

Attachment A

DEER2026 Update

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1 Management of DEER Processes

The following sections provide detail on changes and updates affecting the DEER database and measure packages¹—both structural and to ex ante values.

1.1 (A) Updates to eTRM

Effective Program Year: 2024-2026. As noted in DEER Resolution E-5221, California’s statewide electronic Technical Reference Manual (eTRM) version 2.3 is the *Official Source of California Energy Efficiency Measure Data*² and the sole source for energy efficiency measure package development, submittal, review, and publishing. Measure developers shall follow the rules and procedures as laid out in the documents provided by California Technical Forum (CalTF) as they move measures through the development phase prior to submittal.

1.1.1 (A.1) CalTF and eTRM Funding

Effective Program Year: 2024. The IOUs will continue to fund the CalTF and eTRM and may do so from either their program or evaluation budgets.

1.1.2 (A.2) eTRM Source Code Documentation

Effective Program Year: 2026. The eTRM has been providing monthly files to the CPUC repository of the source code, but the industry standard is for code to be documented and version-controlled using a Git³ platform (e.g., GitHub). This is expected to improve transparency and allow stakeholders to have a better understanding of the changes that occur.

1.1.3 (A.3) Measure Lifecycle Management (MLM) in DEER

Effective Program Year: 2025. In Resolution E-5221, staff proposed to establish a DEER database table to track existing and planned updates to current and future measure packages. This Measure Lifecycle Management (MLM) table will help manage measure package updates in a more strategic manner, including the identification of new research to inform planned updates and manage measure package review timelines to

¹ Formerly referred to as “workpapers”

² <https://www.caetrm.com/>

³ Git is a distributed version control system that tracks changes in any set of computer files, usually used for computer programming.

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avoid highly compressed review and comment periods. The MLM is currently in draft form and will be shared for CPUC review and approval before the next round of measure package updates for PY2028 that will be planned for in 2025. CPUC Staff and stakeholders will target MLM completion to review alongside the DEER2028 Measure Package Update Schedule to aid in the scoping of DEER2028 measure package updates.

1.1.4 (A.4) Assess Enabling Filtering on CPUC Support Tables in eTRM

Effective Program Year: 2026. The eTRM houses the CPUC Support Tables that are synchronized with the DEER database, but the support tables have very limited functionality. The same functionality that is provided for the Shared Values Tables should be replicated for the CPUC Support Tables.

1.1.5 (A.5) eTRM Table Structure Changes

The fields contained in the permutations table and the CPUC Support Tables within the eTRM shall be updated as needed to support evolving policies and measure development. Updates to fields may result from fields added to the DEER support tables in the DEER database or they be required in the permutations (e.g., Restricted Permutation Flag). Measure developers may work with CalTF to identify those fields and communicate a process whereby the permutation tables will be changed to accommodate the new data. Where the new fields and associated data impact DEER, California Energy Data and Reporting System (CEDARS), or the Cost Effectiveness Tool (CET), CPUC staff will review and approve necessary changes to meet these needs.

Effective Program Year: 2024. The source status table in DEER is no longer maintained as the eTRM is the data source of record for active measure packages, using the Measure Detail ID. The eTRM may discontinue synchronizing with this table nightly and remove it from the CPUC Support Table page.

Effective Program Year: 2026. Retire the FuelSubID field and add the FuelID field in the permutations to align with the replacement of the FuelSub table with the FuelID table in DEER.

Effective Program Year: 2028. The following revisions are needed:

- Adding new field(s): Net lifecycle refrigerant leakage emissions, in metric tonne CO₂e; Refrigerant Type for measure, standard practice, and existing equipment

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cases (alternatively include in an existing field like base and measure case descriptions where equipment uses refrigerant); end-use specific energy consumption fields for measure, standard practice, and existing equipment. (Presently, the consumption fields often contain whole-building consumption levels.)

- Retire existing field(s) that are no longer needed: DEERMeasureID. When a field is “retired,” it must be retained for years prior to PY2026, but need not be populated by measure package developers thereafter.

1.2 (B) DEER System and Measure Package Updates

Effective Program Year: 2024-2028. This section describes updates to the DEER system encompassing any changes to policies that affect the eTRM and measure packages.

1.2.1 (B.1) Refrigerant Leakage Impacts

Effective Program Year: 2024-2026. For mid-cycle new offerings added to existing measure packages or mid-cycle updates to existing measure packages (e.g. code or standard change), measure package developers shall use the CPUC’s Refrigerant Avoided Cost Calculator and Fuel Substitution Calculator (RACC-FSC_v3.0 and RACC-FSC_v3.1) that was released on April 22, 2024 and November 1, 2024, respectively.⁴ Either version of the RACC-FSC workbook shall also be used for 2026 measure package updates. The Avoided Costs Calculator (ACC) versions to use are described in Table A-1-1.

Table A-1-1. Avoided Cost Calculator Version to use with RACC-FSC_v3.0/v3.1

Measure Package Update Type	ACC Version*
New offering(s) added to existing approved measure package for PY2024-2025	ACC2022 values shall be used in RACC-FSC for new offering permutations, <u>only</u>
Mid-cycle updates to existing approved measure packages for PY2025	ACC2022 values shall be used for all permutations

⁴ See <https://cedars.cpuc.ca.gov/deer-resources/tools/supporting-files/resource/2/history/>. RACC-FSC_v3.1 was released to enable distinguishing between former and updated EUL values as a matter of convenience and clarity. Both versions of the workbook yield equal results and either version is acceptable for DEER2025 and DEER2026 measure packages.

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Measure Package Update Type	ACC Version*
Measure package updates for PY2026	ACC2024 values shall be used for all permutations
New measure packages for PY2026	

* The RACC-FSC_v3.0/v3.1 allows the user to select which ACC version is used.

The RACC-FSC_v3.0/v3.1 shall be used to calculate refrigerant leakage emissions and avoided costs of net refrigerant leakage emissions for all measures that involve adding or replacing equipment that uses refrigerant and involves a change to the refrigerant type or to the refrigerant charge⁵—these include most fuel substitution and electric resistance to heat pump measures. The completed RACC-FSC_v3.0/v3.1—containing the relevant parameters associated with a given measure package—shall be provided as an addendum to each affected measure package in the eTRM. Guidance for how to do so is described in the “RACC-FSC Technical Guidance Document”⁶ that was issued along with the RACC-FSC_v3.0 workbook.

Since the RACC-FSC_v3.0/v3.1 contains both the RACC and the FSC, Table A-1-2 lays out which components are to be completed for various types of deemed measure packages and custom applications.

Table A-1-2. Worksheets to be Completed within RACC-FSC_v3.0/v3.1

Measure type	2 RACC	3 FSC
Efficiency rating differs between the measure, standard practice, and/or existing equipment cases (i.e., refrigerant type and amount is the same between the cases)	-	-
Type of refrigerant differs between or changes for the measure, standard practice, and/or existing equipment cases	X	Only requires completion for fuel-substitution measures
Amount (charge) of refrigerant differs between or changes for measure, standard practice, and/or existing equipment cases	X	

⁵ Refrigerant charge describes the weight of the refrigerant contained within equipment, typically measured in pounds.

⁶ See <https://cedars.cpuc.ca.gov/deer-resources/tools/supporting-files/resource/16/history/>. Since the 2024 Avoided Cost Calculators were finalized on November 7, 2024, Appendices A and B were updated accordingly.

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Measure type	2 RACC	3 FSC
Claiming avoided emissions when refrigerant in existing equipment is recovered and documentation provided*	X	
Fuel substitution measure without refrigerant (e.g., induction range)	X**	X

* Although the “2 RACC” and “3 FSC” worksheets include the functionality to claim credit for refrigerant recovery from existing equipment, its use is not currently sanctioned by the CPUC.

** The “2 RACC” worksheet contains a dropdown menu that includes “No refrigerant” to indicate when equipment contains no refrigerant. The “2 RACC” worksheet must be filled in prior to any use of the “3 FSC” worksheet.

New measure offerings added to approved measure packages shall use the version of the RACC-FSC that is current at the time that the new offerings are being added—even when the measure package otherwise uses a former version of the *Deemed Measure RACC v2.2* and or the *Fuel Substitution Calculator v1.1*. Mid-cycle updates to existing measure packages shall use the version of the RACC-FSC that is current at the time that the measure package is submitted for Ex Ante Review.

The version of the RACC-FSC used for the new offerings shall be noted in the measure characterization narrative. The measure package should specify the date of synchronization with DEER that are tracked and embedded within the RACC-FSC. The DEER tables that are used by the RACC-FSC include those listed in Table A-1-3. The DEER tables embedded within the RACC-FSC are updated when the user refreshes using the Excel Refresh button.

Table A-1-3. DEER Database Tables Used by RACC-FSC_v3.0/v3.1

Schema	Table	Description
applic	BldgWts	This table contains the weights used to produce the counterfactual standard practice baseline for residential heat pumps that replace a gas furnace without room/window or ducted AC.
costeff	CARB_EPA_GWP_Limits*	This table contains the GWP limits established by either the California Air Resources Board (CARB) or the Environmental Protection Agency (EPA), depending upon which prevails in a given year.

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Schema	Table	Description
	CARB_RefrigLeaks*	This table contains the refrigerant leakage rates established by the California Air Resources Board for a variety of sectors, building types, and applications.
	EUL_basis	This table contains the DEER-approved EULs and RULs for deemed measures.
	OtherRatesACC*	This table contains natural gas heat rates, source energy rates, methane leakage rates and adders, and PA-specific capital rates and associated weights established (to inform the statewide weighted capital rate) for each ACC update.
	Refrigerant*	This table contains a list of refrigerants and their associated GWPs for 20- and 100-year horizons. ⁷
	RefrigerantACC*	This table contains the avoided costs of refrigerant leakage, electric generation emissions rates, and source energy factors for each ACC update.
spt	RACC_FSC_InputTracker	This table contains a list of the changes made to the rest of the tables that are used by the RACC-FSC. This is used to ensure that the connected copies of the DEER tables stored within the submitted measure package addendum or custom application are current. This table is automatically refreshed each time the workbook is opened.
tech	TechType	This table contains the DEER-approved TechTypes for all deemed measures.

* Table was added to the DEER database in the first and second quarters of 2024.

1.2.2 (B.2) Refrigerant Benefits/Costs for EULs Exceeding 20 Years

Effective Program Year: 2024-2026. The avoided refrigerant leakage emissions for accelerated replacement (AR) measure application types sometimes consider an end-of-life (EOL) refrigerant leakage event for the counterfactual standard practice equipment

⁷ Intergovernmental Panel on Climate Change (IPCC), Fourth Assessment Report (AR4), 2007. (see <https://www.ipcc.ch/assessment-report/ar4/>.)

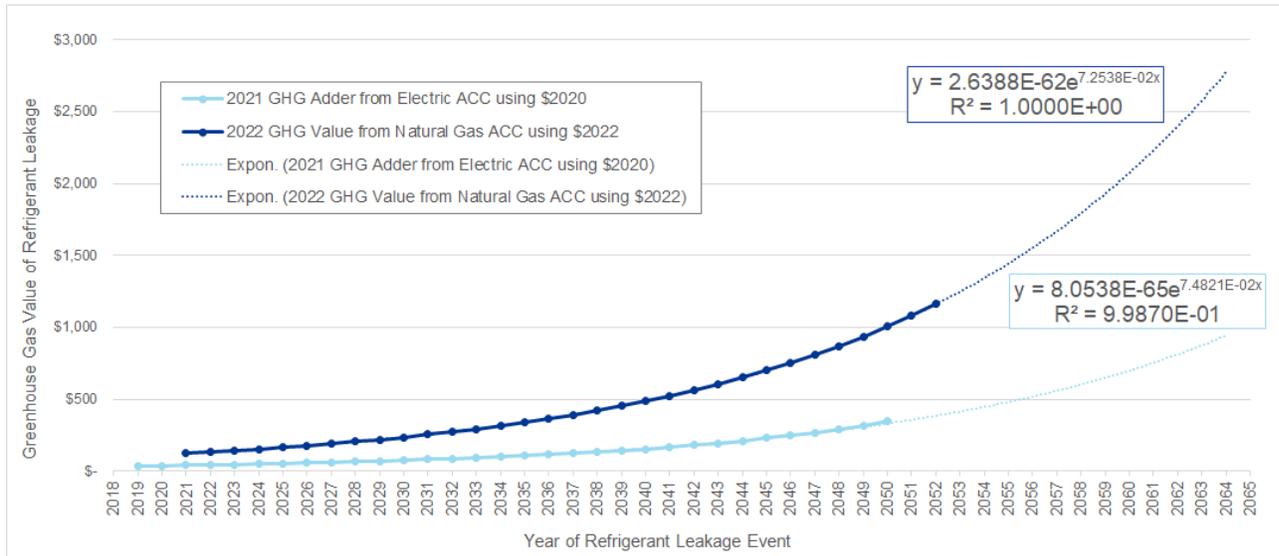
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that occurs beyond the life of the measure. In these cases, it is sometimes necessary to know the costs of those refrigerant emissions in years beyond the scope of the ACC updates. Since recent studies have found that some equipment categories have effective useful lives (EULs) that exceed 20 years, this can mean that an EOL refrigerant leakage event might occur more than 30 years beyond the date that the measure is installed. ACC updates, however, only forecast values for 30 years in the future. This presented a challenge for the RACC-FSC workbook to determine the monetary value of an EOL event more than 30 years in the future. For example, the 2023 Residential HVAC and Water Heating EUL Study resulted in furnace and heat pump EUL values of 30 and 23 years respectively. An accelerated replacement (AR) application of this fuel substitution EE scenario would result in a first baseline lifecycle of 10 years (RUL of the existing furnace) and a second baseline lifecycle of 23 years (EUL of the measure case heat pump) resulting in 33 years.

