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## AHRI Comments â€“ Title 24-2025 15-day Express Terms

*Additional submitted attachment is included below.*

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Docket Unit, MS-4
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(Submitted electronically to Docket 24-BSTD-01)

**Re: AHRI Comments – Title 24-2025 15-day Express Terms *[Docket No. 24-BSTD-01]***

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Dear CEC Staff:

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI) respectfully submits this letter in response to the CEC 2025 15-day Express Term proposed changes to Energy Code (Title 24, Part 6), published on the CEC public docket on June 13, 2024.

AHRI represents more than 330 manufacturers of air conditioning, heating, water heating, and refrigeration equipment. It is an internationally recognized advocate for the heating, ventilating, air-conditioning, and refrigeration (HVACR) and water heating 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 is disappointed to see many key elements unchanged from the 45-day Express Terms draft language despite overwhelmingly persuasive comments submitted to the docket. In particular, the extreme limitation CEC proposed on permissible mechanical systems when complying with the prescriptive path raised significant concern for a diverse group of stakeholders. Manufacturers, utility representatives, building designers, and building owners all objected to changes proposed for schools and offices. Additionally, AHRI has 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. Lastly, AHRI's legal concerns regarding proposed revisions to the Energy Code were ignored. AHRI supports taking a measured, transparent approach to Energy Code improvements and urges CEC to reconsider our most important recommendations, outlined below.

**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.[1]

As outlined in the 2025 Multifamily Individual Heat Pump Water Heater Baseline Report,[2] 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.[3] 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 (HPWH) 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,[4] the CEC has proposed changes for the 2025 baseline is to utilize heat pumps for both space heating and water heating in all climate zones.[5] Section 4.4 Cost Effectiveness analysis (over 30 years) appears to combine both measures heat pump 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?

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] 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.
[2] TN #: 255318-2, 2025 Multifamily Individual Heat Pump Water Heater Baseline Report
[3] 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
[4] TN #: 255318-5. 2025 Single-Family Two Heat Pump Baseline Report.
[5] 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.

$1,708 and $765 respectively (by home size).[6] It is unclear why the CEC has used different costs for water heaters in single and multifamily homes.

For nonresidential buildings, AHRI opposes 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. The system proposed to be prescribed is extremely uncommon for schools. Were VRF or commercial packaged heat pumps, both commonly installed in schools, 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

A new concern is that CEC has proposed to add "Federal Minimum IEER" for equipment that is not federally regulated. Condensing units rated to AHRI 365 in **Table 110.2-A** Air Conditioners and Condensing Units – Minimum Efficiency Requirements are unable to obtain an IEER by testing to AHRI 365. AHRI recommends striking "Federal Minimum IEER" from the Efficiency column for air-, water-, and evaporatively cooled condensing units ≥135,000 Btu/h in Table 110.2-A.

AHRI reaffirms all comments made in 45-day comments regarding CEC proposed modifications to minimum efficiency requirements for mechanical equipment. AHRI does not support deleting tables.

AHRI also reiterates our request to add adiabatic fluid cooler minimum efficiencies and test procedures to **Table 110.2-E** in Title 24-2025. This is consistent with additions to Table 6.8.1-7 (Heat Rejection Equipment) made in the 2022 edition of ASHRAE Standard 90.1.[7] Not adding this equipment is a lost savings opportunity.

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

AHRI also reiterates the importance of all comments made in response to the 45-day Express Terms. We were disappointed that CEC failed to make changes to blowdown

[6] TN #: 255318-5. 2025 Single-Family Two Heat Pump Baseline Report. Table 16
[7] Equipment added in Addendum "q" to 90.1-2022

control requirements (**Section 110.2(e)**) supported by AHRI, ASHRAE, and Cooling Technology Institute. 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 requests CEC modify blowdown control section as suggested by these organizations.

## C. SECTION 140.4 – PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS

AHRI is disappointed with the minimal changes CEC has made in response to concern from many stakeholders regarding prescriptive limitations proposed for mechanical system choices for offices and schools in **Section 140.4** – Prescriptive Requirements for Space Conditioning Systems. To moderate commenters, CEC proposed adding new Section 140.4(a)G, "A space-conditioning system determined by the Executive Director to use no more energy than the systems specified in Section 140.4(a)3." No information has been provided for stakeholders to understand the process of submitting determinations to the Executive Director. Specifically, there is no guidance provided as to what information is needed for Executive Director review, nor what mechanism would be used to collect that information. Would this be a portal that generates an automatic response, or would the system rely entirely on staff review? The Executive Director may quickly become delayed by the potentially overwhelming number of requests. CEC should provide parameters for the review and response timeline. Furthermore, specification of a system that uses no more energy than systems identified in the prescriptive path *is the performance path*. Adding a prescriptive option to use the performance path is wholly unacceptable.

