Attachment A
DEER2023 Update Summary

Contents

Lists of Tables and Figures

1 Introduction and background

Decision D.21-05-031, established the general approach to be used for the biennial Database for Energy Efficiency Resources (DEER) update. The updates are grouped into these nine topic areas:

1. Transition to eTRM
2. DEER methodology updates
3. DEER error corrections and clarifications
4. Review of energy efficiency evaluation, measurement, and verification (EM&V) studies
5. Review of codes and standards changes
6. Review of market and research studies
7. New measure additions
8. Support table updates

2 Transition to Electronic Technical Reference Manual (eTRM)

The eTRM (electronic Technical Reference Manual) launched Version 2.1 in January 2021 in accordance with direction given in the DEER2022 update Resolution E-5082. Throughout 2021, CPUC staff continues to work on transitioning ex ante data and review activities to the eTRM environment. The "workpaper" term is updated to "measure package" for improved consistency with the eTRM framework. Furthermore, the distinction between DEER and non-DEER is eliminated.

3 DEER methodology updates

DEER methodology updates affect the methods and approaches used to generate measures savings and support table values. Examples include changes that would alter the database structure, building prototype models, or the use of DEER database measures.

3.1 Feasibility study for transitioning to EnergyPlus™

Effective Program Year: 2024-2026. From Commission staff's ongoing analysis of the 2019 RASS data and other updates considered for the existing deemed building prototype system, it has become increasingly obvious that a forward-focused, significant overhaul of the existing system is needed rather than incremental modification and streamlining. Although the system was restructured for DEER2020, many of the basic underpinnings and assumptions used to construct and ground the models are also in need of updates and in need of additional transparency. Rather than streamlining and updating elements of the existing system as was proposed in the Scoping Document,[1] Commission Staff will instead assess the options for transitioning to an EnergyPlus-based system and away from the current eQUEST™/DOE2.3™-based system. Commission Staff's primary and critical need is to have a functional set of prototypes system that can be used to provide unit energy savings, unit energy added loads, and the associated load shapes for deemed energy efficiency measures.

[1] https://pda.energydataweb.com/#!/documents/2490/view

Another primary reason for pausing updates to the current prototype system is to allow use of the new CZ2022 weather data as quickly as possible to update measure packages. This urgency is driven by the need for PAs to submit a two-year ABAL to cover PY2022-2023 as directed by Decision D.21-05-031.[2] The P&G and the latest avoided costs already incorporate the CZ2022 weather data, so the measure packages used for ABALs should be synched as much as possible. Commission Staff and the PAs can use the existing MASControl3 (MC3) system as-is except for the changes needed to run simulation with the new CZ2022 weather files. Commission staff will focus immediately on working with PAs to identify the highest impact measures for the portfolio and utility measures and generate the updated results. Other measures can be processed for a PY2023 update or used as-is until the next iteration of prototypes as determined by the feasibility plan.

3.2 Update simulation weather files to CZ2022

Effective Program Year: 2023-24. The last ten years have been observed to be among the hottest on record, and temperatures and the frequency-duration of heat waves are expected to increase. The typical meteorological year (TMY) weather files used for deemed measure building simulations to date, CZ2010, were based on 12 years of National Oceanic Atmospheric Administration (NOAA) data from 1988 through 2009. PG&E launched a project in collaboration with the other IOUs, CEC, CPUC and White Box Technologies to update the typical year weather files used in California and produced a report[3] and presentation[4] documenting the methodology. New weather files (CZ2022) were created using a 20-year period from 1998 through 2017. The California Energy Commission (CEC) will be adopting new time-dependent valuation (TDV) costs and the CZ2022 weather data for the 2022 Title 24 update, effective January 1, 2023. To be in alignment with CEC, all non-residential simulated and other weather-dependent deemed measures will be updated with the CZ2022 weather data, with updated deemed savings values effective for program year 2023. The residential weather dependent measures will all be updated for program year 2024. All other weather-dependent deemed measures (residential and non-residential) not provided directly by CPUC-maintained tools effective January 1, 2023 and later shall also be updated using the CZ2022 weather files.

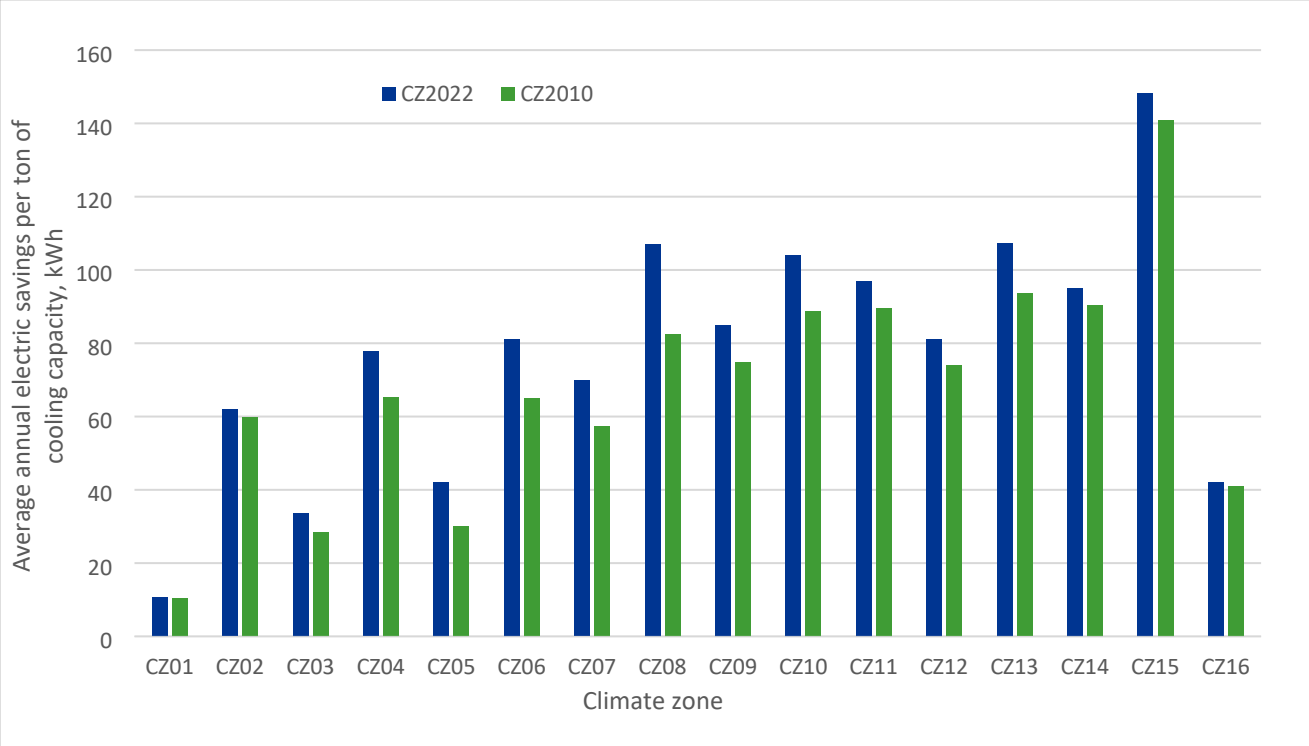
The new weather files are located on the DEER Resources website[5] and should be used by replacing the old (.BIN) weather files with the new (.BIN) weather files in the "DOE2/weather" folder before running the model. We are also making changes to the existing peak demand period with this weather update; see section 3.2 for updates to the starting date for the 3-day "heat wave" used to calculated peak demand. New post-processing scripts will be published on the DEER website that incorporate these new dates.

The following figures show examples of cooling dominated and heating dominated deemed measure savings estimated by building simulations using the new weather files compared to the old weather files for commercial and residential sectors. Across the board, cooling savings are higher and heating savings are lower using the new CZ2022 weather than they are using the older CZ2010 weather. The

[2] https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M378/K256/378256443.PDF
[3] Update of California weather files for use in utility energy efficiency programs and building energy standard compliance calculations, 2020. https://tinyurl.com/5akf9s2t
[4] https://pda.energydataweb.com/api/view/2280/Weather%20webinar%20CALEE2018%207-12-2019.pptx
[5] http://deeresources.com/index.php/mascontrol3-resources

savings are shown in Figure A-3-1 for a 12.5 EER,[6] 65 kBtu/h non-residential split/package air conditioning unit by California CEC climate zone.

Figure A-3-1. Annual savings by climate zone for commercial split/package AC systems

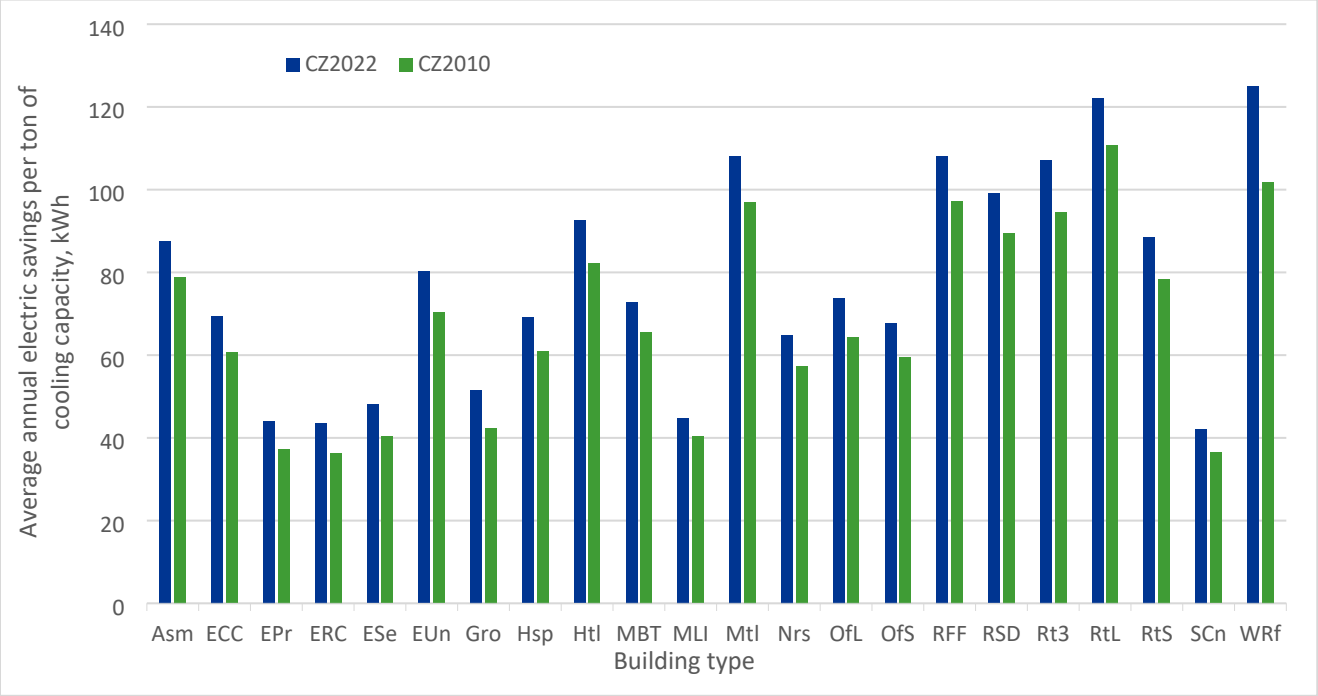


Equipment capacity: 65 kBtu/h; Equipment efficiency: 12.5 EER

Climate zones 4, 6, 8, 10 and 13 show the most change in cooling savings due to the new weather. Figure A-3-2 shows average deemed measure savings for the same system by DEER non-residential building types. The building type descriptions and corresponding abbreviations are shown in Table A-3-1. The refrigerated warehouse building type shows the most difference in savings due to the change in weather. Both figures show that, some climate zones and some building types show a greater weather impact than others.

[6] EER represents the energy efficiency ratio at full-load conditions.

Figure A-3-2. Annual savings by building type for commercial split/package AC systems



Equipment capacity: 65 kBtu/h; equipment efficiency: 12.5 EER

The next two figures show average heating savings from a non-residential, roof-top, package 92 AFUE furnace by climate zone in Figure A-3-3 and by building type in Figure A-3-4.

Figure A-3-3. Annual savings by climate zone for 92 AFUE commercial furnaces

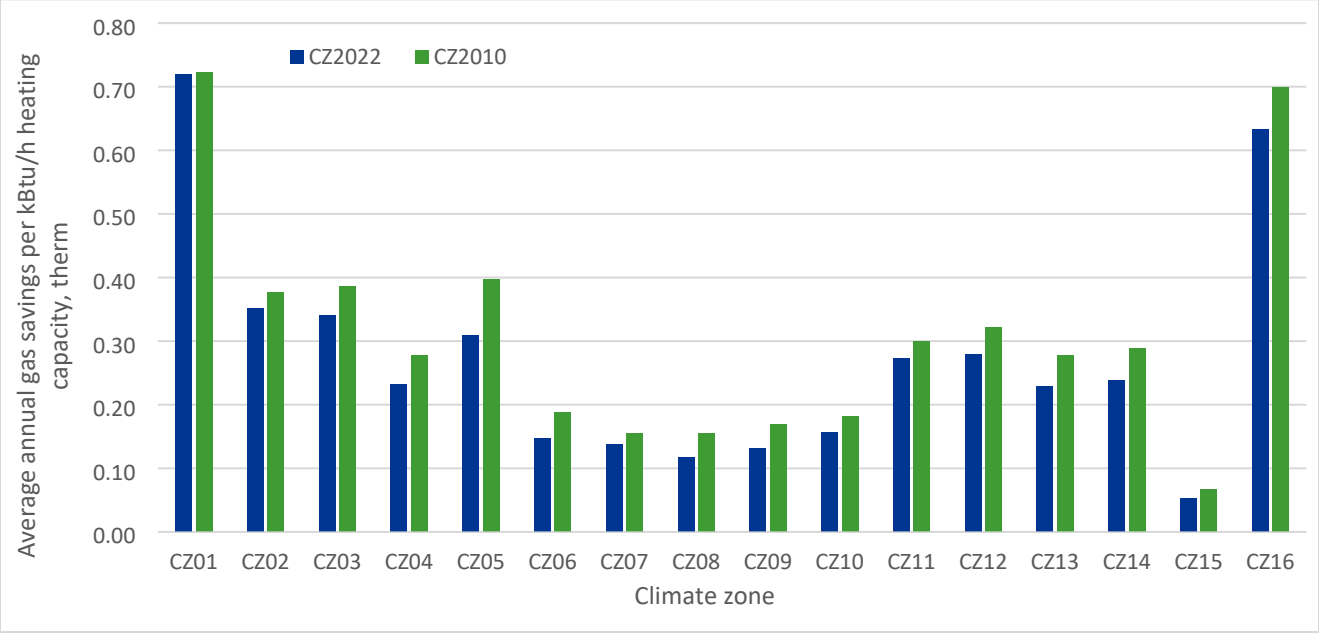


Figure A-3-4. Annual savings by building type for 92 AFUE commercial furnaces

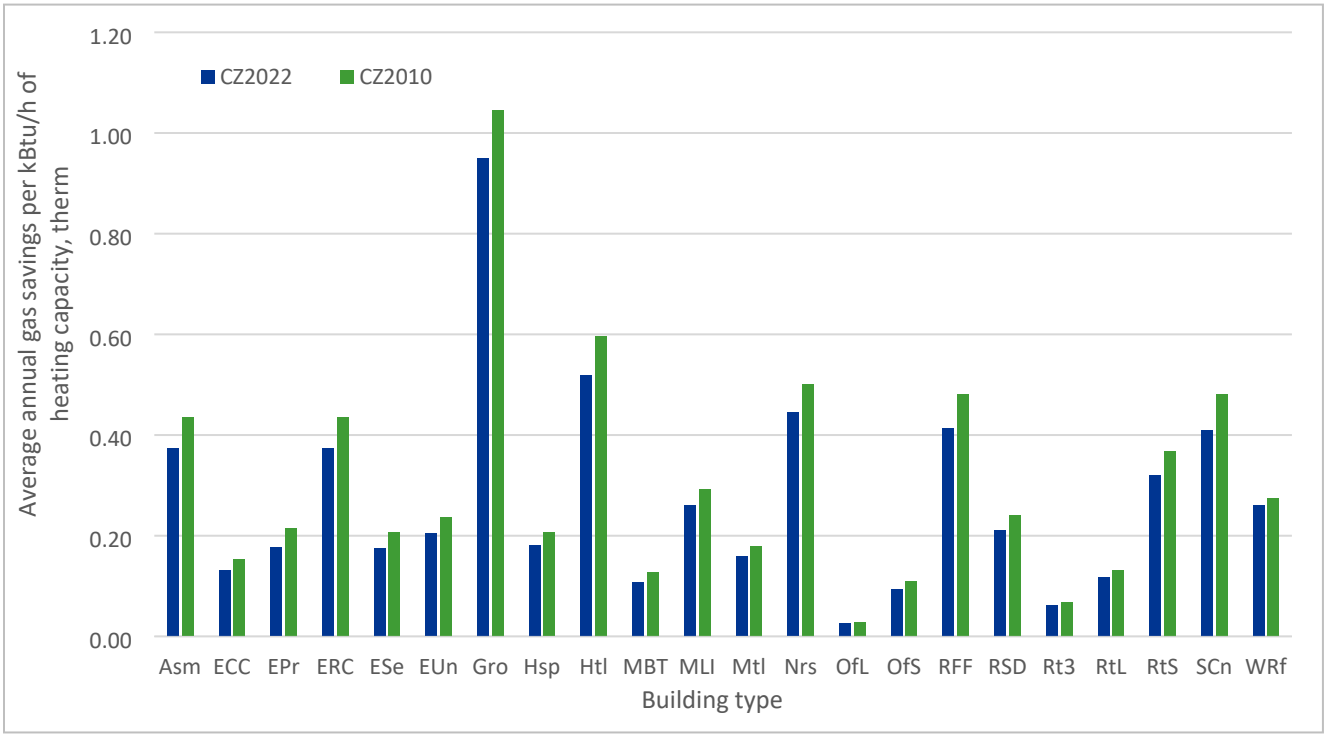


Table A-3-1. DEER Commercial Building type descriptions and codes

Description	Code
Assembly	Asm
Community College	ECC
Primary School	EPr
Secondary School	ESe
University	EUn
Grocery	Gro
Hospital	Hsp
Hotel	Htl
Bio/Tech Manufacturing	MBT
Light Industrial Manufacturing	MLI
Motel	Mtl

Description	Code
Nursing Home	Nrs
Large Office	OfL
Small Office	OfS
Fast-Food Restaurant	RFF
Sit-Down Restaurant	RSD
Department Store	Rt3
Big Box Retail	RtL
Small Retail	RtS
Conditioned Storage	SCn
Refrigerated Warehouse	WRf

The following figures show the effects of the weather change on residential cooling and heating measures. Figure A-3-5 shows the savings from an 18 SEER air conditioner by climate zone and Figure A-3-6 shows the savings from the same equipment by building type. We see same trend as in the commercial measures of increased energy savings for cooling dominated measures and decreased savings for heating dominated measures.

