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Comments on HVAC Load calcs, EER2 in PV, and Ceiling Insulation trigger in Replacement Duct Systems

Additional submitted attachment is included below.

May 2, 2024
Re: 2025 45 Day Title 24 Part 6 Energy Standards (CEC Docket: 24-BSTD-01)

Dear Commissioner McAllister and Building Standards Office staff,

Commentary on 150.0(h) and 150.2(a)1E (Load calculations and System Capacity) :

We recommend adoption of 10-103 language that requires load calculation and duct design at permit application.

We appreciate these additions to the Energy Code to bolster extant but vague requirements for sizing in parts 2.5 and 11, especially as heat pumps are becoming more prevalent, as this class of equipment is more sensitive. First– we note that the proposed language and modifications to Section 10-103 suggested in the CASE Report[1] were not included in the 45 day language. This draft language in the CASE Report explicitly requires load calculations and duct design as a part of permit applications and its exclusion deeply undermines the success of the broader effort to achieve right-sizing outcomes for space conditioning systems, and especially heat pumps. Proper sizing, and therefore long-term efficiency, performance and comfort of HVAC systems is a journey that should start as early as possible in the design process, and it is one that is rarely ever begun due to a litany of market failures. The proposed language in the CASE Report intends to target those failures at the time and place where it would be most beneficial and productive for all parties.

We recommend elimination of limits on electric resistance supplementary heating in section 150.0(h)8

We note that heat pump systems must be sized to meet the design loads without consideration of any supplementary heating. Furthermore, electric resistance heating is limited in 150.0(h)8 to no more than 2.7 kW per ton of cooling capacity. No such limit on supplementary heat is placed on dual-fuel systems. We speculate that this code may be unintentionally antagonistic to long-term building decarbonization goals expressed in other regulations and statutes.

We see a lot of heat pumps in our work in both new and existing construction (though much less recently in the latter– more on that later). These heat pumps are nearly always oversized for the loads, and often integrate supplementary heating– either electric strip heat or gas. Given the equipment sizing, the backup will rarely, if ever, run. The purpose of supplementary heating is really an insurance policy for the HVAC subcontractor to cover for unknown deficiencies in the building envelope. When homes are uncomfortable, the HVAC system is usually the first system to be blamed.

For supplementary heat, many HVAC subs prefer dual-fuel systems, since it feels more comfortable and familiar for them since gas has long been the default choice in any place with the infrastructure, and is still the preference due to the high (and ever increasing) price for electricity in much of California. Dual-fuel heat pumps are especially prevalent in existing homes since the existing ductwork can remain, and

[1] Revised_2025_T24_Final-CASE-Report-RES-HVAC-Performance.pdf (title24stakeholders.com) page 176

the dual-fuel choice gives homeowners a low cost system that can offer present and future fuel-substitution opportunities[2].

For the purposes of the natural gas grid, an implicit preference for dual fuel heat pumps will result in another connection (in both existing and new construction) that must be maintained by the utility, and one that serves a critical health and safety requirement (CRC 303.10) that will be difficult to remove in the future (even if it's never actually needed). Removing the sizing constraint for electric resistance backup removes a barrier to all-electric homes without any likely impact to actual load on the electrical grid.

Removing this limitation on strip heat sizing in 150.(h)8 doesn't mean that electric resistance won't face other limitations. Within the Performance path (which is used for most new construction projects and additions), supplementary strip heating in undersized heat pumps is significantly penalized[3]. Also, the possibility of triggering a service upgrade per NEC 220 calculations is itself a powerful incentive against incautious HVAC sizing and design, especially with strip heat. Given these other policy and market barriers addressing undersizing, the limitation on strip heating in 150.0(h)8 is redundant and unnecessary. And following from our observation that HVAC designers will still seek a measure of 'insurance' on their designs via some supplementary heating source, then we find the implicit bias here towards gas backup to be imprudent in light of California's decarbonization goals.

We recommend removal of the EER2 factor in Equations 150.1-C and 170.2-C

We understand that the addition of this term was to add a compliance variable to recapture efficiency loss due to the lack of minimum EER2 in heat pumps due to federal regulations. EER2 generally represents AC efficiency better than SEER/SEER2 ratings during peak summertime cooling hours, which are of special concern during this energy code cycle.