A plot of the annual costs of refrigerant emissions over the past two ACC updates shows that these costs increase at a fixed exponential rate over time as shown in Figure A-1-1. Thus, it was decided that these values can reasonably be extrapolated beyond the bounds of the ACC update as needed. Since these greenhouse gas values of refrigerant leakage values will be added to the RefrigerantACC table in the DEER database following each ACC update, the extrapolated values for those years beyond the ACC will also be added to the table at the same time. (These extrapolated values for the 2022 and 2024 ACCs have already been added to the RefrigerantACC table.)

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Figure A-1-1. Greenhouse Gas Value of Refrigerant Leakage in 2022 ACCs



1.2.3 (B.3) Water-Energy Nexus (WEN) Impacts

Effective Program Year: 2024. In December 2021, the CPUC Energy Division released the new Water-Energy (W-E) Calculator 2.0.⁸ On December 22, 2021, CPUC staff issued a guidance memo describing a short and long-term solution for how the embedded energy savings outputs of the W-E Calculator 2.0 are to be used. In 2023, the CET was updated to include a separate field for embedded water savings, the long-term solution, and allow for WEN measure packages to use the new CET functionality to accept the direct energy savings and embedded energy savings separately into the CET. The embedded-water-energy savings are calculated following the same methodology described in the short-term solution, but the embedded energy savings are stored independently of the direct energy savings within the eTRM to facilitate reporting and cost-effectiveness calculations.

1.2.4 (B.4) Lighting Baseline Updates

Effective Program Year: 2024-2026. The standard practice baseline in measure packages will conform to the updated values in the Modified Lighting Calculator (MLC). The new MLC update and corresponding standard practice efficacy will be effective upon

⁸ <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/energy-efficiency/water-energy-nexus-programs>

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approval. Any new mid-cycle measure package submissions should use the most up-to-date baseline values. Existing measure packages using the MLC methodology will be updated to reflect the latest MLC methodology in the DEER2026 version of the measure package.

1.2.5 (B.5) Definition of Incentive and Rebate

Effective Program Year: 2026. Because the Standard Practice Manual (SPM) has made a distinction between rebates and incentives, and the policy results in a different mathematical treatment in the Cost Effectiveness Tool (CET), it is important that we clearly define the terms and use them precisely. This is not a change in policy, and may not require any changes in the CET. It is a clarification to align CET inputs with policy stated in the Standard Practice Manual, D.06-06-063, D.07-09-043 and D.08-01-006. A rebate is a return of part of a payment, or an amount owed, whereas an incentive is something that incites or has a tendency to incite to determination or action. It follows from these two definitions that a rebate is a specific kind of incentive.

D.08-01-006 discusses the rebates and incentives defined by the SPM and implemented in the cost effectiveness test calculations.

the SPM defines the incentive (INC) term very narrowly as the type of incentive that can be treated as a transfer payment in the SPM TRC formulation. The definition of the INC term, as set forth in the SPM, is restricted to "dollar benefits" such as rebates or rate incentives (monthly bill credits) paid by the sponsoring utility to the customers participating in the program. Moreover, the SPM is very clear that the term "participant" refers to the customer participating in the program, and that this transfer incentive (INC) is one that is paid directly to the participating customer.^{9,10}

In the CET Input Guide, the values that are input to the INC term are referred to as rebates (i.e., "UnitEndUserRebate").¹¹

Decision D.08-01-006 goes on to state,

⁹ https://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/77638.PDF, p. 10

¹⁰ The INC term is used as the transfer payment included in the denominator of the Program Administrator Cost (PAC) test but not included in the denominator of the Total Resource Cost (TRC) test. The INC term is also used to calculate participant costs.

¹¹ https://edcentralserver.files.com/preview/f/f7b564868ffdc879/CET_Input_Guide_10132022.xlsx

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In D.06-06-063, we reiterated the SPM definition of Program Administrator Cost (PRC) as any program expense except those program expenses that fit the narrow definition of a transfer payment incentive (INC) defined above. This means that the "non-transfer" incentive payments to midstream/upstream market actors and payments to contractors to deliver or install energy efficiency measures at customer premises are included in the PRC term. More specifically, under the utility "midstream/upstream programs," the utility pays incentives with program funds to manufacturers and distributors in order to buy down the retail price of energy efficiency measures or to stock efficient appliances. Under "direct-install programs," the utility arranges for measures to be either delivered to a participating customer for their installation or to be installed at the customers' premises. As discussed in D.06-06-063, the definition of PRC includes all utility payments to these entities, i.e., to manufacturers, distributors, contractors, builders, or energy service companies.¹²

These types of payments should be referred to as costs or non-rebate incentives and not be confused with the narrow definition of a rebate described above. CET Input Guide documentation refers to payments made to non-customers as incentives, i.e., "UnitIncentiveToOthers", "UnitDirectInstallLab", or UnitDirectInstallMat." If an upstream/midstream/direct install program can verify that an incentive was provided in the form of a cash rebate or bill credit to the end use customer, then those payments should be reported as rebates in the CET.

It is important to point out the cases where the Total Resource Cost (TRC) test is the same for both direct installation and downstream delivery types and the cases where they are different. Both cases are discussed in D.06-06-063 starting on pg. 68 with numerical examples that show no difference between TRC and Program Administrator Cost (PAC) test results for different delivery types. Then on page 70 the Decision states, "However, the manner in which the program is delivered or the rebate is provided to the customer should not result in different cost-effectiveness results, except in the very limited instances discussed below." It goes on to show numerical examples where the

¹² https://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/77638.PDF, p. 13

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two delivery types have the same TRC but different PAC test results. Then on page 72 the Decision states,

We recognize that there may be limited instances for program design purposes where the cash rebate to the customer exceeds the measure installation cost. Under these circumstances, the TRC results will be the same for both direct install and the rebate program (all other things being equal), given the transfer payment treatment of cash rebates in the SPM. However, the PAC test will favor the direct install program. It was precisely to address these types of circumstances that we adopted the “Dual Test” of cost-effectiveness in our policy rules. Those rules recognize that both the TRC and PAC tests of cost effectiveness need to be considered when evaluating program proposals, in order to ensure that program administrators and implementers do not spend more on rebates/cash incentives than absolutely necessary to achieve TRC net benefits.

To further illustrate this example, Table A-1-4 shows the non-administrative portion of the PAC and TRC costs for direct install and rebate programs and it is obvious in Example 1, the circumstance described above, that the TRC costs will be the same for the two programs whereas the PAC cost will be larger for the rebate program because the rebate is larger than the measure cost. In Example 1, the customer received an appliance through the direct install program, but they received a rebate larger than the cost of the appliance through the rebate program so the benefit to the customer was not the same for the two delivery types. Consider another example where the rebate is larger than the measure cost. In Example 2, a direct install program installs a normal replacement (NR) measure such as an air source heat pump in a customer’s home for free compared to a rebate program that provides a rebate for the full measure cost (FMC) of the air source heat pump.¹³ The benefit to the customer is the same through these two programs and these two delivery methods will result in equal PACs, but different TRCs since customer cost is defined as the incremental measure cost (IMC) for NR measures.

¹³ For NR measures the measure cost is defined as the IMC so the FMC rebate is larger than the measure cost.

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Table A-1-4. Non-Administrative PAC and TRC Costs for Example Direct Installation and Rebate Programs

Example Number	Test Type	Direct Installation Cost	Rebate Cost
Example 1	PAC	Program paid measure cost	Program paid rebate (greater than measure cost)
Example 1	TRC	Program paid measure cost	Customer paid measure cost
Example 2	PAC	Program paid FMC	Program paid rebate = FMC
Example 2	TRC	Program paid FMC	Customer paid IMC

Decision 07-09-043 reiterated on page 160 that direct install programs and customer rebate programs are treated consistently with respect to the cost effectiveness tests except in limited instances where the cash rebate to the customer exceeds the measure installation cost.

Rebates and incentives are treated differently in the CET in two ways. 1) Rebates are transfer payments that are not included as costs in the Total Resource Cost (TRC) test so only rebate payments to free riders are included in the TRC denominator (cost term)¹⁴; and 2) rebates and incentives are treated differently in the “excess incentives” term which does not apply to rebates because a rebate larger than the measure cost is allowed. Now that the CET is programmed in a database where validation can be applied to field entries, the “excess incentive” term may be removed and replaced by a validation ensuring that incentive fields are not larger than the measure cost. Rebates and incentives are also treated differently in the guidance document “CPUC Guidance Requiring and Addendum to Measure Package Documenting Rebate Greater than Incremental Measure Cost” which applies to rebates and not to incentives.¹⁵

1.2.6 (B.6) Clarification of Deemed Measure Cost and Incentive Reporting to CEDARS
Effective Program Year: 2026. This section offers clarification for reporting of costs and incentives in CEDARS and the Cost Effectiveness Tool (CET). This is not a change in

¹⁴ Note that per the SPM, transfer payments are not excluded from the Program Administrator Cost (PAC) test so rebates (INC) is added to the non-rebate program costs (PRC) for the PAC test.

¹⁵ Note that if the IMC happens to be negative, the measure package will require not only the addendum documenting the reasons for the negative IMC but also the addendum documenting rebate greater than IMC for the measure to be eligible for a rebate.

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policy, but it is a clarification to align CET inputs with policy stated in D.06-06-063, D.07-09-043 and D.08-01-006.

The CET inputs “UnitDirectInstallLab” and “UnitDirectInstallMat” are not labor and materials costs, but are the incentives paid by the utility or its agent toward the labor and materials costs for directly installed measures. A direct install program customer co-pay field will be added to the CET for clarity so the following calculations can be performed within the CET. For application types that use the full measure cost (FMC) namely add-on equipment (AOE), building weatherization (BW), and behavioral, retrocommissioning, and operational (BRO) measure application types, the customer co-pay will be subtracted from the measure costs to arrive at the direct install labor and materials incentives. For incremental measure cost (IMC) or accelerated replacement measure cost (ARC) application types, namely new construction (NC), NR, and AR measure application types, any customer co-pay higher than the baseline measure cost (FMC-IMC or FMC-ARC¹⁶) will be subtracted from the IMC or ARC to arrive at the direct install labor and materials incentives. Once the co-pay field has been added to the CET, direct install programs will report all costs at the program level. The CET will be modified to allocate measure level incentives from those program costs according to the logic above and then allocate the remaining program costs using the current savings-weighted method.

Measure package measure costs, FMC and IMC, should be entered into the CET fields “UnitMeaCost1stBaseline” and, where applicable, “UnitMeaCost2ndBaseline” fields for all measures regardless of delivery type according to the existing rules. The “UnitMeaCost1stBaseline” field contains the FMC for AR, AOE, BW, and BRO measure application types whereas it contains the IMC for NC and NR measure application types. “UnitMeaCost2ndBaseline” is only used for AR measure application types and should be populated with the IMC only for those measures.