Figure A-3-5. Annual savings by climate zone for 18 SEER residential split/package AC systems

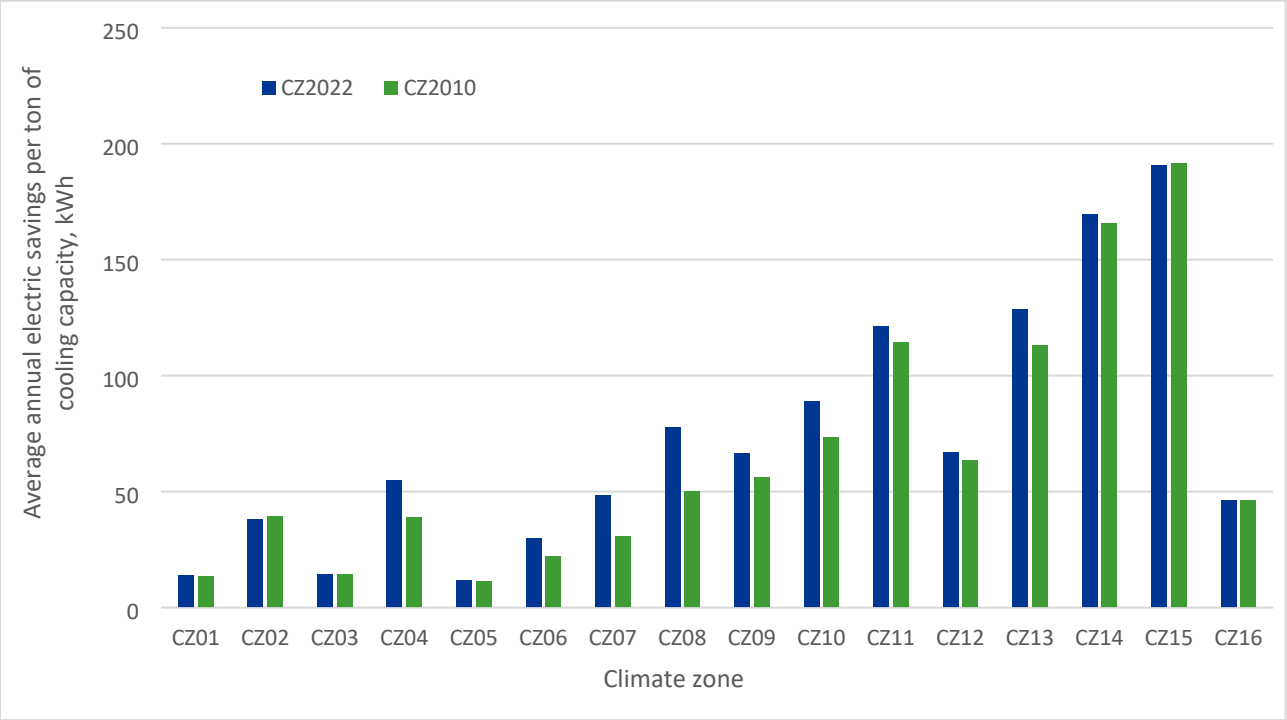


Figure A-3-6. Annual savings by building type for 18 SEER residential split/package AC systems

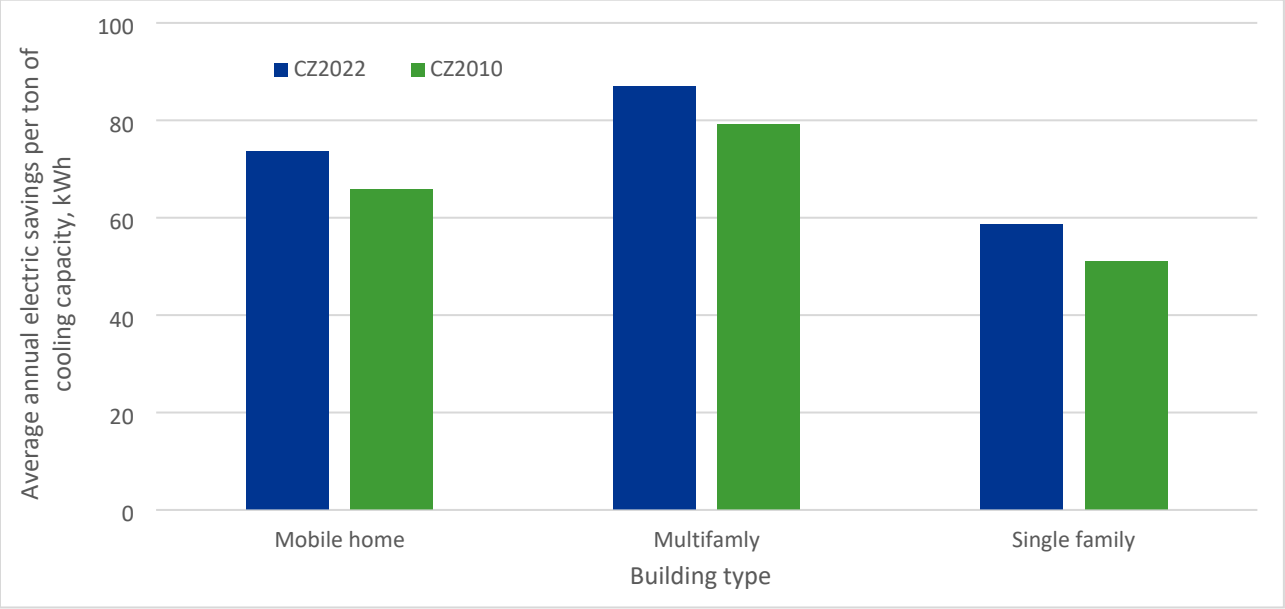


Figure A-3-7 shows the average annual savings for a 90 AFUE residential furnace by climate zone and

Figure A-3-8 shows the savings for the same equipment by building type. We see the same trend as in commercial heating dominated measures, where savings are reduced across all climate zones and building types using the new weather.

Figure A-3-7. Annual savings by climate zone for 90 AFUE residential furnaces

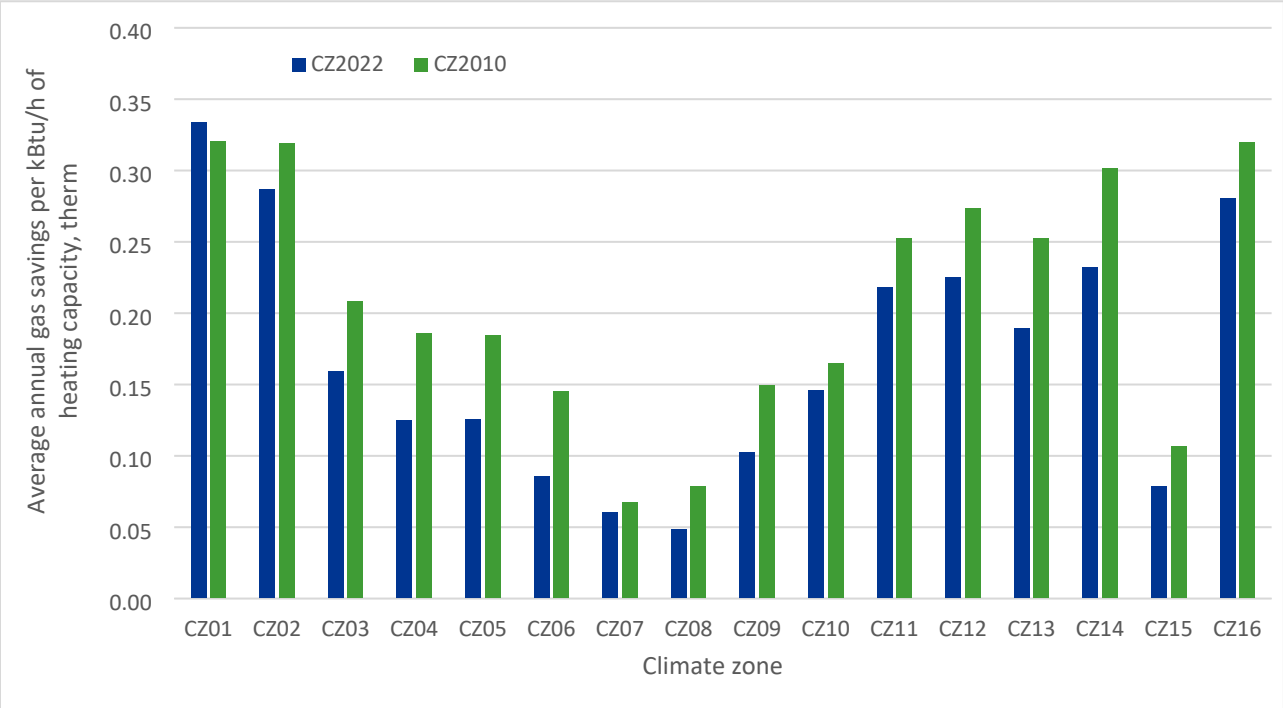
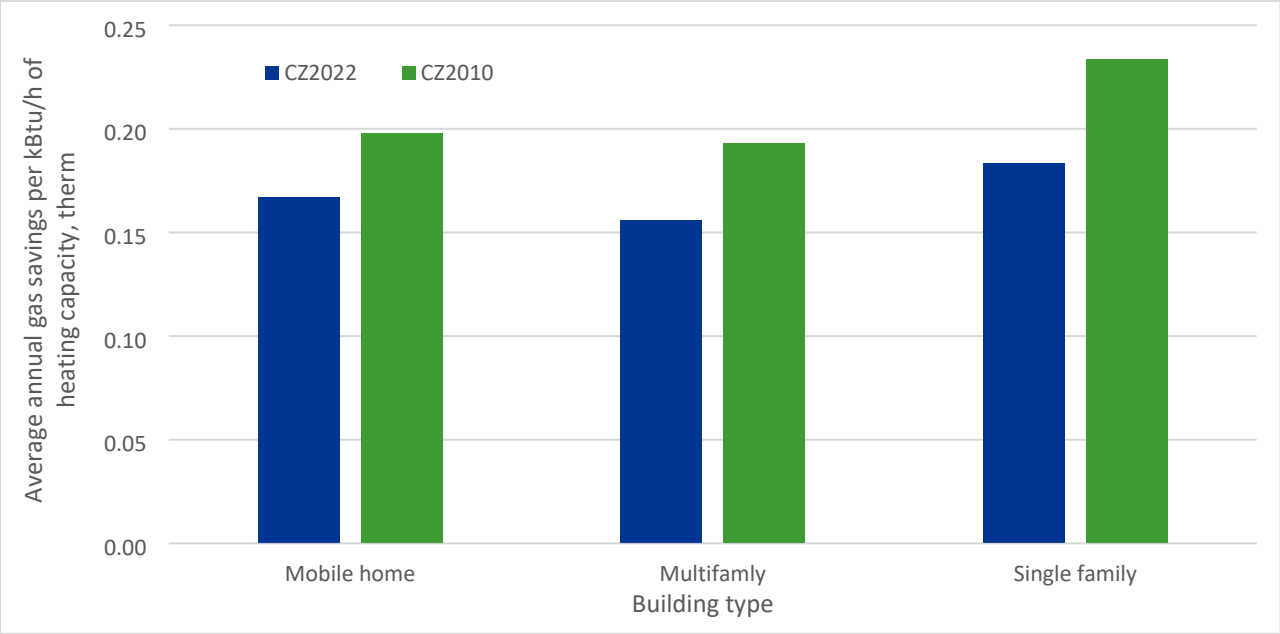


Figure A-3-8. Annual savings by building type for 90 AFUE residential furnaces



Effective Program Year: 2022. The switch from CZ2010 to CZ2022 weather data for DEER2023 measures calls for a new field—*Weather*—be added to the following tables in the PEAR/ExAnte databases: Measure, LoadShapeElec_2022, and LoadShapeGas_2022. If PY 2022 workpapers are submitted that use CZ2022 weather data, the new *Weather* field will need to be added to the Measure table within the submitted ExAnte Data (EAD) workbook.

Effective Program Year: 2023. The new *Weather* field will need to be added to the eTRM permutations table that is submitted with each new measure package. Coordination with the Reporting PCG, CEDARS, and the PAs will be necessary.

3.3 Peak demand period definition update

Effective Program Year: 2023. We must update the peak demand period dates to align with the new building simulation weather files, so the peak kW consumption is accurately calculated. The current approach to develop peak demand periods is as follows: Electric peak demand impacts for energy efficiency measures are represented by the average kWh reduction over a 15-hour window. The 15-hour window is from 4 p.m. to 9 p.m. (5 hours) over a three-day "heat wave" that occurs on consecutive days in June through September. The first day of that heat wave is determined for each climate zone and marks the start date for the peak demand period.

The rules used to identify the three-day peak demand periods for the new weather data can be summarized more simply as follows:

- Consistent with Title 24 and CZ2010, a 2009 calendar year is used to determine which days are weekends and holidays
- The heat wave occurs between June 1 and September 30
- The heat wave occurs on consecutive days and does not include weekdays or holiday
- 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. to 9 p.m. over the three-day period

This general approach is outlined in the previous 2014 weather update document[7] and the CPUC Energy Efficiency Policy Manual,[8] and an update to the peak demand period hours of 4 p.m. to 9 p.m. was specified in the DEER2020 Update.[9]

The peak demand period start-dates determined for the new CZ2022 weather file data are presented in Table A-3-2 along with the previous CZ2010 values.

[7] "DEER2014-Codes and Standards Update for the 2013-14 Cycle," February 11, 2014, http://deeresources.com/files/DEER2013codeUpdate/download/DEER2014UpdateDocumentation_2-12-2014.pdf
[8] CPUC Energy Efficiency Policy Manual, version 6, April 2020, pg. 36.
[9] Resolution E-4952, October 11, 2018. http://www.deeresources.com/files/DEER2020/download/Resolution%20E-4952.PDF

Table A-3-2. Comparison of CZ2010 and CZ2022 peak demand period start-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)	
			Maximum Peak	3-day Average			Maximum 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	Sep 2	Wed	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 1	Tue	100	82.9
CZ10	Sep 1	Tue	109	86.3	Jun 29	Mon	105	85.5
CZ11	Jul 8	Wed	113	88.3	Jun 29	Mon	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

The first thing to notice about the new values is that for about half the climate zones the month of the peak has shifted, but not consistently in one direction. For some climate zones, the peak happens a month sooner but for others it happens a month later. In addition, for some climate zones the CZ2022 peak temperatures are lower than the CZ2010 values, but that may be because the hottest day of the year has shifted outside of the conventional June-September summer period, for example for CZ08 the hottest days of the year for CZ2022 weather data occur in October. For these reasons, CPUC staff may explore revision to the peak demand period definition for the 2024 DEER update.

For reference, the weather stations used to represent the Title 24 climate zones are provided in Table A-3-3.

Table A-3-3. Weather stations representing Title 24 climate zones

Climate Zone	Weather Station locations	
	Location	Elevation (ft)
CZ01	Arcata	203
CZ02	Santa Rosa	125
CT03	Oakland	6
CZ04	San Jose-Reid	135

Climate Zone	Weather Station locations	
	Location	Elevation (ft)
CZ05	Santa Maria	253
CZ06	Torrance	88
CZ07	San Diego-Lindbergh	13
CZ08	Fullerton	395
CZ09	Burbank-Glendale	741
CZ10	Riverside	840
CZ11	Red Bluff	348
CZ12	Sacramento	16
CZ13	Fresno	335
CZ14	Palmdale	2,523
CZ15	Palm Springs-Intl	475
CZ16	Blue Canyon	5,279

3.4 Modifications to allow new load shape sources

Effective Program Year: 2023. New sources of generalized load shape parameters (e.g., simulation-based tools or advanced metering infrastructure analysis) could originate from impact evaluations or from studies conducted to support measure packages will be noted. For 2023, PAs may also produce new load shapes using simulation outputs or advanced metering infrastructure (AMI) analysis and submit them using the load shape processing workbooks available on the DEEResources.com website.[10] These load shapes will be reviewed through the measure package review process and included as possible shapes for processing into avoided cost combinations for 2023 claims. The details of the 2023 processes may not be the same as current processes.[11] The expectation is that all measures with updates will use the deemed load shapes made available in as of 2022-01-01. Measures that have an urgent need for additional load shapes—for measure packages submitted after the DEER2023 Resolution and before the next avoided cost update—may either request creation of a new load shape or use any one of the load shape processes available next year.

