

## DOCKETED

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**City of Palo Alto Comments on Framework for Doubling Energy Efficiency Savings**

*Additional submitted attachment is included below.*

**City of Palo Alto Comments on Framework for Doubling Energy Efficiency Savings  
Docket 17-IEPR-06**

Submitted by:

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**SUMMARY**

City of Palo Alto (Palo Alto) supports the California Energy Commission (CEC) staff proposal to include the counting of fuel-substitution measures towards meeting SB 350's statewide energy efficiency goals. Fuel-substitution will contribute not only to overall energy savings, but also significant reductions in the state's GHG emissions as California continues decarbonizing its electric supply. For communities like Palo Alto with 100% carbon neutral electric supply, the GHG emission reductions associated with electrifying natural gas appliances is more pronounced.

Palo Alto recommends that the CEC specifically recognize both heat pump water heaters (HPWH) and heat pump space heating (HPSH) amongst the fuel-substitution measures that can be counted towards SB 350 targets. In addition, Palo Alto recommends that the CEC clarify that only high efficiency versions of HPWH and HPSH be eligible measures to qualify in the fuel-substitution category. The minimum efficiency standard of fuel-substitution measures can be determined at a later point under CEC guidance. To realize the potential of fuel-substitution energy savings and GHG reductions, Palo Alto further recommends the CEC explore funding sources to support fuel-substitution efforts.

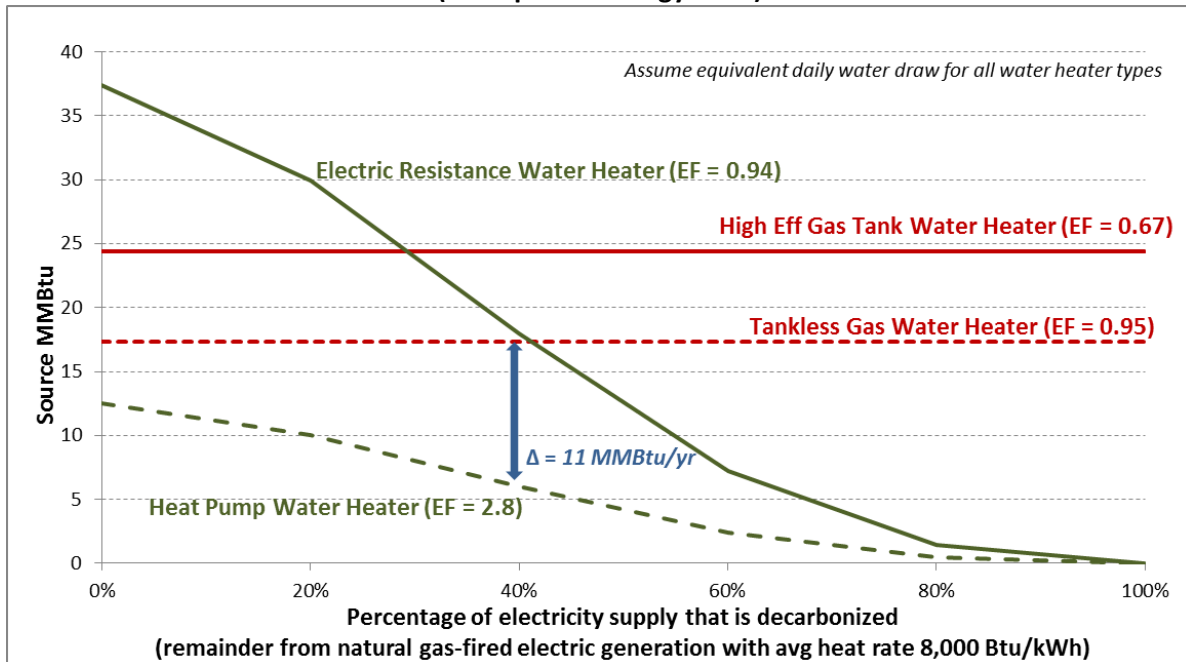
**BACKGROUND & DISCUSSION**

As the CEC Staff Proposal notes, SB 350 identifies a non-exhaustive list of types of programs to achieve the doubling of EE savings, including *"programs that save energy in final end uses by using cleaner fuels to reduce GHG emissions as measures on a lifecycle basis from the provision of energy services."* (Section 25310(d)(10)) Palo Alto shares the view CEC Staff set forth in the Staff Proposal "any fuel substitution measures 'that save energy in final end uses by using cleaner fuels'" are eligible candidates to meet SB 350 targets. For the reasons set forth below, Palo Alto maintains that HPWH and HPSH are such fuel substitution measures.