The CET input “UnitIncentiveToOthers” is a per-measure incentive to a retailer, distributor, dealer, or manufacturer that directly reduces the customer cost to purchase the measure. Any incentives that do not reduce customer costs (such as payments to

¹⁶ $ARC = FMC - (FMC - IMC) / (1 + D)^{RUL}$ where D is the utility WACC discount rate used in the CET and RUL is the remaining life of the accelerated replacement measure. The baseline measure cost is $(FMC - ARC)$ which simplifies to the second term of the ARC or $(FMC - IMC) / (1 + D)^{RUL}$.

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distributors to stock shelves with energy efficient appliances, or payments to sales associates to promote energy efficient appliances) must be reported as program costs in the “UserInputIncentive” field. Incentives to upstream and midstream program implementers must be split between those that reduce the customer measure cost and those that do not. If the program administrator cannot show that the incentive paid to a third party reduces the customer’s cost to purchase the measure, then it cannot be reported in the “UnitIncentiveToOthers” field in CEDARS.

1.2.7 (B.7) Peak Load Definition

Effective Program Year: 2028. Resolution E-5152 DEER2023 Update made an inadvertent error in the definition of a heat wave, originally defined in D.06-06-063.¹⁷ The error was made in the Attachment on page A-12 and A-13 in Section A3-3 “Peak demand period definition update”. The text is corrected as follows with red text added:

The heat wave has the highest index value computed by adding and giving equal weight to each of these values:

- The peak temperature over the three-day period
- Average temperature over the three-day period
- The average temperature from ~~4 p.m.~~ noon to ~~9 p.m.~~ 6 p.m. over the three-day period

The criteria above are used to determine which days to use for determining the peak demand. Using the corrected definition the heat wave start day changes for CZ06 from 9/2 to 6/29, CZ09 from 9/1 to 9/2 and CZ11 from 6/29 to 8/12. The corrected table from E-5152 is shown as Table A-1-5.

Table A-1-5. Updated E-5152 Table A-3-2. Comparison of CZ2010 and CZ2022 Peak Demand Period Starting Dates

Climate Zone	CZ2010 (Title 24 2013) Weather Files				CZ2022 (Title 24 2022) Weather Files			
	Start Date	Week-day	Temperature (°F)		Start Date	Week-day	Temperature (°F)	
			Max. Peak	3-day Average			Max. Peak	3-day Average

¹⁷ D.06-06-063 OP 1. The DEER version adopted in D.12-05-015 utilizes a 3-day “heat wave” that occurs on consecutive days in June through September such that the three consecutive days do not include weekends or holidays, and where the heat wave is ranked by giving equal weight to the peak temperature during the 72-hour period, the average temperature during the 72-hour period and the average temperature from noon – 6 pm over the three days.

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Climate Zone	CZ2010 (Title 24 2013) Weather Files				CZ2022 (Title 24 2022) Weather Files			
	Start Date	Week-day	Temperature (°F)		Start Date	Week-day	Temperature (°F)	
			Max. Peak	3-day Average			Max. Peak	3-day Average
CZ01	Sep 16	Wed	81	59.8	Aug 26	Wed	86	60.2
CZ02	Jul 8	Wed	103	75.9	Aug 26	Wed	102	74.7
CZ03	Jul 8	Wed	91	69.2	Aug 26	Wed	87	71.3
CZ04	Sep 1	Tue	99	77.5	Aug 26	Wed	101	80.0
CZ05	Sep 8	Tue	87	64.8	Sep 16	Wed	93	68.3
CZ06	Sep 1	Tue	102	77.1	Jun 29	Mon	85	76.1
CZ07	Sep 1	Tue	90	73.9	Sep 2	Wed	83	74.4
CZ08	Sep 1	Tue	105	79.8	Sep 2	Wed	98	79.7
CZ09	Sep 1	Tue	107	86.6	Sep 2	Wed	100	82.9
CZ10	Sep 1	Tue	109	86.3	Jun 29	Mon	105	85.5
CZ11	Jul 8	Wed	113	88.3	Aug 12	Wed	110	90.2
CZ12	Jul 8	Wed	109	82.4	Jun 29	Mon	107	84.5
CZ13	Jul 8	Wed	108	86.7	Jun 29	Mon	109	90.6
CZ14	Aug 26	Wed	105	86.8	Jun 29	Mon	109	88.9
CZ15	Aug 25	Tue	112	97.5	Jun 29	Mon	120	100.8
CZ16	Jul 8	Wed	90	78.8	Aug 12	Wed	88	77.7

Note: Corrected values are shown in red.

The corrections above only apply to the determination of the start date of the heat wave that defines the peak period in each climate zone. The peak demand window is still from 4 p.m. to 9 p.m. Annual peak demand is defined as the average of the kW consumption during the peak demand window on three consecutive days starting on the date defined in Table A-1-5. Five hours within the window on each of three days provide 15 hours where kW consumption is averaged to determine the annual peak kW consumption.

1.2.8 (B.8) Vintage and Era Definitions

Effective Program Year: 2026. Historically, many building vintages were modeled, each coinciding with a CA-Title 24 energy code release. As directed in the DEER2020 Update Resolution the outputs of these models were rolled up into eras using weights (from 2006 Commercial End-Use Survey) representing the proportion of building stock for

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each vintage within the four eras: new, recent, existing, and old. An era is a collection of building vintages and is used to group buildings with similar energy use indexes¹⁸ (EUIs). Producing a building model for each building vintage is costly in terms of energy model simulation time, quality control simulation review, and database storage space and two eras (recent and old) are rarely used.

With the switch to EnergyPlus building models CPUC staff and staff consultants reduced the number of residential vintage models required by creating one model to represent all existing residential building stock. Details on our methods are noted in the Residential EnergyPlus Calibration Memo.¹⁹ That methodology is not available for commercial building models since the 2022 Commercial End-Use Survey²⁰ (CEUS) did not provide normalized energy consumption values (for calibration) as in the 2019 RASS study. Instead, we created representative existing commercial building prototypes using weighted building shell parameters (such as ceiling R-value) based on historical CA Title-24 values, and the afore mentioned building weights. Starting in PY2026, the recent and old building eras are removed, and the existing era represents all existing buildings. Table A-1-6 shows the building eras that will be used going forward in PY2026.

Table A-1-6. Residential and Commercial Building Vintage Definitions

Building Vintage	Year Built
Existing	Permitted or built before the beginning of the current building code cycle
New	Permitted and built after the beginning of the current building code cycle

1.2.9 (B.9) *EnergyPlus Prototypes*

Effective Program Year: 2026. The DEER prototypes (residential and commercial) have transitioned from a DOE2 based system to EnergyPlus building simulation models.²¹ The new prototypes use Modelkit to facilitate the building of input files and running batch simulation models. The entire system including post processing scripts are

¹⁸ A building EUI is the energy consumption per square foot of building area.

¹⁹ <https://cedars.cpuc.ca.gov/deer-resources/tools/energy-plus/resource/13/history>

²⁰ <https://www.energy.ca.gov/publications/2023/2022-california-commercial-end-use-survey-ceus-final-report>

²¹ Commercial water heating measures, however, will continue to use the DEER Water Heater Calculator to determine energy usage and savings.

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available on GitHub²² for use in PY2026-27 measure updates. A User Guide posted on CEDARS²³ describes how to use the new prototype system. A new version of California Energy Efficiency code, 2025 Title-24, will be updated effective January 1, 2026. This new code should be used as the baseline for all modeled measures effective PY2026. Measure packages will use draft 2025 Title-24 values to update modeled measure baselines. The final 2025 Title-24 values are expected September 2024. If the draft 2025 Title-24 values do not get adopted or there are changes between the draft and final values, CPUC will update the impacted building prototype code file (in Modelkit) and measure package developers will update measure packages and their baselines as a mid-cycle change in Q1 2025 as shown in Table A-1-7. Previously submitted PY2026 measure packages will be adjusted according to any differences between draft 2025 Title-24 values and final 2025 Title-24 values.

Table A-1-7. Tentative Timeline for DEER2026-2027 Measure Package Updates Due to 2025 Title-24 California Energy Codes

End Use Category	Update Detail	Measure Package Submittal By
All affected end uses	Final 2025 Title-24 documents	2025-03-31

1.2.10 (B.10) Data Requirements for Distributor/Contractor-delivered Measures

Effective Program Year: 2024. The data collection requirements outlined in Resolution E-5221 should continue to be listed in measure packages moving forward. Please note that *SiteID* is not a replacement for end use or customer tracking data for evaluation purposes. As noted in Resolution E-5152, the site data in claims information will contain location and contact information for stores, contractors, or other service providers where the ultimate customer purchase occurs.²⁴

²² <https://github.com/sound-data/DEER-Prototypes-EnergyPlus>

²³ <https://cedars.cpuc.ca.gov/deer-resources/tools/energy-plus/file/3085/download>

²⁴ Resolution E-5152, Attachment Section 5.1, pg. A-32

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1.3 (C) DEER 2028 Update and Measure Package Submission/Review Timeline

Effective Program Year: 2024. This proposal sets forth the recommended schedule for DEER Update and for submission of measure packages for CPUC staff approval for PY2028-29. The timeline and schedule are provided in Table A-1-8 and Table A-1-9.

Table A-1-8. Tentative PY2028-2029 DEER Update Cycle Timeline

Description	Responsible Party	Due Date	Approval Date	Effective Date
Draft DEER2028 Update Resolution	CPUC	2026-07-31	-	-
DEER2028 Update Resolution	CPUC	-	2026-10-30	2028-01-01*
Measure Package Update Schedule	PAs/Stakeholders	2025-08-01**	-	-
Measure Package Submittals	PAs	2026-03-31**	2026-07-31 ⁺	2028-01-01*

* There may be exceptions when updates become effective mid-cycle.

** Draft for workflow scheduling; updates to the schedule may be made if needed. Future updates like EnergyPlus prototypes, EM&V evaluations, and CPUC policy will be incorporated into the review of the Measure Package Update Schedule to properly stagger measure package submissions and reviews.

+ Per Draft Resolution release, adoption in Final Resolution.

CPUC staff will work with PAs to set a prioritized schedule of updates for all PY2028-29 measure packages resulting from updates directed in Sections 1.5 and 2.0. PAs may submit additional updates to measure packages beyond what is directed and may include additional measure packages for update during that time. Examples of such updates may include, but are not limited to costs, new study data, and EM&V results. Only measure packages adopted in the DEER2028 will be included in the set of deemed measures for the PY2028-29 program cycle.

Staff will work with the PAs to develop a schedule of submissions so measure packages requiring more time to develop, and review can be submitted well before the standard three-month timeframe for review and approval to avoid delays. It is the responsibility of the PAs to follow the agreed schedule for submissions or risk measure packages not being included in the DEER resolution and therefore not receiving approval.

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Table A-1-9 summarizes the measures presently planned for updates, when the PA-led research needs to be completed, and the deadline for measure package submittals.

Table A-1-9. Anticipated Timeline for DEER2028-2029 Measure Package Updates from PA-Led Research

End Use Category	Update Detail	Data Needed By	Measure Package Submittal By
HVAC (HC)	Performance curve research	2025-12-01*	2026-03-31*
	Refrigerant charge level research	2025-12-01*	2026-03-31*

* Draft for workflow scheduling; updates to the schedule may be made if needed.

1.4 (D) Mid-Cycle Adjustments to the Locked Ex-Ante Values

Effective Program Year: 2024. D. 21-05-031 (p. 39) locks ex-ante values used in Potential & Goals as well as claims for the two-year DEER cycle. The DEER Resolution also adopts the vintage of deemed values to be used in forecasting and portfolio planning. It further notes that there may be mid-cycle adjustments that will account for reasonable corrections to the existing locked values and allow new measures to be added to the portfolio. Mid-cycle reasonable correction measure package updates will be reviewed on a case-by-case basis to determine measure package effectiveness as stipulated by D. 21-05-031. Mid-cycle corrections to existing locked values will be communicated to the lead IOU for stakeholder awareness. Per Resolution E-5152 these mid-cycle adjustments are further clarified as new measure package submittals, new measure package offerings, error corrections, or codes and standards changes that occur and become effective during the mid-cycle period. New measures or offerings are effective upon approval. Changes to existing measures are effective 90 days after approval or reviewed on a case-by-case basis at the discretion of CPUC staff to account for application, true-up, and mid-cycle filings. Typographical and clerical correction measure package updates will be reviewed on a case-by-case basis to determine when they become effective.

1.4.1 (D.1) Codes and Standards

Effective Program Year: 2024. As discussed in Resolution E-5221, anticipated changes to codes and standards that occur mid-cycle shall be planned for by Program

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Administrators (PAs). PAs will work with CPUC Staff and the ex-ante review team to document mid-cycle measure package revision timelines.