Resolution E-5082 described the format and database changes that were made to accommodate load shapes. As we transition to the eTRM database, the load shapes will be incorporated into the eTRM database structure.

3.5 Measure cost methodology and documentation guidance

Effective Program Year: 2023. The DEER database contains tables with outdated gross incremental measure costs because the costs for all measures are updated in measure packages and are approved by the review team. When upstream lighting comprised the majority of portfolio savings, the cost information was quite detailed based on extensive review and EM&V. As the portfolio becomes more diversified and as cost effectiveness continues to be refined, the measure costs must also remain as

[10] http://www.deeresources.com/index.php/deer-load-shape
[11] At this time, limited avoided cost "combo" processing ability requires that load shapes are prioritized based on percent of overall claims in recent years.

up to date as the savings estimates and avoided costs. The DEER2023 update expires out-of-date values and revises the measure cost tables to align with the eTRM transition. The DEER2023 update also clarifies the following to ensure the gross incremental measure costs are aligned:

- For normal replacement measures, the costs for standard/code baselines should align (e.g., if two measures use the same baseline efficiency assumption in a model, they should both use the same baseline costs).
- For accelerated replacement measures, the costs need to address remaining useful life (RUL) and expected useful life (EUL) periods properly, as described in the Energy Efficiency Policy Manual.[12] The following equation summarizes the policy manual definition of accelerated replacement costs (ARC) based on full measure cost (FMC), standard efficiency measure cost (SMC), discount rate of capital (D) and the RUL of the replaced equipment:

$$ARC = FMC - \frac{SMC}{(1+D)^{RUL}}$$

- For fuel-substitution measures, the labor costs do not often cancel out as they do for "like for like" replacement measures.
- For some measure groups and some specific measures, the costs should only include the energy saving measures/features and not include costs for non-energy impacts or aesthetic features.

3.6 Refrigerant avoided costs

Effective Program Year: 2023. D.21-05-031 directs program administrators to use the Refrigerant Avoided Cost Calculator (ACC) for portfolio forecasts, filings, and measure packages beginning in PY2022 where the retrofit involves adding (not replacing) equipment with refrigerant – these include fuel substitution, electric resistance to heat pump measures, or where low-GWP refrigerant benefits will be claimed. They further direct program administrators to "seek out all cost-effective opportunities to incorporate low-GWP measures in the energy efficiency portfolios."[13]

The Refrigerant Avoided Cost Calculator (RACC) available on CPUC's Cost Effectiveness information page is a new tool that will be used to calculate refrigerant carbon equivalent emission impacts to be included in cost effectiveness calculations in 2022. The most recent copy of the refrigerant avoided cost calculator resides on CPUC website.[14] Updates to the refrigerant avoided cost calculator will coincide with IDER ACC update cycles.

Using the Intergovernmental Panel on Climate Changes (IPCC) methodology and leveraging emissions estimates from the California Air Resources Board (CARB), the tool predicts the refrigerant leakage impact in a dollar equivalent avoided cost value. Refrigerants need to be addressed using the RACC only where the retrofit involves adding (not replacing) equipment with refrigerant – these include fuel substitution, electric resistance to heat pump measures, or where low-GWP refrigerant benefits will be claimed. Note that the output field is labeled "net present value (NPV) avoided costs" regardless of whether that value represents a benefit or a cost, so users must be careful to input this data correctly

[12] https://www.cpuc.ca.gov/uploadedfiles/cpuc_public_website/content/utilities_and_industries/energy_-_electricity_and_natural_gas/eepolicymanualv5forpdf.pdf
[13] https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M378/K256/378256443.PDF, p. 58.
[14] See ftp://ftp.cpuc.ca.gov/gopher-data/energy_division/EnergyEfficiency/CostEffectiveness/Refrigerant%20Calculator.xlsx.

into their cost-effectiveness tools. Positive avoided costs are a benefit while negative avoided costs are a cost in the California cost effectiveness tests.

The Refrigerant Avoided Cost Calculator tool calculates the refrigerant leakage for one piece of equipment at a time. To accurately account for the effect of a measure installed through an energy efficiency program, the NPV avoided cost of refrigerant leakage should be calculated for the baseline equipment and for the installed equipment, the difference of which is the NPV avoided cost attributable to the installed measure. For statewide measures, the weighted average cost of capital (WACC) used should be a load-share based average (SW funding proportions). The GWP time horizon should be 100 years. Required device types are those that use refrigerant and are installed as part of an EE project and either a) are fuel substitution b) electric resistance to heat pump conversion or c) include low-GWP refrigerant (lower than standard equipment and regulation).

If an up/midstream measure uses a lower-than-standard GWP refrigerant, a measure package should be filed incorporating the benefit of the low-GWP (versus new "standard" refrigerant). Where fuel substitution measures are being claimed by up/midstream and/or where replacement of electric resistance with a heat pump is being claimed, the up/midstream program would rely on the deemed measure package values; these, in turn, rely on average installed equipment characteristics. To the extent that the baseline refrigerant may be difficult to identify, additional work may be needed. However, we have already stated that refrigerants used in typical installations in the 2019/2020 portfolio or the current regulation—whichever has lower GWP—may be used as baseline for normal replacement. Accelerated replacement may use the removed refrigerant during the first baseline period and the standard refrigerant for the second baseline period after the RUL of the removed equipment.

The reporting of refrigerant leakage avoided costs is enabled by the refrigerant avoided cost calculator, to be included in cost effectiveness calculations in 2022 and is applicable to all measures that add new refrigerant. The reporting does not only apply to deemed measure reporting. It applies to all claimed measures: custom and deemed. If the custom project is fuel substitution with heat pump added, or replacing electric resistance technology with a heat pump, or if the project involves use of low-GWP refrigerants then it should use the calculator.

Documentation of the refrigerant avoided cost inputs and a copy of the refrigerant avoided cost calculator are required for applicable measure package submissions custom measures as dictated by the CPUC schedule. Documentation of refrigerant avoided cost inputs also apply to custom projects. Documentation of refrigerant avoided cost inputs and copy of the refrigerant avoided cost calculator also apply to custom projects and must be similarly included as part of the custom application documentation package. New refrigerant avoided cost fields will need to be added to eTRM permutation tables as described in section 9.4.

3.7 Expire all deemed refrigerant charge adjustment measures

Effective Program Year: 2023. The expiration of refrigerant charge adjustment (RCA) measures was based on a final report regarding the study conducted for the CPUC, "Proposer-Defined Study – A Roadmap for Accelerating the Adoption of Low-Global Warming Potential HVAC Refrigerants."[15] In addition, the RCA measures have garnered relatively low realization rates across years of

[15] "Proposer Defined Study. A Roadmap for Accelerating the Adoption of Low-Global Warming Potential HVAC Refrigerants," for CPUC by DNV GL, May 3, 2021, p. 8, https://pda.energydataweb.com/#!/documents/2506/view.

evaluations[16] partly because many RCA claims were for small adjustments to refrigerant levels[17] which has a small effect on HVAC efficiency.[18] We are discontinuing this measure because small adjustments to refrigerant charge are not necessary whereas large adjustments to refrigerant charge require the leak is fixed, but the repair is not currently required in the RCA measure.

Hence, the Measure IDs provided in Table A-3-4 will be expired at the end of 2022.

Table A-3-4. Expired Refrigerant Charge Adjustment (RCA) measures

Measure ID	Description	Version	Start Date	Expiry Date
Non-residential				
NE-HVAC-RefChg-Inc-High-ntxv	Small Pkg AC system with No TXV, increase refrigerant charge from High under-charge (10 - 50%) to factory specified level	DEER2020	2020-01-01	2022-12-31
NE-HVAC-RefChg-Inc-High-txv	Small Pkg AC system with TXV, increase refrigerant charge from High under-charge (10 - 50%) to factory specified level			
NE-HVAC-RefChg-Inc-Low-ntxv	Small Pkg AC system with No TXV, increase refrigerant charge from Low under-charge (4 - 5%) to factory specified level			
NE-HVAC-RefChg-Inc-Low-txv	Small Pkg AC system with TXV, increase refrigerant charge from Low under-charge (4 - 5%) to factory specified level			
NE-HVAC-RefChg-Inc-Typ-ntxv	Small Pkg AC system with No TXV, increase refrigerant charge from Typical under-charge (4 - 50%) to factory specified level			
NE-HVAC-RefChg-Inc-Typ-txv	Small Pkg AC system with TXV, increase refrigerant charge from Typical under-charge (4 - 50%) to factory specified level			

[16] The evaluated gross realization rates for residential RCA measures from 2006 through 2019 have averaged 33 percent; for commercial, it is slightly better at 47 percent.
[17] "Impact Evaluation of 2015 Commercial Quality Maintenance Programs" 2015. http://www.calmac.org/publications/HVAC3_2015_FINAL_Impact_Report.pdf
[18] R. Mowris, E. Jones, R. Eshom, K. Carlson, J. Hill, P. Jacobs, J. Stoops. 2016. Laboratory Test Results of Commercial Packaged HVAC Maintenance Faults. Prepared for the California Public Utilities Commission. http://www.calmac.org/publications/RMA_Laboratory_Test_Report_2012-15_v3.pdf

Measure ID	Description	Version	Start Date	Expiry Date
Residential				
RB-HV-RefChrg-DuctLoss-Typ-Inc	Increase Refrigerant Charge - Typical (8% rated charge) and Duct Sealing (medium to low)	DEER2020	2020-01-01	2022-12-31
RE-HV-RefChrg-Dec-NTXV-typ	Decrease Refrigerant Charge - System with No thermal expansion valve (TXV) - Typical (8% rated charge)			
RE-HV-RefChrg-Dec-TXV-typ	Decrease Refrigerant Charge - System with thermal expansion valve (TXV) - Typical (8% rated charge)			
RE-HV-RefChrg-Inc-NoTXV-typ	Increase Refrigerant Charge - System with No thermal expansion valve (TXV) - Typical (8% rated charge)			
RE-HV-RefChrg-Inc-NTXV-16pct	Increase Refrigerant Charge - System with No thermal expansion valve (TXV) - (16% rated charge)			
RE-HV-RefChrg-Inc-NTXV-4pct	Increase Refrigerant Charge - System with No thermal expansion valve (TXV) - (4% rated charge)			
RE-HV-RefChrg-Inc-TXV-16pct	Increase Refrigerant Charge - System with thermal expansion valve (TXV) - (16% rated charge)			
RE-HV-RefChrg-Inc-TXV-4pct	Increase Refrigerant Charge - System with thermal expansion valve (TXV) - (4% rated charge)			
RE-HV-RefChrg-Inc-TXV-typ	Increase Refrigerant Charge - System with thermal expansion valve (TXV) - Typical (8% rated charge)			

3.8 Clarify add-on equipment approach to EUL

Effective Program Year: 2023. Resolution E-4818 adopted the definition for Add-On Equipment (AOE) as presented in Section 2.2.5 of the Preponderance of Evidence guidance document.[19] The AOE definition states that

> *"An Add-on Equipment (AOE) measure installs new equipment onto an existing host improving the nominal efficiency of the host system. The existing host system must be operational without the AOE, continue to operate as the primary service equipment for the existing load, and is able to fully meet the existing load at all times without the add-on component. The AOE must not be able to operate on its own. The actual energy reduction occurs at the host equipment, not at the add-on component, although any add-on component energy usage must be subtracted from the host savings."*

The EUL of add-on equipment measures is capped at the RUL of the host equipment being retrofitted, and for deemed measure a default RUL is set at one-third the EUL. As stated in the guidance

[19] "Early Retirement Using Preponderance of Evidence" (also Resolution E 4818, p. 24) http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5325.

document, the default may be amended in a measure package when evidence to do so is provided. Additionally, the host equipment is defined as the equipment that uses less energy as a result of the add-on measure.[20] However, in some cases the add-on measure is not installed directly on the host equipment allowing the measure to remain in place even if the host equipment is replaced. Current policy zeros out savings when the host equipment is replaced, but we recognize that savings for the remote AOE will in fact be greater than zero if the AOE measure remains in place and is compatible with the new host equipment. We may allow changes to the host equipment to increase or remove the cap on the EUL of the add-on measure in some of these cases where the add-on measure is not installed directly on the host equipment. An example of this might be an ozone laundry add-on to a washing machine that would remain even if the washing machine was replaced.

The CPUC will review PA proposals for EULs not in DEER through the measure package review process on a case-by-case basis. Within the measure package for an add-on-equipment (AOE) measure, the host equipment needs to be clearly defined, the logic clearly explained for the choice of measure application type (MAT), and the EULs listed for all relevant equipment (including the measure, the equipment it is installed upon, and the equipment that saves energy by increasing efficiency due to the add-on measure). The AOE MAT should be used for measures that affect the operation or efficiency of energy-consuming equipment such as VFDs or other equipment-specific controls but is usually inappropriate for measures that affect the load on energy-consuming equipment. Some measures—including showerheads, faucet aerators, pipe insulation, and building insulation (which have been previously classified as AOE in resolution E-4952)—affect the load on the energy-consuming equipment, typically remain in place upon replacement of said equipment and should not be classified as AOE. When measure packages are naturally revised, the measure application type(s) (MAT) will be reviewed and revised in accordance with existing MAT definitions.

3.9 Clarify approach to DEER GSIA table updates

Effective Program Year: 2023. Decision D.11-07-030 (p. 22) initiated the tracking of installation rate values in DEER and populated them with EM&V results from the 2006-08 evaluation reports. The decision states that installation rates must be stored separately and not embedded in the gross savings for a measure. However, the DEER table name retains the Gross Savings and Installation Rate Adjustment factor (GSIA).[21] Rather than storing the values as a product, it would be clearer if the tables were separated into an installation rate table for deemed measures and a realization rate table for custom measures. The Decision does not provide a mechanism for updating the GSIA values and many have not been updated since inception. The DEER2023 Update will create a new installation rate table and update the installation rate values stored in the table.

3.10 Custom measure usage of deemed values

Effective Program Year: 2021. Deemed measures can be processed through the custom programs as long as the deemed savings values are used. This is not a change from previous policy, it is a restatement of existing policy that has not been consistently followed.

[20] Resolution E-4818, Section 1.3.6.2 Add-On Equipment, pp. 26-27.

[21] The GSIA is a DEER adjustment factor that combines the Realization Rate and Installation Rate (CPUC Energy Efficiency Policy Manual). Note that for CEDARS claims, the reported deemed measure realization rate (RR) is always 1, and for custom projects the reported installation rate (IR) is always 1.

3.11 Revisions to fieldnames for baseline clarity

Effective Program Year: 2024. Throughout the CEDARS, CET, and eTRM data platforms, the terms "1st baseline" and "2nd baseline" describe energy savings during either the RUL or EUL periods, depending upon the measure application type (MAT) of a given measure. In reviewing the claims reporting data for 2019, several thousand records were found to contain non-zero 2nd-baseline energy savings for measure application types other than "Accelerated Replacement" (AR). Since we anticipate that fewer mistakes will occur with field names that resemble more closely those long employed by DEER that describe the baselines in use, we are moving forward with this transition as presented in Table A-3-5 and Table A-3-6. The new field names should be used according to the default baseline policy for all sectors adopted by Resolution E-4818.[22] These revisions will require coordination with the Reporting PCG, CET, CEDARS, the PAs, and the eTRM.

Table A-3-5. Current and DEER2022 fieldnames for CET, CEDARS, and eTRM

Unit-level, baseline-specific fieldnames	Rule by Measure Application Type (MAT)	
Current		
UnitkW1stBaseline	For NC and NR MATs: Non-zero, fuel-specific UES values using standard/code baseline	For AOE, BW, BRO and AR MATs: Non-zero, fuel-specific UES values using pre-existing baseline unless the delivery type is midstream or upstream where standard/code baseline is used[23]
UnitkWh1stBaseline		
UnitTherm1stBaseline		
UnitkW2ndBaseline	For all MATs but AR: Zero UES values	For AR MAT: Non-zero, fuel-specific UES values[24] using standard/code baseline
UnitkWh2ndBaseline		
UnitTherm2ndBaseline		
UnitMeaCost1stBaseline	For NC and NR MATs: Non-zero, fuel-specific incremental cost values using standard/code baseline or pre-existing baseline	For AOE, BW, BRO and AR MATs: Non-zero, fuel-specific full measure cost values using pre-existing baseline
UnitMeaCost2ndBaseline	For all MATs except AR: Zero or null incremental cost values	For AR MAT, only: Non-zero incremental measure cost values[25] using standard/code baseline

[22] Resolution E-4818, Table 1, p. 4. (See https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M179/K264/179264220.PDF.)
[23] Ibid.
[24] There are a few deemed measure packages for which above-standard/code savings are disallowed in some instances (e.g., SCE17LG097.2, SWLG009-01, and SWCR004-01).
[25] The cost effectiveness tool (CET) calculates the accelerated replacement cost (ARC) from the full measure cost and the incremental measure cost entered in the 1st and 2nd baseline cost fields respectively.

