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AHRI Comments â€“ Title 24-2025 45-day Express Terms [Docket No 24-BSTD-01]

Additional submitted attachment is included below.

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California Energy Commission (CEC)
Docket Unit, MS-4
1516 Ninth Street
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(Submitted electronically to Docket 24-BSTD-01)

Re: AHRI Comments – Title 24-2025 45-day Express Terms *[Docket No. 24-BSTD-01]*

Dear CEC Staff:

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI) respectfully submits this letter in response to the CEC 2025 45-day Express Term proposed changes to Energy Code (Title 24, Part 6), published on the CEC public docket on March 29, 2024.

AHRI represents more than 330 manufacturers of air conditioning, heating, water heating, and refrigeration equipment. It is an internationally recognized advocate for the HVACR industry and certifies the performance of many of the products manufactured by its members. In North America, the annual economic activity resulting from the HVACR industry is more than $211 billion. In the United States alone, AHRI member companies, along with distributors, contractors, and technicians employ more than 704,000 people.

AHRI supports efforts to reduce greenhouse gas (GHG) emissions while promoting sustainable, safe, reliable, and affordable access to the essential air and water heating, and cooling provided by the products manufactured by AHRI members. As discussed below, AHRI has legal and technical concerns regarding proposed revisions to the Energy Code. Most importantly, CEC has proposed overly prescriptive mechanical systems to be used for residential and nonresidential buildings when using the prescriptive path. Not only does this unacceptably limit owner and designer choices when using the prescriptive path – a more cost-effective path through the Energy Code – it impacts the performance path by inflating the energy budget. Additionally, we have serious questions and concerns regarding the proposed new metric, Long Term System Cost, which is used both to analyze the cost effectiveness of proposed updates to the Energy Code and for compliance when comparing proposed building design to their energy budget when using the performance compliance approach. AHRI supports taking a measured, transparent approach to Energy Code improvements and urges CEC to consider our recommendations.

EPCA Preempts the Proposed Revisions to the Prescriptive Compliance Path

The Proposed Revisions in Title 24 are preempted by the Energy Policy and Conservation Act (EPCA). 42 USC § 6291 *et al*. EPCA's preemption provisions prohibit states and localities from instituting laws, regulations and building codes which "concern" energy use of EPCA-covered products and equipment. Although there are limited exemptions for building codes, these exemptions do not apply in this instance. On January 2, 2024, the Ninth Circuit Court of Appeals upheld its April 2023 decision in the *California Restaurant Association v. City of Berkeley* (*Berkeley*) case. The court ruled that building codes that ***concern*** energy use are preempted by EPCA. Additionally, the case law related to the prescriptive compliance path and the performance compliance path indicates that EPCA preempts the proposed Title 24 revisions. As such, the revisions as currently proposed are subject to legal scrutiny, if enacted as written.

1. EPCA Preemption Provision

EPCA gives the U.S. Department of Energy (DOE) the authority to set nationwide energy conservation standards for various types of appliances and equipment. Its goal is to prevent individual states from creating rules that would affect the energy consumption standards of these appliances, with limited exceptions.

Under EPCA's preemption provision, state regulations "concerning" the "energy efficiency" or "energy use" of covered products "shall [not] be effective."[1] Courts have interpreted this preemption provision to be expansive, finding that the term "concerning" suggests Congress intended the provision to have a "broad preemptive purpose."[2]

Congress intended for EPCA to "preempt State law under most circumstances." *Air Conditioning, Heating, & Refrigeration Inst.*, 2008 WL 5586316, at *7; H.R. Rep. 100-11 at 19. "The plain language of the [Act's] preemption statute makes clear that Congress intended the preemption to be broad in scope." *Air Conditioning, Heating, and Refrigeration Inst. v. City of Albuquerque*, 835 F. Supp. 2d 1133, 1136 (D.N.M. 2010). In particular, "the use of the word 'concerning' suggests that Congress intended the preemption provision to be expansive." *Id.* (citation omitted).

The Proposed Revisions to the prescriptive compliance path, in Table 150.1-A prohibit the ability to use gas space or water heating for Single-Family Standard Building Design in climate zones 1-16, and a performance path to compliance is irrelevant to whether the Proposed Revisions are preempted.[3] The Proposed Revisions to the prescriptive path are regulations concerning the energy use of covered products, regardless of the existence of exemptions or the availability of the performance path to compliance. EPCA does not require a regulation to prohibit the energy use of covered products to be preempted in all

[1] *See* 42 U.S.C. § 6297(b).
[2] *See id.*; *see also Metro. Life Ins. Co. v. Massachusetts*, 471 U.S. 724, 739 (1985); *Nat'l Elec. Mfrs. Ass'n*, 2017 WL 6558134 at *5.
[3] "In Table 150.1-A, NA (not allowed) means that feature is not permitted in a particular climate zone…" Section 150.1(c).

circumstances; it merely must ***concern*** the energy use of covered products. The Proposed Revisions to the prescriptive path to compliance do just that.

While this is not a mandatory ban, there are significant cost barriers to installing fossil fuel space and water heaters when using the performance path. The tradeoffs required to install non-heat pump space and water heaters were cataloged at the July 27, 2023, pre-rulemaking staff workshop.[4] The cost of tradeoffs is significant and prohibitive.

2. Cases Involving EPCA

There are two cases that present similar facts which are relevant to the discussion around the Proposed Revisions at issue: (1) *California Restaurant Association v. City of Berkeley* (*Berkeley*); and (2) *Air Conditioning, Heating, and Refrigeration Institute v. City of Albuquerque*. Discussion of these two cases below indicates the necessity for CEC to reassess the Proposed Revisions, as written, as they are legally invalid.

a. *California Restaurant Association v. City of Berkeley*

States are expressly preempted from setting energy use regulations for products that DOE regulates.[5] Recently, the Ninth Circuit in *Berkeley*, stated "EPCA preempts regulations, including "building code requirements," §6297(f), that relate to "the quantity of [natural gas] directly consumed by" certain consumer appliances at the place where those products are used."[6] In *Berkeley*, the court ruled that EPCA expressly preempts the City of Berkeley's 2019 ordinance banning the installation of natural gas piping in newly constructed buildings.

Further, the court in *Berkeley* stated that "EPCA's preemption provision extends to regulations that address the products themselves *and* building codes that concern their *use* of natural gas. By enacting EPCA, Congress ensured that States and localities could not prevent consumers from using covered products in their homes, kitchens, and business."[7]

The Ninth Circuit concluded that Berkeley's ordinance was a "regulation concerning the … energy use" of a covered product because the plain text and structure of EPCA's preemption provision encompasses building codes that regulate natural gas use by covered products," including eliminating the use of natural gas. "EPCA preemption extends to regulations that address the products themselves and the on-site infrastructure for their use of natural gas."

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[4] CEC Presentation - July 27, 2023 - 2025 Pre-Rulemaking Staff Workshop on Heat Pump Baselines and Photovoltaic System Requirements. TN# 251405, Docket 22-BSTD-01

[5] *Air Conditioning, Heating & Refrigeration Inst. v. City of Albuquerque*, No. 08-633, 2008 WL 5586316, No. 08-633 at *6 (D. N.M. Oct. 3, 2008); *Nat'l Elec. Mfrs. Ass'n v. Calif. Energy Comm'n*, No. 2:17-CV-01625-KJM-AC, 2017 WL 6558134 at *5 (E.D. Ca. Dec. 21, 2017).

[6] *California Restaurant Association v. City of Berkeley* (January 2, 2024).

[7] *Id.*

Berkeley's ruling is the prevailing law of the land in the states and U.S. territories that lie in the Ninth Circuit, including California. As such, any enacted building codes that *concern* the energy use of EPCA-covered products are subject to scrutiny by the decision of that court. As such, AHRI urges the CEC to consider amending the proposed revisions to align with the court's decision in *Berkeley's* legal scrutiny.

b. *Air-Conditioning, Heating, and Refrigeration Institute v. City of Albuquerque*

It is important to consider the court's decision in *Air-Conditioning, Heating and Refrigeration Institute v. City of Albuquerque* (*Albuquerque*). In *Albuquerque*, AHRI challenged Volumes I and II of the 2007 Albuquerque Energy Conservation Code on the grounds that the code imposed minimum energy efficiency standards for commercial and residential buildings that were preempted by EPCA. 835 F. Supp. 2d at 1135. Volume I applied to commercial and multi-family residential buildings, and Volume II applied to one- and two-family detached dwellings and townhouses. *Id*. Both volumes included performance and prescriptive paths to compliance. The prescriptive paths included in both volumes set prescriptive standards for individual components that provided for energy efficiency standards more than federal standards. *Id*. However, the City of Albuquerque argued the prescriptive compliance path was not preempted because there were other lawful compliance paths. *Id*. at 1136.