In addition, EPA finalized the American Innovation and Manufacturing Act, AIM in October 2023 and as of January 2, 2025, all manufactured HVAC systems and products shall use refrigerants having a global warming potential (GWP) of no more than 700. This update to the code will result in reduced CO_{2e} emissions stemming from refrigerant leakage and the benefits of those avoided emissions. The expected impact of this change is that more fuel substitution measure package permutations are expected to pass the fuel substitution test requirement of not increasing CO_{2e} emissions. The measure packages that will be affected are listed in Table A-1-10. The measure packages that are listed as only requiring updates to the Accelerated Replacement (AR) permutations are affected by standard updates that go into effect in 2028 or later. The measure packages that require updates to all of the permutations are affected by standard updates that go into effect as of 2026 or earlier.

Table A-1-10. Measure packages affected by EPA refrigerant standards updates in 2025

Measure Package	Measure Package Title	Permutations
SWAP007	Room Air Conditioner, Residential	AR, if any
SWCR017	Ultra-Low Temperature Freezer	AR, if any
SWCR018	Reach-In Refrigerator or Freezer, Commercial	AR, if any
SWCR021	Medium or Low-Temperature Display Case with Doors	AR, if any
SWCR020	Medium-Temperature Open Display Case Retrofit	AR, if any
SWFS006	Ice Machine, Commercial	AR, if any
SWHC005	Water-Cooled Chiller	AR, if any
SWHC013	Unitary Air-Cooled Air Conditioner or Heat Pump, Under 65 kBtu/hr, Commercial	AR, if any
SWHC014	Unitary Air-Cooled Air Conditioner or Heat Pump, Under 65 kBtu/hr, Commercial	AR, if any
SWHC020	Air-Cooled Screw Chiller, Path A	AR, if any
SWHC027	Package Terminal Air Conditioner or Heat Pump, Under 24 kBtu/hr	AR, if any

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Measure Package	Measure Package Title	Permutations
SWHC043	Multiple Capacity Unitary Air-Cooled Commercial Air Conditioners Between 65 and 240 kBtu/hr	AR, if any
SWHC044	Ductless HVAC, Residential, Fuel Substitution	All
SWHC045	Heat Pump HVAC, Residential, Fuel Substitution	All
SWHC046	Packaged Heat Pump Air Conditioner Commercial, Fuel Substitution	All
SWHC052*	Air-Cooled Chiller, Path B	AR, if any
SWHC049	Ducted AC and HP HVAC Equipment, Residential	AR, if any
SWHC050	Ductless Heat Pump, Residential	AR, if any
SWSV014	Lifecycle Refrigerant Management, Residential	All
SWWB008	All-Electric Homes, Residential, New Construction	Space heating equipment

*SWHC052 is sunset as of February 28, 2024, but is planned to be brought back with updated calculations.

1.4.2 (D.2) Policy Updates

Effective Program Year: 2024. In addition to codes and standards updates that trigger mid-cycle measure package updates, PAs shall plan for mid-cycle updates that are triggered by a Decision or Rulemaking that either sunsets or modifies a parameter used by a measure package.

1.5 (E) Structural Changes to DEER Tables

Effective Program Year: 2024-2026. The changes listed in the subsections to follow will be made to the structures of some new and existing DEER database tables.

1.5.1 (E.1) Retiring Table for Fuel Substitution Measures

Effective Program Year: 2024. CPUC staff is retiring the recently added “FuelSub” table that was added to DEER’s “costeff” schema. In its place, the “FuelID” table described in Section 1.5.2 was added.

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1.5.2 (E.2) Adding FuelID Table

Effective Program Year: 2026. In response to D.23-04-035, the need for a more detailed set of descriptors became necessary as a means to build a global exclusion table for the various types of *FuelIDs* that have been established. This field shall be added to the eTRM's permutations table for 2026 measure offerings and populated by CalTF on the back end. Table A-1-11 presents the *FuelIDs* established to date.

Table A-1-11. Fields in FuelID Table for DEER2026

FuelID	Description
EE-Elec-Only	Energy efficiency measure that does not burn natural gas
Exempt	Add-on equipment (AOE), BRO (BRO-Bhv, BRO-Op, or BRO-RCx), or building weatherization (BW) measure that saves electricity and/or natural gas but does not burn natural gas
Exempt-AllElec-New	All-electric new construction without gas service where the standard practice baseline is natural gas-burning equipment
Exempt-FuelSub-ToElec-Ex	Fuel substitution measure that replaces natural gas-burning equipment with electric-only equipment
None	A non-saving measure that uses neither electricity nor natural gas
NonExempt-EE-Gas-Ex	Energy efficiency measure that burns natural gas in an existing building
NonExempt-EE-Gas-New	Energy efficiency measure that burns natural gas at a new agricultural or industrial building
NonExempt-EE-Gas-NoVEA-New	Energy efficiency measure that burns natural gas and has no viable electric alternative at a new building
NonExempt-FuelSub-ToGas-Ex	Fuel substitution measure that replaces electric-only equipment with natural gas-burning equipment

A given measure package will usually contain only one *FuelID*, but some may contain multiple *FuelIDs* (e.g. a measure package with electric and natural gas-burning offerings). A given permutation, however, will only contain one *FuelID*.

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1.5.3 (E.3) Locking Measure and Energy Impact Tables

Effective Program Year: 2026. CPUC staff plans to lock down these tables in the DEER database. New records will no longer be added to either the “Measure” table or the “EnergyImpact” table. The eTRM will be the only repository for deemed measure package offering permutations and their respective unit energy savings values and their unit energy consumption values (both end-use, only, and whole building). CEDARS Reporting will no longer test the MeasureIDs in the DEER database and will rely solely on the eTRM’s Measure Detail ID to validate claims.

1.5.4 (E.4) Field Changes to the TechType Table

Effective Program Year: 2024. Several fields were added to the TechType table to support D.23-04-035 as shown in Table A-1-12. These new fields should be added to the corresponding CPUC Support Table in the eTRM for transparency, but do not need to be added to permutations at this time. New fields may be needed to indicate if a measure has a viable electric alternative (VEA) or is exempt from the rules. Policy on VEA is currently being developed.

Table A-1-12. Modifications to TechType Table

Fieldname	Status	Description
IsExempt	Added	Boolean field to indicate if a given TechType is an exempt measure
HasElecAlt	Added	Boolean field to indicate if a given gas-fueled TechType has an electric alternative
HasRefrigerant	Added	Boolean field to indicate if a given TechType contains refrigerant
HasRefrigerantAlt	Added	Boolean field to indicate if a given electric TechType has a viable electric alternative that contains refrigerant (e.g., electric-resistance clothes dryer)
UsesElec	Added	Boolean field to indicate whether a given TechType uses electricity
UsesGas	Added	Boolean field to indicate whether a given TechType uses gas

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Fieldname	Status	Description
NormUnit	Proposed for deletion	Measure packages may opt to use a different normalizing unit for EnergyPlus modeling or program design reasons
defEULCode	Proposed for deletion	All records contain "Any" and thus is unused

1.5.5 (E.5) Building Weights Table Created

Effective Program Year: 2024. For transparency and ease of access, the "BldgWts" table was added to the "applic" schema of the DEER database that contains building weights and HVAC weights to be used for post-processing of energy impacts. These are also available for use by 1) the eTRM to calculate the percent change in savings between a new measure package version and its prior version and 2) the RACC-FSC_v3.xlsx.

1.6 (F) Updates to DEER Support Table Values

Effective Program Year: 2023-2028. The following changes to the DEER support table values are planned.

1.6.1 (F.1) Updates to Net-to-Gross Table

Effective Program Year: 2024. The following NTG IDs are expired and no longer available for use. They were established and intended for use when, according to Resolution E-4952, there were to be above-code NTGRs and below-code NTGRs. While that plan was deferred, the NTG IDs were never expired.

- All-Ltg-LED-WRR
- NonRes-Out-Ltg-LEDFixt
- Res-InCmn-Ltg-LEDFixt
- Res-OutCmn-Ltg-LEDFixt

In addition, CPUC staff has the authority to change the Custom project NTG values based on current studies or evaluation results.

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1.6.2 (F.2) Updates to Delivery Types

Effective Program Year: 2026. As indicated in Resolution E-5221, the Delivery Types shown in Table A-1-13 shall be used.

Table A-1-13. DEER2026 Delivery Types

Delivery Type	Change	Description of Delivery Type
Up-Manuf	Was UpDeemed ²⁵	Incentivizes an energy-efficient technology through a program administrator partnership with the manufacturer
Mid-Distr		Incentivizes an energy-efficient technology through a program administrator partnership with the distributor
Mid-Retail		Incentivizes an energy-efficient technology through a program administrator partnership with the retailer
Down	Was DnDeemed and DnCust	Incentivizes an energy-efficient technology or service to a participating customer for them to install or have installed
DI	Was DnDeemDI and DnCustDI	Incentivizes the downstream delivery and/or installation of an energy efficient technology and/or service at a customer property by a program implementer-managed third-party contractor or trade professional. Program incentives are paid directly to the installation contractor or technology/service provider. (see guidance memo on CEDARS site for details)
C&S	None	Codes and Standards (C&S advocacy and related programs)

In 2026, the Upstream Flag used by CEDARS will no longer be needed. Until that time, the Upstream Flag will be set to “true” for the upstream delivery type and “null” for either of the midstream delivery types.

1.6.3 (F.3) Updates to Measure Impact Types

Effective Program Year: 2026. Since there is no longer a distinction between DEER and non-DEER measures and the *FuelID* will be added to eTRM permutations for program year 2025, the Measure Impact Types will be consolidated as shown in Table A-1-14.

²⁵ “Upstream (at the manufacturer level) and midstream (at the distributor or retailer level, but not the contractor or installer level) interventions are required to be delivered statewide. Some, but not all, downstream (at the customer level) approaches are also appropriate for statewide administration.” D.16-08-019, O.P. 5, pp. 109-110.

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Table A-1-14. DEER2026 Measure Impact Types

Measure Impact Type	Description of Measure Impact Type
Cust-Gen	Custom Generic: generic, site-specific calculation or using approved tool or method and/or metered data (excluding NMEC, SEM, or RCT offerings)
Cust-NMEC-Pop	Population-level Normalized Metered Energy Consumption (NMEC) energy impacts are specified on a custom basis.
Cust-NMEC-Site	Site-level Normalized Metered Energy Consumption (NMEC) energy impacts are specified on a custom basis.
Cust-RCT	Custom RCT: uses a randomized-control trial (RCT) or experimental design method
Cust-SEM	Custom SEM: uses a strategic energy-management method
Deem	Deemed measure

1.6.4 (F.4) Updates to EULs**1.6.4.1 (F.4.1) EUL for Residential Behavioral NMEC Programs**

Effective Program Year: 2025. Although not the direct result of an EM&V study, data was provided to Ex Ante Review that showed evidence of a population-level NMEC (Normalized Meter Energy Consumption) Residential Behavioral Program delivering measurable savings for two years. The first year of savings were evaluated for the 2019, 2020, and 2021 cohorts of participants and reported to have delivered 7.5%, 7.7%, and 6.7%, respectively, of electric savings and 6.1%, 3.4%, and 3.5% of gas savings.²⁶ A new EUL ID has been created (Res-Behavioral-NMEC) where each year's energy savings will be empirically derived in accordance with NMEC rules.

1.6.4.2 (F.4.2) Residential Weatherization Measures

Effective Program Year: 2024. Documentation was submitted to Ex Ante Review to support the addition of the EUL_IDs and EULs as shown in Table A-1-15.

²⁶ "CPUC Group A Impact Evaluation Report, Population-Based NMEC – Program Years 2019-2021," Dec. 22, 2023, CALMAC ID: CPU0365.01, pp. 4-5. (See: <https://pda.energydataweb.com/#!/documents/3904/view>.)

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Table A-1-15. Residential Weatherization EULs

Measure	DEER2024 EUL_ID, year(s)
Residential solid-core wood door ²⁷	BS-Door: 20.0
Residential door seals ²⁸	BS-DoorSeals: 15.0
Residential door sweep ²⁹	BS-DoorSweep: 5.0

1.6.4.3 (F.4.3) Other Mid-cycle EUL Additions

Effective Program Year: 2023-2024. Documentation was submitted to Ex Ante Review to support the addition of the EUL_IDs and EULs as shown in Table A-1-16. Some of these measures have not yet been approved.