Unit-level, baseline-specific fieldnames	Rule by Measure Application Type (MAT)	
DEER2022 additions for fuel-substitution or interactive effects loads added		
UnitAddkW1stBaseline	For NC and NR MATs: Non-zero, fuel-specific added-load values using standard/code baseline	For AOE, BW, BRO and AR MATs: Non-zero, fuel-specific added-load values using pre-existing baseline
UnitAddkWh1stBaseline		
UnitAddTherm1stBaseline		
UnitAddkW2ndBaseline	For all MATs except AR: Zero or null added-load values	For AR MAT, only: Non-zero, fuel-specific added-load values using standard/code baseline
UnitAddkWh2ndBaseline		
UnitAddTherm2ndBaseline		

NC = new construction; NR = normal replacement; AOE = add-on equipment; AR = accelerated replacement; BW = building weatherization; BRO = behavioral, retro-commissioning or operational

Table A-3-6. DEER2024 fieldnames for CET, CEDARS, and eTRM

Unit-level, baseline-specific fieldname	Rule by Measure Application Type (MAT)	
DEER2024 version		
UESkWStdBaseline	For NC, NR, and AR MATs: Non-zero UES values using standard/code baseline	For AOE, BW, and BRO MATs: Zero or null UES values unless the delivery type is midstream or upstream where standard/code baseline is used[26]
UESkWhStdBaseline		
UESThermStdBaseline		
UESkWPreBaseline	For AOE, BW, BRO and AR MATs: Non-zero UES values using pre-existing baseline unless the delivery type is upstream or midstream	For NC and NR MATs: Zero or null UES values
UESkWhPreBaseline		
UESThermPreBaseline		
UEAddkWStdBaseline	For NC, NR, and AR MATs: Non-zero, fuel-specific added-load values using standard/code baseline	For AOE, BW, and BRO MATs: Zero or null unit energy added-load values unless the delivery type is upstream or midstream
UEAddkWhStdBaseline		
UEAddThermStdBaseline		
UEAddkWPreBaseline	For AOE, BW, BRO, and AR MATs: Non-zero, fuel-specific unit energy added-load values using pre-existing baseline	For NC and NR MATs: Zero or null unit energy added-load values
UEAddkWhPreBaseline		
UEAddThermPreBaseline		
UnitMeaCostStd[27]	For NC, NR, and AR MATs: Non-zero incremental cost value using standard/code baseline.	For AOE, BW, and BRO MATs: Zero or null cost unless delivery type is midstream or upstream

[26] Resolution E-4818, Table 1, p. 4. (See https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M179/K264/179264220.PDF.)
[27] The standard/code baseline uses the incremental measure cost.

Unit-level, baseline-specific fieldname	Rule by Measure Application Type (MAT)	
UnitMeaCostPre[28]	For AOE, BW, BRO, and AR MATs: Non-zero full measure cost[29]	For NC and NR MATs: Zero or null cost

4 DEER error corrections and clarifications

DEER error corrections or clarifications are those that typically impact the actual DEER values or application of the values.

4.1 DEER water heater calculator corrections for commercial buildings

Effective Program Year: 2021. The commercial sector-wide energy savings (BldgType=Com) were incorrectly calculated in the *DEER_WaterHeater_Calculator_v4.1.xlsm*. The savings calculations were corrected, the calculator was re-issued (*DEER_WaterHeater_Calculator_v4.2.xlsm*), and both the Preliminary Ex Ante Review (PEAR) and Ex Ante energy impact records were updated to provide the corrected sector-wide energy savings (as of 2020-09-16).

4.2 Large commercial tankless water heater measure extensions

Effective Program Year: 2021. After discussions with Southern California Gas (SCG), it was agreed that the DEER water heater calculator methodology does not accurately estimate the energy savings provided by efficient large non-residential tankless water heaters (≥200 kBtu/h input capacity) used to deliver service hot water. As a result, the following DEER measures—previously unavailable beyond December 31, 2020—have been extended for use through December 31, 2021 as shown in Table A-4-1. Note that new unit energy savings (UES) values will be generated for DEER2023 due to changes to the Federal standards as described in Section 6.1.

Table A-4-1. Expiry date updates for large tankless commercial water heater measures

DEER Measure ID	Version	Start Date	Expiry Date	
			Revised	Previous
NG-WtrHt-LrgInst-Gas-gt200kBtuh-0p80Et	DEER2014	2013-01-01	N/A	2020-12-31
NG-WtrHt-LrgInst-Gas-gt200kBtuh-0p85Et			2022-12-31	2020-12-31
NG-WtrHt-LrgInst-Gas-gt200kBtuh-0p90Et			2022-12-31	2020-12-31
NG-WtrHt-LrgInst-Gas-gte200kBtuh-lt2G-0p80Et	DEER2021	2021-01-01	2021-01-01	none
NG-WtrHt-LrgInst-Gas-gte200kBtuh-lt2G-0p90Et				
NG-WtrHt-LrgInst-Gas-gte200kBtuh-lt2G-0p96Et				

[28] The pre-existing baseline uses the full measure cost.
[29] Two cost values are entered for AR measures, both the full measure cost and the incremental measure cost.

4.3 Water-cooled chiller measure tier definitions

Effective Program Year: 2023. For all liquid chilling machines (chillers), Resolution E-4952 defined two tiers of chiller measures. Tier 1 must exceed Title 24 by 10 percent for both full and part load efficiencies. Tier 2 must exceed Title 24 minimum requirements by 15 percent for both full- and part-load efficiencies. Resolution E-5082 changed the efficiency criteria for Path B[30] *air-cooled* chiller tiers, relaxing the full load efficiency requirement and increasing the part load efficiency requirement such that they exceed Title 24 minimum efficiency requirements as follows:

- Tier 1 at 7 percent full-load efficiency improvement and 12 percent part-load efficiency improvement
- Tier 2 at 7 percent full-load efficiency improvement and 20 percent part-load efficiency improvement

The 2023 DEER update will revise the efficiency tiers for Path B *water-cooled* chiller tiers such that they exceed Title 24 minimum efficiency requirements as follows:

- Tier 1 at 7 percent full-load efficiency improvement and 12 percent part-load efficiency improvement
- Tier 2 at 7 percent full-load efficiency improvement and 17 percent part-load efficiency improvement

4.4 DEER2020 residential measures missing some energy impacts

Effective Program Year: 2020. Energy Impact records were missing for 92 residential measures at climate zones CZ14, CZ15, and CZ16 for the multifamily (MFm) and mobile home (DMo) building types. Along with providing the missing Energy Impact records, it was necessary to correct the sector-wide Energy Impact records for CZ14, CZ15, and CZ16 for the "Res" building type.

4.5 Residential duct sealing measures normalizing unit modification

Effective Program Year: 2021. Historically, the normalizing unit for residential duct-sealing measures for all HVAC types was tons of cooling capacity (Cap-Tons). For furnace-only HVAC systems, however, it makes more sense to use Cap-kBTUh as the normalizing unit. A conversion methodology was developed for revising the normalizing unit and presented in *Res_Duct-Sealing_NormUnit=kBtuh_rNCGF_2020-11-19.xlsx*, available at deeresources.com. The resulting EnergyImpact records using Cap-kBTUh as the normalizing unit for BldgHVAC=rNCGF were uploaded to the PEAR database.

4.6 Residential duct sealing GSIA values expiration

Effective Program Year: 2021. The gross savings and installation adjustment (GSIA)[31] values for duct sealing GSIA_IDs are out of date, based on EM&V from 2006-08, and will be expired as shown in

[30] Two efficiency compliance paths are available for chillers. Path A is used for single-speed chillers designed primarily to run at full load and Path B is used for variable speed chillers designed to operate primarily at part load. For example, for a <150-ton air-cooled chiller, Path A efficiency minimums are 10.1 EER/12.7 IPLV and Path B efficiency minimums are 9.7 EER/15.8 IPLV. The DEER tier 1 Path B air-cooled chiller minimum efficiency is (9.7)x(1.07)=10.38 EER and (15.8)x(1.12)=17.7 IPLV.

[31] The gross savings and installation adjustment (GSIA) is a DEER adjustment factor that combines the realization rate and installation rate according to the Energy Efficiency Policy Manual Version 6, p. 39.

Table A-4-2. Duct sealing measures will use the GSIA default value of 1.0 given that 2018 EM&V realization rate is 95 percent based on billing analysis that captures both realization rate and installation rate. The older 2006-08 EM&V report found a high incidence of duct sealing measures that had not been installed due to one contractor who was promptly removed from the program.

Table A-4-2. GSIA IDs to be expired effective 2020-12-31

GSIA_ID	GSIA Value
Res-DuctSeal-PGE-2000	0.490
Res-DuctSeal-PGE-2078	0.410
Res-DuctSeal-SCE-2502	0.410
Res-DuctSeal-SCE-2507	0.510
Res-DuctSeal-All	0.463
Res-DuctSeal-SDG	0.410
Res-DuctSeal-PGE	0.584
Res-DuctSeal-SCE	0.468

4.7 Refrigerator/freezer measures normalizing unit modification

Effective Program Year: 2021. Historically, the normalizing unit for residential refrigerators/freezers was "Household." For the DEER2020 update, however, "Area-Ft2" was indicated as the normalizing unit (NormUnit). Since floor area was not the correct normalizing unit—and could have been misinterpreted to allow the unit energy savings (UES) to be multiplied by household floor area—NormUnit was changed to "Household" and no changes were made to the unit energy savings.

4.8 Fuel substitution default NTG applicability clarification

Effective Program Year: 2020. The delivery type options for the "FuelSubst-Default" NTG ID were corrected so that this NTG ID is now available for use with fuel substitution measures offered through any delivery type.

4.9 Align residential clothes washer measures with ENERGY STAR® tiers

Effective Program Year: 2023. The current ENERGY STAR Version 8.0 clothes washer program requirements became effective February 5, 2018. Only front- and top-loading clothes washers with capacities greater than 1.6 ft^3 and less than 8.0 ft^3—and are not defined as combination all-in-one washer-dryers, residential clothes washers with heated drying functionality, or top-loading commercial clothes washers—are eligible for ENERGY STAR certification. There are currently no new versions in development.

The Consortium for Energy Efficiency (CEE) specification does not differentiate between top- and front-loading models, while ENERGY STAR does. The CEE specification defines standard sized clothes washers as greater than 2.5 ft^3. As of February 5, 2018, top-loading clothes washers meeting ENERGY STAR minimum efficiency requirements would not qualify for any CEE tier.

The equipment efficiencies will be updated as shown in Table A-4-3.

Table A-4-3. Residential clothes washer measure criteria, capacity between 1.6-8.0 ft³

Category	Efficiency Tier	Minimum IMEF[32]		Maximum IWF[33]	
		DEER2023	DEER2020	DEER2023	DEER2020
Front-loading clothes washer	ENERGY STAR/CEE Tier 1	≥ 2.76	≥ 2.38	≤ 3.2	≤ 3.7
	ENERGY STAR Most Efficient/ CEE Tier 2	≥ 2.92	≥ 2.74	≤ 3.2	≤ 3.2
	CEE Tier 3	≥ 3.10	≥ 2.92	≤ 3.0	≤ 3.2
	Code/Standard baseline	> 1.84	> 1.84	< 4.7	< 4.7
	Pre-existing baseline	> 1.84	> 1.79	< 4.7	< 4.8
Top-loading clothes washer	ENERGY STAR	≥ 2.06	≥ 2.06	≤ 4.3	≤ 4.3
	CEE Tier 1	≥ 2.76	≥ 2.06	≤ 3.2	≤ 4.3
	CEE Tier 2	≥ 2.92	≥ 2.32	≤ 3.2	≤ 4.0
	CEE Tier 3	≥ 3.10	≥ 2.76	≤ 3.0	≤ 3.2
	Code/Standard baseline	> 1.57	> 1.29	< 6.5	≤ 8.4
	Pre-existing baseline	> 1.29	> 1.08	< 8.4	≤ 9.4

To align existing DEER measures with the applicable standards, the measures shown in Table A-4-4 will be updated.

Table A-4-4. Relevant DEER measures for residential clothes washers

Category	DEER Measure ID	Version
Front-loading clothes washer	RB-Appl-EffCW-med-Tier1-Front	DEER2020
	RB-Appl-EffCW-med-Tier2-Front	
	RB-Appl-EffCW-med-Tier3-Front	
Top-loading clothes washer	RB-Appl-EffCW-med-Tier1-Top	
	RB-Appl-EffCW-med-Tier2-Top	
	RB-Appl-EffCW-med-Tier3-Top	

4.10 Align residential dishwasher measures with ENERGY STAR® tiers

Effective Program Year: 2023. The current ENERGY STAR Version 6.0 dishwasher program requirements became effective January 29, 2016. The CEE revised dishwasher specification from 2015

[32] Integrated modified energy factor (IMEF) is the energy performance metric for ENERGY STAR-certified residential clothes washers as of March 7, 2015.
[33] Integrated water factor (IWF) is the water performance metric for ENERGY STAR-certified residential clothes washers as of March 7, 2015.

did not include a Tier 2 due to concerns around cleaning performance. While the ENERGY STAR market share has been reported to be 90 percent among dishwasher products,[34] this finding helped to spur the proposed update to the specification whereby the maximum annual energy consumption (kWh) will decrease. This also means that the ISP used for the baseline has to be updated. The Environmental Protection Agency (EPA) determined that approximately 15 percent of residential dishwashers qualify for the updated specification.

The Version 7.0 specification is currently under revision, with the first draft published March 10, 2020. For Version 7.0, the EPA has increased the minimum efficiency requirements for residential dishwashers, decreasing the annual energy consumption allowance for standard sized models to 240 kWh/year. According to the EPA, the expected effective date is the first quarter of 2021.

Equipment efficiencies will be updated as shown in Table A-4-5.

Table A-4-5. Residential Dishwasher, Standard Capacity Measure Criteria

MeasureID	Efficiency	Maximum Annual Energy Consumption, kWh	
		DEER2023	DEER2020
Appl-Dishwash-StdSize-Tier1	ENERGY STAR/CEE Tier 1	≤ 240	≤ 260
Appl-Dishwash-StdSize-Tier2	CEE Tier 2	N/A	≤ 220
Appl-Dishwash-StdSize-Tier3	CEE Tier 3	N/A	≤ 180
Appl-Dishwash-StdSize-Tier1/2/3	Code/Standard	≤ 307	≤ 307

To align existing DEER measures with the applicable standards, the measures shown in Table A-4-6 will be updated.

Table A-4-6. Relevant DEER measures for residential dishwashers

Category	DEER Measure ID	Version
Standard size dishwasher	Appl-Dishwash-StdSize-Tier1	DEER2020
	Appl-Dishwash-StdSize-Tier2	
	Appl-Dishwash-StdSize-Tier3	
	Appl-Dishwash-StdSize-Tier1/2/3	

4.11 Whole-house fan measure updates

Effective Program Year: 2023. Whole-house fans became a Title-24 code requirement in 2014 for single-family homes in climate zones CZ08 through CZ14. Resolution E-4795 was the most recent update of the whole-house measure resulting in new whole-house fan UES values for DEER2017 and the inclusion of whole-house fans in new construction baseline models in climate zones where they are

[34] ENERGY STAR Program Requirements Product Specification for Residential Dishwashers, Eligibility Criteria, Draft 1 Version 7.0. https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Residential%20Dishwasher%20Version%207.0%20Draft%201%20Sepcification.pdf

required by code. The whole house fan is utilized in single-family homes and the eQUEST model for this measure assumes that the whole-house fan is on when outdoor cooling is available, the cooling load can be met by the whole-house fan, and the outdoor temperature is at least five degrees below the cooling thermostat setpoint. The whole-house fan will cool the space down to 70°F, if possible, regardless of the actual cooling thermostat setpoint.

At the time of the DEER2017 update, a number of changes were needed for the specification of whole-house fan parameters including flow rates, fan power, control sequences, and improvements to the definition and distribution of thermal mass in the residential prototypes. The new whole-house fan measures considered a range of capacities and fan efficiencies. There has been some concern about the accuracy of whole-house fan unit energy savings developed using DOE2-based modeling, particularly because the results are approximately one-third of the CEC-developed savings results[35] used in the publicly-owned utilities' (POU) 2017 Technical Reference Manual.[36] The CEC-developed savings are modeled using the 2013 version of the California Simulation Engine (CSE) that is the basis for CBECC-Res software. The CEC whole-house fan input assumptions are as follows such that the whole-house fan will:

- turn on if outdoor temperature is at least five degrees cooler than the indoor temperature
- cool the house to a fixed 68°F lower-limit setpoint, consistent with natural ventilation assumptions when the thermostat is in cooling mode
- turn off if the lower setpoint limit is reached, the 5°F minimum indoor-outdoor temperature difference no longer exists, or if the time is between 11 p.m. and 6 a.m. (with windows assumed closed, for security reasons)

The CEC-modeled home used their 2,700 ft^2 residential prototype with a whole-house fan airflow rate of 2,000 cfm, so the modeled ventilation rate was 0.74 cfm/ft^2. The study noted a 25-percent derating of whole-house fan nominal airflow but provided no explanation for doing so. The study mentioned fan electricity consumption for a ducted economizer-type nighttime ventilation system but did not indicate the fan electricity consumption assumed for whole-house fans.

