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Code updates needed to align with CA's greenhouse gas goals

Additional submitted attachment is included below.

May 4, 2017

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California Energy Commission

Subject: Sierra Club Comments on the 2019 Building Energy Efficiency Standards and Workshop on Zero Net Energy **(**Docket #17-BSTD-01)

The Sierra Club appreciates the opportunity to provide these comments to the California Energy Commission ("CEC" or "Commission") on the 2019 Building Energy Efficiency Standards ("Standards"), as presented and discussed at the Staff Workshop on 2019 Zero Net Energy ("ZNE") Standards on April 20, 2017.

I. Introduction

The Sierra Club supports the Commission's ongoing effort to achieve cost-effective energy savings and greenhouse gas emission reductions through the adoption of updates to the Title 24 Building Energy Efficiency Standards. We appreciate the significant amount of work that went into updates for Residential ZNE, the Model PV Ordinance, and the workshop on April 20, 2017.

As California moves toward a 50% renewable portfolio standard (RPS) and a more decarbonized electricity supply, it is essential that our building codes keep pace with these electric sector developments. In order to achieve our climate, air quality, and clean energy goals, the Commission should update the Building Standards to ensure that residential and commercial buildings optimize use of clean energy resources and transition away from direct combustion of natural gas and propane. Building designs that utilize energy-efficient electric heat pumps for space and water heating will have the potential to dramatically reduce or eliminate a building's carbon footprint while also mitigating "duck curve" constraints by shifting load from peak to off-peak.

The Sierra Club is concerned that the deployment of efficient electric heat pump technologies will be discouraged by today's building code. The current calculation of and use of the TDV metric risks entrenching the state on a path of constructing higher polluting mixed-fuel buildings despite the lower carbon and cleaner electric building alternatives, particularly for space and water heating. Our comments are focused on how the Commission can, given the limits of the guiding Warren-Alquist Act, improve the Buildings Standards to help the state achieve our climate, energy, and air quality goals in a cost effective and timely manner.

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Our overall recommendations are to:

1) Establish an electric reference building baseline for space and water heating.
2) Establish performance credits for self-utilization and grid flexibility services offered by electric heat pumps and other controllable electric equipment and appliances.
3) Create an alternative pathway for code compliance using a weighted average of the TDV and a greenhouse gas emissions budget.
4) Carry out further updates to TDV for the 2019 Code Cycle to make the gas and electric TDV values more accurate measures.

II. The Commission should establish an electric reference building baseline for space and water heating and establish performance credits to incentivize self-utilization and grid flexibility services in low-carbon electric buildings.

The TDV metric and the general use of natural gas as the baseline fuel make it difficult to build lower emissions electric buildings in California. Most new construction in California complies with Title 24 using the performance path, where the proposed building design needs to have an equal or lower TDV energy use than the reference building, which is most often based on natural gas end uses. Currently, the baseline fuel for water heating is gas for both new construction and retrofits, and is gas for space heating in retrofits. TDV values for electricity range from approximately two to over 100 times greater than those for natural gas. The combination of the drastically higher electric TDV values *and* the predominant use of gas to determine the TDV budget create a structural bias in the code toward natural gas space and water heating despite the potential to significantly cut greenhouse gas emissions with efficient electric heating. If Title 24 continues to base building compliance on TDV budgets from natural gas, then the state will forgo important and timely opportunities to make large reductions in emissions in the buildings sector.

Analyses by E3, and Enercomp demonstrate the disconnect between TDV energy use and greenhouse gas emissions from mixed-fuel and electric buildings. In E3 and Enercomp's preliminary investigation[1] of the impacts of the proposed 2019 TDV values on residential electrification, they modeled three prototype buildings (both single and multi-family) and one combination of building measures and features across all 16 climate zones. Across all climate zones, electric homes have consistently lower lifecycle greenhouse gas emissions but higher lifecycle TDV consumption values than mixed-fuel homes. For space heating, buildings with gas space heaters typically produced roughly twice the lifecycle emissions of buildings with electric space heating. While buildings with gas space heating had lower lifecycle TDV values than electric space heating, the difference in most climate zones (except CZ 16) was negligible.

[1] Results of analysis were presented by E3 at the CEC Staff Workshop on 7/15/16.

These results were even more pronounced for water heating. Buildings with gas water heaters produced *more* than twice the emissions of buildings with electric water heaters (see Figure 1).