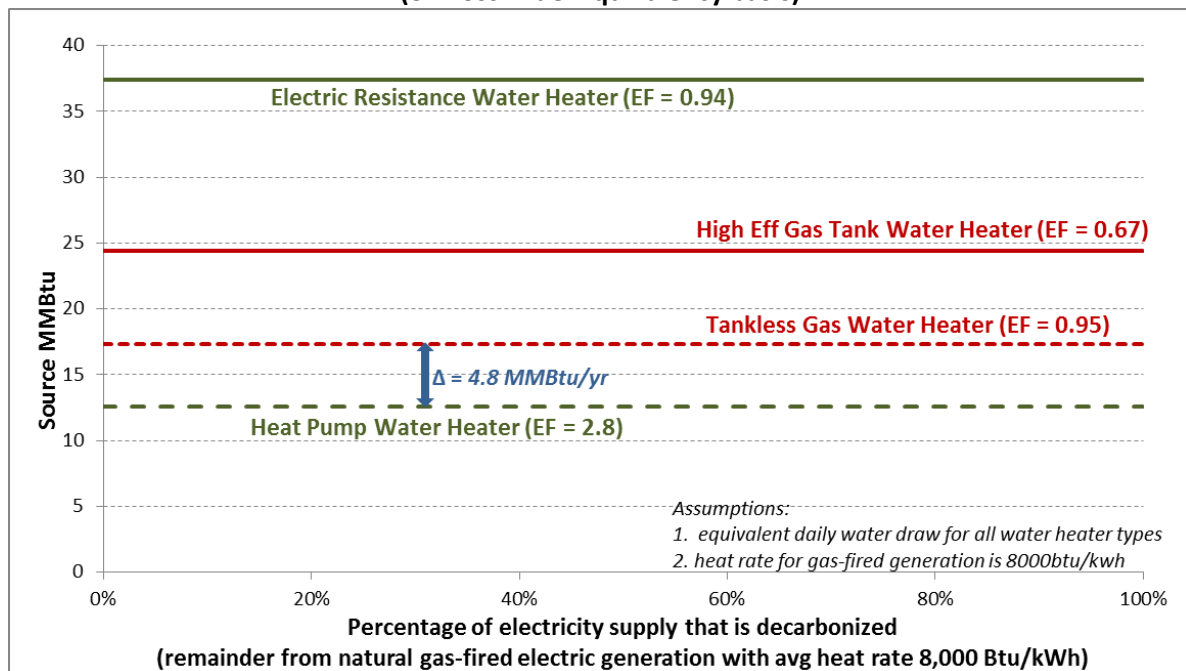
Palo Alto analyzed both the annual GHG emissions and source energy of various water heating technologies under different degrees of decarbonization of the electric supply. Assuming that all non-renewable energy are gas-fired generation with an average heat rate of 8,000 Btu/kWh in California, a HPWH with Energy Factor (EF) of 2.8 has lower source energy input than the most efficient gas water heater, under both the "Captured Energy" and "Fossil Fuel

Equivalency” methodologies for calculating the source energy of renewable generation<sup>1</sup>, as illustrated in Figure 1 and 2 below.