The DEER assumptions to model whole-house fans are very similar to those used by the CEC, though the lower limit setpoint is 70°F (causing slightly lower cooling savings, but also lowering the heating penalty). The DEER cooling availability schedule varies by climate zone and follows the 2017 T-24 Residential Alternative Compliance Manual (ACM) manual, allowing ventilation cooling only during shoulder months. DEER assumptions do not include a derating of nominal airflow, however it does assume that the windows will only be open half the time when there is an opportunity to use the whole-house fan.[37] This is the only factor used to account for windows open for cooling or airflow and windows closed at night for security reasons. A 2006 survey of ventilation behavior[38] found that 82 percent of respondents thought it was important to open the windows to cool the house and 70 percent thought it was important to open windows to save energy. The study also reported 92 percent

[35] Night Ventilation Cooling Compliance Option, Codes and Standards Enhancement Initiative, September 2011.
[36] 2017 Savings Estimation POU Technical Reference Manual published by the California Municipal Utilities Association.
[37] The probability fraction is set to 100% on peak kW days for accuracy of peak savings calculations.
[38] Price, Phillip and Max Sherman. Ventilation Behavior and Household Characteristics in New California Houses, LBNL #59620, 2006.

of respondents thought it important to close windows for safety/security. The 50-percent probability assumption should be checked by calibrating the simulation results to measured energy savings.

The DEER modeled savings were compared to measured savings from two evaluation studies of whole-house fans installed in California homes. The first study, a 2005 impact evaluation of Northern California Power Agency programs, found annual whole house fan measure savings from 18 homes were 203 kWh +/- 65 kWh.[39] These homes were presumably located in NCPA member areas in climate zones 4, 5, 11, and 12. The analysis method used billing data to report normalized annual consumption (NAC) on a per-home basis and compared consumption pre- and post-retrofit for homes installing exclusively whole house fans. The average savings of the sample with low pre-retrofit NAC (<1,000 kWh/yr) removed is 265 kWh. The annual DEER savings (average of all four PSC motor measures) for climate zones 11 and 12 average 141 kWh with a standard deviation of the 16 models at 53 kWh. The modeled savings are approximately 70% of the measured savings of the overall sample or 53% of the higher NAC portion of the sample.

The second study, a 2003 impact evaluation of the Statewide Low-Income Energy Efficiency (LIEE) Program showed average annual whole house fan measure savings from 88 homes was 108 kWh.[40] Eighty seven of these 88 homes were located in PG&E territory. Since the program installed multiple measures, the cooling end-use saving measures were disaggregated based on engineering models which assigned 20% of the cooling savings to whole house fans. PGE climate zones include primarily CZs 1, 2, 3, 4, 11, 12, 13, and 16. The DEER savings from those climate zones averaged across the old and existing eras are 53 kWh, about half the measured savings. Central valley savings (CZs 11-12-13) are much higher and more closely grouped at 153 Wh. Because this study uses engineering analysis to disaggregate the cooling load into the component measure savings, it is given less weight than the previous study.

Given these studies, it seems that whole house fan measure savings are underestimated by the DEER models, and the assumption with the highest uncertainty is that occupants will open windows half the time when outdoor cooling is available. This assumption will be adjusted, and DEER savings for whole house fans will be re-modeled.

For transparency, the whole-house fan measure input assumptions are documented in Table A-4-7 and Table A-4-8.

Table A-4-7. DEER input parameters for the whole-house fan measure

Parameter	Parameter name[41]	Pre-existing baseline case value	Measure case value
Ventilation method	VentMethod	AIR-CHANGE	AIR-CHANGE+FAN
Fan ventilation, cfm/sq.ft.	FanVentCFMpSF	0	0.7, 1.5, 2, 3
Ventilation control, °F	VentMaxT	70	70

[39] Mowris, Robert. Measurement and Verification Load Impact Study for NCPA SB5X Miscellaneous Rebate Programs, 2005. (M&V_Load_Impact_Study_for_NCPA_SB5X_Miscellaneous.pdf at http://calmac.org/results.asp?flag=&searchtext=NCPA+SB5X+Miscellaneous&Submit=Search)
[40] KEMA-Xenergy. Impact Evaluation of the 2001 Statewide Low Income Energy Efficiency (LIEE) Program, 2003.
[41] DOE2 Key words are documented in Volume 2 Dictionary file; specifically, VENT-METHOD is described on pg. 442. https://doe2.com/Download/DOE-23/DOE23Vol2-Dictionary_50d.pdf

Parameter	Parameter name[41]	Pre-existing baseline case value	Measure case value
Ventilation fan power, W/cfm	VentFanWperCFM	0	0.15, 0.125

Table A-4-8. Enabled periods by climate zone for the whole-house fan measure

Climate Zone	Period 1		Period 2		Period 3		Period 4		Period 5	
	Start	End	Start	End	Start	End	Start	End	Start	End
CZ01	never enabled									
CZ02	20-May	30-Sep	7-Oct	21-Oct						
CZ03	22-May	18-Jun	1-Jul	8-Oct	18-Oct	24-Oct				
CZ04	30-Apr	3-May	15-May	31-Oct						
CZ05[a]	28-May	28-May	31-May	2-Jun	12-Jun	13-Jun	10-Jul	15-Aug	29-Aug	29-Aug
CZ06	30-Apr	2-May	7-May	6-Nov	16-Nov	19-Nov				
CZ07	17-Feb	20-Feb	25-Apr	2-May	13-May	23-Nov	18-Dec	18-Dec	20-Dec	25-Dec
CZ08	18-Mar	27-Mar	20-Apr	21-Apr	24-Apr	10-Nov	15-Nov	21-Nov	18-Dec	23-Dec
CZ09	17-Mar	26-Mar	24-Apr	7-May	12-May	6-Nov	17-Nov	22-Nov	17-Dec	22-Dec
CZ10	18-Mar	25-Mar	25-Apr	7-May	13-May	6-Nov	17-Dec	22-Dec		
CZ11	28-Apr	4-May	15-May	29-Oct						
CZ12	28-Apr	4-May	15-May	29-Oct						
CZ13	2-Apr	2-Apr	26-Apr	8-May	12-May	1-Nov				
CZ14	27-Apr	6-May	15-May	30-Oct						
CZ15[b]	14-Jan	24-Jan	3-Feb	9-Feb	19-Feb	28-Feb	14-Mar	10-Apr	14-Apr	24-Nov
CZ16	24-May	1-Oct								

[a] Climate zone 5 has three additional enabled periods: 3-Sep. to 17-Sep., 30-Sep. to 2-Oct., and 5-Oct. to 12-Oct.

[b] Climate zone 15 has one additional enabled period: 16-Dec. to 25-Dec.

4.12 Residential gas furnace fan efficiency revision

Effective Program Year: 2022. Per the federal Energy Conservation Program for Consumer Products—as of July 3, 2019—new residential furnace fans must be driven by electrically commutated motors (ECMs).[42] Since these have long been a deemed measure in California, those updated for DEER2020 and listed in Table A-4-9 will be expired as of 2021-12-31. The standard description will be revised as shown beginning 2022-01-01.

Table A-4-9. Residential furnace measures to be expired

MeasureID	Standard Description	Measure Description
Res-GasFurnace-AFUE81-ECM	Through 2021-12-31:	Efficient Residential Gas Furnace - AFUE 81 with ECM supply fan motor

[42] https://www.energy.gov/sites/prod/files/2014/06/f17/furnace_fans_final_rule.pdf

MeasureID	Standard Description	Measure Description
Res-GasFurnace-AFUE90-ECM	Furnace AFUE 80 with Standard Efficiency supply fan motor As of 2022-01-01: Furnace AFUE 80 with ECM supply fan motor	Efficient Residential Gas Furnace - AFUE 90 with ECM supply fan motor
Res-GasFurnace-AFUE91-ECM		Efficient Residential Gas Furnace - AFUE 91 with ECM supply fan motor
Res-GasFurnace-AFUE92-ECM		Efficient Residential Gas Furnace - AFUE 92 with ECM supply fan motor
Res-GasFurnace-AFUE93-ECM		Efficient Residential Gas Furnace - AFUE 93 with ECM supply fan motor
Res-GasFurnace-AFUE94-ECM		Efficient Residential Gas Furnace - AFUE 94 with ECM supply fan motor
Res-GasFurnace-AFUE95-ECM		Efficient Residential Gas Furnace - AFUE 95 with ECM supply fan motor
Res-GasFurnace-AFUE96-ECM		Efficient Residential Gas Furnace - AFUE 96 with ECM supply fan motor
Res-GasFurnace-AFUE97-ECM		Efficient Residential Gas Furnace - AFUE 97 with ECM supply fan motor
Res-GasFurnace-AFUE98-ECM		Efficient Residential Gas Furnace - AFUE 98 with ECM supply fan motor

4.13 LED commercial lighting measure clarification

Effective Program Year: N/A. Almost all LED lighting measures were expired in 2020 due to LED becoming the baseline. Three measures were retained by using a higher-performance LED, as measured in lumens per watt (lm/W). DEER Resolution E-4952 (published in 2018) set the base and measure cases using the Lighting Facts database, a compendium of the majority of LED lighting products available in the marketplace. The bottom tier products set the baseline (concluding that a 100 lm/W TLED base efficacy was appropriate) while the top quartile products set the measure case efficacy. The Lighting Facts database was not updated after 2018 and could no longer be used to set efficacy standards.

After 2018, updates to LED efficacy (for both base and efficient cases) were based on multiple sources, including the Southern California Edison Industry Standard Practice (ISP) Study (October 2019), DesignLights Consortium updates (DLC, the DLC is a compendium of qualifying products that must meet standards of efficacy and quality), and the Department of Energy (DOE) Lighting R&D Opportunities Study (January 2020). Aggregate analysis of these resources and their subsequent revisions resulted in updates to LED efficacies which are exemplified by the TLED baseline efficacy trend of 100, 111, and 128 lm/W in 2019, 2020, and 2021 measure packages, respectively.

After the base updates were made, the measure case efficiencies were similarly adjusted. The updated measure case efficacies were compared to the DLC database and it was observed that about 45 percent of high-bay products qualified. The DLC qualified products are intended to represent the best products in the market and would correspond to the top tier of all products on the market, possibly the top quartile, although that could not be confirmed since the Lighting Facts database no longer exists.

The 2021 measure packages expiration dates were extended to 2022-12-31 (November 3, 2020 disposition) due to the impact of COVID on markets and a conclusion that it would be unlikely that

clear market trends would emerge in time to update measure packages for 2022. The expiration date was later extended to 2023-12-31. Program administrators are instructed to submit revised measure packages reflecting revised efficacy assumptions by June 1, 2022 such that those measure packages can become effective no later than January 1, 2024.

5 Review of energy efficiency EM&V and special studies

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. The current evaluation is focused on program year 2019 (PY2019) claims. Year 2019 is an important milestone for deemed measures and the application of EM&V results because it was the last year for PA-specific measure packages. For PY2020, the use of statewide measure packages for nearly all measures will make application of the EM&V results prospectively much easier.

The DEER team has examined the 2019 EM&V draft impact evaluation reports and other studies to identify findings that may result in updates to deemed measure parameters and/or savings estimation approaches. Additional updates may be made looking across studies for recent years such as looking across measures at the default NTG by delivery type (e.g. direct install, rebate, upstream).

A complete list of the studies to consider is provided in Appendix E of the CPUC's 2019-2021 EM&V Plan.[43] As for other studies, we only considered studies that were essentially final by April 2021. A summary of the recommended updates to gross unit energy savings (UES), EUL, load shapes and/or net-to-gross (NTG) values resulting from PY2019 impact evaluations is provided in Table A-5-1.

Table A-5-1. Assessment of expected 2019 EM&V study results

Market Sector	Measure	Gross Savings*	NTG Ratio	
			Current	DEER2023*
Residential	Tankless Water Heaters	None	0.55	0.40
Residential	Storage Water Heaters	None	0.55	0.40
Residential	MF Recirc Pump Demand Control	None	0.55	1.00 (DI)
Residential	MF Temperature Controller	None	0.55	0.94 (DI)
Residential	Smart Controllable Thermostat	UES, LS**	*No change*	
Lighting	Nonresidential Indoor LED Tube	None	0.60	0.65
Lighting	Nonresidential Indoor LED Fixture	None	0.91	0.65
HVAC-Residential	Fan Motor Control	None	0.55	0.88
HVAC-Residential	Condenser Coil Cleaning	None	0.65-0.67	0.80

[43] "Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan FINAL, 2019-2021, Version 10," California Public Utilities Commission, 12/30/2020, https://pda.energydataweb.com/api/downloads/2462/2019-21_EMV_Plan_final.pdf.

Market Sector	Measure	Gross Savings*	NTG Ratio	
			Current	DEER2023*
Small Commercial	Process Ozone Laundry	UES**	0.60	0.70

*Per E-4952, values are only changed if EM&V studies show a trend and if change is greater than +/- 0.05.

**UES=unit energy savings; LS=load shape; HOU=hours of use; EUL=effective useful life; and VFD=variable frequency drive

5.1 Upstream and midstream program tracking data requirements

Effective Program Year: 2023. Tracking data issues were raised in last year's DEER Resolution and encountered again for the PY2019 EM&V of Upstream Lighting (PY2017-2019), Upstream HVAC (PY2018-19), and Small/Medium Commercial Measures (PY2018-19).

CPUC reemphasizes the requirement for site information data for all claims for upstream and midstream delivery types. The general requirements are provided in the California EM&V Protocols[44] pages 209-210. The guidance in the EM&V protocols that PA's should collect additional data for upstream and midstream resource programs and have them available for data requests remains in effect for IOU's and third party implementers. CEDARS already requires site information for upstream or midstream claims, though the quality of the data provided may vary.

For PY2023, the CPUC directs the PAs to work with CPUC staff to develop more specific tracking data specifications for each measure via the workpaper process or EM&V project coordination groups (PCGs). The data specification should also consider primary inputs and contextual data needed for proper application and evaluation of the savings such as building type and climate zone. The developed requirements should be posted into the "Data Collection Requirements" section of the deemed measure template. Although these data requirements might more typically be included in program implementation plans or manuals, placing them in the workpapers will ensure maximum visibility and communication to all stakeholders including implementers and evaluators.

For 2022 Workpapers and Claims: There is no change needed for 2022 workpapers (measure packages) nor the CEDARS data specification. PY2022 claims information must be provided in the existing Site Table related to the claim recipient. Commission Staff expect that the information will include the incentive recipient consistent with the referenced EM&V Protocols and not the customer/ratepayer. The site data will contain location and contact information for stores, contractors, or other service providers where the ultimate customer purchase occurs.

An example of the new data requirements for upstream and midstream programs is provided below:

- SiteID – A unique identifier for the installed location of the incentivized equipment
- EquipmentID - A unique identifier for each unit of incentivized equipment on the site
- Measure Size category – General size or capacity range specific to each measure type, for example HVAC equipment would be AHRI product type and size range
- Equipment manufacturer – Manufacturer of the incentivized equipment, e.g., Carrier, Trane, Nest, Philips, GE, etc.

[44] "California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals," April 2006, https://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5212.

- Equipment model number – Manufacturer number that can be used to lookup size, features, performance, etc. for the incentivized equipment
- Rated capacity – Actual size, capacity, load rating, etc. for the incentivized equipment
- Rated efficiency unit (EfficUnit) – The engineering unit basis for the efficiency or performance rating, e.g., Unit Energy Factor (UEF), thermal efficiency (TE), SEER (seasonal energy efficiency ratio)
- Rated efficiency (ref. EfficUnit) – Efficiency or performance rating value for the Rated efficiency unit basis
- Quantity per sales transaction, project, or site – Total units of incentivized equipment located at the site or project

Additional information verifying incentives or equipment are installed in ratepayer sites will continue to be required via data requests from Commission staff to the PAs.

5.2 Updates per residential 2019 EM&V reports

Two residential program evaluation reports for PY2019 were reviewed for potential deemed measure updates: water heating equipment and smart thermostats. The PY2019 evaluation of residential domestic water heating equipment included efficient storage, tankless, and heat pump water heater (HPWH) measures, as well as multifamily central water heating measures and controls. This was primarily a NTG and market-measure characterization study, and it illustrates the complexity of the water heating market caused by the variety of technology/efficiency options. The study also collected residential hot water use information that can potentially be used for a future update to the deemed savings methodology and the DEER water heating calculator. The smart thermostat evaluation continued the effort begun in 2018 to update the previous and dated savings values with values developed from billing analysis.

5.2.1 Residential water heaters

Effective Program Year: 2023. Commission Staff reviewed the 2019 impact evaluation of residential water heaters.[45] Efficient water heaters were offered via plug-load/appliance, multifamily, and general residential energy efficiency programs. The measures evaluated were primarily storage, tankless, and heat pump water heaters (HPWHs) for single family, multifamily and mobile homes, but also targeted multifamily boiler controls. The evaluation explored uncertainties around key savings parameters including installation rate, realization rate, NTG, effective useful life (EUL), and unit energy savings (UES). However, the only updates from the evaluation are NTG values and EUL for one of the technologies as discussed below.

Natural Gas Storage and Tankless Water Heaters. The evaluated NTG values for gas tankless water heaters was 0.36 with 90/7 confidence/precision, and for gas storage water heaters was 0.40 with 90/13 confidence-precision. Both of these values are substantially lower than the current value of 0.55 which is the default NTG value for residential measures 2 years and older. Since the NTG values for the two technologies are within the same error band and within the same technology group, it is sensible to use a single value for both measures. Therefore, we direct the use of a NTG value of 0.40

[45] "Impact Evaluation of Water Heating Measures – Final, Residential Sector - Program Year 2019, EM&V Group A", California Public Utilities Commission, 4/21/2021. https://pda.energydataweb.com/api/downloads/2503/CPUC Group A Report Water Heating PY 2019_final_PDA.pdf

for both storage and tankless natural gas water heaters. This is the actual evaluated NTG value for storage water heaters and a small rounding up of the tankless water heater NTG value.