The court held that revisions to a prescriptive path to compliance was a regulation subject to EPCA's preemption provision, regardless of the availability of a performance path to compliance. *Id.* at 1140. In reaching this holding, the court stated, "[t]he City has not persuaded the court that a local law is not preempted when it presents regulated parties with viable, non-preempted options. (*See* Mem. Op. and Order at 14, Doc. No. 61, filed October 3, 2008, 2008 WL 5586316 ("the Court can find no support for the novel proposition that the inclusion of one or more alternatives for compliance in a regulation keeps each of the alternatives from being considered a regulation"))." *Id*. at 1137. The court concluded "that the prescriptive provisions of Volume I requiring the use of heating, ventilation, or air conditioning products or water heaters with energy efficiency standards more stringent than federal standards are regulations that concern the energy efficiency of covered products and, therefore, are preempted as a matter of law." *Id*

The case law confirms the broad scope of EPCA's preemption. The court ruled that local codes that set energy standards exceeding federal requirements are preempted under EPCA, regardless of other compliance paths offered by the code (835 F. Supp. 2d 1133, 1136 (D.N.M. 2010)). The word "concerning" in the statute is interpreted broadly, meaning regulations related to the energy use of covered products are preempted if they dictate specific equipment like heat pumps and prohibit the use of gas fired appliances under the prescriptive path, as currently proposed in these revisions.

3. Building Codes Exemption

EPCA allows for building codes to be exempt from its preemption provisions if it meets a seven-factor test outlined in 42 USC 6297(f)(3). The CEC has not demonstrated that the Proposed Revisions meet the required seven-factor test to qualify for an exemption from preemption. Most notably, the prescriptive codes proposed fail to satisfy the fourth factor of the seven-factor test.[8]

The fourth factor states that a state's energy code cannot require that "a covered product have an energy efficiency exceeding the applicable energy conservation standard established in or prescribed under" 42 U.S.C. § 6295, unless DOE Secretary has issued a rule granting a waiver for the state regulation. In this instance, the Proposed Revisions fail to meet this factor as there is a requirement, as outlined above, for use of specific equipment, such as heat pumps, and an outright ban on gas fired equipment in all climate zones, per Table 150.1-A. This effectively bans the use of EPCA-covered products from use in new buildings under the code. In banning EPCA-covered products, the Proposed Revisions reduce the energy use of those covered products to zero. This effectively requires that "a covered product have an energy efficiency exceeding the applicable energy conservation standard," and the CEC has not sought a waiver from the DOE Secretary allowing this.

4. Legal Summary

In conclusion, the Proposed Revisions are attempting to set stricter energy standards than those prescribed by EPCA and are thus preempted. Both *Berkeley* and *Albuquerque* provide helpful guidance regarding the proposed prescriptive codes. These provisions, as written, do not provide the necessary flexibility nor do they align with the minimum federal requirements, and fail to qualify for a building code exempt under EPCA. If these Proposed Revisions are enacted as written, they would be legally invalid.

New Metrics for Evaluation of Measures and Compliance with Energy Code Raise Concerns

AHRI is concerned about the implementation of new metrics for proposed measures and code compliance. The CEC has proposed using a new metric, Long-term System Cost (LSC), to evaluate cost-effectiveness for proposed measures, including impactful changes to the heat pump (HP) Baseline, and within Title 24's compliance software (Section 10-109), in the performance approach.[9] If adopted, LSC will also be used for code compliance with the performance path. Software, developed by the Energy Code, implements simulation and compliance rules to simulate the energy use of a proposed residential or nonresidential building and compares it to a standard design energy budget to determine if the building complies with the Energy Efficiency Standards.

[8] 42 USC 6297(f)(3)(D)
[9] Title 24-2025 Pre-rulemaking Express Terms, Section 140.1 – Performance Approach: Energy Budget, (Docket 21-BSTD-01, TN# 252915)

Since the two pre-rulemaking presentations were made regarding metric changes in 2022, the CEC has released the "2025 Energy Code Accounting Methodology Report"[10] This report "documents the technical methods and tools used to assess energy efficiency proposals for the 2025 California Building Energy Efficiency Standards."[11] However, the report lacks important details on the fundamental approach and assumptions being used to cost justify measures for the Energy Code.

The report also highlights important gaps between statutory requirements and the CEC's interpretation. In the Accounting Methodology Report, the CEC acknowledges that cost-effectiveness is defined relative to the *consumer*.[12] California Public Resource § 25402 (c)(1)(A)(i) states that "standards or other cost-effective measures shall be drawn so that they do not result in any added total costs *for consumers over the designed life of the appliances concerned*." However, in the new metrics, the CEC has extended statutory requirement of "life-cycle cost of complying"[13] to a measure period of 30 years.[14] Additionally, LSC is a metric created to determine the dollar value of energy efficiency measures relative to the state, not the consumer. Using a 30-year period of analysis, even if it includes multiple product purchases, distorts life-cycle cost beyond what is intended by the plain language of the authorizing statue. Measures proposed must be analyzed relative to the consumer and over the ***design life of the appliance*** concerned. The CEC must reevaluate the use of metrics, including the proposed LSC, that do not accomplish this simple mandate.

In addition to LSC, the CEC uses the Source Energy metric for energy accounting. The CEC states these two metrics enable it to evaluate hourly system cost and hourly marginal source energy of the 30-year period of analysis.[15] Per the report, the primary purpose in updating the metrics is to better correlate the cost-effectiveness with greenhouse gas impacts. The CEC explains that to establish cost-effectiveness it uses forecast energy demand in California and weather data. Energy demand is created by forecasts of construction floor area by prototype and climate zone. Energy consumption of prototype building models is calculated operating in a climate that has also been forecast over 30-years. While AHRI appreciates the additional information explaining the new metrics, the report does not answer questions AHRI asked during the pre-rulemaking, including: [16]

> "How does the LSC and source energy forecast account for the variables involved with the eventual power plant closure? How are other long-term changes addressed within the 30-year period? How accurate are these forecasts? How sensitive is the

[10] TN Number: 255318-1: 2025 Energy Code Accounting Methodology Report
[11] *Ibid.*
[12] California Public Resources Code 25000, § 25402 (b)(3)
[13] *Ibid.*
[14] Per the 2025 Energy Code Accounting Methodology Report, "measures are assessed over the economic life (also called "period of analysis") of 30 years, and that both the benefits and the costs are assessed incrementally — meaning in comparison to the latest adopted version of the Energy Code. Measures considered for the 2025 Energy Code are analyzed in comparison to the minimum requirements in the 2022 Energy Code."
[15] TN Number: 255318-1: 2025 Energy Code Accounting Methodology Report (pg.10)
[16] Slide 19 from the November 10, 2022 Energy Accounting Workshop (Docket 22-BSTD-01 TN# 248216)

analysis? What alternatives were analyzed in the scenario selection process for the 2025 hourly factors?"[17]

The CEC also must explain why it "uses eight percent annual growth rate for residential gas price models to forecast future residential gas retail rates," but it does not address residential electric retail rate forecasting. In a recent California Public Utility Commission (CPUC) report, "the average annual rate increases between the first quarter of 2023 and fourth quarter of 2026: [Pacific Gas and Electric] PG&E 10.4 percent, [Southern California Edison] SCE 6.0 percent, and [San Diego Gas & Electric] SDG&E 10.4 percent."[18] Additionally, CPUC states that "by 2026, bundled [residential average rates] RARs are forecast to be approximately 65 percent (PG&E), 30 percent (SCE), and 100 percent (SDG&E) higher than they would have been if rates for each IOU had grown at the rate of inflation since 2013."[19] What residential electric price models does CEC use for its analysis? How has the CEC forecast increases in electric rates?

As AHRI noted in pre-rulemaking comments, California receives a sizable amount of zero-carbon emissions energy from the Diablo Canyon nuclear generator – it generates 8.5% of all California's in-state generation.[20] The current operating licenses for Diablo Canyon power plant Units 1 and 2, expire on November 2, 2024, and August 26, 2025,[21] but there are no publicly available plans for replacement – zero emissions or other. Diablo Canyon is also the subject of ongoing petition to shutter the power plant.[22] There is much volatility in Diablo Canyon's future and no plans on renewables to replace it in 2025, or 2030. How is this important uncertainty reflected in CEC's analysis?