At the April 16, 2024, Lead Commissioner Hearing on 2025 Building Energy Efficiency Standards CEC staff stated, "in the time that we've had and in the analysis that we had, these are the systems that we've identified that are cost-effective and that are technically feasible and that can achieve the targets that we're seeing."[8] And later, CEC staff stated, "we recognize that there are multiple strategies to achieve energy efficiency and to achieve our general long term goals, you know, and we're looking to try and -- step one is get one that meets our rulemaking criteria and then, you know, the next step will be to continue to see what we can do to iterate, and hopefully capture other strategies that meet the same criteria. It's just, I think the system that we have is what we can do in the time that we have right now."[9] Not having sufficient time to conduct thorough and exhaustive testing is an unacceptable justification for prohibitive regulations.

Another process that requires Executive Director approval are applications to provide a Home Energy Rating System (HERS) Provider's external digital data source

[8] Transcript for April 17, 2024, Lead Commissioner Hearing on 2025 Building Energy Efficiency Standards (Docket 24-BSTD-01, TN# 256840, p. 80)
[9] Transcript for April 17, 2024, Lead Commissioner Hearing on 2025 Building Energy Efficiency Standards (Docket 24-BSTD-01, TN# 256840, p. 81)

(EDDS) service.[10] To use an EDDS service, CEC approved HERS Providers must apply to and receive approval from the CEC. The application to use an EDDS service is a new option provided by the *2019 Building Energy Efficiency Standards*. Regulatory time limits were included in Title 24, Part 1, Section 10-110 and in Title 20, Section 1674. CEC also developed an accompanying staff report to aid the process.[11] CEC staff's recommendation on applications are reviewed by the CEC's Executive director, who then determines if the application is approved, denied, or recommended to be heard at a CEC business meeting. The timeline for approval on the application is between 225 and 375 days.[12] The addition of hundreds of days for projects to receive Executive Director approval would be unacceptable. Consider the impact of this timeline on a school renovation project with children in a holding school or temporary classrooms. Should CEC move forward with this pathway for Executive Director approval, a similar staff report should be developed, with input from the public. The timeline for Executive Director approval should be no more than 5 business days, from receipt of a complete package.

AHRI raised several technical issues with this section in 45-day comments that also went unaddressed. AHRI urges CEC to make all changes recommended by AHRI in 45-day comments.

## D. SECTION 160.9 – MANDATORY REQUIREMENTS FOR ELECTRIC READY BUILDINGS

AHRI reiterates concern 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

[10] An EDDS service is a data exchange service used by authorized users to upload data to a database that registers Energy Code compliance documents.
[11] Loyer, Joe. 2020. Approval Process for Use of an External Digital Data Source: Application Requirements and Staff Recommendations for Data Registry Providers. California Energy Commission. Publication Number: CEC-400-2020-011.
[12] *Id*. Table 2.

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 complicated 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 speculation.

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,[13] 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."

[13] "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.

## E. SECTION 170.2 – PRESCRIPTIVE APPROACH FOR MULTIFAMILY BUILDINGS

The 2022 Energy Code reorganized low-rise (three or fewer stories) and high-rise (four or more stories) multifamily buildings into one building type and moved requirements for multifamily buildings to their own subchapters. AHRI asks if there is analysis that justifies CEC's proposed **Exception 1 to Section 170.2(d)1** be limited to multifamily buildings be only for those four habitable stories or greater?[14] AHRI provided extensive comments on this topic in response to 45-day comments. AHRI suggests 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, AHRI recommends 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 reiterates 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 no longer be relevant. This would also block products qualifying to more recent versions of the specification.

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

[14] 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.

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.

F. 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.

G. 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 HVACR and water heating industry has worked extensively for more than a decade to develop a clear path to low GWP refrigerants. Significant efforts by industry have been taken 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 are simply inaccurate. Low GWP refrigerants are already available today and have been used for several years in Europe and Asia.