**Figure 1. Comparison of Source Energy Input for different water heater technologies (on Captured Energy basis)**



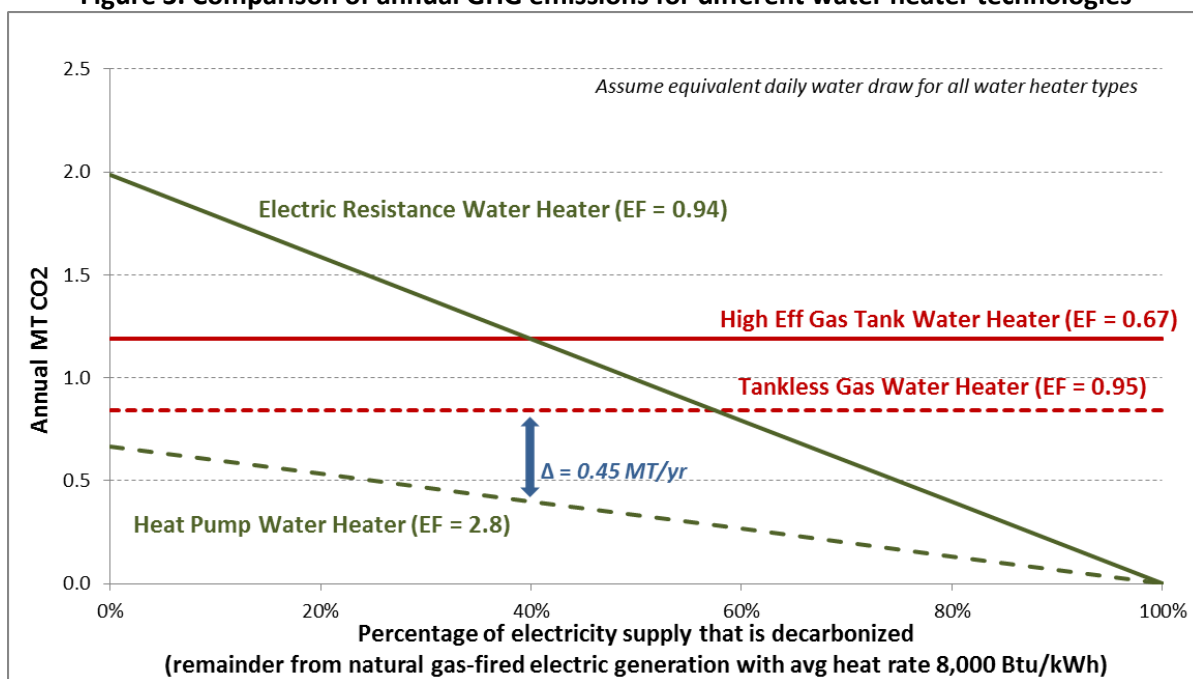
**Figure 2. Comparison of Source Energy Input for different water heater technologies (on Fossil Fuel Equivalency basis)**



<sup>1</sup> Definitions for the Captured Energy and Fossil Fuel Equivalency methodologies are given in the Department of Energy document titled “Accounting Methodology for Source Energy of Non-Combustible Renewable Electricity Generation”, October 2016.

Not surprisingly, the GHG emission of a HPWH is also lower than that of the most efficient gas water heater. Based on the 2015 Power Content label, 22% of California’s electricity supply is comprised of RPS eligible resources, another 5% from large hydroelectric plants, and 9% is nuclear power. It is foreseeable that California’s electric supply will be 40% decarbonized before 2020. Figure 3 illustrates that with a 40% decarbonized electric supply, a heat-pump water heater with EF of 2.8 will result in an annual GHG reduction of 0.45 MT of CO<sub>2</sub> per year over a corresponding high efficiency tankless gas water heater. For customers with a 100% decarbonized electric supply (by either sizing their rooftop photovoltaic system to accommodate the year-round electric load of water heating, or purchasing 100% renewable energy from their electric service provider), the annual GHG reduction of replacing a tankless water heat with electric heat pump water is around 0.8 MT.

**Figure 3. Comparison of annual GHG emissions for different water heater technologies**



Fuel-substitution should encourage high efficiency heat pump electric alternatives to natural gas appliances. The efficiency level of the heat pump appliances can be determined at a later point under CEC guidance.