However, taking a step back, we wonder if this addition is prudent and worthy of the added complexity and inscrutability of the Energy Code. We cannot see the merit of this particular language in light of other, and arguably better targeted rules which address this concern.

The ACM Standard Design and LSC values already penalize low EER equipment:

The vast majority of new construction (both single and low-rise multifamily) uses the performance pathway. The proceedings for the 2025 ACM have not yet happened, but we'll make an educated guess that EER2 for Standard Design will remain unchanged from the 2022 to 2025 code cycle– i.e. the Standard Design EER2 will be fixed at 11.7. Casual review of the AHRI database indicates that heat pump EER2 can go as low as 7, however we observe that this would incur a significant penalty in the Performance path. If peak cooling is of concern here, why aren't the LSC values themselves a sufficient and more rigorously quantitative policy signal to disincentivize low EER equipment?

[2] However, even among those who choose dual-fuel systems, there is some amount of acclimation and accommodation to these systems due to the there are occasional complaints about the comfort and acoustics of these systems.

[3] This compliance penalty for supplementary heating is significantly less for dual-fuel systems, resulting in another implicit policy preference for mixed-fuel homes.

The Peak Cooling test adds additional regulation to Single-Family

There is an *additional* compliance test in the Performance path that also addresses peak cooling hours for single-family. We noted that in the meetings on this new compliance test that it does not apply to multifamily, but for some reason the added EER2 is still included in the low-rise Multifamily PV calculation. If we're correct that the EER2 term is intended to address times of peak cooling, then we cannot rationalize why the much more targeted peak cooling test was not adopted for multifamily.

Additional PV is poorly aligned with peak cooling energy use

For Prescriptive and Standard Design, CFI1 can range from 150 degrees to 270 degrees on steep slope roofs. A PV system, even with increased size that is oriented at 150 degrees does not have peak production during the hours of peak cooling (4pm-9pm) when EER2 performance on the heat pump equipment is most important. We observe that the EER2 and PV tradeoffs are often not well aligned.

We encourage the Commission to reconsider the necessity of this additional EER2 factor in the context of the overall compliance framework. This added EER2 factor for PV strikes us as overwrought, and in the context of other codes, is overdetermined. If this requirement must remain, then we encourage simplifying the language and equations to just capture the 4-6 climate zones where the results are anything more than a rounding error on any project.

We recommend elimination attic insulation trigger (150.2(b)1J) in New/Replacement Duct Systems

In duct alteration projects where the project is installing Entirely New or Complete Replacement duct systems, Section 150.2(b)1Diia prescriptively triggers the requirements of 150.2(b)1J when the air handler and ducts are located in a vented attic. In the Performance path, Section 150.2(b)1J is applied to Standard Design any time the ducts are Altered or New and regardless of location of the ducts or air handler.

We have found this requirement to be quite antagonistic to any duct alterations and, in particular, electrification of space heating and encourage the removal of the 150.2(b)1J trigger here

When evaluating compliance on a project where the clients are considering heat pumps to replace their existing furnace, the typical recommendation is to install new ductwork, as that is the best way to ensure proper airflow and delivery of conditioned air to the dwelling. This already comes at a significant added expense relative to replacing the existing furnace/AC unit. This triggered section then adds an R-49 insulation requirement and other air-sealing measures to the existing ceiling, regardless of whether or not altering the ceiling is within the scope of work, which adds even more expense.

Though this added ceiling insulation has gone through formal cost-effectiveness tests, the added costs for adding this insulation, even if proven to be cost-effective at the project level in the long-term (which is not always the case), are often a deal-breaker. All projects are budget constrained, and this trigger can double or more the cost of the HVAC system. It should not be surprising that some projects balk.

The reaction from the trades and code enforcement we get is that this is an inappropriate overreach of requirements and either discourages scope (as mentioned above) or discourages permit applications. We've heard specifically from a few building departments that do not enforce it as a result—there is no internal mechanism they have for this trigger nor are they interested in creating one. HVAC subcontractors that are aware of this carefully limit their scope and system selection as to not trigger the insulation requirement in spite of compromised efficiency. And we've heard that others simply don't pull

permits on this kind of system scope. In any of these cases, the ultimate loser is not just efficiency and decarbonization, it's the integrity and legitimacy of the energy code itself. We encourage the removal of this trigger.

Sincerely,

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