**Title 24 Proposed Revisions Preempted by EPCA**

AHRI raised the issue of EPCA preemption in its 45-day comments and reiterates them below, as the prescriptive path remains unchanged in the 15-day Express Terms. The Proposed Revisions in Title 24 are preempted by the Energy Policy and Conservation Act (EPCA), 42 U.S.C. § 6291 et al. EPCA prevents states and their political subdivisions from enacting laws, regulations, and building codes that *concern* the energy use of EPCA-covered products and equipment. Limited exemptions exist under EPCA, including for building codes, but no exemptions apply here.

On January 2, 2024, the Ninth Circuit Court of Appeals upheld its April 2023 decision in *California Restaurant Association v. City of Berkeley*, ruling that building codes concerning energy use are preempted by EPCA. Case law on prescriptive and performance compliance paths indicates that EPCA preempts the Title 24 Proposed Revisions, making them legally vulnerable if enacted, as written.

## 1. EPCA Preemption Provision

EPCA grants the U.S. Department of Energy (DOE) to set national energy conservation standards for appliances and equipment, preventing states from imposing conflicting rules. EPCA does allow for exceptions in limited circumstances, including certain building codes. However, the exceptions for building codes do not apply to the Proposed Revisions. Under EPCA, state regulations "concerning" the "energy efficiency" or "energy use" of covered products "shall [not] be effective."[15] Courts interpret this provision broadly, which indicates that Congress intended for EPCA to have a wide preemptive reach.

The Proposed Revisions to the prescriptive compliance path in Table 150.1-A, which prohibit gas space or water heating for Single-Family Standard Building Design in climate zones 1-16, fall under EPCA's preemption. These revisions concern the energy use of covered products, regardless of exceptions or the availability of performance path for compliance. Although the Proposed Revisions do not impose a mandatory ban, the performance path imparts significant cost barriers to installing fossil fuel space and water heaters.

## 2. Relevant EPCA Preemption Cases

There are two relevant cases that address aspects of the Proposed Revisions: (1) *California Restaurant Association v. City of Berkeley* (*Berkeley*); and (2) *Air Conditioning, Heating, and Refrigeration Institute v. City of Albuquerque* (*Albuquerque*).

In *Berkeley*, the Ninth Circuit Court of Appeals stated that EPCA preempts regulations, including building code requirements, that relate to the energy use of consumer appliances. The court ruled that EPCA preempts the City of Berkeley's 2019 ordinance banning natural gas piping in new buildings, emphasizing that EPCA covers regulations addressing product energy use and building codes related to natural gas use. This ruling is binding in the Ninth Circuit, which includes California, implying that any building codes concerning EPCA-covered products may face legal scrutiny if enacted. Therefore, AHRI recommends CEC consider revising the Proposed Revisions.

In *Albuquerque*, AHRI challenged the 2007 Albuquerque Energy Conservation Code for imposing energy efficiency standards preempted by EPCA. The court held that revisions to a prescriptive compliance path are subject to EPCA's preemption, regardless of performance path availability. State and local codes which set energy standards that exceed federal minimums are preempted under EPCA.

The applicable case law reaffirms the notion that Congress intended for EPCA to have broad preemptive scope. This means that regulations "concerning" energy use of EPCA-covered products are preempted if they impose specific equipment requirements like heat pumps and prohibit gas-fired appliances under the prescriptive path. Both *Berkeley* and

[15] *See* 42 U.S.C. § 6297(b).

*Albuquerque* reinforce the necessity for CEC to modify the Proposed Revisions as they are legally invalid, as written.

### 3. Building Codes Exemption

EPCA allows building codes to be exempt from its preemption provisions if they meet a seven-factor test outlined in 42 USC 6297(f)(3). The Proposed Revisions have not been shown to meet this test. In particular, the fourth factor is not satisfied.[16]

***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 the DOE Secretary grants a waiver. The Proposed Revisions fail to meet this factor by mandating specific equipment like heat pumps and banning gas-fired equipment in all climate zones (Table 150.1-A), effectively banning EPCA-covered products. This reduces their energy use to zero, exceeding federal standards without a DOE waiver.

The Proposed Revisions aim to set stricter energy standards than EPCA and are preempted. Both the *Berkeley* and *Albuquerque* cases indicate that the proposed prescriptive path lacks flexibility, does not align with federal requirements, and fails to qualify for an exemption under EPCA. If enacted as written, these Proposed Revisions 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.[17] 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.

Since the two pre-rulemaking presentations were made regarding metric changes in 2022, the CEC has released the "2025 Energy Code Accounting Methodology Report"[18] This report "documents the technical methods and tools used to assess energy efficiency proposals for the 2025 California Building Energy Efficiency Standards."[19] However, the report lacks important details on the fundamental approach and assumptions being used to cost justify measures for the Energy Code.