Table A-1-16. Mid-cycle EULs added to DEER

Measure	DEER2023 EUL_ID, year(s)
Residential fan controller for HVAC	HV-FanControl: 9.7
Commercial Patio Heater	Com-GasPatioHeater: 7.5
Commercial weather-based Irrigation Controller	Wtr-Irrig-Ctrl-Weather-Com: 3.0*
Residential Toilet	Wtr-WaterFixt-Toilet-Res: 10.0
Commercial Toilet	Wtr-WaterFixt-Toilet-Com: 20.0
Commercial Urinal	Wtr-WaterFixt-Urinal: 20.0
Large Rotary Nozzle	Wtr-Irrig-Nozzle-LrgRot: 10.0*
Soil Moisture Station	Wtr-Irrig-Ctrl-SoilMoist: 3.0*
Residential Weather-based Irrigation Controller	Wtr-Irrig-Ctrl-Weather-Res: 3.0*
Rotary Multi-Stream Nozzle	Wtr-Irrig-Nozzle-MultiStrm: 5.0*
Turf Removal	Wtr-Irrig-TurfRemoval: 10.0*

*Mid-cycle measure package approval status is under review by CPUC.

²⁷ ENERGY STAR, "Residential Windows Doors and Skylights Data Package.xlsx", Version 7.0, "3. Energy and Cost Savings" worksheet.

<https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Version%207.0%20Residential%20Windows%20Doors%20and%20Skylights%20Data%20Package.xlsx>

²⁸ Pennsylvania P.U.C., "Technical Reference Manual, Volume 2: Residential Measures", Aug. 2019 (rev. Feb. 2021), p. 155.

²⁹ Regional Technical Forum, Northwest Council, "ResDoorSweep_v2_1.xlsm", Jul. 17, 2023, "Summary" worksheet.

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1.6.5 (F.5) Updates to Building Weights Using 2022 Commercial End Use Study (CEUS)

Effective Program Year: 2028. The CEUS results were used to update the commercial building weights that are used to generate the unit-energy consumption and unit-energy savings values for the “Com” sector-level commercial building type.

1.6.6 (F.6) New Gas Impact Profile IDs

Effective Program Year: 2026. The 2022 Avoided Cost Calculator includes adders for methane leakage for upstream leakage and for behind the meter leakage.³⁰ They state that upstream leakage is to be applied to both residential and commercial measures, but downstream leakage is only to be applied to residential fuel substitution measures where a gas appliance is removed. To implement this, three GasImpactProfileIDs were added:

- Annual-FuelSub-ToElec
- Winter-FuelSub-ToElec
- Summer-FuelSub-ToElec

These should only be used for gas-to-electric fuel substitution measures where a gas appliance is removed. The avoided cost combinations associated with these IDs will have the same load shapes as their non-fuel-sub counterparts, but the avoided cost combination will include behind the meter methane leakage adder for residential measures.

1.6.7 (F.7) New TechTypes

Effective Program Year: 2026. Structural changes made to the TechType table included adding flags to indicate whether a given TechType uses natural gas (UsesGas) and/or uses electricity (UsesElec). As a result it was necessary to replace some of the existing TechTypes with two TechTypes (e.g., the “Fryer” TechType is replaced with “Fryer-Elec” and “Fryer-Gas” TechTypes), the TechTypes added to DEER are shown in Table A-1-17. Other TechTypes were added to support new mid-cycle measure packages or measure package offerings.

³⁰ <https://cedars.cpuc.ca.gov/deer-resources/tools/supporting-files/file/3105/download>

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Table A-1-17. TechTypes added to DEER

TechGroup	Description	Elec. TechType(s)	Gas TechType
Clean equip	Dishwasher, Door Type	DishWash-Door	N/A
	Dishwasher, Res.	DishWash-Res	N/A
	Dishwasher, Undercounter	DishWash-Under	N/A
Cook equip	Broiler	Broiler-Elec	Broiler-Gas
	Broiler, Conveyor	N/A	ConveyBroiler-Gas
	Fryer	Fryer-Elec	Fryer-Gas
	Fryer, Pressure	PressFryer-Elec	PressFryer-Gas
	Griddle	Griddle-Elec	Griddle-Gas
	Oven	Oven-Elec	Oven-Gas
	Oven, Combination	OvenComb-Elec	OvenComb-Gas
	Oven, Convection	OvenConv-Elec	OvenConv-Gas
	Oven, Conveyor	OvenConvey-Elec	OvenConvey-Gas
	Oven, Deck	OvenDeck-Elec	OvenDeck-Gas
	Oven, Rack	OvenRack-Elec	OvenRack-Gas
	Oven, Rotisserie	Rotisserie-Elec	Rotisserie-Gas
	Range	Range-Elec, Range-Induct	Range-Gas
	Soup Well	SoupWell-Induct	N/A
	Steamer	Steamer-Elec	Steamer-Gas
Stovetop	Stovetop-Elec, Stovetop-Induct	Stovetop-Gas	
Toaster	Toaster	N/A	
PoolSpa_eq	Swimming Pool/Spa Heater	PoolHeater-Elec, PoolHeater-HP	PoolHeater-Gas

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2 Research Needs for PY2028-29

Effective Program Year: 2028. The focus of future research needs to center around forecasting important updates that will have significant impact on deemed measure savings. Future codes and standards and emerging technologies are two broad categories that influence how measure baseline definitions evolve resulting from new codes and standards. Additional research may be needed to bridge from case studies to a reliable sample or pilot evaluation that can be used to create a new measure. Beyond the baseline research and to support new measures, further research could support newer policies and use assumptions that could be updated with research. These items may not be measure specific and could affect default parameters such as NTG or EUL.

2.1 (G) Research to Improve HVAC Refrigerant Charge Values

Effective Program Year: 2028. Since the avoided emissions due to refrigerant leakage have a direct effect on both the cost effectiveness of a given measure offering and—for fuel substitution measures—whether a given measure offering permutation passes part two of the fuel substitution test, it is important to have a better understanding of the refrigerant charge (lb./NormUnit) for HVAC systems and products. A study should answer the following research questions using product information from no fewer than three leading manufacturers of products sold in California:

1. Does the amount of refrigerant charge increase proportionally to the Cap-Tons for air conditioning equipment for all sizes? Should these be binned?
2. Does the amount of refrigerant charge increase proportionally to the Cap-kBtuh for HVAC heat pump equipment? Should these be binned?
3. Does the amount of refrigerant charge vary by efficiency tier? And if so, by how much?
4. Does the amount of refrigerant charge vary by refrigerant? And if so, by how much?

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2.2 (H) VRF Heat Pump and AC Performance Curves

Effective Program Year: 2028. SDG&E has funded additional research in high efficiency equipment using inverter-driven compressors with variable refrigerant flow to further address data gaps in the study that SDG&E performed in 2023. We support this research and recommend relying on published independent lab-test data rather than manufacturer data to inform performance curves.

2.3 (I) Improvements for Commercial Water Heater and Hot Water Measures

Effective Program Year: 2028. In the past year, CPUC staff and staff consultants conducted literature and internet research to identify whether more recent hot water load profiles could be identified for commercial buildings. This effort did not identify any sources that would be better than those presently in use in the DEER Water Heater Calculator v5.1. The Ex Ante Review Team will revisit this effort once the last of the data gathered during the 2019 Commercial End Use Study (CEUS) has been published. Additional activity-level load shapes (e.g., gyms, laundromats) will be pursued for development. Pathways to migrating these commercial measures into EnergyPlus that are currently modeled using the DEER Water Heater Calculator will be explored. New measures will also be developed using EnergyPlus templates in phases as follows:

1. Large central water heating measures
2. Small split-system heat pump water heating measures
3. Small unitary “one-to-one” water heating measures

Given that load shifting may be pursued as an energy efficiency measure on a limited basis, we may shift the order of the phases in the future.

3 Measure Adoption

Effective Program Year: 2024-2025 and 2026-2027. This resolution will adopt and lock approved ex ante values contained in the measure packages for PY2026-2027 and mid-cycle change from PY2024-25. New guidance that has not been previously issued is provided in the sections below.

3.1 (J) Guidance from 2021 Custom Industrial, Agricultural, and Commercial (CIAC) Impact Evaluation

Effective Program Year: 2026. The 2020-2021 CIAC study³¹ evaluated electric and gas energy reductions by the CIAC program, which includes Savings by Design (SBD) and custom programs. All lighting calculators (Modified Lighting Calculator, Easy Lighting Calculator, GrowGreen Calculator, SCE's Type B TLED Calculator) use DEER inputs for hours of use (HOU), coincidence demand factors, and interactive effects. PAs should use area-specific categories to facilitate correct accounting of savings when installations significantly deviate from the DEER building type HOU assumptions. Per D.12.05.015, the PAs can conduct a study to develop additional HOU categories if DEER values are not available or not applicable. That said, the study found that DEER EUL/HOU values were generally accurate, and the DEER EULs should continue to be used when available. This recommendation is subject to ongoing collaboration with the custom project review ex-ante team and the MLC update.

In general, the study supported the improvement of thorough review of measure application types (MATs) applied to claims and/or projects, appropriate baseline application, more permit documentation for savings by design projects, and a general improvement in documentation including customer contact information.

The deemed portion of a custom project is recommended to be clearly identified as a deemed claim with deemed savings. There are no changes to current DEER values as a result of this study.

³¹ [https://pda.energydataweb.com/api/downloads/2816/CIAC 2020-2021 Evaluation Final Report - Revised.pdf](https://pda.energydataweb.com/api/downloads/2816/CIAC%2020-2021%20Evaluation%20Final%20Report%20-%20Revised.pdf)

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3.2 (K) Guidance from Effective Useful Life (EUL) studies

Effective Program Year: 2024-2025. This section summarizes CPUC guidance for measure packages related to three recent effective useful life (EUL) studies.

3.2.1 (K.1) 2023 Residential Insulation EUL Study updates

Effective Program Year: 2024. The CPUC Group A 2023 Residential Insulation EUL Study FINAL Report³² published in December 2023 presents the report findings of a 30-year EUL for ceiling and wall insulation measures. The findings of this study updated the following insulation measures for program years 2024-25 with the new EULs per O.P. 5 in D.23-04-035 and as shown in Table A-3-1.

Table A-3-1. EUL Results from 2023 Residential Insulation EUL Study

Measure	Existing EUL_ID, years	DEER2024 EUL_ID, years
Ceiling Insulation (SWBE006)	BS-Ceillns: 20.0	BS-Ceillns: 30.0
Wall Insulation, both blown-in and non-blown-in insulation (SWBE007)	BS-BlowInIns: 20.0 BS-WallIns: 20.0	BS-BlowInIns: 30.0 BS-WallIns: 30.0

3.2.2 (K.2) 2023 Residential HVAC and Water Heating EUL Study updates

Effective Program Year: 2025. The 2023 Residential HVAC and Water Heating EUL Study updated the EUL for fuel substitution HVAC and water heating measures. The study focused on both measure case and baseline equipment EULs as shown in Table A-3-2. We direct that the EULs established in this study shall be used for the DEER2026 cycle.³³ Although residential central air conditioning was not part of this EUL study, the EUL (ID: HV-ResAC) was increased from 15 years to 23 years so that it was equal to the EUL of heat pumps. This is consistent with the commercial EUL, in that the air conditioner EUL was consistent with heat pump EUL. We direct that the EULs established in this study shall be used for the DEER2026 cycle, but also allow program administrators to utilize the updated values for their 2025 programs. This allows the programs to utilize the most current EUL to best capture the true values of these

³² <https://pda.energydataweb.com/api/downloads/3903/CPUC Group A 2023 Residential Insulation EUL Study Final Report.pdf>

³³ <https://pda.energydataweb.com/api/downloads/3952/CPUC Group A 2023 Res HVAC and DHW EUL Study Final Report.pdf>

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technologies and not miss opportunities to increase installations during the 2025 program year.