LSC appears to modify the hourly source energy (HSE), and likewise, AHRI expects LSC to be forecasted differently for electricity, gas, and propane consumption, based on planned changes for each fuel.[23] But these details have not been made public, despite the presentation of LSC for the first time over one year ago. If LSC is like HSE, why is the CEC now making efforts

[18] Sieren-Smith, B., Jain, A., Phillips, P. S., Velasquez, C., La Cour, E., Spencer, J., Zanjani, N., Love Asiedu-Akrofi, Christopher Arroyo, Amardeep Assar, Adam Banasiak, Gelila Berhane, Kristina Boyaci, Jack Chang, Franz Cheng, Jordan Christenson, Emily Clayton, Michael Conklin, Julia Ende, . . . David Zizmor. (n.d.). *2023 SENATE BILL 695 REPORT*. https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/electric-costs/sb-695-reports/2023-sb-695-report_final.pdf

[18] Sieren-Smith, B., Jain, A., Phillips, P. S., Velasquez, C., La Cour, E., Spencer, J., Zanjani, N., Love Asiedu-Akrofi, Christopher Arroyo, Amardeep Assar, Adam Banasiak, Gelila Berhane, Kristina Boyaci, Jack Chang, Franz Cheng, Jordan Christenson, Emily Clayton, Michael Conklin, Julia Ende, . . . David Zizmor. (n.d.). *2023 SENATE BILL 695 REPORT*. https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/electric-costs/sb-695-reports/2023-sb-695-report_final.pdf

[19] *Ibid.*

[20] CEC 2021 Total System Electric Generation (most recent year available). https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2021-total-system-electric-generation

[21] Nuclear Regulatory Commission Decision Approving Retirement of Diablo Canyon Nuclear Power Plant, Application 16-8-006. Decision 18-01-022, January 11, 2018. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M205/K423/205423920.PDF

[22] Kaur, A. (2023, September 15). Advocates urge feds to shut off reactor at California's last nuclear plant. Washington Post. https://www.washingtonpost.com/climate-environment/2023/09/14/diablo-canyon-nuclear-reactor-closure-danger/

[23] Slide 21 from the November 10, 2022 Energy Accounting Workshop (Docket 22-BSTD-01 TN# 248216) provides high-level forecast demand and applies an 8% annual growth cap on forecasted systemwide residential gas costs.

to fully replace it? HSE was contemplated by the CEC to "complement the time dependent valuation (TDV) metric."[24]

AHRI also requests the CEC clarify how HSE was used in measure development and code compliance Title 24-2022. The California 2021 Integrated Energy Policy Report (IEPR) states that, "to comply with the Energy Code, the TDV and HSE target budgets must be met independently by the building design" but AHRI finds no reference to HSE in the Express Terms document.

TDV is used in Title 24-2022, for comparing proposed building design to their energy budget when using the performance compliance approach. TDV is based on the concept that the energy impacts of a building energy feature should be valued when energy is consumed and has been described by CEC as being, reflective of the "actual cost of energy to consumers and to the grid."[25] The CEC has proposed that the 2025 energy code state,

> "The Energy Budget for newly constructed, low-rise residential buildings are expressed in terms of the Long-Term System Cost (LSC) and Source Energy. Additionally for newly constructed single-family buildings, the energy budget includes peak cooling energy. The Energy Budget for additions and alterations are expressed in terms of LSC."[26]

LSC is defined in Section 100.1 of the draft 2025 Express Terms as, "the present value of costs over a 30-year period related to California's energy system." Like HSE, LSC factors are used to convert predicted site energy use to long-term dollar costs to California's energy system. LSC is used in conjunction with "long run marginal source energy of *fossil fuels* following the long-term effects of any associated changes in resource procurement, focusing on the amount of fossil fuels that are combusted in association with demand-side energy consumption."[27] It is unclear why the 2025 Energy Code has proposed only using source energy for fossil fuel, when the CEC has in the past acknowledged that, source energy is the, "total system input energy (in the form of fuel *including both natural gas and electricity*) that is required to serve building loads."[28] AHRI requests the CEC confirm that source energy is being accounted for all energy sources.

AHRI also requests the CEC explain how the 30-year period that LSC captures applies to the energy use of covered products, which have a markedly shorter average lifetime. The CEC should be aware of the timing disconnect between products and LSC. In heat pump baseline presentations, the cost of replacement products has been accounted for, but the energy use aspect has not been explained.

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[24] The Final 2021 Integrated Energy Policy Report Volume I Building Decarbonization (Docket 21-IPER-01, TN# 241361) has a chapter devoted to California Energy Code — Time-Dependent Valuation and Hourly Source Energy Metrics (pg. 20).
[25] *Ibid.*
[26] 2025 Joint Appendices, Appendix JA3 – Energy Budget, pg. 58
[27] Per section JA3.1.2 of Appendix JA3 – Energy Budget from the draft 2025 Joint Appendices
[28] Slide 8 of CEC Presentation - 2022 Building Standards -Time Dependent Valuation (TDV) & Hourly Source Energy (Docket 21-IEPR-06, TN# 239439)

Any calculation procedure must provide an equitable comparison between products, be technically accurate, and *fully documented*. As AHRI has requested in the pre-rulemaking, CEC must provide a technical support document for the LSC and for the HP Baseline. The docketed reports[29] are insufficient for this purpose, as it does not allow for a complete stakeholder analysis. The changes are so significant, AHRI questions if the multipliers used in both TDV and LSC to convert lifecycle dollars per unit of energy ($/kWh, $/therm) to code compliance units of kBTU/kWh and kBTU/therm have changed.

CEC must also explain how the use of the new metrics meet the statutory requirement that "performance standards shall be promulgated in terms energy consumption per gross square foot of floorspace."[30] AHRI notes that neither TDV nor LSC can be used by the energy code community to establish building energy intensity performance targets or be used to track energy reductions. In other words, these metrics do not support building performance standards.

Another example of the need for more robust technical documentation is to explain why LSC splits out energy differently from TDV. In the pre-rulemaking presentations, LSC has two factors, the "efficiency LSC, which is the sum of LSC energy for space-conditioning, water heating, and mechanical ventilation," and the "total LSC, which includes efficiency LSC and LSC energy from photovoltaic, battery systems, lighting, demand flexibility, and other plug loads."[31] The TDV energy budget included the sum of the energy for space-conditioning, indoor lighting, mechanical ventilation, photovoltaic (PV) and battery storage system, and service water heating and covered process loads. However, there is no mention of "efficiency LSC" in the Accounting Methodology report.

In the 2022 Energy Code, a building designed using the performance path is required to separately comply with the source energy budget and the TDV energy budget. AHRI notes that ASHRAE Standard 90.1's performance path includes the cost of energy used for components of the building with requirements in Sections 5 through 10 of the standard in the regulated energy cost. This includes the cost of energy used for HVAC, lighting, service water heating, motors, transformers, vertical transportation, refrigeration equipment, computer-room cooling equipment, and other building systems, components, and processes with requirements prescribed in Sections 5 through 10. Unregulated energy cost is the cost of energy used for all other end-uses in the building, mostly covered processes. The CEC must explain why changes were made to the package of energy-using equipment when calculating the objective for LSC compared to TDV. Confirming how accounting is being done for required on-site renewables is unclear. Is LSC being compared on a net basis or only grid-based electrical energy? The CEC must also

[29] 2025 Energy Code Accounting Methodology Report. Docket 24-BSTD-01, TN255318-1. 2025 Multifamily Individual Heat Pump Water Heater Baseline Report. Docket 24-BSTD-01, TN255318-2. 2025 Nonresidential HVAC Heat Pump Baseline Report. Docket 24-BSTD-01, TN255318-3. 2025 Single-Family Two Heat Pump Baseline Report. Docket 24-BSTD-01, TN255318-5.
[30] California Public Resources Code 25000, § 25402 (b)(1)
[31] Title 24-2025 Pre-rulemaking Express Terms, Section 10-109 – COMPLIANCE SOFTWARE, ALTERNATIVE COMPONENT PACKAGES, EXCEPTIONAL METHODS, DATA REGISTRIES AND RELATED EXTERNAL DIGITAL DATA SOURCES, ALTERNATIVE RESIDENTIAL FIELD VERIFICATION PROTOCOLS, ELECTRONIC DOCUMENT REPOSITORIES, PHOTOVOLTAIC, AND BATTERY STORAGE SYSTEM REQUIREMENT DETERMINATIONS (Docket 21-BSTD-01, TN# 252915)

explain the divergence from the approach adopted by ASHRAE Standard 90.1, the national model energy code.