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[16] 42 USC 6297(f)(3)(D)
[17] Title 24-2025 Pre-rulemaking Express Terms, Section 140.1 – Performance Approach: Energy Budget, (Docket 21-BSTD-01, TN# 252915)
[18] TN Number: 255318-1: 2025 Energy Code Accounting Methodology Report
[19] *Ibid.*

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*.[20] 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"[21] to a measure period of 30 years.[22] 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.[23] 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: [24]

> "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 analysis? What alternatives were analyzed in the scenario selection process for the 2025 hourly factors?"[25]

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,

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[20] California Public Resources Code 25000, § 25402 (b)(3)
[21] *Ibid.*
[22] 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."
[23] TN Number: 255318-1: 2025 Energy Code Accounting Methodology Report (pg.10)
[24] Slide 19 from the November 10, 2022, Energy Accounting Workshop (Docket 22-BSTD-01 TN# 248216)
[25] Petrillo-Groh, Laura. (2023, November 17.) *AHRI Comments – Title 24-2025 Pre-Rulemaking Express Terms*. Docket No. 22-BSTD-01

and [San Diego Gas & Electric] SDG&E 10.4 percent."[26] 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."[27] 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.[28] The current operating licenses for Diablo Canyon power plant Units 1 and 2, expire on November 2, 2024, and August 26, 2025,[29] 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.[30] There is much volatility in Diablo Canyon's future and no plans on renewables to replace it in 2025, or 2030. Is this uncertainty reflected in CEC's analysis?

The current hourly source energy (HSE) metric was contemplated by the CEC to "complement the time dependent valuation (TDV) metric."[31] LSC appears to modify HSE, and likewise, AHRI expects LSC to be forecasted differently for electricity, gas, and propane consumption, based on planned changes for each fuel.[32] These details, however, 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 replacing the HSE metric?

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.

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[26] 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

[27] *Ibid.*

[28] 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

[29] 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

[30] 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/

[31] 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).

[32] 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.

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."[33] 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."[34]

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."[35] 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."[36] AHRI asks the CEC to confirm that source energy is being accounted for all energy sources.

AHRI also asks the CEC to provide information about how the 30-year period that LSC captures applies to the energy use of covered products, which have a significantly shorter average lifetime. There is a 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.

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 should provide a technical support document for the LSC and for the HP Baseline. The docketed reports[37] are insufficient for this purpose, as it does not allow for a complete stakeholder analysis. Given the significance of these changes, 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.

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[33] *Ibid.*
[34] 2025 Joint Appendices, Appendix JA3 – Energy Budget, pg. 58
[35] Per section JA3.1.2 of Appendix JA3 – Energy Budget from the draft 2025 Joint Appendices
[36] Slide 8 of CEC Presentation - 2022 Building Standards -Time Dependent Valuation (TDV) & Hourly Source Energy (Docket 21-IEPR-06, TN# 239439)
[37] 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.

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."[38] 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, therefore, 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."[39] 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 by components of the building (requirements in Sections 5 through 10) 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 should 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 should also 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."[40] This issue was discussed in *Buildings Industry Ass'n of Washington v. Washington State*,[41] 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

[38] California Public Resources Code 25000, § 25402 (b)(1)
[39] 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)
[40] 42 U.S.C. § 6297(f)(3)(C)
[41] *Buildings Industry Association of Washington v. Washington State*, 683 F.3d 1144, (Cal. 2012).

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."[42]

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.[43] The term "energy use"[44] 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.[45]

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).[46] 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.

DOE's procedures for converting site to FFC energy are detailed in robust Technical Support Document (TSD) and supported by policy statements.[47] 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

[42] *Id*. at 1154.
[43] 42 USC § 6297(f)(3)(G)
[44] 42 USC § 6291(4)
[45] 42 U.S. Code § 6297(f)(3)(C)
[46] 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/.
[47] 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

*AEO2023*.[48,49] 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.[50] 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 water heating is served by gas appliances.[51] 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.

[48] 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.
[49] 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.
[50] CEC Memo with Signed Form 399 for the 2019 Energy Code, Title 24, Parts 1 and 6 (Docket: 17-BSTD-02, TN#: 225059)
[51] CEC 2022 Energy Code Impact Analysis & Certification of Federal Equivalency. (Docket 21-BSTD-01, TN# 250892)

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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