Institute, *The Economics of Electrifying Buildings*, at 29. 2018, <https://rmi.org/insight/the-economics-of-electrifying-buildings/>

⁵ Rocky Mountain Institute, *The New Economics of Electrifying Buildings*, at 8. 2020, <https://rmi.org/insight/the-new-economics-of-electrifying-buildings/>

⁶ Rocky Mountain Institute, *Heat Pumps for Hot Water: Installed Costs in New Homes*, at 1, July 2020, <https://rmi.org/insight/heat-pump-hot-water-cost/>

The report *2019 Energy Efficiency Ordinance Cost-Effectiveness Study*,⁷ prepared for the California Energy Codes and Standards Program by Frontier Energy, evaluated the cost effectiveness of code compliance package options for both mixed-fuel and all-electric homes across all sixteen California climate zones. The report concluded that the all-electric code compliance option was cost effective in every climate zone when using time dependent valuation (TDV). This study did not take high efficiency HVAC or water heating technologies into account, which would improve the economics of these code compliant packages across all climate zones. The report also indicated that with the addition of solar PV, all-electric new construction was always more cost effective than dual-fuel new construction.

Conclusion

In summary, an all-electric Title 24 code in the 2022 code cycle is a cost-effective and crucial step in achieving California's climate goals.

Respectfully submitted,

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⁷ California Energy Codes & Standards, *2019 Cost-effectiveness Study: Low-Rise Residential New Construction*, at 41-42. July 2019, <https://srcity.org/DocumentCenter/View/25380/2019-State-Cost-Effectiveness-Study-for-Residential-Reach-Codes>