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HVI Comment - Docket No 19-BSTD-03; Response to CEC's Nov 3 Proposal to Establish Minimum Prescriptive Requirements for HERVs

Additional submitted attachment is included below.

17 November 2020

Building Standards Office
California Energy Commission
1516 Ninth Street
Sacramento, California 95814

Re: Docket No. 19-BSTD-03, 2022 Energy Code Pre-Rulemaking; *Response to CEC's November 3rd Proposal to Establish Minimum Prescriptive Requirements for H/ERVs*

Dear CEC Staff:

As North America's leading certification body for residential heat and energy recovery ventilation (H/ERV) products, the Home Ventilating Institute (HVI) welcomes CEC's proposed modifications to Title 24 that would establish prescriptive path requirements for H/ERVs in climate zones 1-2 and 11-16. Additionally, HVI encourages CEC to expand the proposed requirements as follows:

1. Include any additional scenarios which have been shown by the California Statewide Codes and Standards Enhancement (CASE) Program to achieve CEC's cost effectiveness target (i.e., benefit:cost ratio exceeding 1.0), and
2. Include any additional scenarios that could be shown to be cost effective when reasonable modifications are made to CASE's underlying modeling assumptions.

CEC's acceptance of these recommendations should significantly and justifiably expand the applicability of this proposal to climate zones 3-5 and possibly 10.

Rationale supporting recommendations 1 and 2 follow:

1. **Include any additional scenarios which have been shown by CASE to achieve CEC's cost effectiveness target.** Table 1 provides a summary of the benefit:cost ratios that were reported by CASE in their final report.[1] Green cells identify the climate zone and building types meeting the cost effectiveness metric. Yellow cells identify the climate zones and building types that narrowly missed the cost effectiveness metric, and the green highlighted cells in the purple boxes represent CASE's and CEC's recommendations for H/ERV prescriptive path requirements. Because CASE decided to only recommend requirements for H/ERVs when each of four MF building types (i.e., low-rise garden style, low-rise loaded corridor, mid-rise, and high-rise) in a given climate zone met CEC's cost effectiveness target, there are six scenarios that CASE

[1] Goebes M, Grindrod R, McLaughlin G, Nakajima M, Perry N, McCollum E, Springer D, German A, Peralta J, Dichter N, Harrington C, Young N. 2020. Multifamily Indoor Air Quality. Prepared by: the California Statewide Codes and Standards Enhancement (CASE) Program. Prepared for: Pacific Gas and Electric Company, Southern California Edison, San Diego Gas & Electric Company, Los Angeles Department of Water and Power, and Sacramento Municipal Utility District. Report number: 2022-MF-IAQ-F. TN# 235290.

determined to be cost effective that did not receive recommendations for H/ERVs (i.e., all green cells in Table 1 that are not within a purple box). If CASE had elected to group the results according to low-rise (e.g., a straight or weighted average of both low-rise building types) and mid/high-rise (e.g., a straight or weighted average of mid-rise and high-rise), another three scenarios might be considered cost-effective (these are shown in the yellow cells that are within the blue boxes in Table 1). HVI appreciates CASE's desire to have identical requirements across all multifamily dwelling units in any given climate zone, but CEC should adopt all prescriptive path requirements where they are cost effective and should not leave energy savings on the table. To maximize energy savings associated with CASE's results, HVI recommends that CEC explore these options for expanding the prescriptive path requirements for H/ERVs where cost effective.

Climate Zone	Low-Rise Garden Style	Low-Rise Loaded Corridor	Mid-Rise	High-Rise
1	4.5	3.6	3.1	1.8
2	2.9	2	1.9	1.5
3	1.5	0.8	1.2	0.7
4	1.6	1.2	1	0.9
5	1.3	0.7	0.6	0.8
6	0.1	-0.7	-0.2	0.3
7	-0.2	-1	-0.6	0.1
8	0	-0.7	-0.2	0.5
9	0.6	-0.4	0.3	0.7
10	1.2	0.2	0.6	1
11	3.1	2.5	2.5	1.9
12	2.5	1.8	1.8	1.6
13	2.7	2.3	2	1.7
14	3	2.5	2.2	2
15	1.6	1.2	1.2	1.6
16	4.3	4.1	3.1	2.7

Table 1. CASE's benefit:cost ratios, by building type and climate zone. Green cells meet CEC's cost effectiveness target (benefit:cost ratio > 1.0). Green cells in purple boxes are those scenarios that CASE and CEC recommended have a prescriptive requirement for H/ERVs. Cells within the blue boxes could potentially show cost effectiveness by being grouped together. Yellow cells are close to achieving cost effectiveness and would likely show cost effectiveness if CEC were to accept one or more of the modifications in recommendation 2.