EPCA requires credits be awarded for compliance on a "one-for-one equivalent energy use or equivalent cost basis."[32] This issue was discussed in *Buildings Industry Ass'n of Washington v. Washington State*,[33] where the court held that EPCA recognized that a perfect 1:1 credit ratio is impossible given the different types of technologies, building types, and climate zones at play, but EPCA requires that credit ratios not be so skewed that they effectively discriminate between products and building methods. The Washington State Code did not fail the preemption test because that code assigned credits that are even-handed and not unfairly weighted. To avoid preemption, "Subsection C [of EPCA's statutory conditions] provides that where a building code grants credits for reducing energy use, the code must give credit in proportion to energy use savings, without favoring certain options over others."[34]

EPCA also requires that the estimated energy use of any covered product permitted or required in the code, *or used in calculating the objective*, is determined using the applicable test procedures prescribed under Section 6293, except that the State may permit the estimated energy use calculation to be adjusted to reflect the conditions of the area where the code is being applied, if such adjustment is based on the use of the applicable test procedures prescribed under section 6293 of this title or other technically accurate documented procedure.[35] The term "energy use"[36] means the quantity of energy directly consumed by a consumer *product at point of use*, determined in accordance with test procedures under 42 USC § 6293. [*emphasis added*]

AHRI questions whether the adjustments proposed by the CEC to modify the estimated energy use of covered products may stray too far from adjustment required to reflect California conditions. Modifying the source energy metric to include *forecasted long-term changes* in powerplant capacity drastically skews proportionality of credit ratios and may go beyond the necessity outlined in EPCA.[37]

Comparing the little information available on LSC to methodology used by DOE during Appliance Standards rulemakings, is very stark. As part of the National Energy Savings (NES) Analysis DOE takes estimated energy consumption and savings based on site energy and converts the energy consumption and savings to primary and full-fuel-cycle (FFC) energy using annual conversion factors derived from the most recent version of the National Energy Modeling System (NEMS).[38] This is not unlike what the CEC requires of a metric for evaluation of cost-effectiveness, for proposed measures, and for use within Title 24's compliance software for the performance approach.

[32] 42 U.S.C. § 6297(f)(3)(C)
[33] *Buildings Industry Association of Washington v. Washington State*, 683 F.3d 1144, (Cal. 2012).
[34] *Id*. at 1154.
[35] 42 USC § 6297(f)(3)(G)
[36] 42 USC § 6291(4)
[37] 42 U.S. Code § 6297(f)(3)(C)
[38] For more information on NEMS, refer to EIA. The National Energy Modeling System: An Overview. 2018. EIA: Washington, D.C. DOE/EIA–0581(2018). Available at www.eia.gov/outlooks/aeo/.

DOE's procedures for converting site to FFC energy are detailed in robust Technical Support Document (TSD) and supported by policy statements.[39] In the NES Analysis, DOE calculates the cumulative energy savings as the sum of the annual NES. Inputs to the NES analysis include annual energy consumption per unit and site-to-power-plant, FFC conversion factors, shipments, and stock. DOE's FFC calculations incorporate the energy consumed in extracting, processing, and transporting or distributing source fuels (upstream activities), DOE developed FFC multipliers using the data and projections generated by the NEMS used for *AEO2023*.[40,41] As an example, recently published Commercial Water Heaters Final Rule TSD, provides FFC multipliers are provided for the 2026-2050, nearly the full 30-year analysis period. It is held constant after 2050, as that is the last year in the *AEO2023* projections. Beyond that, there is likely too much uncertainty for forecasting. The FFC multiplier for electricity reflects the shares of various primary fuels in total electricity generation throughout the forecast period. The complete methodology associated with this approach is in the thorough TSD, but it provides a technically accurate documented procedure to shift from estimated site energy use determined using the applicable test procedure to a metric more reflective of emissions and energy cost. Comparatively, CEC's documentation of LSC in the Title 24-2025 Docket is lacking in detail and justification of need.

LSC is also intended to prove measures to be cost effective. While AHRI understands the importance of time that energy is used is as important as the amount of energy used, AHRI questions whether the forecasting over 30-years, and multiple equipment purchases, is accurate or technically correct. For each Energy Code cycle, the cost of construction has increased. In some code editions, the increase in cost has been substantial. For example, the 2019 Energy Code increased the initial cost of a single-family house average cost, which ranges, depending on climate zone it is built in, between $8,205 and $17,511.[42] In the 2022 Energy Code, a group of measures is required when performing alterations to single-family and low-rise multifamily buildings: cool roofs, low-sloped roof insulation, electric replacement heating equipment, duct sealing, duct insulation, and attic insulation. Nonresidential alterations are impacted by the new 2022 Energy Code approach to calculate the fan power allowance. This measure affects fan systems in all prototypes and affects nearly the entire nonresidential building stock.

In the 2022 Energy Code Impact Analysis, the CEC estimated a 5% replacement rate for HVAC measures. CEC estimated the shares of gas and electric appliances for water heating and space heating of single-family and multifamily buildings: 82.8% of single-family space heating is served by gas appliances; 94.9% of single-family water heating is served by gas appliances; 46.6% of single-family space heating is served by gas appliances; and 97.0% of multifamily

[39] DOE's FFC Statement of Policy (76 FR 51282 (August 18, 2011), as amended at 77 FR 49701 (Aug. 17, 2012), available, here: https://www.regulations.gov/docket/EERE-2010-BT-NOA-0028

[40] The AEO2023 provides extensive information about the energy system, including projections of future oil, natural gas, and coal supplies; energy use for oil and gas field and refinery operations; and fuel consumption and emissions related to electric power production.

[41] Refer to Table 10.3.3 of the DOE Final Rule Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Commercial Water Heating Equipment. July 28, 2023.

[42] CEC Memo with Signed Form 399 for the 2019 Energy Code, Title 24, Parts 1 and 6 (: 17-BSTD-02, TN#: 225059)

water heating is served by gas appliances.[43] The costs associated with code required measures for alterations do not seem to be accounted for in the 30-year analysis period in the CEC's proposal. The CEC must account for replacement costs in the cost methodology because it is substantial and may be impactful to California home and business owners.

Modifications to the Heat Pump Baseline for Residential and Nonresidential Buildings

The CEC is proposing prescriptive requirements to install both heat pump space and water heaters in single and multifamily residential and nonresidential buildings. AHRI disagrees with the removal of technology options in the prescriptive path. It is imperative that the CEC preserve the flexibility for equipment to use any energy source when it is economically and environmentally beneficial to do so within the prescriptive path.[44]

As outlined in the 2025 Multifamily Individual Heat Pump Water Heater Baseline Report,[45] CEC proposed to modify prescription water heater options by removing the option for water heaters serving individual dwelling units to comply with this subsection under Subsection 170.2(2)1.C, agas or propane instantaneous water heater with an input under 200,000 Btu/hr.[46] The proposed regulations also add an exception which allows gas or propane instantaneous water heaters to meet the requirements when installed in buildings of four habitable stories or greater. These proposed establish heat pump water heaters as the baseline for performance path compliance for multifamily buildings of four or more stories.

As outlined in the 2025 Single-Family Two Heat Pump Baseline Report,[47] the CEC has proposed change for the 2025 baseline is to utilize heat pumps for both space heating and water heating in all climate zones.[48] Section 4.4 Cost Effectiveness analysis (over 30 years) appears to combine both measures (HP for space conditioning, and a HPWH for service water heating). Why has the CEC combined these two measures for the analysis? In the current code, Exception 1 to Section 150.1(c)8 allows for climate zones 3, 4, 13 and 14, to prescriptively install a gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank may be installed. Why does the benefit-cost-ratio change to greater than 1 in 2025, when in the 2022 code cycle the HPWH benefit analysis did not support such a conclusion for climate zones 3, 4, 13, and 14?

[43] CEC 2022 Energy Code Impact Analysis & Certification of Federal Equivalency. (Docket 21-BSTD-01, TN# 250892)
[44] In written comments filed on August 9, 2023 in response to the July 27, 2023 stakeholder workshop, AHRI raised several technical and cost concerns with the heat pump baseline proposal. (Docket 21-BSTD-01, TN# 251553) AHRI expects these concerns to be addressed in the forthcoming staff report.
[45] TN #: 255318-2, 2025 Multifamily Individual Heat Pump Water Heater Baseline Report
[46] The 2022 Energy Code added Section 170.2(d), which are prescriptive options for multifamily residential buildings with central and individual water heaters. There are three options for compliance with water heaters serving individual dwelling units: 1) a 240 volt heat pump water heater (HPWH) with compact hot water distribution in climate zones 1 and 16 and drain water heat recovery in climate zone 16; 2) a HPWH meeting the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher and drain-water heat recovery in climate zone 16; and 3) a gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank
[47] TN #: 255318-5. 2025 Single-Family Two Heat Pump Baseline Report.
[48] The 2022 Energy Code baseline currently utilizes heat pumps for either space heating or water heating, depending on the climate zone location of the building.