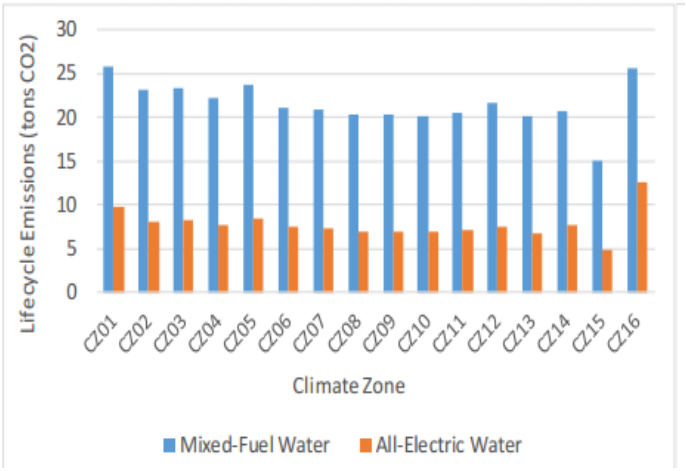

Figure 1: Lifecycle CO2 Emissions from Mixed-Fuel and All-Electric Water Heating (E3 2016).

Again, while buildings with gas water heating had lower TDV consumption, the difference in most cases (except CZ 16) was marginal (see Figure 2).

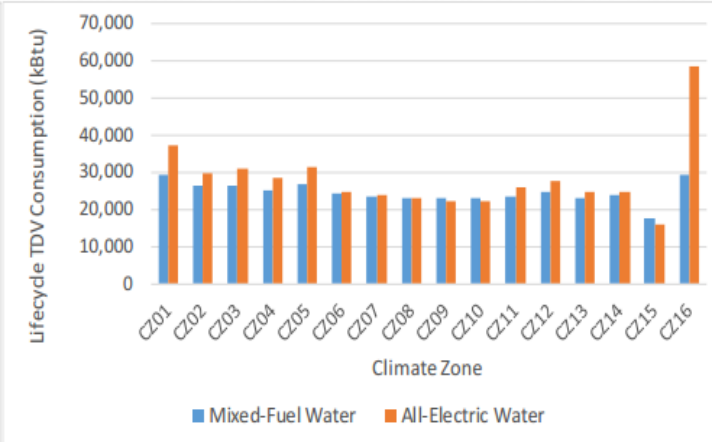

Figure 2: Lifecycle TDV Consumption from Mixed-Fuel and All-Electric Water Heating (E3 2016)

Recommendation: The Commission should solicit and consider recommendations for how it can better align Title 24 and the Warren-Alquist Act's cost effective energy savings mandate with the broader state directive to support policies that will contribute to a 40 percent and 80 percent reduction in greenhouse gas emissions below 1990 levels by 2030 and 2050 respectively. We urge the Commission to reconsider its use of gas as the baseline fuel for water heating in new construction and retrofits, and for space heating in retrofits. **Specifically, we recommend the Commission establish a same fuel baseline for the TDV budget of a reference building and proposed design in the 2019 code cycle.** For water heating, the baseline for buildings designed with electric water heating should be a minimum standard 55 gallon electric water heater. While changing the baseline fuel will not necessarily incentivize construction of lower-emission

buildings, it will at least remove a major barrier to the construction of low- or zero-emissions electric buildings.

The Building Code should also provide performance credits for grid harmonization services, such as self-utilization and thermal storage. Heat pump water heaters can shift load to off-peak hours to use electricity when there is excess solar in the afternoon or wind in the evening. Heat pumps can also be programmed to be powered by on-site renewables thereby avoiding undesirable exports to the grid. Electric technologies like heat pumps that can provide this load flexibility service should be valued and incentivized by the Building Code with appropriate level of credits.

III. The Commission should create an alternative pathway for code compliance using a weighted average of the TDV and a greenhouse gas emissions budget.

The TDV metric does not accurately reflect the quantity or cost of greenhouse gas emissions. Currently, the TDV values for electricity, natural gas, and propane are built up from a variety of components. The electricity TDV is based on the hourly marginal wholesale cost of electricity, system capacity, ancillary services, CO2 emissions costs of the marginal resource, an adder to reflect the cost of complying with California's RPS, and a retail rate adder. The natural gas TDV is based on a long-run monthly forecast of retail and wholesale gas prices, transmission distribution costs, and emissions costs. The propane TDV is based on forecasted monthly retail costs and emissions costs. Electricity's higher retail price forecasts and the large peak costs associated with summer electricity use are the main drivers in the difference between electricity TDV values and gas and propane TDV values. The CO2 emissions price in the TDV values gets overshadowed by the large retail price differential and does not currently end up having a meaningful impact on the TDV values of electricity, gas, or propane. The inclusion of CO2 emissions price in TDV values is essentially a drop in the bucket and does signal climate-friendly fuel decisions for buildings.