### Palo Alto Initiatives to Electrify Natural Gas Appliances

In the case of Palo Alto, which operates its own electric and gas utility, the City’s electric supply has been carbon-neutral since 2013. In December 2014, Palo Alto City Council directed staff to explore electrification through programs and incentives as well as local building code changes as a potential strategy for the City to reduce its GHG emissions. In August 2015, Palo Alto City Council approved a 10-point electrification work plan to explore the viability and feasibility of various electrification strategies, which includes, among other actions, promoting HPWH and HPSH and exploring local building code changes to expedite electrification<sup>2</sup>.

<sup>2</sup> <http://www.cityofpaloalto.org/civicax/filebank/documents/48443>

Residential end uses account for between 35 to 40% of Palo Alto's annual natural gas consumption; in particular, water heating and space heating are the dominant natural gas end uses among households. City of Palo Alto Utilities Department (CPAU) estimates that the electrification of water heating and space heating can result in annual gas savings of over 50,000 therms/yr and avoided GHG emissions of 450 metric tons/yr by 2020 for the our city. At a statewide level, substituting gas water heating and space heating with efficient electric heat pump technologies can be a big step to meeting SB 350's goals of doubling energy efficiency savings by 2030.

Palo Alto recently contracted a study to examine the cost effectiveness of HPWH and HPSH in both existing and new buildings for single family, low-rise multi-family, and small-medium office buildings<sup>3</sup>. The study incorporates costs that reflect the higher contractor/construction costs in Silicon Valley, and uses both the CEC Time Dependent Valuation (TDV) cost perspective as well as Palo Alto customer costs perspective (based on Palo Alto's electric and gas rates). From a TDV cost perspective, the study finds that while HPWH as a standalone measure is not cost effective in most cases (except for office new construction projects), HPSH is cost effective for residential new construction and renovation projects, and HPWH and HPSH in an all-electric building with no gas connections are cost effective in residential and small office new construction projects.

From a customer perspective, the study shows that HPWH and HPSH are not cost-effective. This is primarily because the increased electric consumption is charged at a higher electric tariff (Tier 2 of the CPAU residential/small commercial electric rate is about 40% higher than the Tier 1 rate.) For customers who have onsite photovoltaic generation to offset their electric consumption, the economics of replacing gas appliances with electric heat pump appliances can be favorable. Palo Alto may conduct a follow-up study to examine the cost-effectiveness of HPWH and HPSH bundled with rooftop PV systems.

As directed by the electrification work plan, Palo Alto launched a pilot program in late spring 2016 to encourage customers to replace gas water heaters with HPWHs. Early results of the pilot program suggest substantial barriers hindering the adoption of HPWH in existing homes, even for highly motivated residents. A major inhibiting factor is the upfront costs of replacing a gas water heater with a HPWH, especially for households that need to upgrade their electric panel to accommodate a dedicated 30 amp circuit for the HPWH. Limited availability of HPWH units from distributors/retailers is also an issue. Due to low demand, there are very few retailers that maintain an inventory of HPWH units in their warehouse. With the expiration of the federal tax credit for heat pump water heater at the end of 2016, homeowners now have lower incentive to adopt heat pump water heaters. Additionally, we also found a general lack of awareness and understanding of heat pump-based appliances.

From a contractor perspective, replacing a gas water heater with an electric heat pump water heater involves both plumbing and electrical work. However, there are very few plumbers who

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<sup>3</sup> <http://www.cityofpaloalto.org/civicax/filebank/documents/55069>

are also licensed to do electrical work, and vice versa. Among the licensed plumbers contacted by CPAU staff, very few are familiar with HPWHs or stock these units for emergency replacement.

#### CONCLUDING REMARKS

Palo Alto urges CEC to include fuel-substitution as a strategy to meet the state's energy efficiency and GHG reduction targets set for 2030, specifically with respect to HPWH and HPSH. Fuel-substitution will need both time and funding to support market transformation activities in order to realize its potential of energy savings and GHG emissions reductions. Palo Alto recommends that the CEC explore funding sources to support fuel substitution efforts, including opportunities for (1) initiating or administering statewide grant or rebate programs to incentivize customers and/or supply-chain actors; and (2) collaborating, where possible, with other state agencies responsible for energy and greenhouse gas related portfolios, to identify funding sources, such as the California Air Resources Board in its administration of the Greenhouse Gas Reduction Fund.