In multi-family buildings, the total installed cost of the instantaneous gas water heater and the 55-gallon HPWH are $1,636 and $2,034, respectively, with an incremental first cost of $398. Table 11 presents a summary of the California state-average first cost for the instantaneous gas water heater and the HPWH. For single family buildings, the incremental first of the gas instantaneous water and a 65-gallon storage HPWH for the 500 ft² and 2100/2700 ft² homes are $1,708 and $765 respectively (by home size).[49] It is unclear why the CEC has used different costs for water heaters in single and multifamily homes.

For nonresidential buildings, AHRI opposes proposed strict prescriptive standards that limit appropriate, energy-saving system choices. These business-level decisions are made on a case-by-case basis, and the CEC should not exclude energy efficiency-improving technologies. The proposed changes for offices and schools in Section 140.4 – Prescriptive Requirements for Space Conditioning Systems limit consumer choice to an unsuitable degree. There are also technical issues with this section, discussed below.

Likewise, AHRI opposes the proposed prescriptive requirement that offices use either a variable refrigerant flow (VRF) and dedicated outdoor air system (DOAS) or a four-pipe fan coil (FPFC) with heating hot water supplied by an air-to-water heat pump (ATWHP) and DOAS for ventilation for all climate zones. For schools, only one prescriptive system choice exists – an FPFC with ATWHP and DOAS –which is even worse. The system proposed to be prescribed is extremely uncommon for schools. Why were VRF or commercial packaged heat pumps, both commonly installed in schools, not considered?

Technical Review of the Express Terms

AHRI reviewed the Express Terms and developed recommendations to address concerns, below.

A. Section 110.2(a) – Minimum Efficiency Tables

The CEC has proposed modifications to minimum efficiency requirements for mechanical equipment. First, regarding federal minimum efficiencies, CEC has proposed to remove the entire table if federal minimum requirements were entirely the same as listed in the table so references to Tables 110.2-A through Table 110.2-N are proposed to be Tables 110.2-A through Table 110.2-L. CEC has proposed to remove **Table 110.2-E** Package Terminal Air Conditioners and Packaged Terminal Heat Pump – Minimum Efficiency Requirements, **Table 110.2-J** Gas- and Oil-Fired Boilers, Minimum Efficiency Requirements, **Table 110.2-L** Floor-Mounted Air Conditioners and Condensing Units Serving Computer Rooms – Minimum Efficiency Requirements, and **Table 110.2-M** Ceiling-Mounted Air Conditioners and Condensing Units Serving Computer Rooms – Minimum Efficiency Requirements. While we agree it is difficult to maintain equipment efficiency tables, AHRI does not support deleting tables. At the very least, particularly while equipment is subject to MAEDbS and federal database requirements, there is value in referencing the equipment types that follow the federal standards in an accompanying document. A compendium to Title 24 with federal standards would provide designers with relevant information quickly and would be easier

[49] TN #: 255318-5. 2025 Single-Family Two Heat Pump Baseline Report. Table 16

to maintain by CEC staff, as it may not be subject to the same regulatory requirements for updates.

Second, where the federal minimum efficiency requirements were the same as the 2022 version of ASHRAE 90.1, CEC has proposed the table to reference federal minimum requirements. AHRI appreciates modifications to **Table 110.2-FG** ~~G~~ Electrically Operated VR) Air Conditioners Minimum Efficiency Requirements and **Table 110.2-GH** Electrically Operated Variable Refrigerant Flow Air-to-Air and Applied Heat Pumps - Minimum Efficiency Requirements in response to AHRI pre-rulemaking comments. We have one additional suggestion. For both tables, the minimum efficiency of air-cooled VRF equipment <65,000 Bth/h, should cite the AHRI 210/240-2023 as the applicable test procedure. Additionally, for **Table 110.2-GH**, the relevant HSPF2 adopted in ASHRAE 90.1-2022 for three-phase equipment, and later by the DOE, is 7.5. Federal standards for this equipment are effective January 1, 2025 (Table 19 to 10 C.F.R. § 431.97(h)). AHRI also notes that several categories of commercial air-conditioners and heat pump equipment that need to be included in **Tables 110.2-A and 110.2-B** including three-phase space constrained and small-duct high velocity systems, also included in ASHRAE 90.1-2022 and in Table 19 to 10 C.F.R. § 431.97(h).

Third, where the 2022 version of ASHRAE 90.1 was different from existing federal minimum requirements, the 2022 version of ASHRAE 90.1 efficiencies are being evaluated for inclusion in Title 24. These tables include Table 110.2-F Electrically Operated VRF Air Conditioners Minimum Efficiency Requirements, and **Table 110.2-H** DX-DOAS Units, Single Package and Remote Condenser – Minimum Efficiency Requirements. AHRI supports CEC harmonizing with ASHRAE 90.1. AHRI supports harmonizing with ASHRAE 90.1-2022, except in the case of DX-DOAS, where the addendum to modify efficiencies were not approved in time for publication. Tables for DX-DOAS equipment should be harmonized federal standards in Table 14 to § 431.97—Minimum Efficiency Standards for Direct Expansion-Dedicated Outdoor Air Systems and effective May 1, 2024.

Lastly, ASHRAE Standard 90.1 added adiabatic fluid cooler minimum efficiencies and test procedures to Table 6.8.1-7 (Heat Rejection Equipment) in the 2022 edition.[50] AHRI recommends adding these minimum efficiencies and test procedures to **Table 110.2-E** in Title 24-2025.

B. Section 110.2(e) – Open and closed-circuit cooling towers.

AHRI appreciates the reduction in the required minimum efficiency for axial fan open circuit cooling towers utilized on water cooled chiller plants over 300 tons from a maximum of 120 gpm/hp to 80 gpm/hp. This modification to the prescriptive cooling tower efficiency **Sections 140.4(h)5 and 170.2(c)4Fv** helps to minimize many of our concerns over the significant increases originally proposed as described in our memo to Docket 22-BSTD-01 dated July 18, 2023. However, there is evidence that further study of the minimum efficiency values by climate zone should be performed to evaluate if

[50] Equipment added in Addendum "q" to 90.1-2022

additional reductions are warranted. This is a result of flawed control strategies for cooling towers contained in many energy modeling programs which have the potential to overestimate fan energy usage.

AHRI has also reviewed the 45-day language for the blowdown control requirements (**Section 110.2(e)**) and generally agrees with the changes. These requirements will help to reduce water usage by cooling towers in the State of California by helping to ensure more consistent control of the necessary blowdown while minimizing the risk of scaling. AHRI appreciates the CEC reaching out and consulting with water treatment experts from both ASHRAE and the Cooling Technology Institute for guidance on the development of these requirements. As such, AHRI looks forward to reviewing blowdown control section modifications suggested by these organizations included in the 15-day Express Term package.

C. Section 110.3 – MANDATORY REQUIREMENTS FOR SERVICE WATER-HEATING SYSTEMS AND EQUIPMENT

In new **Section 110.3(c)7B**, Ventilation for HPWH Installations, CEC has proposed, "the installation space shall have a volume equal to the greater of 100 cubic feet per kBtu per hour of compressor capacity, or the minimum volume provided by the manufacturer for this method." If the calculation method yields a smaller net-free air requirement than the manufacturer requirements, AHRI is concerned that the proposal is overly prescriptive. While AHRI does not object to the inclusion of a calculation method, in no case should HPWH ventilation net-free air be less than as specified by the manufacturer and designers should be provided with additional flexibility for space planning. AHRI recommends modifying the language as follows, shown in red text:

"the installation space shall have a volume not less ~~equal to~~ than the greater of 100 cubic feet per kBtu per hour of compressor capacity, or the minimum volume provided by the manufacturer for this method."