2. **Include any additional scenarios that could be shown to be cost effective when reasonable and justifiable modifications are made to CASE's underlying modeling assumptions.** There are several scenarios that are on the cusp of being cost effective, especially in climate zones 3, 4, 5, and 10. If CEC were to approve one or more of the following recommended modifications to CASE's study, these borderline scenarios may show cost effectiveness:
    a. <u>Modification 1: update the time dependent valuation (TDV) values in CASE's analysis with the latest available from CEC</u>. At a minimum, CEC should ensure that the latest TDV values are applied to CASE's analysis.

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b. Modification 2: increase the airflow rate to at least 125% of the ASHRAE 62.2 minimum. Lawrence Berkeley National Laboratory's (LBNL's) research[2] sponsored by CEC has shown that in practice and on average, California builders specify ventilation systems with airflow rates that are 1.5 times the older Title 24/ASHRAE 62.2 minimum airflow rates. Within a follow-on conversation with LBNL staff, LBNL staff agreed that an oversizing multiple of 1.25 to 1.4 is a reasonable expectation for builders trying to meet current Title 24/ASHRAE 62.2 airflow rates. Therefore, using an airflow rate of 125% is reasonable when estimating energy use and savings associated with dwelling unit ventilation systems.

c. Modification 3: use an Adjusted Sensible Recovery Efficiency (ASRE) when modeling the heat recovery effectiveness of an HVI certified H/ERV, not a Sensible Recovery Efficiency (SRE). The CASE team used a sensible recovery efficiency (SRE) of 67 in their simulations, selected as a value achieved by the majority of H/ERVs in HVI's Certified Product Database (CPD). However, the best metric available to model the performance of an HVI-certified H/ERV when fan energy is calculated separately from heat exchanger performance (as is done within California Building Energy Code Compliance [CBECC] software and EnergyPlus software) is the rated ASRE at a temperature of 32°F. Following is HVI Publication 920's definition of ASRE that is applicable to the rated ASRE at 32°F and that clarifies HVI's recommendation to use an ASRE when conducting building energy simulations:

> *Adjusted Sensible Recovery Efficiency (ASRE): The net sensible energy recovered by the supply airstream as adjusted by case heat loss or heat gain, air leakage, (and) airflow mass imbalance between the two airstreams… as a percent of the potential sensible energy that could be recovered. This value should be used for energy modeling when wattage for air movement is separately accounted for in the energy model.*

Communications with CEC staff and Bruce Wilcox on March 27, 2020 confirmed that CEC staff also support the use of ASRE when simulating H/ERV performance in CBECC. Based on a regression of SRE and ASRE values of H/ERVs in the HVI CPD, an SRE of 67 is correlated with an ASRE of 72 (see Figure 1). HVI therefore recommends that CASE's simulations be modified to use an ASRE of 72 when simulating heat exchanger effectiveness.

[2] Chan WR, Kim YS, Less BD, Singer BC, and IS Walker. 2020. Ventilation and Indoor Air Quality in New California Homes with Gas Appliances and Mechanical Ventilation. Prepared by: LBNL. Prepared for: CEC. Report number: CEC-500-2020-023. https://ww2.energy.ca.gov/2020publications/CEC-500-2020-023/CEC-500-2020-023.pdf.

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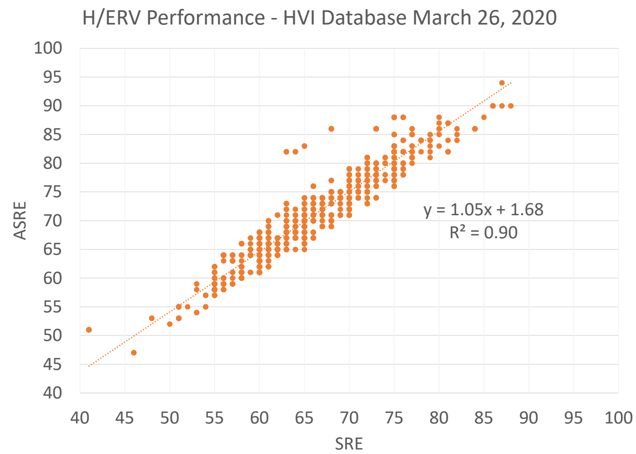

Figure 1. A regression of HVI's H/ERV CPD shows that an SRE of 67 is correlated to an ASRE of 72.