Table A-3-2. Results from 2023 Residential HVAC and Water Heating EUL Study

Measure	Existing EUL_ID, years	DEER2025 EUL_ID, years
Residential Heat Pump HVAC (Ductless and Central)	HV-ResHP: 15.0	HV-ResHP: 23.0
Residential Gas Furnace (Central and Wall)	HV-EffFurn: 20.0	HV-EffFurn: 30.0
Residential Heat Pump Water Heater	WtrHt-HtPmp: 10.0	WtrHt-Res-HPWH: 20.0
Residential Gas Storage Water Heater	WtrHt-Res-Gas: 11.0	WtrHt-Res-Gas: 25.0
Residential Gas Tankless Water Heater	WtrHt-Instant-Res: 20.0	WtrHt-Instant-Res: 20.0

3.2.3 (K.3) 2023 Commercial Measure EUL Study updates

Effective Program Year: 2025. The 2023 Commercial Measure EUL Study updated the EUL for fuel substitution HVAC and water heating measures. The study focuses on both measure case and baseline equipment EULs as shown in Table A-3-3. The EULs established in this study are to be formally adopted into the DEER2026 cycle.³⁴ In addition, the EULs established in this study should be formally adopted into DEER2025 for reasons stated earlier.³⁵

³⁴ <https://pda.energydataweb.com/api/view/3980/CPUC%20Group%20A%202023%20Commercial%20HVAC%20and%20Water%20Heating%20EUL%20Study%20Final%20Report.pdf>

³⁵ <https://pda.energydataweb.com/api/view/3980/CPUC%20Group%20A%202023%20Commercial%20HVAC%20and%20Water%20Heating%20EUL%20Study%20Final%20Report.pdf>

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Table A-3-3. EUL Results from 2023 Commercial HVAC and Water Heating EUL Study

Measure	Existing EUL_ID, years	DEER2025 EUL_ID, years
Commercial Heat Pump HVAC (Ductless and Central)	HVAC-airHP: 15.0	HVAC-airHP: 20.0
Commercial Air Conditioner (packaged and split with gas heating)	HVAC-airAC: 15.0	HVAC-airAC: 20.0
Commercial Heat Pump Water Heater	WtrHt-HtPmp: 10.0	WtrHt-Com-HPWH: 13.0
Commercial Gas Storage Water Heater	WtrHt-Com: 15.0	WtrHt-Com: 13.0
Commercial Gas Tankless Water Heater	WtrHt-Instant-Com: 20.0	WtrHt-Instant-Com: 20.0

3.3 (L) Guidance Based on Other Studies

Effective Program Year: 2026. This section summarizes CPUC guidance for measure packages related to three other recent studies.

3.3.1 (L.1) Hard-to-Reach (HTR) Net-to-Gross Ratios

Effective Program Year: 2026. Resolution E-5221 required research to determine whether there was evidence for having different default net-to-gross ratios (NTGRs) for HTR and non-HTR customers participating in direct install and downstream programs. The results of this study³⁶ found insufficient evidence to support having different NTGRs for participants in direct install programs. For residential participants—both HTR and non-HTR—the NTGR was 0.89 and 0.87, respectively; for commercial participants, these were 0.65 and 0.71, respectively. No statistically significant difference was found between these pairs of results. For commercial participants, the results were less conclusive and had relative precision results that were outside of the targeted $\pm 10\%$. The resulting updates in DEER are as shown in Table A-3-4.

³⁶ “Group A Forward Looking Research: Cross-Program Net-to-Gross Ratios for Hard-to-Reach Customers”, August 2024. (see <https://pda.energydataweb.com/#!/documents/4023/view>)

Table A-3-4. Recommended updates to NTG_IDs and NTGRs

Sector	Existing/Related NTG_IDs	Recommended Change	DEER2026 NTG_ID
Res	Res-Default>2: 0.55	Shall no longer be used for direct install measures	Res-Default-di: 0.90
	All-Default<=2yrs: 0.70		
	Res-Default-HTR-di: 0.85	Expire	
Com	Com-Default>2yrs: 0.60	Shall no longer be used for direct install programs	Com-Default-di: 0.70
	All-Default<=2yrs: 0.70		
	Com-Default-HTR-di: 0.85	Expire	

The change to the NTGR for HTR customers does not, however, modify the expectation that programs will continue to serve HTR customers and track which participants are categorized as HTR along with the criteria used to qualify them at HTR.

3.3.2 (L.2) High-SEER Heat Pump and AC Performance Curves

Effective Program Year: 2026. Resolution E-5221 requested research to inform revised EnergyPlus performance curves for high SEER inverter-driven heat pumps. The study, titled “Adding SEER2 VCHP Offerings to DEER” and funded by SDG&E, was completed in November 2023. Although the study tried to obtain manufacturer performance data from a wide range of systems, they were only successful at getting sufficient information from two manufacturers: one product line from each. The authors developed performance curves from this data, and ultimately recommended one curve to represent all high-SEER equipment. The curves are very similar to the previous multispeed DEER curves for air conditioner performance (see Figure A-3-1) but differ for heat pump performance (see Figure A-3-2).³⁷ In the new curves heating capacity degrades by only 10% at 32 °F compared to the 20% degradation using the earlier curves. Although it may be true that heat pump heating performance has improved with the introduction of cold climate heat pumps in the past ten years, it is difficult to justify a change to the curves for all SEER-rated equipment based on data from such a small number of systems, therefore heat pumps designed for cold weather temperatures should use different performance curves once there is sufficient data obtained to generate curves that have robustness similar to the existing set.

³⁷ In the figures OEM stands for Original Equipment Manufacturer, and refers to the new curves developed in the SDG&E-funded study

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Figure A-3-1. Cooling performance curves at 75 °F indoor wet bulb

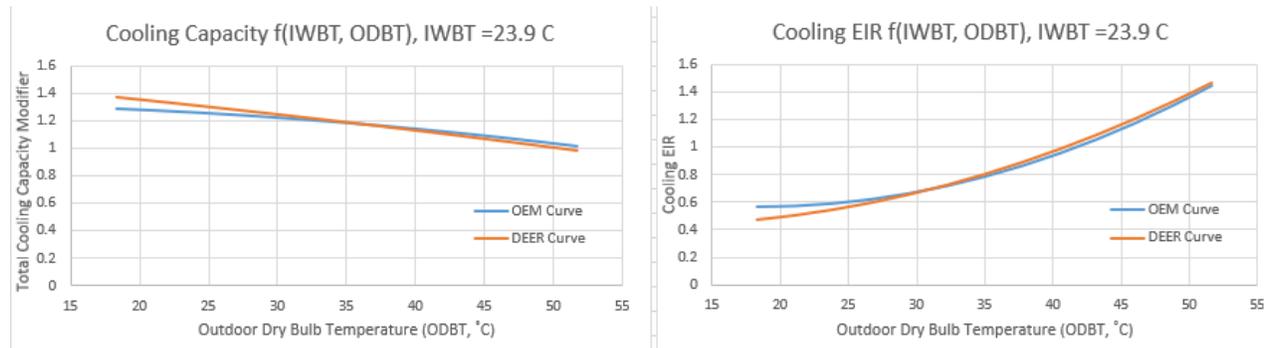
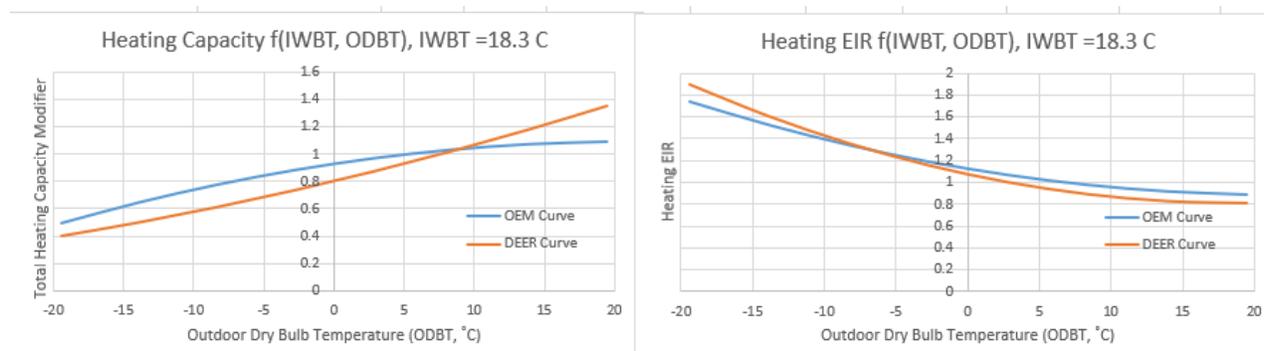


Figure A-3-2. Heating performance curves at 65 °F indoor wet bulb



The previous DEER curves were based on a 2013 NREL report “Improved Modeling of Residential Air Conditioners and Heat Pumps for Energy Calculations.” That report compared lab-test data to manufacturer-reported data and found the manufacturers extended performance table data to be unreliable. Therefore, the NREL report based its performance curves on AHRI 210/240 laboratory testing of 460 air conditioner and heat pump systems. Because this older study uses a much more robust dataset, we cannot justify a change to the performance curves based on potentially unreliable manufacturer-reported data from only eight systems.

Although we don’t recommend updating the performance curves at this time, we do agree with the study’s other recommendations. Variable compressor systems should be modeled using the MULTISPEED function in EnergyPlus, setting the number of compressor speeds to 4, and using no cycling losses for speeds 4, 3, and 2. This represents a 4:1 turn-down ratio which was determined for the eight system in this study based on Air-conditioning, Heating, and Refrigeration Institute (AHRI) 210/240

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data from the Northeast Energy Efficiency Partnership's (NEEP's) cold climate air source heat pump (ccASHP) database.

The study also recommends, and we agree, that measure packages include program requirements intended to ensure that the new offerings function correctly.

1. Require the OEM-recommended controls and thermostats.
2. Outdoor units must be considered capable of "variable capacity" performance (reference the definition we provided in the "Introduction to VCHP Technology" section of this report, based on AHRI 210/240 definitions).
3. If high efficiency air-handling unit (AHU) offerings are pursued, consider performance requirements such as an electronically commutated motor (ECM) or ≥ 3 fan speed settings.

3.3.3 (L.3) Boiler Compliance with Condensation of Exhaust Gases and Energy Efficiency

Effective Program Year: 2026. Resolution E-5221 requested research to inform updates to measure packages consisting of condensing boilers. For a boiler to run in condensing mode, the return water temperature must be below 140 °F. CPUC staff has approved measures for condensing boilers, but it is necessary verify that they operate in a mode where the return water temperatures are low enough to allow for condensing of water vapor in the exhaust gases. The study yielded the following key findings:

- The hot water return temperature must be below 130 °F for condensing boilers to start operating in condensing mode. To achieve the system's peak or advertised efficiency (e.g., 97% efficiency), a much lower return temperature will be needed.
- Supply hot-water temperatures for condensing boiler systems should not exceed 140 °F in order to achieve the low return-water temperature.
- For retrofit projects (replacing boilers only), it is likely that most of the existing end use equipment (e.g., heating coils, radiators, etc.) is not designed for low supply temperatures but is typically designed for a supply temperature of 180 °F. As such, it is very likely that end-user equipment will most likely need to be upgraded or go through extensive commissioning for the new condensing boilers to operate in condensing mode.

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- Condensing boilers in retrofit systems are expected to operate in condensing mode less than 50% of the time. New construction systems can be expected to condense greater than 90% of the time given that they are designed for condensing operation.
- Boiler outside-air reset control is a standard feature with condensing boilers. 2022 CA Title 24 code requires new hydronic systems larger than 500,000 Btu/h to include reset temperature control. Typical boiler reset temperature has a delta-T range of 20 °F – 60 °F.

3.4 (M) Guidance from Review of PY2021 and PY2022 EM&V Reports for Deemed Measure Claims

Effective Program Year: 2026. EM&V market sector evaluation results and/or special studies will continue to be some of the primary sources for DEER measure and measure package updates. Evaluation results with sufficient rigor and precision will be used to update DEER and measure package assumptions. Parameters in need of data to reduce uncertainty or increase accuracy will also be identified and fed back into the next EM&V cycle. This review is focused on evaluations of PY2021 and PY2022 claims from the following studies:

1. Comfortably California HVAC Statewide Third-Party Program Evaluation, Program Year 2021
2. Foodservice Instant Rebates Statewide Third-Party Program Evaluation, Program Year 2021
3. PY2021 MCE Impact Evaluation Final Report
4. Program Year 2021 Residential Energy Efficiency Impact Evaluation
5. CPUC Group A Residential Direct Install Program Final Impact Evaluation - Program Year 2021
6. CPUC Group A Local Third-Party Programs PY2021 - Final Impact Evaluation Report
7. CPUC Group A Impact Evaluation of Southern California Edison's Plug Load and Appliance Program, Program Year 2021
8. Local Third-Party Programs Impact Evaluation, Program Year 2022
9. Regional Energy Network Evaluation, Program Year 2022

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10. Third-Party Commercial Programs Impact Evaluation Program Year 2022

CPUC staff has examined the 2021 and 2022 EM&V final impact evaluation reports and other studies to identify findings that may result in updates to deemed measure parameters and/or savings estimation approaches.