In addition, evaluation results included the customer-reported ages of failed equipment as presented in Table A-5-2. The table shows that 78 percent of tankless water heaters failed much earlier than the current 20-year EUL for this measure. A recommendation to reduce the EUL for this measure to 12-15 years was considered but not adopted because these findings are customer self-reports. However, based on these results, tankless water heaters should be a priority for future EUL research. The life of a storage water also appears to be longer than the current EUL but only slightly more so.

Table A-5-2. Customer-reported age of replaced water heaters

Replaced Unit Type	Sample size	EUL per tracking data	Proportions of Responses		
			Less than 10 years	10-15 years	Older than 15 years
Natural Gas Storage Water Heater	738	10	0.26	0.40	0.26
Natural Gas Tankless Water Heater	171	20	0.36	0.42	0.17
Heat Pump Water Heater	9	10	0.53	0.39	0.08

Heat Pump Water Heaters (same-fuel). The 2019 evaluation also included some heat pump water heaters. Although the evaluation produced a NTG of value 0.50 for this measure, the sample was not robust enough and the measures were primarily conventional same-fuel rather than fuel substitution measures. In addition, we anticipate that the 2020 EM&V effort will target fuel-substitution HPWH measures (which have a policy-stipulated NTG value of 1.0) and that the samples and findings will be much more robust. As such, we will not apply these interim findings to HPWH measures.

5.2.2 Multifamily boiler demand control at recirculation pumps

The results for this measure are labeled as "Recirculation Pump" in the evaluation report. The evaluated NTG value of 1.00 for this measure is an upward adjustment from the current default value of 0.55. The updated NTG value is based on a robust survey sample size of 53 respondents, and. The NTGRs for the multifamily water heater technologies were almost uniformly 100%. This high NTG value is because program incentives do spur multifamily property managers to implement upgrades that they would have otherwise delayed or never undertaken. Multifamily central equipment can usually be repaired almost indefinitely without requiring a replacement or adding new features, and the property manager may be indifferent to system inefficiencies if the tenants pay for energy use either directly or indirectly. This NTG value shows that program awareness and incentives can impact this cycle. Therefore, we direct the use of a NTG value of 1.00 for multifamily direct install boiler demand control recirculation pumps.

5.2.3 Multifamily hot-water loop temperature controller

The results for this measure are labeled as "Water Heater Boiler Controls" in the evaluation report. The evaluated NTG value of 0.94 for this measure is a significant increase from the current default value of 0.55. The updated NTG recommendation is based on a survey sample size of 48 respondents and has a relative precision of 7.6 percent at 90% confidence. As explained for the previous measure,

these high NTG values reflect the unique situation for multifamily properties. Therefore, we direct the use of a NTG value of 0.94 for multifamily direct install hot-water loop temperature controllers.

5.2.4 Smart Controllable Thermostats

Effective Program Year: 2022. Commission staff reviewed the PY2019 Impact Evaluation of Smart Thermostats report.[46] Evaluated parameters include UES, NTG, and load shapes and the evaluation encompassed thermostat installations for direct install and rebate delivery types and all residence types. This evaluation completes the two-part effort begun in 2020 to update the previous dated and PA-specific values with statewide values derived from billing analysis. Only NTG value updates are discussed here because only those values are stored in the DEER database (and not the UES and load shapes). NTG, UES, and load shape update guidance will be provided via the measure package update process.

5.3 Updates per nonresidential lighting 2019 EM&V report

Effective Program Year: 2023. Commission Staff reviewed the PY2019 impact evaluation of non-residential lighting.[47] Only two of the six measures considered for evaluation—the two that accounted for 90 percent of the savings—were evaluated: Indoor Linear LED Fixtures and Indoor Linear LED Tubes. These measures are offered in and were evaluated for downstream and midstream program delivery types and are still offered in the current PA portfolio as statewide measures.

The PY2019 evaluation is the first opportunity to conduct NTG research of lighting measures with the new LED baselines. The deemed lighting baselines and offerings have continued to increase in efficacy with the benchmark baseline efficacy increasing from 100 lumens per watt (lm/W) in PY2019 to the current assumption of 128 (lm/W). While the underlying assumptions of baseline and offerings have evolved, their relationship to the market has remained consistent and similar attribution is expected, hence the PY2019 evaluation findings are applicable to the current statewide measures.

For LED fixtures, the evaluated NTG values were significantly lower than the current ex ante value of 0.91 established by the previous DEER Resolution E-4952. In Resolution E-4952, lighting fixture baselines were revised to reflect either an all-LED or significantly-LED (small fraction of linear fluorescent), and the 0.91 NTG value was stipulated to reflect this change, and the expected substantial barriers and reduced opportunity for free-riders.[48] For TLEDs, the evaluated NTG values were slightly higher (0.71 and 0.63) than the ex ante default value of 0.60.

2019 EM&V Statewide average NTG results are summarized in Table A-5-3, which also includes a mapping to the currently-active eTRM nonresidential lighting measures. Downstream values are slightly higher than midstream ones, but the entire range is relatively tight. Because the range of values is relatively small and to simplify the NTG implementation while providing a good

[46] "Impact Evaluation of Smart Thermostats - Draft Residential Sector Program Year 2019, EM&V Group A", California Public Utilities Commission, 3/23/2021. https://pda.energydataweb.com/api/downloads/2487/CPUC Group A Residential SCT draft Report_PDA.pdf

[47] "CPUC Group A Lighting Sector: PY 2019 Nonresidential Deemed Lighting Impact Evaluation Final Report," 3/26/2021, https://pda.energydataweb.com/#!/documents/2489/view. "Final Impact Evaluation, NonResidential Lighting Sector Program Year 2019," 3/26/2021, https://pda.energydataweb.com/api/downloads/2489/PY2019_NonresLgtImpact_FinalRpt.pdf

[48] "2018 Disposition Update for High and Low Bay LED Fixtures based on resubmission of measure package PGECOLTG178 Revision 3 in response to a 2017 Phase Disposition", May 7, 2018.

representative value, we direct the use of a NTG value of 0.65 for both TLED and LED fixtures and for all delivery types.

Table A-5-3. PY2019 evaluated net-to-gross ratio by nonresidential lighting type

Lighting Type	Current Statewide eTRM Measures	Net to gross (NTG) ratio	
		Downstream	Midstream
Fixtures	SWLG011-03 (LED, High or Low Bay) SWLG012-01 (LED Ambient Fixtures and Retrofit Kits, Commercial)	0.67	0.63
TLEDs	SWLG009-02 (LED, Tube) SWLG018-01 (LED, Tube, Type B and Type C)	0.71	0.63

5.4 Updates per HVAC sector 2019 EM&V reports

Commission staff reviewed the PY2019 HVAC Sector Commercial HVAC[49] and Residential HVAC[50] evaluation reports. All measures were reviewed for potential UES and NTG updates. The two Commercial measures were Rooftop and Split Systems and package terminal air conditioner/heat pump (PTAC/PTHP) controls. Neither one of these measures will be updated this cycle. The Rooftop and Split System measure NTG value was updated last year, and this year's evaluation validated the updated value. And although the PTAC/PTHP Controls measure was being evaluated for the first time, it has since been discontinued and is no longer offered because it is now required by Title 24. The Residential HVAC evaluation covers the package of measures described below.

5.4.1 Residential HVAC sector 2019 EM&V updates

Effective Program Year: 2022, 2023. The Residential HVAC evaluation covered a package of six measures. All measures were reviewed for potential UES and NTG updates. In addition, one of the measures – refrigerant charge adjustment is also immediately impacted by the low-GWP refrigerant report findings. The measures and evaluation results are described in detail below.

High-Efficiency Furnaces. The 2019 EM&V results for this upstream program indicated significant issues for both the UES and NTG savings as indicated by the GRR and the NTG values. The evaluated gross savings was 84 percent lower than claimed savings (average GRR of 14%). Ninety percent of the measure claims were wall furnaces and the programs had no way to verify that the furnaces had actually been installed at a customer site due to a lack of tracking information. In addition, for central furnaces the evaluated savings was half of the claimed savings. However, these are tracking data issues rather than UES algorithm issues. The evaluation also found a statewide NTG ratio of 0.28 compared to a claimed average NTG value of 0.60, due primarily to participants indicating they would have installed the same furnace without the program. For reference, the current statewide residential furnace measures use the default residential sector NTG value of 0.55. Because the relative precision of the evaluated NTG value was more than 20 percent, the NTG will not be updated. The evaluation

[49] "Impact Evaluation Draft Report Commercial HVAC Sector, Program Year 2019", 3/12/2021. https://pda.energydataweb.com/api/downloads/2483/CPUC Group A Commercial HVAC Impact Evaluation Report PY2019 Draft for PDA (1).pdf

[50] "Impact Evaluation Draft Report Residential HVAC Sector, Program Year 2019", 3/17/2021. https://pda.energydataweb.com/api/downloads/2484/CPUC Group A Residential HVAC Impact Evaluation Report PY2019 Draft for PDA.pdf

findings, however, indicate significant changes should be considered for the upstream wall furnace program and it should be targeted for EM&V in 2020 to provide a more robust NTG value.

Fan motor replacement. This measure was evaluated last year for the PY2018 EM&V cycle and the NTG value was updated to 0.85. The PY2019 evaluated statewide NTG ratio of 0.90 is higher but within 0.05 points of the updated NTG value, so no additional updates will be made. This year's PY2019 evaluation found GRRs of 27, 29, and 17 percent for kWh, therms, and peak kW respectively, primarily due to interactive effects with measures co-installed with duct sealing measures. Although we do not make any specific recommendations for UES updates, the low GRRs and interaction with other measures should be investigated further and the UES estimates adjusted accordingly.

Fan motor control. PY 2019 evaluation results indicated low GRR values of 65 and 63 percent respectively for fan motor control kW and kWh savings. The evaluation also found that this measure is often installed alongside other efficiency measures - such as smart thermostats that may have similar controls - leading to reduced savings due to the interactive effects between these measures. Although specific UES updates cannot be specified, we recommend investigating whether fan controls and smart communicating thermostat fan-delay functionality is redundant, and adjusting UES values, measure offerings, or measure eligibility requirements if needed. The evaluation also found an average electric NTG ratio of 0.88, which is much higher than both the PY2019 average value of 0.65 and the default residential value of 0.55 used by the current statewide eTRM measure.

Duct testing and sealing. This measure was also evaluated for last year's 2018 EM&V cycle, and the NTG ratio was updated to 0.95, so it will not be updated again this year. The PY2019 evaluation, we found GRR values of 33, 25, and 86 percent for kWh, therm, and peak kW respectively. These reductions are primarily due to interactive effects with other measures co-installed with the duct sealing measure. The evaluation again found an NTG ratio of 95 percent, which validates last year's update.

Condenser Coil cleaning. The 2019 EM&V evaluation GRR was 130% percent for kWh and 95 percent for kW. The increased kWh savings is the result of improved cooling capacity and efficiency from improved air flow values from the HVAC3 evaluations compared to PA measure package claims. These results are consistent with previous evaluation efforts that coil cleaning provides a small amount of electrical energy savings. The evaluation also found an average NTG value of about 0.80 (range of 78 to 83 percent) determined from phone and web surveys. This evaluated value is significantly higher than the current residential sector default value of 0.55. The increased higher attribution is a result of the program delivery approach. The programs proactively offer reduced and no cost coil cleaning options to the consumer, and many customers report they would not have done the measure without program intervention. Many respondents (33 percent) even indicated they were unaware of the need for condenser coil cleaning. Therefore, we direct the use of a NTG value of 0.80 for the condenser coil cleaning measure to be revised from the current eTRM value of 0.55.

Refrigerant Charge Adjustment (RCA). The evaluation found a 96 percent reduction in savings compared to the claimed savings values. In addition, the simulated impacts of RCA are the smallest of any measure group evaluated. Evaluation NTG values were also relatively high at 84 percent versus the current statewide measure default NTG value of 0.55. However, no additional effort will be made to update either of these values as the measure is expired as per Section 3.7.

5.5 Updates per small\medium commercial 2019 EM&V report

Effective Program Year: 2023. Commission staff reviewed the 2019 EM&V report for the 2019 small/medium commercial sector.[51] The four measures selected for evaluation represented the most significant percent of the savings encompassed by this market/sector evaluation group. Results and findings were strongly dependent on the delivery method used (upstream, midstream, downstream, direct install). One of the measures – Agricultural (drip) Irrigation - is no longer offered by PAs so is not discussed in this review. All other measures were reviewed for potential UES and NTG updates and are discussed below.

5.5.1 Process ozone laundry

This is the first time this measure has been evaluated by the current EM&V team. The UES evaluation indicated several possible changes to the savings calculation should be considered for future updates. One recommendation was that very large-scale and unique projects consider a Custom program approach to maximize site-level savings and ensure the projects are vetted through the program application process. Since very large sites can represent a large fraction of overall program savings, this would also stabilize overall deemed measure results. The second recommendation is to consider using the calculator developed by the evaluation team to estimate savings for the more typical projects like nursing homes. The evaluation team amassed industry knowledge, tools, and experience in assembling the calculator which should be considered for improving the deemed savings calculation. A detailed list of the key parameters and parameter estimates are provided in the report.

The evaluated overall average NTG value was 0.70 versus the PA-specific NTG ratios evaluated for PG&E, SCG and SDG&E of 0.55, 0.79 and 0.73, respectively. The current eTRM Statewide measure uses the commercial default greater than 2 years (Com-Default>2yrs) NTG value of 0.60. Because the evaluated NTG value is in-line with the previous SCG and SDGE NTG values and more than 0.05 points different than the existing eTRM value, we direct the NTG value for the Ozone Laundry measure to be updated from the current value of 0.60 to 0.70.

5.5.2 Process pump VFD

This measure was evaluated last year for PY2018 EM&V. No UES changes were made but PAs were directed to change the NTG value to 0.40 (from 0.60) for PY2022. For the PY2019 evaluation the evaluated NTG value of 0.34 was lower than last year's update. However, Commission staff will not update the NTG value again but will continue to monitor for a downward trend. No UES updates will be made either, although the evaluation recommended that an enhanced deemed measure savings algorithm with some site-level customization be incorporated into measure packages. A detailed list of the recommended inputs for the algorithm is provided in the report. The evaluation also found that AMI (advanced metering infrastructure) data was invaluable for considering and analyzing pump operation, but if readily available could also be considered for creating a more realistic measure savings load shape for the measure.

[51] "Final Impact Evaluation, Small/Medium Commercial Sector PY2019", 3/30/2021, https://pda.energydataweb.com/api/downloads/2488/___SmCom_Full_4Posting.pdf

5.5.3 Commercial tankless water heaters

No updates are recommended for commercial tankless water heater UES parameters or NTG values. This measure was evaluated last year for PY2018 EM&V and no updates were made at that time either. The findings this year were very similar to last year's: The evaluated NTG value of 0.62 was within 0.05 of the reported NTG ratios of 0.57 (PG&E) and 0.60 (SCG) and the current eTRM measure NTG of 0.60. Regarding possible UES updates, the evaluation did find differences in water temperature and uniform energy factor (UEF) values relative to the measure packages. For example, the evaluation found UEF values of 0.952 (large) and 0.934 (small) compared to the assumed measure package values of 0.90 (PG&E and SCG) and 0.87 (SCG) which would lead to greater energy savings. These discrepancies, however, were more closely related to tracking data improvement issues rather than changes to algorithms.

6 Review of codes and standards

The following sections describe updates to DEER measures based on changes to federal and state codes and standards.

6.1 Federal standards for commercial natural-gas packaged boilers

Effective Program Year: 2023. Changes to the federal standard, effective January 10, 2023[52] increase the minimum efficiency ratings for all but the very large commercial packaged boilers as shown in Table A-6-1.

Table A-6-1. Federal standards update for commercial natural gas packaged boilers

Equipment	Size Category (input)	Minimum Efficiency[53]	
		New	Previous
Small Gas-Fired Hot Water Commercial Packaged Boilers	≥300 kBtu/h and ≤2,500 kBtu/h	0.84 E_T	0.80 E_T
Large Gas-Fired Hot Water Commercial Packaged Boilers	>2,500 kBtu/h and ≤10,000 kBtu/h	0.85 E_C	0.82 E_C
Very Large Gas-Fired Hot Water Commercial Packaged Boilers	>10,000 kBtu/h	0.82 E_C (no change)	
Small Gas-Fired Steam Commercial Packaged Boilers	≥300 kBtu/h and ≤2,500 kBtu/h	0.81 E_T	Natural draft: 0.77 E_T All others: 0.79 E_T
Large Gas-Fired Steam Commercial Packaged Boilers	>2,500 kBtu/h and ≤10,000 kBtu/h	0.82 E_T	
Very Large Gas-Fired Steam Commercial Packaged Boilers[54]	>10,000 kBtu/h	0.79 E_T	

[52] Table I.1, CFR §431.87 at https://www.govinfo.gov/content/pkg/FR-2020-01-10/pdf/2019-26356.pdf.
[53] E_T means "thermal efficiency;" E_C means "combustion efficiency."
[54] Prior to March 2, 2022, for natural draft very large gas-fired steam commercial packaged boilers, a minimum thermal efficiency level of 0.77 is permitted and meets Federal energy conservation standards for commercial packaged boilers.