D. Section 110.4 – MANDATORY REQUIREMENTS FOR POOL AND SPA SYSTEMS AND EQUIPMENT

AHRI supports proposed **Exception 2**, "Alterations to existing pools and/or spas with existing heating systems or equipment" and **Exception 4**, "Heating systems which are used exclusively for permanent spa applications in existing buildings with gas availability" to **Section 110.4(c)**. These two exceptions allow for consumer flexibility in replacing equipment and altering existing buildings. AHRI also supports proposed **Exception 5 to Section 110.4(c)**, "Heating systems which are used exclusively for permanent spa applications where there is inadequate solar access for a solar pool heating system to be installed," which recognizes that locations may not always have adequate access to install a solar heater in accordance with sizing requirements and provides consumer flexibility.

E. SECTION 120.1 – REQUIREMENTS FOR VENTILATION AND INDOOR AIR QUALITY

Recent editions of the Energy Code have sought to align California nonresidential ventilation requirements with ASHRAE Standard 62.1. AHRI notes that equations and minimum occupant load densities in Section 120.1 diverge from ASHRAE 62.1. The 2025 Energy Code is still citing the 2019 edition of ASHRAE 62.1. AHRI requests CEC consider modifying the reference to ASHRAE 62.1-2022 and adopt into TABLE 120.1-A– Minimum Ventilation Rates, *Minimum occupant load density* (# persons / 1000 ft^2) and *Area-based minimum ventilation rate* (cfm / ft^2) values in Table 6–1 of ASHRAE 62.1–2022. AHRI also requests that CEC adopt ASHRAE 62.1–2022 equation 6-1 to maximize harmonization.

F. SECTION 120.6 – MANDATORY REQUIREMENTS FOR COVERED PROCESSES

In mandatory sections, the 2022 Energy Code erroneously includes prescriptive requirements for commercial refrigeration systems and equipment that are federally and state regulated. In the Code of Federal Regulations, covered equipment, by definition, includes commercial refrigerator, freezer, or refrigerator-freezer, as defined in 10 CFR § 431.62 and walk-in cooler and walk-in freezers, as defined in 10 CFR § 431.302. California Code of Regulations, Title 20, Section 1605.1 and 1605.2 includes standards for Refrigerated Warehouses. Title 24 includes additional prescriptive requirements for mechanical systems serving refrigerated spaces is inappropriate, regardless of size. While the spaces may have size limitations, the equipment does not. AHRI recommends CEC add two exemptions to resolve this issue:

- Exception 4 to Section 120.6(a)3B: Evaporators covered by California Code of Regulations, Title 20, Sections 1605.1 and 1605.2

- Exception 1 to Section 120.6(a)4: Condensing units covered by California Code of Regulations, Title 20, Sections 1605.1 and 1605.2

G. SECTION 140.4 – PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS

The CEC should not prescriptively limit appropriate system choices that provide important energy efficiency improvements. These business-level decisions are made on a case-by-case basis, and the CEC should not exclude energy efficiency-improving technologies. The proposed changes for offices and schools in **Section 140.4** – Prescriptive Requirements for Space Conditioning Systems limit consumer choice to an unsuitable degree. There are also technical issues with this section, discussed below.

First, in Section 140.4(a)2.D, CEC has proposed mandating prescriptively that for schools in "Climate Zones 1 and 16, the space-conditioning system shall be a dual-fuel heat pump." AHRI recommends that CEC instead offer designers the option to meet the prescriptive code by specifying either a dual-fuel heat pump or a heat pump. As heat

pump technology continues to advance, it may meet the load requirements of Climate Zones 1 and 16 without being a "dual fuel heat pump." Specifying a mandatory dual fuel heat pump would prevent the most efficient and advanced cold climate heat pumps from being prescriptively specified in California Climate Zones 1 and 16.

Section 140.4(a)3.B, Multizone zone space-conditioning system types for Schools proposes to allow for only a single space conditioning system type to be used for prescriptively designing school buildings. The FPFC terminal units with a DOAS providing ventilation is an uncommon system type for offices and schools and should not be the only choice. There should be several compliance options available to contractors and designers. VRF plus a DOAS is a viable option for an all-electric solution, but such a system is prohibited in the prescriptive compliance path. Rooftop units and variable air volume systems are also commonly used in schools today. To remove options, particularly for smaller schools in disadvantaged communities, is not appropriate. Designing a building prescriptively saves $10,000-$20,000 on performance modeling costs. Supporting documentation analyzes "large schools;" however, there is no distinction between large and small schools in the Energy Code.[51] Further comments that infer that air-to-water heat pump (AWHP) are a more cost-effective solution ignore the fact that the costs assumed do not include the pump operational costs. Generally, AHRI found the supporting documents to lack technical justification and system-type analysis to justify the severe prescriptive limitations proposed.

In **Section 140.4(a)3.A**, Multizone zone space-conditioning system types for Office, the CEC proposes offices designed prescriptively must use either a VRF and DOAS or a FPFC with heating hot water supplied by an AWHP and DOAS for ventilation for all climate zones. AHRI opposes limiting the prescriptive path to such a degree.

There are no broadly accepted industry definitions of AWHP in the U.S. AWHPs can provide space heating, space heating and cooling, space heating and domestic hot water, or space heating, cooling, and domestic hot water. There are a variety of space heating applications, including in-floor (radiant) heating, heating through radiators, pre-heating domestic hot water using an indirect tank with hydronic coil, and heating using hydronic air handlers. The temperature of water for end-uses can be high, medium, or low temperature, depending on the application.

Air-to-water heat pump units designed to heat potable water are federally regulated commercial or consumer water heaters. Regarding commercial heat pump water heaters: applications are more challenging than consumer applications, but commercial HPWH technologies are advancing. [52] The minimum efficiency requirements

[51] TN Number: 255319-6: 2025 CASE Report - Nonresidential HVAC Space Heating refers to "Large Schools" and at the April 17, 2024, Lead Commissioner Hearing, CEC staff stated that only schools over 150,000 sf were analyzed.

[52] In DOE's Energy Conservation Standards Final Rule for Commercial Water Heating Equipment (Pre-published 7/18/23), DOE notes that "[it] did not consider commercial integrated heat pump water heaters [standards] in this final rule. DOE found only one such model on the market, at a single storage volume and heating capacity. Given

outlined in **Section 140.0(a)3.C** cannot be applied to those federally regulated products. Even for equipment that may be outside the scope of federal regulation, there are no industry consensus test procedures and no industry certification programs.

Several questions arise for AHRI and its members when considering proposed requirements for air-to-water heat pumps: What assurance will California consumers have when sourcing this equipment? How are these products being modeled? What market research has California conducted that indicates that there is sufficient availability of air-to-water heat pumps with rated capacities exceeding 20-ton?

AHRI is concerned that Californian building owners may struggle to comply with these overly prescriptive requirements, especially as they apply to additions and alterations of nonresidential buildings. To address concerns, AHRI proposes the following modifications to **Section 140(a)3.A and B** show in red text:

A. Offices and Schools. Office buildings and Schools shall use space conditioning systems complying with one of the following requirements:

i. The space conditioning system shall be a variable refrigerant flow (VRF) heat pump system with a dedicated outdoor air system (DOAS) providing ventilation. Indoor fans shall meet the requirements of Section 140.4(a)3D. The DOAS shall comply with Section 140.4(a)3E; or

ii. The space conditioning system shall be a four-pipe fan coil (FPFC) system with a DOAS providing ventilation. The FPFC hot water coils shall be supplied by an air-to-water heat pump (AWHP) space-heating hot water loop which complies with Section 140.4(a)3C. The DOAS shall comply with Section 140.4(a)3E; or

iii. The space conditioning system shall utilize heating supplied through a hot water loop served by an AWHP which complies with Section 140.4(a)3C. Ventilation systems shall include DCV in all zones. All air systems shall be equipped with a heat recovery system in compliance with Section 140.4(q). A hydronic recirculated-air heating system complying with Section 140.4(a)3F shall be used in climate zone 16.

iv. Commercial packaged air conditioners and heat pumps

v. Variable Air Volume Systems

B. ~~Schools.~~

the wide range of capacities and stored water volumes in products currently on the market, which are required to meet hot water loads in commercial buildings, it is unclear based on this single model whether heat pump water heater technology would be suitable to meet the range of load demands on the market. Similarly, based on the information currently available and comments regarding the performance of heat pump water heaters as compared to electric resistance water heaters in commercial settings, it is uncertain if split-system heat pump water heaters can serve all the applications currently filled by electric instantaneous water heaters." (p.53)

AHRI is also concerned with the unnecessarily redundant language proposed in new **Sections 140.4(a)3.D** and **140.4(a)3.E**.