The list of studies reviewed is provided in Table A-3-5 along with links to where they are stored on the Energy Project Status Reporting System. Also, a complete list of the studies to consider is provided in Appendix E of the CPUC’s 2019-2021 EM&V Plan and the Energy Project Status Reporting System.³⁸

Table A-3-5. Final EM&V Studies Reviewed

Study	Study Title (with link)	Evaluated PY2021 or PY2022 Measures
1	Comfortably California HVAC Statewide Third-Party Program Evaluation, Program Year 2021	SWHC001 – Wall Furnace, Residential SWHC004 – Space Heating Boiler, Commercial & Multifamily SWHC013 – Unitary Air-Cooled Air Conditioner Over 65 kBtu/hr, Commercial SWHC014 – Unitary Air-Cooled Air Conditioner or HP Under 65 kBtu/hr, Commercial SWHC031 – Furnace, Residential SWHC049 – SEER Rated AC and HP HVAC Equipment, Residential

³⁸ <https://psr.energydataweb.com/#!/project-status>

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Study	Study Title (with link)	Evaluated PY2021 or PY2022 Measures
2	<u>Foodservice Instant Rebates Statewide Third-Party Program Evaluation, Program Year 2021</u>	SWCR017 – Ultra-Low Temperature Freezer, Commercial SWCR018 – Reach-In Refrigerator or Freezer, Commercial SWFS001 – Convection Oven, Commercial SWFS002 – Door-Type Dishwasher, Commercial SWFS003 – Combination Oven, Commercial SWFS004 – Griddle, Commercial SWFS005 – Steamer, Commercial SWFS006 – Ice Machine, Commercial SWFS007 – Insulated Hot Food Holding Cabinet, Commercial SWFS009 – Deck Oven, Electric, Commercial SWFS011 – Fryer, Commercial SWFS012 – Exhaust Hood Demand Controlled Ventilation, Commercial SWFS014 – Rack Oven, Gas, Commercial SWFS017 – Automatic Conveyor Broiler, Commercial SWFS018 – Undercounter Dishwasher, Commercial SWFS019 – Underfired Broiler, Commercial
3	<u>MCE Impact Evaluation Final Report, Program Year 2021</u>	SWLG009 – LED, Tube, Type A
4	<u>Residential Energy Efficiency Impact Evaluation, Program Year 2021</u>	SWAP003 – Clothes Dryer, Residential SWAP004 – Clothes Washer, Residential SWHC001 – Wall Furnace, Residential SWHC031 – Furnace, Residential SWHC039 – Smart Thermostat, Residential SWHC047 – Gas Fireplace, Residential SWRE004 – Pool Heater, Residential SWSV001 – Duct Seal, Residential SWWH002 – Low-Flow Showerhead, Residential SWWH010 – Boiler, Multifamily SWWH012 – Storage Water Heater, Residential SWWH013 – Tankless Water Heater, Residential

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Study	Study Title (with link)	Evaluated PY2021 or PY2022 Measures
5	<u>Residential Direct Install Program Impact Evaluation, Program Year 2021</u>	SWHC029 – Fan Controller for Air Conditioner, Residential SWHC038 – Brushless Fan Motor Replacement, Residential SWHC039 – Smart Thermostat, Residential SWSV001 – Duct Seal, Residential SWSV006 – Refrigerant Charge Adjustment, Residential SWWH001 – Faucet Aerator, Residential

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Study	Study Title (with link)	Evaluated PY2021 or PY2022 Measures
6	<u>Local Third Party Programs Impact Evaluation, Program Year 2021</u>	SWAP012 – Gas Dryer Modulating Valve, Commercial and Multifamily SWHC002 – Intermittent Pilot Light, Residential SWHC029 – Fan Controller for Air Conditioner, Residential SWHC031 – Furnace, Residential SWHC038 – Brushless Fan Motor Replacement, Residential SWHC039 – Smart Thermostat, Residential SWLG009 – LED, Tube, Type A SWPR003 – Steam Trap, Commercial SWSV001 – Duct Seal, Residential SWSV006 – Refrigerant Charge Adjustment SWSV007 – Condenser Coil Cleaning, Residential SWSV009 – Airflow Adjustment, Residential SWWH001 – Faucet Aerator, Residential SWWH002 – Low-Flow Showerhead, Residential SWWH003 – TSV with and without an Integrated Low-Flow Showerhead, Residential SWWH006 – Tankless Water Heater, Commercial SWWH013 – Tankless Water Heater, Residential SWWH015 – Demand Control for Centralized Water Heater Recirculation Pump, Multifamily & Commercial SWWH016 – Domestic Hot Water Loop Temperature Controller, Multifamily & Commercial SWWH017 – Hot Water Pipe Insulation, Nonresidential & Multifamily SWWH018 – Hot Water Tank Insulation, Nonresidential & Multifamily SWWH020 – Low-Flow Showerhead, Commercial SWWH023 – Diverting Tub Spout with TSV, Residential SWWH026 – Water Heater Pipe Wrap, Residential SWWH027 – Heat Pump Water Heater, Commercial, Fuel Substitution

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Study	Study Title (with link)	Evaluated PY2021 or PY2022 Measures
7	<u>Southern California Edison's Plug Load and Appliance Program, Program Year 2021</u>	SWHC044 – Ductless HVAC, Residential, Fuel Substitution SWHC045 – Heat Pump HVAC, Residential, Fuel Substitution SWHC050 – Ductless Heat Pump, Residential SWWH025 – Heat Pump Water Heater, Residential, Fuel Substitution

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Study	Study Title (with link)	Evaluated PY2021 or PY2022 Measures
8	<u>Local Third Party Programs Impact Evaluation, Program Year 2022</u>	SWAP012 – Gas Dryer Modulating Valve, Commercial and Multifamily SWCR018 – Reach-In Refrigerator or Freezer, Commercial SWFS003 – Combination Oven, Commercial SWFS006 – Ice Machine, Commercial SWHC029 – Fan Controller for Air Conditioner, Residential SWHC038 – Brushless Fan Motor Replacement, Residential SWHC039 – Smart Thermostat, Residential SWLG009 – LED, Tube, Type A SWLG018 – LED, Tube, Type B and C SWPR003 – Steam Trap, Commercial SWSV001 – Duct Seal, Residential SWWH001 – Faucet Aerator, Residential SWWH002 – Low-Flow Showerhead, Residential SWWH003 – TSV with and without an Integrated Low-Flow Showerhead, Residential SWWH006 – Tankless Water Heater, Commercial SWWH013 – Tankless Water Heater, Residential SWWH015 – Demand Control for Centralized Water Heater Recirculation Pump, Multifamily & Commercial SWWH016 – Domestic Hot Water Loop Temperature Controller, Multifamily & Commercial SWWH017 – Hot Water Pipe Insulation, Nonresidential & Multifamily SWWH018 – Hot Water Tank Insulation, Nonresidential & Multifamily SWWH023 – Diverting Tub Spout with TSV, Residential SWWH025 – Heat Pump Water Heater, Residential, Fuel Substitution SWWH026 – Water Heater Pipe Wrap, Residential SWWH027 – Heat Pump Water Heater, Commercial, Fuel Substitution SWWH028 – Large Heat Pump Water Heater, Commercial and Multifamily, Fuel Substitution SWWH031 – Heat Pump Water Heater, Commercial

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Study	Study Title (with link)	Evaluated PY2021 or PY2022 Measures
9	Regional Energy Networks Evaluation, Program Year 2022	SWAP004 – Clothes Washer, Residential SWAP006 – Dishwasher, Residential SWAP010 – Smart Connected Power Strip SWAP013 – Cooking Appliances, Residential, Fuel Substitution SWAP014 – Heat Pump Clothes Dryer, Residential, Fuel Substitution SWBE006 – Ceiling Insulation, Residential SWBE007 – Wall Insulation, Residential SWHC005 – Water-Cooled Chiller SWHC031 – Furnace, Residential SWHC039 – Smart Thermostat, Residential SWHC044 – Ductless HVAC, Residential, Fuel Substitution SWHC045 – Heat Pump HVAC, Residential, Fuel Substitution SWHC049 – SEER Rated AC and HP HVAC Equipment, Residential SWRE003 – Heater for Pool or Spa, Commercial and Multifamily SWSV001 – Duct Seal, Residential SWWH001 – Faucet Aerator, Residential SWWH002 – Low-Flow Showerhead, Residential SWWH012 – Storage Water Heater, Residential SWWH013 – Tankless Water Heater, Residential SWWH014 – Heat Pump Water Heater, Residential SWWH015 – Demand Control for Centralized Water Heater Recirculation Pump, Multifamily & Commercial SWWH017 – Hot Water Pipe Insulation, Nonresidential & Multifamily SWWH025 – Heat Pump Water Heater, Residential, Fuel Substitution

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Study	Study Title (with link)	Evaluated PY2021 or PY2022 Measures
10	Third-Party Commercial Program Evaluation, Program Year 2022	SWCR001 – Anti-Sweat Heater Controls SWCR004 – ECM Retrofit for a Walk-in Cooler or Freezer SWCR005 – Auto Closer for Refrigerated Storage Door SWCR015 – Medium-Temperature Case Doors SWHC027 – Package Terminal Air-Conditioner or Heat Pump, Under 24 kBtu/hr SWHC042 – Evaporative Pre-Cooler System and Controls for Packaged HVAC Unit SWLG009 – LED, Tube SWLG011 – LED, High or Low Bay SWLG018 – LED, Tube, Type B and Type C SWWH027 – Heat Pump Water Heater, Commercial, Fuel Substitution SWWH028 – Large Heat Pump Water Heater, Commercial and Multifamily, Fuel Substitution SWWH031 – Heat Pump Water Heater, Commercial

We only considered EM&V studies that were expected to be final by April 2024. A summary of the recommended updates to gross unit energy savings (UES), and NTGRs resulting from PY2021 and PY2022 impact evaluations is provided in Table A-3-6 and Table A-3-7, respectively. In addition, CPUC staff has the authority to change the Custom project NTG values based on current studies or evaluation results.

Table A-3-6. Proposed UES Parameter Updates Based on EM&V Studies

Study	Measure	Previous UES	DEER2026 UES
5	SWHC039 - Smart Thermostat, Residential	Varies	Low GRR indicates further investigation
	SWHC059 – Smart Fan Controller, Residential	Varies	Revise baseline

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Study	Measure	Previous UES	DEER2026 UES
	SWHC038 – Brushless Fan Motor Replacement, Residential	Varies	Revise methodology
	SWWH001 – Faucet Aerator, Residential	Varies	Revise assumptions

Table A-3-7. NTGR Parameter Updates Based on Final EM&V Studies

Study	Measure	Current NTGR	Evaluated NTGR	DEER2026 NTGR
5	SWHC059 – Smart Fan Controller, Residential	0.88	0.76	0.80
	SWHC038 – Brushless Fan Motor Replacement, Residential	0.85	0.86	0.90
	SWHC039 – Smart Thermostat, Residential (direct install only)	0.95	0.83	0.85
	SWSV001 – Duct Seal, Residential	0.95	0.91	0.95*
	SWWH001 – Faucet Aerator, Residential (all residential building types except multi-family)	0.59	0.81	0.85
	SWWH002 – Low-Flow Showerhead, Residential	0.70	0.81	0.85
6	SWAP012 – Gas Dryer Modulating Valve, Commercial and Multifamily (downstream and excluding dwellings)	0.60	0.83	0.85
	SWWH017 – Hot Water Pipe Insulation, Nonresidential and Multifamily (direct install and multifamily only)	0.55	0.64	0.65
	SWWH026 – Water Heater Pipe Wrap, Residential (direct install)	0.55	0.88	0.90

*Evaluated NTG for DEER2026 is unchanged from previously evaluated NTG value.

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3.4.1 Comfortably California HVAC Statewide Third-Party Program Evaluation, Program Year 2021

The Comfortably California HVAC Statewide Third-Party Program Evaluation reviewed targeted midstream/upstream programs of the following measures for PY2021: residential furnace, commercial packaged AC, residential AC and Heat Pump HVAC equipment, and commercial/multifamily space heating boilers.