As a result, the energy savings for high-efficiency space-heating boilers and instantaneous tankless water heaters are expected to change. Affected DEER Measure IDs are provided in Table A-6-2.

Table A-6-2. DEER measures affected by update to federal standards

Use Category	DEER Measure ID	Version
SHW	NG-WtrHt-LrgInst-Gas-gt200kBtuh-0p80Et	DEER2014
	NG-WtrHt-LrgInst-Gas-gt200kBtuh-0p85Et	
	NG-WtrHt-LrgInst-Gas-gt200kBtuh-0p90Et	
HVAC	NG-HVAC-Blr-Stm-300to2500kBtuh-81p0Et-Drft	DEER2020
	NG-HVAC-Blr-Stm-300to2500kBtuh-82p0Et-Drft	
	NG-HVAC-Blr-Stm-gt2500kBtuh-80p0Et-Drft	
	NG-HVAC-Blr-Stm-gt2500kBtuh-81p0Et-Drft	
	NG-HVAC-Blr-Stm-gt2500kBtuh-82p0Et-Drft	

6.2 Federal standard for residential gas furnace fan

Effective Program Year: 2022. As of July 3, 2019, new residential furnace fans must be driven by electrically commutated motors (ECMs) per the federal Energy Conservation Program for Consumer Products.[55] Hence, the baseline for efficient furnace measures will be updated to have fan motors driven by ECMs, as listed in Table A-6-3.

Table A-6-3. New residential furnace measures

MeasureID	Version	Standard Description	Measure Description
Res-GasFurnace-AFUE90-ECM	DEER2022	Furnace AFUE 80 with ECM supply fan motor	Efficient Residential Gas Furnace - AFUE 90 with ECM supply fan motor
Res-GasFurnace-AFUE91-ECM	DEER2022	Furnace AFUE 80 with ECM supply fan motor	Efficient Residential Gas Furnace - AFUE 91 with ECM supply fan motor
Res-GasFurnace-AFUE92-ECM	DEER2022	Furnace AFUE 80 with ECM supply fan motor	Efficient Residential Gas Furnace - AFUE 92 with ECM supply fan motor
Res-GasFurnace-AFUE93-ECM	DEER2022	Furnace AFUE 80 with ECM supply fan motor	Efficient Residential Gas Furnace - AFUE 93 with ECM supply fan motor
Res-GasFurnace-AFUE94-ECM	DEER2022	Furnace AFUE 80 with ECM supply fan motor	Efficient Residential Gas Furnace - AFUE 94 with ECM supply fan motor
Res-GasFurnace-AFUE95-ECM	DEER2022	Furnace AFUE 80 with ECM supply fan motor	Efficient Residential Gas Furnace - AFUE 95 with ECM supply fan motor
Res-GasFurnace-AFUE96-ECM	DEER2022	Furnace AFUE 80 with ECM supply fan motor	Efficient Residential Gas Furnace - AFUE 96 with ECM supply fan motor
Res-GasFurnace-AFUE97-ECM	DEER2022	Furnace AFUE 80 with ECM supply fan motor	Efficient Residential Gas Furnace - AFUE 97 with ECM supply fan motor
Res-GasFurnace-AFUE98-ECM	DEER2022	Furnace AFUE 80 with ECM supply fan motor	Efficient Residential Gas Furnace - AFUE 98 with ECM supply fan motor

[55] https://www.energy.gov/sites/prod/files/2014/06/f17/furnace_fans_final_rule.pdf

6.3 New low global warming potential refrigerant standards

Effective Program Year: 2022. In California, greenhouse gas (GHG) emissions from refrigerants in HVAC equipment is the fastest growing global warming pollutant. To address this climate threat, California State Senate Bill (SB) 1383, 2016, calls for the emissions of hydrofluorocarbons (HFCs) to be reduced so that by 2030, California's HFC emissions will be 40 percent of what they were in 2013 based on GWP impact. California SB 1013, 2018, was passed shortly after SB 1383 to help define the rules and timeline California needs to follow to reach the 2030 HFC emissions reduction goal.[56] While the act's original timeline has already changed, the latest pending amendment to SB 1013 calls for new stationary AC equipment installed after January 1, 2025 to contain a refrigerant with a 100-year GWP value below 750. Furthermore, under SB 1013, the CPUC and other state regulatory agencies are called upon to assess the operational performance of refrigerants with low-GWPs and to develop a strategy to encourage the adoption of those low-GWP refrigerants in equipment funded by energy efficiency programs overseen by the CPUC.

When SB 1383 was written, it appeared the United States was also planning to phase down the use of HFCs. After the passage of SB 1383, a 2017 US District Court ruling limited the US Environmental Protection Agency's (EPA) ability to regulate refrigerants based on GWP. The ruling effectively stalled national efforts to transition away from high-GWP refrigerants. Despite this, California is following the goals set by the Montreal Protocol and moving forward with a state-led phasedown of HFCs.

The most recent California Air Resources Board (CARB) proposed amendment to regulations on HFCs will delay the transition timing from 2023 to 2025. Many indications point to updates in the next cycle of California building and fire codes that will include revised policies and guidelines to allow for the use of mildly flammable HFC refrigerants in most major HVAC equipment. Once the building and fire codes are finalized, potentially starting in June or July of 2021, the policy and timing of California's transition, will be more certain. When the new regulations are in place, the baselines for affected deemed measures containing refrigerant will need to be updated. The 2021 Proposer Defined Study on HVAC Refrigerants, referenced in Section 3.7, provides a roadmap for accelerating the adoption of low-GWP HVAC refrigerants through a literature review and interviews with HVAC refrigerant related experts.[57]

6.4 CEC Title 24 building energy efficiency code updates

Effective Program Year: 2023. While the 2022 Building Energy Efficiency Standards have not yet been finalized, listed below are some of the possible changes we anticipate seeing in 2022 Title 24. These changes will need to be incorporated as measures are naturally revised. They will be applicable to the "New" era prototype that will be developed and become effective in the future when newly constructed buildings reflect the 2022 Title 24 code.

- Some of Title 24 equipment efficiencies given in Table 110.2-A through 110.2-K are going to change to match their values with equipment efficiencies given in Table 6.8.1-1 through 6.8.1-16 of 2019 ASHRAE 90.1. For some equipment, efficiency tables in 2019 ASHRAE 90.1 have different requirements before and after 1/1/2023. The new Title 24 will adopt most of them. They include air-cooled air conditioners and heat pumps—both split system and single package—variable-

[56] https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1013
[57] https://appliance-standards.org/products-and-links

refrigerant flow (VRF) water-source (cooling mode), warm-air furnace (gas-fired and oil-fired), and boiler (hot water and steam), etc.

- 2019 ASHRAE 90.1 includes efficiencies for computer room air conditioners and condensing units and heat-recovery chillers. New Title 24 may include them as well.
- Dedicated outside-air systems (DOAS) units may be included in 2022 Title 24 along with associated efficiency metrics:
    - Integrated Seasonal Coefficient of Performance (ISCOP)
    - Integrated Seasonal Moisture Removal Efficiency (ISMRE)
- Occupant-sensor ventilation-control devices
- Some changes expected regarding the airflow rates for demand-control ventilation (DCV)
- Code will define the airflow rate for bathroom and kitchen exhaust fans
- 2018 AMCA 208 defined new fan efficiency metric called fan energy index (FEI) which is the ratio of actual fan efficiency to the baseline fan efficiency (or baseline fan energy to the actual fan energy) while both measured at the same flow and pressure conditions. AMCA introduced this as part of DOE effort and ASHRAE has already adopted the new term. The code will require all fans with nameplate ratings greater than 1 hp to have an FEI greater than or equal to 1.0.
- In line with ASHARE 90.1, the new Title 24 will define the fan power allowance for the calculation of fan power budget. This will include all fan types (supply, return, make-up air, and relief) for all fans exceeding 1 hp.
- Efficiency requirement update expected for high-capacity space-heating gas boiler systems, requiring a minimum thermal efficiency of 90 percent for boilers greater than 1 MMBtu/h of input capacity. This also comes with an additional condition of a maximum heating hot water return temperature (HHWRT) setpoint of 120°F. Service water heating system may have the same requirement.
- Lighting power density (LPD) of some area categories will change and they will be even better than ASHRAE's latest values. New areas will be added to multi-level lighting control including library, warehouse, parking garages, and staircases.
- Some of the areas that need occupancy-based ventilation control will be controlled with lighting sensors.
- Single family housing updates include:
    - Dimming control for kitchen and living area lighting
    - Solar access roof area (SARA) requirement for single family homes
    - Mandatory requirement for "electric ready building"
- Multifamily housing updates include:
    - Local mechanical exhaust for kitchen and bathroom. Code will define the minimum airflow rate for kitchen and bathroom exhaust fans along with the capture efficiency (CE) of kitchen range hoods
    - Demand controlled mechanical exhaust
    - Community shared solar electric generation system requirement
    - Energy storage system (ESS) requirement
    - Electric cooktop and clothes dryer—for all-electric homes
    - We can expect higher insulation requirements and vapor barrier requirements
    - Thermostatic requirement for temperature setback and occupancy-controlled ventilation
- Requirement for infiltration testing for envelope and between the floors of commercial building. There are new testing requirements for air barriers.

- New requirement for exhaust air heat recovery for different climate zones. These recovery efficiencies will define the part-load efficiency, i.e., varying recovery efficiency with flowrates.
- New efficiency requirement for CO_2-based refrigeration systems. CO_2-based refrigeration system will be proposed for refrigerated warehouse and commercial refrigeration.
- New mandatory requirement for Controlled Environment Horticulture (CEH). It will define new metric for dehumidification.
- New mandatory requirement for indoor grow lighting and horticultural lighting and their controls. There will be updated envelope requirements as well.
- Demand response-enabled system requirements will be based upon the minimum connected kW instead of building area.
- Steam traps and compressed air systems will get new requirements.
- Improvement expected for most of the covered processes.

6.5 CEC Title 20 appliance efficiency code updates

No updates are currently anticipated because most Federal appliance and equipment efficiency standard updates were suspended, as noted on the Appliance Standards Awareness Project website.[58] However, if these updates are restarted and fast-tracked, they would be expected to be incorporated into measure revisions for PY 2024-25. There are a significant number (22) of suspended commercial and residential equipment and appliance updates.

7 Review of market and research studies

Market and research studies, including baseline studies,[59] are a rich source of update information but are only periodically conducted. These types of studies can be used for calibration of whole site and end use energy use, establishing industry standard and/or best practices, developing operating hours, and developing model prototype characteristics.

7.1 Update EULs based on Group A Effective Useful Live (EUL) study

Effective Program Year: 2023. Since an EUL study report by Guidehouse[60] has been finalized, updates to the whole building EULs are anticipated for the DEER2023 update. Those affected are listed in Table A-7-1 as supported by the report. The whole-building EUL values may be further updated if a related report by Guidehouse about the measure life of building insulation is finalized before the Resolution is voted out.[61]

[58] https://appliance-standards.org/products-and-links
[59] For example, CEC's Commercial End-Use Survey (CEUS) and Residential Appliance Saturation Study (RASS), and CPUC's Commercial Saturation Study-Commercial Market Share Tracking (CSS-CMST) studies and California Lighting and Appliance Saturation Study (CLASS).
[60] "EMV Group A, Deliverable 16 EUL Research – Residential Whole Building Retrofits, Final Report," by Guidehouse, for CPUC, June 3, 2021. (See https://pda.energydataweb.com/#!/documents/2512/view.)
[61] "EMV Group A, Deliverable 16 EUL Research – Residential Attic, Floor, and Wall Insulation, Draft Report," by Guidehouse, for CPUC, April 2021.

Table A-7-1. Updated effective/remaining useful life values for whole-building retrofit

EUL_ID	Description	EUL	RUL	Start Date	Expiry Date
WB-#####-w## (45 IDs)	Varies	17.7 (avg.)	5.89 (avg.)	2013-01-01	2022-12-31
WhlBldg-WBInsFen-NEW-MfrHse	SCE: Whole Building new construction manufactured housing building shell improvements	20.0	6.67	2013-01-01	2022-12-31
WhlBldg-WBInsFen-NEW-SF	SCE: Whole Building new construction single family building shell improvements	18.0	6.00	2013-01-01	2022-12-31
WhlBldg-WBInsFen-RET-SF	SCE: Whole Building retrofit single family building shell improvements	14.0	4.67	2013-01-01	2022-12-31
WhlBldg-0-lt25pctElecSvgs	Whole building retrofit with <25 percent electric savings[62]	10.6[a]	3.53	2023-01-01	
WhlBldg-25-lt75pctElecSvgs	Whole building retrofit with 25 to <75 percent electric savings[62]	15.7[b]	5.23	2023-01-01	
WhlBldg-75-100pctElecSvgs	Whole building retrofit with ≥75 percent electric savings[62]	15.9[c]	5.30	2023-01-01	

[a] If the RUL of building-shell insulation increases to 20 years, this EUL nearly doubles to 19.0 years.

[b] If the RUL of building-shell insulation increases to 20 years, this EUL increases to 17.7 years.

[c] If the RUL of building-shell insulation increases to 20 years, this EUL increases slightly to 16.0 years.

8 New measure additions

This section describes the addition of two water heating measures: Commercial tankless water heaters and multifamily central water heating systems that will be added to the DEER database for 2022 and 2023, respectively.

8.1 Commercial tankless water heater

Effective Program Year: 2022. Given the efficiency improvements that have occurred among large tankless water heaters since 2014, a new measure tier will be generated for 2022 claims having a thermal efficiency of 0.96 (see Table A-8-1).

Table A-8-1. New large tankless commercial water heater measure

DEER Measure ID	Version	Start Date	Thermal Efficiency	
			Measure	Standard
NG-WtrHt-LrgInst-Gas-gte200kBtuh-lt2G-0p96Et	DEER2022	2022-01-01	0.96	0.80

[62] Conversion factors used to determine proportion of electric savings: 1 kWh=3.412 kBtu and 1 therm=100 kBtu

Although SoCalGas has requested permission to scale the UES from the extended MeasureIDs discussed in Section 4.2 for use in 2021 to provide tankless water heaters having a thermal efficiency of 0.96 or higher, further discussion is necessary since extrapolation of DEER UES values is generally disallowed.

8.2 Multifamily central water heating systems

Effective Program Year: 2023. There is a need for deemed energy savings for efficient centralized service hot water systems that are typical at some multifamily buildings. These will be generated by first replicating the DEER MFm eQUEST building prototype family in EnergyPlus™ (E+) and then modeling a central hot-water system. While there has been much interest in providing this update as early as PY2022, it is not anticipated that this will be feasible. Efforts will be made to accelerate this priority as much as possible.

9 Support table updates

Throughout the year, additions and modifications must be made to the PEAR database. Once the changes to the PEAR database have been adopted via resolution, these additions and modifications are migrated to the Ex Ante database during the month following the resolution adoption. Events that typically trigger additions and modifications to the PEAR database include new IOU measure packages and changes resulting from new CPUC guidance documents and new CPUC policies. As changes are made to the PEAR database, they are announced via the PEAR Change Log.[63] On the following day, all changes to the PEAR database are reflected in CEDARS and in the CPUC Support Tables in the eTRM. The changes in the subsections that follow were made since the adoption of Resolution E-5082 for DEER2023 Update.

9.1 New EUL values

Effective Program Year: 2020. EUL and RUL values were added to PEAR as shown in Table A-9-1.

Table A-9-1. Effective/remaining useful life values

EUL_IDs	Description	EUL	RUL	Start Date
NonRes-WhlBldg-SEM	Strategic Energy Management (SEM)	5.0	1.67	2020-01-01
ComLau-EffCW-Leased	Leased High-efficiency Clothes Washer (CEE Tiers 1,2,3), 5-year min. term	5.0	1.67	2020-09-24

The first new EUL ID, *NonRes-WhlBldg-SEM*, is consistent with CPUC D.17-09-025 Decision Adopting Energy Efficiency Goals for 2018-2030 and supported by Table 3-26 of the *Energy Efficiency Potential and Goals Study for 2018 and Beyond*.[64] It is being applied retroactively.

The second new EUL ID, *ComLau-EffCW-Leased*, is limited to the 5-year lease term required per the program design; the median lifecycle of a commercial clothes washer is significantly longer than five years.

[63] Available at http://www.deeresources.com/files/deerchangelog/pearchangelog.html.
[64] Navigant. *Energy Efficiency Potential and Goals Study for 2018 and Beyond*, 2017, p. 73.

Additional new EUL IDs are added as indicated in Section 7.1.

9.2 Expired EUL values

Effective Program Year: 2022-23. Many of the legacy EUL and RUL values for lighting measures will be expired in PEAR. Only those that are currently in use in approved measure packages will remain. Final lists of non-lighting and lighting EUL_IDs to be retired are provided in Table A-9-2 and Table A-9-3, respectively. These are in addition to those already indicated in Section 7.1.