Outside of setting a power limitation for indoor fan requirements, these new sections are slightly less refined requirements already established in **Section 140.4(p)**, that must be followed in the prescriptive path regardless. While the new language may help align the intent with the case studies performed, it creates unnecessary complexity in communicating requirements to users, addressing compliance with software verification tools and creates challenges in keeping requirements up to date in future code versions. There is no definition of Indoor Fan in Title 24 and loose interpretations of the requirement may inadvertently reduce the required ventilation rates below levels acceptable for indoor environmental quality (IEQ) established by ASHRAE 62.1. Section 140.4(p)2 already defined this requirement with more precise and helpful language. For these reasons, AHRI recommends striking Sections 140.4(a)3.D and 140.4(a)3.E from the proposed changes and encourages the CEC to use existing prescriptive requirements already set forth in Title 24.

If a fan power limitation is necessary for VRF and FPFC equipment, a better approach for the industry would be to create overarching requirements in **140.4(c) Fan Systems** when the indoor fans fall below the 1kW threshold for evaluation to the current fan power budget method.

Furthermore, with the transition to lower flammability refrigerants, some additional verbiage is required to address required leak mitigation strategies that may require indoor fans to operate continuously or when a refrigerant leak is detected. AHRI proposes the following exception to **Section 140.4(p)(2)**:

> **Exception 4 to Section 140.4(p)2:** Zone heating and cooling fans shall be allowed to operate when required by mechanical code to provide the required refrigerant mitigation strategy.

D. Fan Requirements

Additionally, AHRI questions the cost effectiveness justifying DOAS to be equipped with heat recovery systems in mild climate zones, as proposed in new **Section 140.4(a)3.E**, Multizone zone space-conditioning system types, DOAS. It is expected that even with fan system requirements, heat recovery system requirements, in accordance with Section 140.4(a)3E, would lead to higher energy expended on fan power than saving expected from heat recovery with a small outdoor and indoor temperature differential.

DOAS are also required to comply with prescriptive requirements in Section 140.4(p) Dedicated outdoor air systems (DOAS), which includes total combined fan power requirements and compliance with Section 140.4 (c), Fan Systems. AHRI also suggests that overlapping fan system and energy recovery requirements should be reviewed and streamlined.

Sections 140.4(c)2Bii,[53] 140.4(d)2v,[54] 140.4(e)2D,[55] 140.4(f)3, and 140.4(r) are all new prescriptive requirements for control sequences of operation in nonresidential buildings. AHRI appreciated CEC staff clarifications during the public hearings that these requirements are for building-level controls and do not apply to equipment-level controls. We recommend adding language to ensure that applicability to building-level controls is clear in Title 24. Language in Exception 5 to Section 141.0(b)2C also makes it unclear that Guideline 36 applies to the building management system rather than the equipment. Lastly, while AHRI is supportive of ASHRAE Guideline 36, we generally caution against requiring non-mandatory guidelines.

H. SECTION 141.0 – ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING NONRESIDENTIAL, AND HOTEL/MOTEL BUILDINGS

Proposed requirements in Section 141.0 – Additions, Alterations, and Repairs to Existing Nonresidential, and Hotel/Motel Buildings, specifically section 141.0(b)2.C.ii detail extreme limitations on replacement equipment. The prescriptive path no longer benefits a building owner to replace a piece of equipment not on the list, in kind. Instead, performance modeling would need to be undertaken, and extensive energy tradeoffs would be required to replace equipment not explicitly listed in Section 141.0(b)2.C.ii, which is likely to result in delays and significant additional expense that CEC has not justified. What will happen to economically disadvantaged school systems that cannot easily replace broken space heating equipment in the winter?

Section 141.0(b)2C is applicable to nonresidential alterations, designed prescriptively, where new or replacement space-conditioning systems or component are required. Subsection ii, requirements for new or replacement single zone packaged rooftop systems with a direct expansion cooling with rated cooling capacity less than 65,000 Btu/hr, are overly prescriptive. These requirements may not be able to be met with a package terminal heat pump or single package vertical heat pump, which would create difficulties, particularly for hotels/motels and schools. Additionally, extending economizer requirements to SZAC1, 2, 3[56] and SZHP1[57] to rated cooling capacity less than 65,000 Btu/hr are excessive. There should be a lower limit of rated cooling capacity of 33,000 Btu/hr in the prescriptive economizer requirements section.

In addition, there appears to be capacities of systems not accounted for in Section **141.0(b)2.C.ii,** *New or replacement of single-zone packaged rooftop systems*. The

[53] "Control sequences of operation for static pressure setpoint reset shall be in accordance with ASHRAE Guideline 36"
[54] "Control sequences of operation for reheat zones shall be in accordance with ASHRAE Guideline 36."
[55] "If controlled by a DDC system, configured with control sequences of operation in accordance with ASHRAE Guideline 36."
[56] SZAC1 – Single Zone Air Conditioner with furnace + Economizer
SZAC2 – Single Zone Air Conditioner with furnace + Economizer + Demand Controlled Ventilation
SZAC3 – Single Zone Air Conditioner with furnace + Economizer + Variable Frequency Drive
[57] SZHP1 – Single Zone Heat Pump + Economizer

preamble to section 141.0(b)2.C.ii specifies a cooling capacity limit of 65,000 Btu/h when scoping the section. An alternate compliance path when installing an air-conditioner and furnace is Table 141.0–E–1, which only addresses units with rated capacity <54,000 Btu/h. What requirements are applicable to packaged rooftop systems with a rated cooling capacity ≥54,000 Btu/h but <65,000 Btu/h? AHRI stresses the need to maintain like-for-like replacements, particularly in emergency replacement scenarios.

I. SECTION 150.0 – SINGLE-FAMILY RESIDENTIAL BUILDINGS – MANDATORY FEATURES AND DEVICES

AHRI opposes proposed changes to **Section 150.0(h)**, Space conditioning systems. The reference to California Building Code is effectively a reference to section 150(h)1.A on how to calculate cooling and heating load. The language has been moved from §150(h)1B to new §150(h)5 and amended to disallow supplementary heating to meet heating demand. This may lead to extremely oversized systems, especially in cooling mode, causing systems to constantly cycle. Additionally, the CEC addressed backup heat during the 2022 cycle. In response to AHRI comments to the 2022 energy code development, CEC revisited the language proposed in EXCEPTION 1 to Section 150.2(b)1G (and 180.2(b)2Av in the new multifamily section). Language proposed in the 15-day Express Terms, and ultimately adopted into the 2022 code, made clear that electric resistance heating in heat pumps is excluded, avoiding the inadvertent elimination of back-up and supplementary heat. It is common for strip heat to be installed as emergency backup in the event the heat pump becomes inoperable during the heating season. Especially in freezing temperatures, emergency strip heat would prevent pipes from bursting, while continuing to provide human comfort.

AHRI is also concerned that **Sections 150.0(h)6 (and 160.3(b)7)**, Defrost, imparts a federally preempted design requirement on equipment that impacts equipment ratings. Ratings for equipment are based on default settings. Requiring the defrost delay timer to be set to greater than or equal to 90 minutes, as required in subsection A, may change the default setting for defrost used by some manufacturers. Additionally, some equipment is programmed to defrost on demand, rather than a set schedule. Demand defrost includes use of measured performance parameters to aid in determining when defrost is required. Implementing a set delay timer requirement of 90 minutes would negatively impact equipment performance for these highly efficient products. AHRI recommends striking requirements that impact equipment ratings and limit allowable controls technologies or adding the exception below for equipment using demand defrost controls.

Exception 3 to Section 150.0(h)6: Equipment that uses demand defrost controls.

J. SECTION 150.1 – PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR SINGLE-FAMILY RESIDENTIAL BUILDINGS

As detailed above, AHRI is concerned about the prescriptive requirements that new space and water heating systems be heat pumps.

K. SECTION 150.2 – ENERGY EFFICIENCY STANDARDS FOR ADDITIONS AND ALTERATIONS TO EXISTING SINGLE-FAMILY RESIDENTIAL BUILDINGS

AHRI supports the proposal to permit additions to extend existing space heating systems.

For alterations, AHRI is concerned with the proposal that new water heating systems must be heat pumps via prescriptive path. AHRI recommends the CEC to reconsider this approach. AHRI is concerned with the proposed deletion of "Exception 7 to Section 150.2(a): Space heating system. New or replacement space heating system serving an addition may be a heat pump or gas heating system." Prescriptively, CEC has proposed removing an option for additional water heaters, 150.2(a).1.D.iii. “A gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank."

