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Comments for HPWH and PV exemption

Additional submitted attachment is included below.

To: California Energy Commission (CEC)

Docket: 24-BSTD-01 – 2025 Building Energy Efficiency Standards

From: Michael Little, California Energy Code Compliance

Date: January 1, 2026

Comments for Heat Pump Water Heater (HPWH)

1. Executive Summary

These comments address the unintended consequences of the photovoltaic (PV) exception as applied to small square-footage new construction projects, most commonly Accessory Dwelling Units (ADUs).

The weather data referenced in this comment set is based on **California Climate Zone 9**, which represents a **best-case operating environment** for air-source heat pump water heaters (HPWHs) due to its relatively mild temperature profile and high frequency of outdoor air temperatures within typical HPWH efficiency ranges. **Climate Zone 9 also contains one of the highest population concentrations of any California climate zone, meaning impacts observed here have a significant effect.**

This climate selection is intentional: if performance, cost, and compliance issues exist in Climate Zone 9, they will be even more pronounced in colder climate zones, such as **Climate Zone 16**. Despite this best-case scenario, the current EDR2 compliance framework results in disproportionate cost and performance penalties that most directly impact socio-economically disadvantaged occupants.

Performance observations referenced herein utilize manufacturer data from **Bradford White RE2HP506-1NCTT 50 Gal AeroTherm® HPWH** (Bradford White Corporation, 2025).

2. PV Exemption Context

As you are aware, the California Energy Commission established the <1.8 kW photovoltaic exception under **Exception 2 of Section 150.1(c)14**, recognizing that small PV systems lacked a reasonable return on investment and created disproportionate cost burdens in small residential projects. This exception is now commonly applied to newly constructed ADUs.

Most Authorities Having Jurisdiction (AHJs) require detached, newly constructed ADUs to be modeled as new construction. When modeled this way and the PV exemption is applied, EDR2 compliance cannot be achieved unless major appliances are electrified, effectively mandating HPWH installation.

3. Interior Installation Impacts

In practice, HPWHs in ADUs are rarely installed per manufacturer-recommended conditions. It is not viable to install inside the envelope due to area restraints and volume requirements, and HPWHs impose a **space-conditioning penalty by exhausting approximately 100–200 CFM of ~50 °F air during operation**. Since HPWHs are required to operate during off-peak hours, this penalty is exacerbated. In small ADUs, this airflow represents a significant fraction of total conditioned air volume, further increasing heating demand during winter months.

The **Bradford White RE2HP506-1NCTT 50 Gal AeroTherm® HPWH** specifies that **a room with at least ~700 ft^3 (10′ × 10′ × 7′) of free air volume is recommended for optimal performance** (Bradford White Corporation, 2025). **Gary Klein's research also demonstrates that HPWH efficiency declines rapidly when installed in confined volumes or when inlet air temperatures fall below laboratory test conditions**, both of which are common in ADU applications (Klein, 2024, *HPWH Performance in Real Buildings*).

4. Exterior Installation Impacts

HPWHs are frequently installed in exterior closets, which are allowable and can be modeled in approved compliance software without an apparent performance penalty, making them an attractive compliance option despite the fact that **NEEA provides performance ratings only for indoor installations, not outdoor or semi-conditioned locations**.

When installed outdoors, **units are required by state policy to be programmed for off-peak operation**. In Climate Zone 9, however, off-peak hours align poorly with optimal ambient temperature conditions. **Bin-hour weather data indicates that during off-peak operation windows, ambient temperatures fall within the optimal HPWH operating range of approximately 68–95°F only ~22% of the time**, even in this best-case climate. As a result, recovery times increase and reliance on resistance heating becomes more frequent, directly increasing end-user operating costs.

Recent housing and occupancy studies indicate that ADUs are disproportionately occupied by **low-income residents**, meaning these increased operational costs are borne by the most economically vulnerable households.

5. Greenhouse Gas (GHG) Considerations

The overall GHG impact of this policy pathway is expected to be **insignificant**. The State of California estimates that **residential combustion of fossil fuels accounts for approximately 6.7% of statewide GHG emissions, while electricity generation accounts for approximately 16%** (California Air Resources Board [CARB], 2024). Under this framework, emissions are largely shifted rather than eliminated.

While centralized generation may offer improved emissions control opportunities, the marginal GHG benefit must be weighed against increased consumer costs, particularly in small housing types where **economies of scale do not exist**.

6. Conclusion

In conclusion, I respectfully request that the Commission **apply the same economic and proportionality logic used in establishing the PV exception** to small new construction projects, including ADUs.

Although suitable HPWH technology designed for small volumes, off-peak operation, and outdoor or semi-conditioned environments already exists and is commercially available in Europe (European Heat Pump Association [EHPA], 2023), until such units are available domestically, a **compliance exemption allowing more appropriate water-heating technologies is warranted**.

Failing to do so risks replicating the same inequitable cost impacts that originally justified the PV exception, now through a different compliance mechanism.

References (Inline, for CEC submission)

1. Bradford White Corporation. 2025. *RE2HP506-1NCTT AeroTherm® HPWH Technical Data Sheet*.
2. Klein, Gary. 2024. *HPWH Performance in Real Buildings*.
3. California Air Resources Board (CARB). 2024. *California Greenhouse Gas Emissions Inventory*.
4. European Heat Pump Association (EHPA). 2023. *HPWH Market Overview and Performance Guidelines in Europe*.
