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## **Remove Proposed Title 24 prescriptive heat pump requirements**

We urge the CEC to remove the proposed heat pump baselines in 140.4(a)3.

The proposed changes significantly and unduly restrict compliance options for HVAC systems in offices and schools. The CEC's workshop presentations on July 27, 2023 and August 24, 2023 did not provide sufficient detail and justification for a measure that would have profound impacts to typical practice for office and school HVAC systems. The Heat Pump Baseline Report that was posted to the docket on March 28, 2024 along with the 45-day language was provided extremely late in the process. This significantly limits the opportunity for affected stakeholders to adequately participate in the public review process, and does not provide sufficient time to address serious flaws in the supporting analysis and proposal. For such a radical and restrictive change to Title 24, the CEC should have provided a comprehensive report many months ago documenting the detailed assumptions and calculations that support their analysis, as well as considerations of negative impacts to designers; contractors; building owners, occupants, and operators; and equipment manufacturers.

FPFC + DOAS + AWHP is a very uncommon HVAC system type and extremely unlikely to have lower first costs than baseline system types for offices and schools. The CEC's report ostensibly shows higher first costs for reported components of the FPFC system in Table 41 and higher maintenance costs in Table 42, but yet the cost effectiveness summary for large offices in Table 44 reports FPFCs to have lower costs than VAV. That conclusion defies common sense and suggests major errors in the analysis and assumptions for justifying this measure. For example, an AWHP is likely 5X more expensive than a boiler, plus the cost of the supplemental electric boiler as backup to the AWHP, the FPFC terminals are listed as 3X more expensive than VAV boxes, and FPFC requires an extra chilled water pipe distribution loop that isn't needed for VAV. It is not clear whether the analysis includes costs in the proposed case for heat recovery and VAV boxes at each zone for the DOAS system to meet mandatory occupied-standby and DCV requirements. This system will increase greatly first costs, require complexity that many schools will not be able to manage (e.g., building automation systems, chilled and hot water systems), and significantly increase maintenance costs. There is also no size limitation; VRF or air-to-air HPs may be much more appropriate for small school buildings but would not be prescriptively allowed by this proposal.

For small and medium office buildings, VRF + DOAS is a viable all-electric HVAC system type, however, the first costs assumptions appear to be flawed. For example, the VRF costs are assumed at \$0.5/sf. For a realistic average of 800 sf/zone, this assumption sets VRF installed costs at \$400 per fan coil, which is impossibly low.

On the energy side, though the VRF energy models in EnergyPlus (developed in conjunction with a VRF manufacturer) may show good energy performance, numerous studies have shown that AHRI ratings of VRF equipment are overstated (PG&E, Guidehouse, and DOE). In particular, the VRF ASRAC working group found that AHRI efficiencies were roughly 2X higher than measured performance. Other comparison studies have shown code-compliant VAV reheat to have lower energy performance than VRF in Bay Area climates, contradicting the findings in the CEC analysis. The CEC report does not provide detail on what assumptions were made for modeling the VAV baselines to fully review the energy analysis (e.g., are the VAV minimum airflows set to ventilation as prescriptively required?).

In coastal California climates, the mild weather conditions are ideal for air economizing. Accordingly, decades of Title 24 updates have increasingly made economizer requirements more stringent. Yet, each of the prescriptive baselines mandate that ventilation is provided via DOAS, which effectively eliminates air economizers and reduces the overall outdoor air provided to occupied zones. This change will reduce indoor air quality compared to systems with economizers.

Though the performance compliance pathway may be used for alternative HVAC systems, the additional cost and complexity of performance modeling is prohibitive for many projects, particularly as there is no size limitation with this measure.

While the CEC's proposed changes may be well intended, there appear to be serious flaws in the analysis, there continue to be gaps in the supporting documentation, and the resulting constraints on industry are too severe to enact without more stakeholder engagement and opportunity for detailed review. The late posting of the Heat Pump Baseline Report with the 45-day language does not provide impacted stakeholders sufficient time to review and comment and for CEC to address significant errors in the analysis and shortcomings in the proposed language. Therefore we respectfully request that the CEC remove the proposed heat pump baseline language.