d. **Modification 4: use thermostat setpoints that are better aligned with occupied setpoints in California homes.** CBECC currently uses a thermostat heating setpoint of 60°F for 8 hours per day and 68°F for 16 hours per day. CBECC's thermostat cooling setpoint is a constant 78°F in cooling. These setpoints are far more conservative than setpoints assumed by ASHRAE 90.1, IECC, or those documented by a recent study of thermostat setpoints in California homes. As such, CBECC's setpoints discount the heat recovery benefit of H/ERVs that when modeled within CBECC. A 2016 study conducted by Nest[3] across 150,000 California residential thermostats and 13 million days of data identified a thermostat "comfort set point" in heating and cooling, which was the "typical setting when people are home and want to be comfortable". Arguably, occupancy and comfort-driven behavior are reasonable bases for establishing thermostat setpoints for a building energy standard. Because it is an occupied comfort setting, the comfort setpoint identified by Nest is higher than the average setpoint and is determined as "the 90th percentile of the customer's heating set points and the 10th percentile of their cooling set points" for each climate zone. The state-wide comfort setpoints attributed to the Nest study in Table 2 are values that have been developed by applying a multifamily-starts weighting factor for each climate zone (derived from CEC data) to the Nest study's comfort setpoint for each climate zone. Figures 2 and 3 show both the average and comfort heating and cooling setpoints for each climate zone (Nest data) as well as estimated, weighted state average heating and cooling setpoints (developed from post-processed Nest data). While HVI recommends the use of occupied comfort setpoints for CBECC analysis, it is clear even from the average thermostat setpoints in the Nest data that CBECC's thermostat heating setpoint should be revised upward and CBECC's cooling thermostat setpoint should be revised downward, resulting in greater energy savings for H/ERVs than predicted by the CASE study.

[3] Blasnik et al. 2016. Supplemental Data for California Smart Thermostat Work Paper: Large scale analysis of the efficiency of Nest customer thermostat set point schedules with projected heating and cooling savings compared to baseline behavior using pooled Fixed Regression Model and Comfort Temperature Analysis. https://static1.squarespace.com/static/53c96e16e4b003bdba4f4fee/t/57978c141b631b286ea3dae8/1469549595079/Supplemental+Data+for+California+Smart+Thermostat+Workpaper+-+June+2016.pdf

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Source	Heating Setpoint (°F)	Cooling Setpoint (°F)
Title 24/CBECC	60-68	78
ASHRAE 90.1	70	75
IECC	72	75
Nest Study, Derived*	71	74

Table 2. Heating and cooling thermostat setpoints for various codes, standards, and studies. The state-wide Nest study heating and cooling setpoints were derived by post-processing the Nest study through application of a multifamily-starts weighting factor for each climate zone (derived from CEC data) to the Nest study's comfort setpoint for each climate zone.

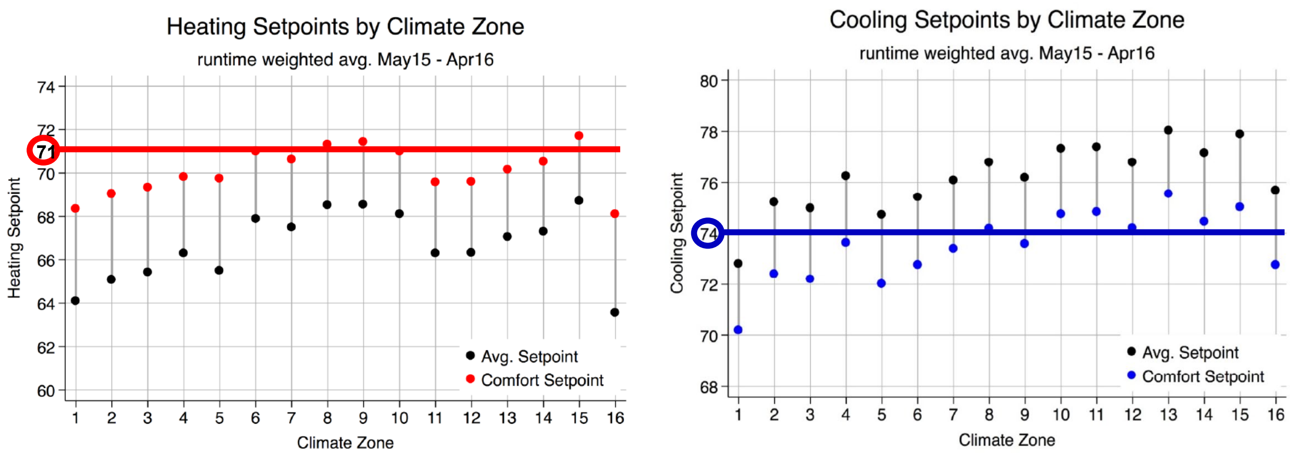

Figure 2. Nest data on California average and comfort heating and cooling setpoints. Horizontal lines represent post-processed, estimated state average comfort setpoints calculated by applying a multifamily-starts weighting factor for each climate zone (derived from CEC data) to the Nest study's comfort setpoint for each climate zone.

In conclusion, HVI supports the CEC/CASE recommendations for H/ERV prescriptive path requirements and encourages CEC to expand the requirements to additional climate zones where cost effectiveness can be demonstrated by making rational and defensible modifications to CASE's approach.

Thank you for the opportunity to provide these comments and for your consideration.

Sincerely,

Jacki Donner, CEO