The NTG results were not adopted because the evaluation found program attribution to be far too low to support a cost effective program and the evaluation made recommendations on how to improve attribution through program changes, rather than recommend adoption of the evaluated NTGRs for these measures delivered through the midstream/upstream channel. There are no changes to current DEER values as result of this study.

3.4.2 Foodservice Instant Rebates Statewide Third-Party Program Evaluation, Program Year 2021

The Foodservice Instant Rebates Statewide Third-Party Program Evaluation, Program Year 2021 examined the newly implemented midstream statewide rebate program offering efficiency incentives focused on serving the food service market. Most of the program claimed electric savings came from measures incentivizing steamers, ovens, refrigerators and freezers, and electric griddles while the gas savings was predominantly from gas fryers, ovens, broilers, and steamer equipment measures.

The evaluation found almost all measures were achieving the expected gross energy and demand impacts, except for the Ultra-Low Temperature Freezer, Commercial measure (SWCR017-02). For this measure package, lower than expected electric impacts (81% GRR) were found due to some of the claims for this measure either being reported using IFP-Food Processing and RSD-Restaurant-Sit-Down building types for which there are no recognized DEER permutation savings or inaccuracies in the claimed climate zone relative to the documented installation location. While the evaluation found that gross energy savings was meeting expectations, the evaluation's assessment of the program's attributable influence on the participants was far below expectations, with the evaluation determining a program-level net-to-gross ratio of 31%, whereas the claimed NTGRs ranged from 60 to 85%, depending on the measure package. This lower NTGR outcome was driven by the end-user survey results in which "over half of the

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end users said that the distributor recommendations were only ‘moderately influential’ on their decision to purchase equipment, with roughly a third saying they are ‘not influential at all.’”

There are no changes to current DEER values as result of this study as the program was still relatively new at the time of the evaluation and was expected to achieve higher influence attribution as the program developed and considers the evaluation recommendations.

3.4.3 MCE Impact Evaluation Final Report, Program Year 2021

The MCE Impact Evaluation reviewed various program delivery types including the Commercial Efficiency Market (CEM) program. CEM is a Normalized Metered Energy Consumption (NMEC) program that pays aggregators a variable rate based on the time during which participants save electricity. The evaluation was conducted during the early stages of implementation and early feedback shows program influence on project expansion. Projects should continue to document accelerated replacement (AR) conditions and follow both custom (Resolution E-5115) and deemed guidance³⁹. The published results from this study do not have sufficient resolution to support updated lighting hours of use in DEER.

3.4.4 Program Year 2021 Residential Energy Efficiency Impact Evaluation

This study evaluated the impacts of Southern California Gas Company’s Residential Energy Efficiency Program administered in program year 2021, which provides incentives for customers adopting efficient gas appliances in single-family and multi-family existing buildings, as well as residential new constructions applications. The vast majority (82%) of savings claimed from this program came from tankless water heating measures, mostly in single-family and residential new construction applications. The evaluation found that the claimed tankless water measures were meeting expectations for gross energy impacts (net attribution was not studied) with a GRR ranging between 100 and 103%. A notable finding from the evaluation survey effort was a lower hot water setpoint temperature of 120/122 °F relative to the measure *package* value of 135 °F,

³⁹ Preponderance of Evidence Requirements for Accelerated Replacement of Deemed Measures, <https://cedars.cpuc.ca.gov/deer-resources/deemed-measure-packages/guidance/file/3060/download>

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though for tankless water heaters using the Deemed Hot Water Calculator in its current version, the annual energy usage is not affected by set point temperature

3.4.5 Residential Direct Install Program Impact Evaluation, Program Year 2021

This study determined measure-level gross realization rates, net-to-gross ratios, and evaluated program delivery performance for the residential direct install programs in PY2021. For these direct install programs, the NTG ratios are all higher than those claimed through the program, and it confirmed a NTG ratio of 0.95 for Residential Duct Seal measures. We recommend making changes to the DEER2026 direct install NTGRs for these measures in Table A-3-8.

Table A-3-8. Evaluated NTGR Findings in Residential Direct Install Programs, PY2021

Measure	Claimed NTGR (electric/gas)	Evaluated NTGR (electric/gas)	DEER2026 NTGR
SWHC029 – Fan Controller for Air Conditioner, Residential 'Res-sAll-mHVAC-FanCtrl-di'	0.69	0.76	0.80
SWHC038 – Brushless Fan Motor Replacement, Residential 'Res-sAll-mHVAC-FanMotor'	0.64/0.70	0.85/0.86	0.90
SWHC039 – Smart Thermostat, Residential 'Res-sAll-mHVAC-SCT-di'	0.90	0.83	0.85
SWWH001 – Faucet Aerator, Residential 'Res-mDHWaerator'	0.66	0.81	0.85
SWWH002 – Low-Flow Showerhead, Residential 'Res-sAll-mDHWshwr'	0.66	0.81	0.85

The study found low gross realization rates for smart thermostats, fan motor replacements and fan motor controls. Based on the study findings, we recommend that the underlying measure savings assumptions be re-evaluated for PY2026 revisions to these measure packages. The following assumptions should be re-assessed:

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- SWHC038 – Brushless Fan Motor Replacement, Residential: the baseline fan motor efficiency is based on a 15-year-old study.
- SWHC039 – Smart Thermostat, Residential: review the savings methodology and underlying data since this measure has a low realization rate relative to the savings which is based on CPUC’s Impact Evaluation of Residential HVAC Measures, Residential Sector – Program Year 2020.
- SWHC059 – Smart Fan Controller, Residential: review the methodology as it is applied to contemporary HVAC systems for relating the part-load ratio to savings impacts.
- SWWH001 – Faucet Aerator, Residential: the assumptions of hot water consumption or change in flow rate should be investigated and corrected if necessary.

3.4.6 Local Third-Party Programs Impact Evaluation, Program Year 2021

The study focused on third-party programs for PY2021 found a high share of the reported local 3PP savings would not have happened without the programs, indicating the programs reached population segments that benefited from the EE services. The programs also served a higher proportion of customers in disadvantaged communities (DAC).

For these local third-party programs, the NTG ratios are all higher than those claimed through the program, and we recommend making changes to the DEER2026 NTGRs for select measures that were not evaluated under the Residential Direct Install Program PY2021 Impact Evaluation. The NTG ratio findings are summarized below in Table A-3-9.

Table A-3-9. Evaluated NTG Findings in Local Third-Party Programs, PY2021

Measure	Claimed NTGR (electric/gas)	Evaluated NTGR (electric/gas)	DEER2026 NTGR
SWAP012 – Gas Dryer Modulating Valve, Commercial and Multifamily (downstream and excluding dwellings)	0.60	0.83	0.85

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Measure	Claimed NTGR (electric/gas)	Evaluated NTGR (electric/gas)	DEER2026 NTGR
SWWH017 – Hot Water Pipe Insulation, Nonresidential and Multifamily (direct install and multifamily only)	0.55	0.64	0.65
SWWH026 – Water Heater Pipe Wrap, Residential (direct install only)	0.55	0.88	0.90

3.4.7 Southern California Edison’s Plug Load and Appliance Program Impact Evaluation, Program Year 2021

The focus of this evaluation was to assess the gross and net impacts achieved through SCE’s Plug Load and Appliance (PLA) program in PY2021, which predominantly encouraged adoption of fuel substitution in residential space heating and water heating applications through midstream (HVAC) and upstream (DHW) program interventions.

The HVAC fuel substitution measures were found to save less site-level gross gas energy than expected, with central HVAC measures achieving around half (54%) of expected gas savings, down from 75% in PY2020, and ductless HVAC measures saving far less gas site-level gross gas energy savings at 6% of expectation, which is similar to the PY2020 finding. The gross site-level electric energy increases remain below expectation but increased relative to PY2020 findings with central HVAC measures realizing 69% of the expected increase, up from 64%, and the ductless HVAC measure realizing 85% of the expected electric energy increase, up from 68%. Influence attribution was not studied for the HVAC measures under the PY2021 evaluation as this effort was conducted just the prior year under the PY2020 HVAC Fuel Substitution Impact Evaluation report, the results and subsequent recommendations of which were adopted beginning in PY2024.

The claimed DHW measure installations were not verifiable and their gross impacts (site energy, source energy, and emissions) remain untested and uncertain due to the extremely limited available data collected by the program’s upstream delivery type, which effectively made these claims unevaluable for gross impacts or net influence attribution as the participating manufacturers did not track and document DHW units provided to the distributors in a manner that enabled identification of installation

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locations to study the achieved gross impacts nor the program's influence on the distributor's normal business practices or sales.

There are no changes to current DEER values as result of this study.

3.4.8 Local Third-Party Programs Impact Evaluation, Program Year 2022

The study focused on third-party programs for PY2022 and found a high share of the reported local 3PP savings would not have happened without the programs, indicating the programs reached population segments that benefited from the EE services. The programs also served a higher proportion of customers in disadvantaged communities (DAC).

Program attribution and NTG ratio is on par with claimed values indicating the programs are reaching the intended population segments. While the local third-party evaluation showed continued focus on HTR/DAC communities, the program implementers did not track efforts to obtain input from these communities making it difficult to evaluate procedural equity efforts.

There are no changes to current DEER values as result of this study.

3.4.9 REN Impact Evaluation, Program Year 2022

This study evaluated 18 active REN resource and non-resource programs in PY2022, run by Bay Area Regional Energy Network (BayREN), Southern California Regional Energy Network (SoCalREN), and Tri-County Regional Energy Network (3C-REN), but of which only three were resource programs that underwent an evaluation of claimed impacts: BAYREN08 (Single-family), BAYREN02/02A (multifamily), and SCR-RES-A1 (multifamily).

Overall, the RENs achieved higher electric savings than claimed for the single-family program (142% GRR) and most of the savings claimed for the multifamily programs (81% GRR for BAYREN and 97% for SoCalREN). The net-to-gross values for the multifamily programs electric results indicate that the programs reached populations that benefited from their interventions significantly (75% and 93% NTGR, respectively), but the single-family program had lower influence (58% NTRG), especially compared to the reported NTGR (97% for single family, 84% and 76% for the respective multifamily programs).

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The programs achieved almost all of the expected gross gas savings, with 96% of gross claimed savings realized (GRR). Like the electric case, the gross evaluated gas savings for the BAYREN02/02A multifamily program were notably lower (69% GRR) than claimed due to unclear measure characterizations and low in-service rates for the following measures: faucet aerators, showerheads, smart thermostats, power strips, common area lighting, and hot water loop controls. Additionally, as in the electric case, multifamily program attribution was high and above claimed levels (92% for BAYREN and 95% for SoCalREN), indicating that the programs succeeded in serving the right population segments, whereas the evaluated single-family program attribution was found to be near the reported level at 49%.

The single-family program had a lot of influence on either small measures (such as aerators and power strips) or large, expensive fuel substitution measures (such as central heat pumps and heat pump water heaters). On the other hand, the program motivated low proportions of the envelope, furnace, and less expensive fuel substitution measures. Results show that the NTGR for multifamily is high but are in line with recent multifamily NTGR estimates from other recent CPUC evaluations.

There are no changes to current DEER values as result of this study.

3.4.10 Third-Party Commercial Programs Impact Evaluation Program Year 2022

This study examined the impacts and attribution influence of three relatively new third-party commercial sector downstream delivered programs offered in PY2022 by the electric IOU program administrators. The majority of impacts claimed from these programs, and the focus for the evaluation of impacts, were for the following commercial refrigeration applied measures: auto-closers for refrigerated storage doors, anti-sweat heater controls, medium-temperature case doors. Additionally, these programs also claimed a small volume of commercial heat pump water heater measures, some classified as fuel substitution, that the evaluation focused on evaluating.

Overall, the evaluation found the program achieved the same or greater gross energy savings impacts compared to reporting expectations (108% electric energy, 123% electric demand, and 95% gas energy GRRs across the evaluated measure packages), with no issues discovered with in-service-rates and only minor adjustments to energy modeling input parameters for each evaluated measure. Net program influence attribution

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exceeded the reported values significantly, with evaluated NTGRs of 97% and 98% for electric and gas, respectively, compared to the reported 64% and 67% for electric and gas, meaning the end-user customers surveyed indicated the incentives and support provided for the program was highly influential to the adoption of these measures by the participating businesses.

There are no changes to current DEER values as result of this study as the majority of claims and evaluated influence attribution is tied to SWCR005 (Auto Closer for Refrigerated Storage Door), a measure package that is being sunset.