Moreover, the actual costs of greenhouse emissions embedded in the TDV values do not reflect the cost of greenhouse gas abatement needed to achieve the state's long-term climate goals. Currently, the proposed emissions price forecast for the 2019 code is from the 2015 IEPR for 2020-2030, and then extrapolated to 2049 using a linear trend (see Figure 3).

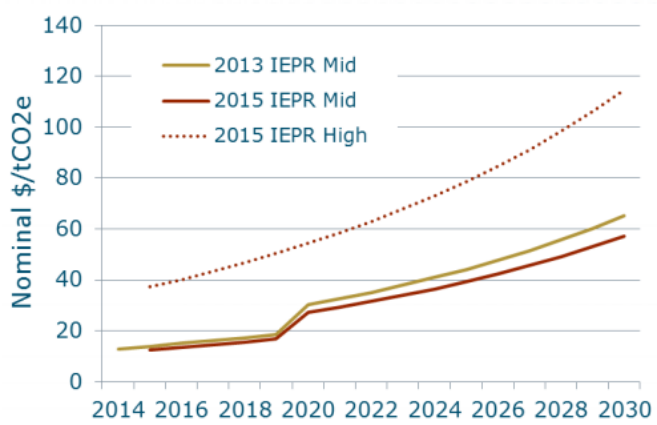

Figure 3: CO2e Emissions Price Forecast from 2015 IEPR (E3 2016)

The emissions price forecast from the 2015 IEPR is too low and will not lead to responsible fuel choice decisions for the future building stock. These carbon prices do not reflect the cost of the infrastructure changes needed to meet California's 2030 and 2050 climate goals.

Recommendation: The Commission should establish a greenhouse gas emissions metric for Title 24 code compliance. Introducing a greenhouse gas metric and budget would shed light on the emissions impact of various fuel choice and building design options, and also help align Title 24 with California's greenhouse gas reduction goals. The Energy Commission could consider various options for how the greenhouse gas emissions budget relates to Title 24 compliance. For example, we support 350 Bay Area's recommendation[2] that a proposed building design could comply with Title 24 by meeting the TDV budget or a weighted average of the TDV and greenhouse gas emissions budget.

The calculation of the greenhouse gas emissions metric should include not only the projected CO2 emissions of the marginal fuel source, but also the fugitive methane emissions of the fuel source. Ignoring fugitive emissions drastically underestimates the greenhouse gas impacts of fuel choices in buildings.

We also recommend the Commission update its emissions price forecast embedded in the TDV metric to more accurately reflect the cost of GHG emissions. **The Commission should use the social cost of carbon as an input for the emissions cost in the TDV calculation**. We recommend the Commission solicit public input through a comment process and consider ongoing work at the CPUC to arrive at appropriate social cost(s) of carbon.

IV. The Commission should update the natural gas TDV values to reflect the full cost of gas consumption.

The monthly TDV values for natural gas do not accurately reflect the cost of gas or mixed-fuel buildings. The gas TDV values neglect to include the cost of gas connections to the

[2] 350 Bay Area, *Updates to the 2019 Time Dependent Valuation of Energy (16-BSTD-06)*, 6/3/16

building, infrastructure upgrades and safety measures, and gas accidents and leakage events like Aliso Canyon.

E3's presentation on 2019 TDV Updates at the workshop on July 15, 2016 notes the removal of a NOx adder to natural gas, which lowers the gas TDVs. However, E3's *Time Dependent Valuation of Energy for Developing Building Efficiency Standards: 2019 Time dependent Valuation Data Sources and Inputs (July 2016)* does not mention or describe the reasoning for dropping the NOx adder. NOx emissions are a significant source of air pollution in California and should be accounted for when determining the fuel choice for buildings.

Recommendation: The Commission should ensure that gas TDV values reflect the true costs of forecasted gas consumption over the 30-year time horizon. We recommend the Commission include the following costs in the 2019 TDV calculation for natural gas:

- Cost of gas connection to the building, including distribution main lines, gas meter and connection to the main, gas piping within the building, and exhaust venting
- Cost of gas infrastructure upgrades and safety measures
- Cost of gas accidents and leakage events (like Aliso Canyon) and associated mitigation measures
- Cost of hazardous air pollution from natural gas use

V. The Commission should update the electricity TDV to more accurately reflect the marginal unit of electricity generation, which is not always natural gas.