Lastly, in 2022, the CEC also made edits to EXCEPTION 2 to Section 150.2(b)1G to permit the in-kind replacement of electric resistance heating systems in alterations. Nearly all manufactured housing heating systems are electric furnaces. Duct work in mobile homes is too small to allow a regularly sized furnace to be installed or safely used. As complicated ties exist between Title 24 and CCR Title 25 - Housing and Community Development, the 2022 code will continue to allow the replacement of electric resistance heating systems in manufactured housing. AHRI recommends that these provisions remain in 2025.

L. SECTION 160.9 – MANDATORY REQUIREMENTS FOR ELECTRIC READY BUILDINGS

AHRI is concerned with certain provisions proposed in **Section 160.9(e).** AHRI opposes new **Sections 160.9(e)3 and 4** because they present several issues. The new section proposes to reserve an additional space of 39” x 39” for a future HPWH which is quite significant for smaller dwelling units. If a homeowner goes through the performance path to select a gas or electric instantaneous water heater for a small dwelling unit, to also be mandated to reserve additional floor space is excessive for the homeowner. **Section160.9(e)4.C** requires two 8” capped ducts, venting to the building exterior. Though the ducts are capped, these requirements would seem to compromise the envelope by creating an unnecessary thermal bridge. Also, future generations of HPWHs may need different infrastructure. AHRI suggests the CEC revisit these provisions.

AHRI has significant concerns with the central heat pump water heater ready requirements in **Section 160.9(f).** Again, the CEC is mandating expensive additional requirements further penalizing gas or propane water heating systems. These requirements are extensive and should be stricken. Regarding the technical analysis, it is unclear what life cycle the CEC used for Central Water Heaters. The CEC should note that Central HPWH are new equipment and technologies are changing rapidly.

Central HPWH systems are typically more complex than individual systems and require more effort to specify, layout, and install. For example, see Ecosizer (ecotope.com), a free tool for sizing central water heating systems based on commercial heat pump water heaters in multifamily and commercial buildings. The Ecosizer shows the tradeoff between storage volume and heating capacity. A designer could choose to have a larger compressor kBTU/hr to tradeoff a smaller storage tank size; and vice-versa the designer could choose a smaller compressor kBTU/hr to tradeoff a larger storage tank size. These differences illustrate choices which will be made in the future; trying to determine the proper floor space for a future HPWH and storage tank(s) is a guess. Ecosizer also demonstrates a return to primary installation, and this is also noted in EnergyTrust of Oregon Central Heat Pump Water Heater Design Guide; a parallel temperature maintenance tank is not required in those scenarios. There could be concerns that requiring Central Heat Pump Water Heater Ready will be obsoleted, similar to the Title 24-2019 Section 150.0(n) Water Heating System which required systems using gas or propane water heater to serve individual dwelling units to include a Category III or IV vent, or a Type B vent with straight pipe between the outside termination and the space where the water heater is installed; and a gas supply line with a capacity of at least 200,000 Btu/hr. Such measures did not have direct impacts to building energy conservation, and one could argue that if these assets are 'lost,' 'stranded,' or unused, the manufacturing, shipping, handling of additional building materials which were not needed, contributed Greenhouse Gas which could have been avoided.

Also, the Central Heat Pump Water Heater Ready space requirements in Section 160.9(e)3 conflict with Individual heat pump water heater ready requirements and the requirements in Joint Appendix JA15. **Section 160.9(e)3** requires that "the construction drawings shall designate a space at least 39 inches by 39 inches and 96 inches tall for the future location of heat pump water heater," or 84.5 ft^3. JA15.2.1(a), states that "If the gas water heating system has an input capacity less than 200,000 Btu per hour, the minimum space reserved for the heat pump shall be 2.0 square feet per 10,000 Btu per hour input of the gas or propane water heating system, and the minimum linear dimension of the space reserved shall be 48 linear inches." For example, a 200,000 Btu per hour water heater would require 2 ft2 x 20 x 4ft or 80 ft^3 using JA15 calculations. A 12 kW HPWH, which is approximately 40,946 Btu/hr, would require 2 ft^2 x 4 x 4ft or 32 ft^3.

AHRI recommends striking Section 160.9(e)3, as proposed,[58] and replacing with "Central water heating systems using gas or propane to serve multiple dwelling units may consider providing space requirements and electrical requirements to serve a future heat pump water heater system as calculated and documented by the responsible person associated with the project."

[58] "The construction drawings shall designate a space at least 39 inches by 39 inches and 96 inches tall for the future location of heat pump water heater," Section 160.9(e)3.

M. SECTION 170.2 – PRESCRIPTIVE APPROACH FOR MULTIFAMILY BUILDINGS

Exception 1 to Section 170.2(d)1: Multifamily buildings four habitable stories or greater may install a gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank.

What analysis did CEC provide to recommend the exemption to multifamily buildings be only for those four habitable stories or greater? TN#255318-2 2025 Multifamily Individual Heat Pump Water Heater Baseline Report analysis is for individual heat pump water heaters. A three-story multifamily building can easily exceed the square footage and number of apartments of a four-story multifamily building. Rather than use an arbitrary four habitable stories or greater, we suggest CEC refer to the low-rise loaded corridor multifamily prototype model in the 2025 Energy Code Accounting Methodology, with a floor area of 39,372 ft2. Accordingly, we recommend the following edits for Section 170.2, shown in red text:

Exception 1 to Section 170.2(d)1: Multifamily buildings ~~four habitable stories~~ with a floor area of 40,000 ft2 or greater may install a gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank.

AHRI has several concerns related to proposed modifications to **Section 170.2(d).2.** This alternate compliance pathway provides a prescriptive path for products meeting the requirements of Version 8.0 Tier 2 (or higher) of the Northwest Energy Efficiency Alliance (NEEA) Advanced Water Heater Specification for commercial heat pump water heaters and the cites the associated qualified products list. First, the NEEA specification includes design requirements for products beyond performance, including sound/warranty. Does the CEC intend to limit consumer choice in this way? Second, unlike the AHRI Directory, the NEEA database is unaudited. What assurance do consumers have that products are meeting the specification? Third, this specification is in the process of being updated. Once a specification is updated, it is not typical for a previous version's qualified product list to be maintained. Has the CEC received assurance from NEEA that this is not the case for version 8.0? If this qualified product list becomes unavailable, the Energy Code option will cease to be relevant. It will also block products qualifying to more recent versions.

The requirements in Section 170.2(d).2 are geared towards split systems and inadvertently ban integrated systems from complying through this pathway. There are no compliance pathways outlined that would allow an integrated product to be installed via the performance pathway given that integrated products are not included in the NEEA specification. This forces the products to fit into the architecture of a split system, which would most closely be characterized as a multi-pass return to primary design. Given the requirement that a central water heater cannot be configured as a multi-pass or a return to primary system, effectively bans integrated systems from complying. AHRI requests that CEC add a compliance pathway or add an exception to this section to allow for integrated systems to comply.

Lastly, Section 170.2(d).2 is also referenced by Section 140.5(b) for hotel/motel occupancies, however the case reports and supporting documentation only looked at the multifamily housing. If hotels and motels were not examined as a building-type, how is the CEC justifying these new requirements? AHRI expects that the proposed changes will have a substantial and different impact than what was considered by the case team and these additional occupancy types need to be evaluated for cost effectiveness.

N. Fan Efficiency Index Requirements

AHRI recommends the CEC review definitions, Section 120.10 and Section 140.4(a)3D related to new Department of Energy (DOE) test procedures adopted federally for commercial fans. CEC should cite the new federal procedures, where applicable. For example, 120.10(a)1 cites fan energy index (FEI) for fan arrays. AHRI recommends the test procedure citation remain ANSI/AMCA 208-18 Annex C, as the federal test procedure is only applicable to single, stand-alone fans. However, it is appropriate to cite the federal test procedure in section 120.10(a)2. For Section 140.4(a)3D, Multizone Prescriptive Requirements, CEC should be cognizant of the DOE FEI efficiencies being considered. If CEC's requirement of 0.35 W/cfm exceeds minimum efficiencies set by the DOE, CEC may be preempted.

O. Low Global Warming Potential (GWP) Refrigerants

In response to several comments that have been submitted to the 45-day Express Terms, it should be noted that the HVAC industry has worked extensively for years to develop a clear path to low GWP refrigerants. Significant efforts by industry have been expelled to update building codes, and product safety standards must allow for use of these low GWP refrigerants. Suggestions that these new refrigerants may not be safe is simply inaccurate. They are already available and have been used for several years in Europe and Asia.

AHRI appreciates the opportunity to provide these comments. If you have any questions regarding this submission, please do not hesitate to contact me.

Sincerely,

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