While the Sierra Club appreciates the Commission's intent to include SB 350 related conditions in the 2019 TDV update, there are several limitations to the data inputs and assumptions. These limitations should be corrected in the rulemaking. The 2019 electricity TDV values assume that natural gas is the marginal fuel in all hours and in all seasons from 2019 - 2049.[3] Based on the assumption that natural gas is the marginal fuel, the electricity TDV metric includes an emissions rate associated with a low or high efficiency natural gas plant. However, natural gas generation is *not* always the marginal unit today, nor is it forecasted to be the marginal unit in every hour for the next 32 years. The type of marginal generating unit depends on the time of the day, season, and year, as well as on state energy policies and energy markets.

Given the increasing penetration of renewables and energy storage, which are propelled by both state mandates and the improving economics of clean energy technologies, there will be a significant number of hours from 2019-2049 where renewable energy is the marginal generation unit, not natural gas.

The current assumption that gas generation is the marginal unit for electricity is not only inaccurate, but problematic from both a greenhouse gas accounting and cost-effectiveness perspective. On the greenhouse gas side, this natural gas assumption means that the proposed

[3] E3, *Time Dependent Valuation of Energy for Developing Building Efficiency Standards: 2019 Time Deoendent Valuation (TDV) Data Sources and Inputs*, July 2016.

2019 electricity TDV value overestimates the cost of emissions when renewables is the actual marginal resource. More significantly, during periods of overgeneration, the cost of producing electricity can drop significantly and even become negative (with a price floor of -$300/MWh).[4] Thus, electricity consumption in periods of overgeneration is a cost-effective way for building occupants to benefit from carbon-free electric services while supporting renewables integration. However, the proposed 2019 electricity TDV metric does not account for these price drops or for the role that electric buildings can play in supporting renewables integration.

Recommendation: The Commission should more accurately reflect marginal generation forecasts for electricity over the relevant 30-year period. Marginal units should vary based on the time of day, month, and year. We are likely to see a growing penetration of renewable energy on the margin as we move further out in time. The Commission should evaluate whether the emissions component of the electricity TDV values and the cost of electricity adequately reflect the share of renewable energy resources at the margin for each hour of the day over the 30-year time horizon.

VI. The electricity TDV value should reflect an increase in renewable energy and energy efficiency beyond 2030 instead of the current assumption of zero growth after 2030.

Title 24 seeks to achieve cost effective energy savings over a 15- and 30-year period. As such, the economics for the 2019 TDV metrics are based on long-term forecasts that should reflect both state policies and energy market trends for 2019-2034 for the 15-year analysis and for 2019-2049 for the 30-year analysis. The Sierra Club sees value in the long-term approach to energy and infrastructure planning, but finds fault with the input assumptions that are used in the proposed 2019 update. The 2019 update reflects SB 350's target of a 50 percent RPS and a doubling of energy efficiency by 2030. However, the 2019 update includes zero growth in renewable energy and energy efficiency from 2030-2049, thereby ignoring both the historical trend of increasing renewable energy and energy efficiency services in California *and* the state's goal to reduce greenhouse gas emissions by 80 percent below 1990 levels by 2050.

Recommendation: The Commission should work with stakeholders to establish a more realistic forecast of renewable energy and energy efficiency to be included in the electricity TDV values from 2030-2049.

[4] David Howarth and Bill Monsen, *Renewable Energy Faces Daytime Curtailment in California*, http://www.nawindpower.com/online/issues/NAW1412/FEAT_04_Renewable-Energy-Faces-Daytime-Curtailment-In-California.html

VII. The electricity TDV for heating should reflect the IOU's electric space heating tariff

The electricity TDV reflects average electricity prices across the IOU territories, and in doing so overlooks a special tariff offered to customers with electric space heating. The IOUs offer an "electric heating" tariff with a larger baseline allowance so customers with electric heating do not get bumped into higher tiered rates. These rates are important to include in the TDV metric as they help to make electric heating more economical for the consumer. In order to accurately reflect the cost of energy, all-electric buildings' TDV values need to account for these electric-heating rates.

Recommendation: Given time and resource constraints, if the Commission decides not to update the electricity TDV to reflect the electric space heating tariff for all-electric buildings, then the Commission should at the very least provide a TDV credit for all-electric buildings to better reflect the actual rates for these buildings.

VIII. Conclusion

Thank you for your consideration of the concerns raised in these comments. We would welcome the opportunity to discuss any of these issues further.

Dated: May 4, 2017

Respectfully submitted,

/s/

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