Table A-9-2. Expired non-lighting effective useful life (EUL) IDs as of 2021-12-31*

Expired non-lighting EUL_IDs		
Agr-DripIrr	EUC_6.6	WB-38962-w10*
Agr-LPSNperm	PGE-EUC-LM005-1975	WB-41522-w06*
Agr-LPSNport	PGE-EUC-LM005-1985	WB-43723-w10*
AppPlug-AllEquip-Audio	PGE-EUC-LM005-1996	WB-43750-w06*
AppPlug-AllEquip-BRDVD	PGE-EUC-LM081-1975	WB-45456-w10*
AppPlug-DesktopComp	PGE-EUC-LM081-1985	WB-52042-w09*
AppPlug-TV	PGE-EUC-LM081-1996	WB-52395-w10*
EnergyPolicyManual-Min	PGE-EUC-LM125-1975	WB-53613-w10*
EUC_3.7	PGE-EUC-LM125-1985	WB-56139-w10*
EUC_3.8	PGE-EUC-LM125-1996	WB-56999-w08*
EUC_3.9	PGE-EUC-LM141-1975	WB-57634-w10*
EUC_4.1	PGE-EUC-LM141-1985	WB-64074-w06*
EUC_4.2	PGE-EUC-LM141-1996	WB-64187-w08*
EUC_4.3	PGE-EUC-LM162-1975	WB-64721-w10*
EUC_4.4	PGE-EUC-LM162-1985	WB-66984-w10*
EUC_4.5	PGE-EUC-LM162-1996	WB-68399-w10*
EUC_4.6	PGE-EUC-LM165-1975	WB-69986-w08*
EUC_4.7	PGE-EUC-LM165-1985	WB-71850-w09*
EUC_4.8	PGE-EUC-LM165-1996	WB-72848-w10*
EUC_4.9	Plug-HiEffCopier	WB-75270-w10*
EUC_5.1	Plug-Software	WB-76805-w10*
EUC_5.2	Res-Plug-Soundbar	WB-79171-w06*
EUC_5.3	WB-13590-w10*	WB-80419-w06*
EUC_5.4	WB-16063-w06*	WB-81881-w10*
EUC_5.5	WB-18288-w06*	WB-82988-w10*
EUC_5.6	WB-18720-w10*	WB-87309-w10*
EUC_5.7	WB-19122-w10*	WB-87379-w10*
EUC_5.8	WB-19550-w10*	WB-87576-w10*
EUC_5.9	WB-20558-w09*	WB-92396-w10*
EUC_6	WB-22378-w10*	WB-95864-w06*
EUC_6.1	WB-26618-w10*	WB-95984-w10*
EUC_6.2	WB-28890-w06*	WB-98013-w10*
EUC_6.3	WB-29480-w08*	WhlBldg-WBInsFen-NEW-MfrHse

Expired non-lighting EUL_IDs		
EUC_6.4	WB-33387-w08*	WhlBldg-WBInsFen-NEW-SF

* Marked whole-building EUL_IDs will expire as of 2022-12-31 as per Table A-7-1.

Table A-9-3. Expired lighting effective useful life (EUL) IDs as of 2021-12-31

Expired Lighting EUL_IDs		
ILtg-CFL-12000hr-Com	ILtg-LED-seas	OLtg-CFLfix-Dusk-to-Dawn
ILtg-CFL-12000hr-ResCmn	ILtg-Lfluor-CommArea	OLtg-CFLfix-ResCmnArea
ILtg-CFL-6000hr-Com	ILtg-Lfluor-fix	OLtg-HID
ILtg-CFL-6000hr-ResCmn	ILtg-Lfluor-Mag	OLtg-HID-Cmn
ILtg-CFL-8000hr-Com	ILtg-Lfluor-T12Mag	OLtg-HPS
ILtg-CFL-8000hr-ResCmn	ILtg-MH	OLtg-Incand-Com
ILtg-CFL-Com	ILtg-T5	OLtg-Incand-Res
ILtg-CFLfix-Com	LtgFixture-Default	OLtg-Incand-Res-Cmn
ILtg-CFLfix-Res	OLtg-CFL	OLtg-Induct
ILtg-CFLfix-ResCmnArea	OLtg-CFL-12000hr-Res	OLtg-LFluor-CommArea
ILtg-CFL-ResCmn	OLtg-CFL-12000hr-Res-Cmn	OLtg-LFluor-Dusk-to-Dawn
Iltg-Com-CldCthd-25000hr	OLtg-CFL-6000hr-Res	OLtg-Lfluor-Mag
ILtg-HID	OLtg-CFL-6000hr-Res-Cmn	OLtg-LFluor-Res
ILtg-HID-Cmn	OLtg-CFL-8000hr-Res	OLtg-MH
ILtg-HPS	OLtg-CFL-8000hr-Res-Cmn	OLtg-T5
ILtg-Incand-Com	OLtg-CFL-Cmn	Recreate-LED_fixt-Res
ILtg-Incand-Res	OLtg-CFL-Dusk-to-Dawn	
ILtg-Induct-Elec	OLtg-CFLfix	

9.3 New technology type

Effective Program Year: 2021. A new DEER database technology type (TechType) was added for commercial heat pump water heaters that are rated using Coefficient of Performance (COP)—*HP_COP*. This TechType belongs to the pre-existing "WaterHtg-eq" technology group for all water heating equipment.

9.4 New support table fields for refrigerants

Effective Program Year: 2022-23. Six new fields are needed for avoided costs of refrigerant leakage calculated using the Refrigerant Avoided Cost Calculator. For PY2022 measures, the calculator must be submitted as an addendum to each approved measure package where the retrofit involves adding (not replacing) equipment with refrigerant – these include fuel substitution, electric resistance to heat pump measures, or where low-GWP refrigerant benefits will be claimed. For PY2023—and consistent with direction provided in Section 3.11—fields will need to be added to the eTRM permutations as shown in Table A-9-4.

Table A-9-4. New fields for refrigerant NPV avoided costs

Fieldname	Field description
RefrigerantNPVBenefitsPre Baseline	NPV avoided costs calculated using the Refrigerant Avoided Cost Calculator for pre-existing baseline equipment
RefrigerantNPVBenefitsStd Baseline	NPV avoided costs calculated using the Refrigerant Avoided Cost Calculator for standard baseline equipment
RefrigerantNPVBenefitsMea	NPV avoided costs calculated using the Refrigerant Avoided Cost Calculator for installed measure equipment
RefrigerantNPVCostsPre Baseline	NPV costs calculated using the Refrigerant Avoided Cost Calculator for pre-existing baseline equipment (should be entered as a positive value)
RefrigerantNPVCostsStd Baseline	NPV costs calculated using the Refrigerant Avoided Cost Calculator for standard baseline equipment (should be entered as a positive value)
RefrigerantNPVCostsMea	NPV costs calculated using the Refrigerant Avoided Cost Calculator for installed measure equipment (should be entered as a positive value)

9.5 DEER2008/2011 records added to DEER2022 load shape tables

Effective Program Year: 2022. The DEER2008 and DEER2011 electric load shape parameters have been uploaded to the PEAR database. The parameters for the following three natural gas load shapes have been generalized and uploaded to PEAR: Annual, WinterOnly, and SummerOnly.

10 APPENDIX I: Assessment of eTRM and Data Source of Record criteria

Resolution E-5082 for the DEER2022 update listed software enhancements needed for the eTRM to meet the Energy Division's standard for a data source of record for deemed energy efficiency measures. Phase 1 enhancements were designed to meet public user requirements for access to approved deemed values; phase 2 enhancements were designed to meet CPUC user requirements for review of deemed measures, budget filing and program reporting, and evaluation activities. Table A-10-1 lists both the enhancements and criteria used by the Energy Division in assessing the eTRM's suitability as the data source of record for phases 1 and 2 in the development process. As of the timing of this public comment draft resolution, the eTRM shared parameter and value tables are updated by a manual process in coordination with the Energy Division and the eTRM developers. By third quarter, the necessary API end points for an automated and seamless nightly synchronization with the ex ante data tables will be installed by the eTRM developers. Therefore, this table reflects a "TBA" status for criteria associated with enhancements underway in the second quarter.

In the tables that follow, "TBA" means that, at the time this resolution is circulating for comment, developers are still working on the enhancement. "TBA (production)" means that the staff working group has reviewed and tested the enhancement in staging, but not in production, at the time that this resolution is circulating for comment. "Yes" means that it meets the requirement.

Table A-10-1. Phase 1 eTRM enhancements assessment

Enhancement				
No.	**Priority**	**Criterion**	**Compliance**	**Due date[65]**
1	Critical	Data fields added at staff direction to meet the Deemed Data Standard.	See Table A-10-2	Release 2.2 2021
2	Critical	Process (API with specific views designed by the ex ante team for the eTRM) syncs with the Ex Ante tables and updates the eTRM shared tables daily.	TBA	Release 2.2 2021
3	Critical	Versioning of shared parameters and value tables occurs at the object (table/parameter) level rather than at the shared data library level.	Yes (staging) TBA (production)	Release 2.2 2021
4	Slight	Measure package developers can choose what columns appear (and their order) in the measure characterization when a shared value table is embedded (both shared and measure-specific).	TBA	Release 2.2 2021
62	Slight	The measure characterization PDFs contain: - Logical page breaks, where possible (not splitting up object/table names from its host object/table, etc.) - Maintain proportionality and consistency in text style levels (headings) and sizes (esp. static vs. dynamic table headings) - Floated elements retain their size, instead of erroneously expanding to full width in the PDF - All symbols in the measure characterization text and calculations will render correctly in the PDF	Yes (staging) TBA (production)	Release 2.2 2021

[65] We anticipate the implementation of these enhancements to be complete by the release of eTRM v2.2 on July 19, 2021.

Table A-10-2 provides the phase 1 requirements for data fields to include in an eTRM shared parameter/value table and/or a measure permutation table.

Table A-10-2. Phase 1 data field requirements assessments

Description	PEAR/ExAnte field	eTRM field	Compliance	Due date[66]
Measure description	Description	OfferingDesc	Yes	-
DEER/Workpaper version	Version	Version	Yes	-
First-baseline case description	PreDesc	Existing Description	Yes	-
Second-baseline case description	StdDesc	Standard Description	Yes	-
Measure case description	MeasDesc	MeasureCase	Yes	-
Sector	Sector	Sector	Yes	-
Technology Group	TechGroup	TechGroup	Yes	-
Technology Type	TechType	TechType	Yes	-
End-use category	UseCategory	UseCategory	Yes	-
End-use sub-category	UseSubCategory	UseSubCategory	Yes	-
Effective useful life ID	EUL_ID	EUL_ID	Yes	-
Effective useful life, years	EUL_Yrs	EUL (YR)	Yes	-
Remaining useful life ID	RUL_ID	RUL_ID	Yes	-
Gross savings & installation adjustment factor	GSIA_ID	GSIA_ID	Yes	-
Net-to-gross ID	NTG_ID	NTG_ID	Yes	-
Measure Impact Type (MIT)	MeasImpactType	MeasImpactType	Yes	-
Start date of measure, etc.	StartDate	Spec_Measure. EffStartDate	TBA	Release 2.2 2021
Expiration date of measure, etc.	ExpiryDate	Spec_Measure. Sunset Date	TBA	Release 2.2 2021
Energy impact ID	EnergyImpactID	EnergyImpactID	Yes	-
Flag for interactive effects	ApplyIE	IE_Applicable	Yes	-
Interactive effects table	IETableName	IETableName	Yes	-
Energy Impact Calculation Type	EnImpCalcType	MeasImpactCalcType	Yes	-
First baseline kW savings	APreWBkW APreEUkW	UnitkW1stBaseline	Yes	-

[66] Due dates are only shown for future or incomplete data additions. We anticipate the addition of these data fields to be complete by the release of eTRM v2.2 on July 19, 2021.

Description	PEAR/ExAnte field	eTRM field	Compliance	Due date[66]
First baseline kWh savings	APreWBkWh APreEUkWh	UnitkWh1stBaseline	Yes	-
First baseline therm savings	APreWBTherm APreEUTherm	Unittherm1stBaseline	Yes	-
Second baseline kW savings	AStdWBkW AStdEUkW	UnitkW2ndbaseline	Yes	-
Second baseline kWh savings	AStdWBkWh AStdEUkWh	UnitkWh2ndbaseline	Yes	-
Second baseline therm savings	AStdWBTherm AStdEUTherm	Unittherm2ndbaseline	Yes	-
HVAC system type	BldgHVAC	BldgHVAC	Yes	-
Climate zone	BldgLoc	BldgLoc	Yes	-
Measure Impact Calculation Type for DEER measures	MeasImpactCalcType	MeasureImpact CalculationType	Yes	-
Building type	BldgType	BldgType	Yes	-
Building vintage bin	BldgVint	BldgVint	Yes	-
Delivery method of measure	DeliveryType	Delivtype	Yes	-
Electric impact profile ID	ElecImpactProfileID	ElecImpactProfileID	Yes	-
Gas impact profile ID	GasImpactProfile ID	GasImpactProfileID	Yes	-
Description	Description	MeasureCase	Yes	-
Measure application type (MAT)	MeasAppType	MeasAppType	Yes	-
Measure Impact Type (MIT)	MeasImpactType	MeasImpactType	Yes	-
Normalizing unit	NormUnit	NormUnit	Yes	-
Program administrator	PA	PA Type	Yes	-

Table A-10-3 provides the phase 2 enhancement requirements that were listed in Resolution E-5082 to improve user experience and meet CPUC requirements. In the second quarter development period of 2021, it became clear to the working group that some priorities had shifted. The group coordinated to update the priorities in E-5082, as listed in the table below. Staff may continue to modify enhancements in coordination with the working group as necessary. Enhancements with an "X" in the "E-5082" column were ordered by Resolution E-5082; those without were later established by staff and the working group to address technical gaps discovered during development. Those enhancements that have no compliance assessment or due date have not yet been scheduled as of the time of this draft resolution; they are expected to be available with Release 2.3 in Q4 2021 or 2.4 in 2022.

Table A-10-3. Phase 2 eTRM enhancements assessments

Enhancements					
No.	**E-5082**	**Priority**	**Criterion**	**Compliance**	**Due date[67]**
5	X	Moderate	CPUC-specific shared data library for DEER measures to support versioned parameters and value tables managed by CPUC and available for eTRM measures to import. Create CPUC-specific workspace to allow for storage and viewing of DEER Measure and Energy data that could be imported into the eTRM Measure. Create template for users who wish to develop a new measure based upon a valid DEER Measure (a DEER measure that has not expired) to be able to import DEER Energy data into the eTRM Measure template for further development of a statewide measure.	Yes (staging) TBA (production)	Release 2.2 2021
6	X	Critical	Ability to maximize production system uptime during deployment of enhancements and fixes. Deployments that require system downtime should be deployed outside typical business hours.		
7	X	N/A	Ability to utilize the staging environment as a User Acceptance Testing platform for all enhancements.		
8	X	Moderate	Ability to retain independent user profiles between staging and production environments during deployment of enhancements and fixes.	-	Release 2.3 2021
9	X	Critical	Ability to deploy enhancements to production environment without compromising existing measures, measure data and user tracking data.		
10	X	Critical	Ability to roll-back changes in the event of failed deployment, without loss of data.		
11	X	Moderate	Ability to associate load shapes--either 8,760-hour or compressed format--to measure permutations based on permutation attributes. eTRM should store library of load shapes, which may be associated at the permutation level. Ability to add load profile IDs and finalize at a later time.	-	Release 2.3 2021

[67] Due dates are only shown for future or incomplete enhancements.

Enhancements					
No.	**E-5082**	**Priority**	**Criterion**	**Compliance**	**Due date[67]**
12	X	N/A	Ability to select any available public field in any order, downloadable as Excel or PDF file. Ability for user to save report format associated with their specific log-in credentials so they can use repeatedly.	-	Release 2.4 2022
13	X	N/A	Incorporate interactive report rendering system (e.g., Tableau Public Version) with eTRM. Build presentment into dedicated eTRM page (via iframe) and add Report link to global navigation.	Yes (staging) TBA (production)	Release 2.2 2021
14	X	Slight	Add an extension of notifications available on measure and permutation reports. Any change to the data in the report, where the source is from a commit (NOT a saved draft) would trigger a notification to subscribers. Notifications would be aggregated so that a user only receives one notification per report per day, in the case that someone is committing updates to a measure multiple times in one day.	-	Release 2.3 2021
15	X	Moderate	Ability to download master report (flat file) of measure permutations that is not limited to a single measure.	Yes	-
16	X	Moderate	Developed master report (flat file) of measure permutations that is not limited to a single measure.	Yes	-
17	X	Critical	Software hard-coded roles and permissions matrix. Roles are categorized into system roles or measure roles. CPUC Roles included.	Yes (staging) TBA (production)	Release 2.2 2021
18	X	Critical	Workflows to eTRM for Energy Division ex ante workpaper review, tracking, approval, and value updating functionality.	Yes (staging) TBA (production)	Release 2.2 2021
19	X	Critical	Added functions that support email notifications as a measure changes status and assignee.	Yes (staging) TBA (production)	Release 2.2 2021
20	X	Moderate	When Shared Table updates occur, the system will determine which measures are affected and permit the administrator to notify the appropriate parties who have registered for notification when specific measures or measure technology types change. Update notification would be at discretion of administrator.	Yes (staging) TBA (production)	Release 2.2 2021

Enhancements					
No.	**E-5082**	**Priority**	**Criterion**	**Compliance**	**Due date[67]**
21	X	Critical	Ability for the eTRM to generate a flat-file export that is compatible with the CET measure import specification: --The user shall be able to select measures from an available list --The user should be able to filter the measures based on parameters that define permutations (e.g., Delivery type, MAT) eTRM shall be able to import permutation-level cost-effectiveness values from a flat file that is compatible with CET measure results file specifications: --Values will be loaded and stored at the measure permutation level.	Yes (staging) TBA (production)	Release 2.2 2021
22	X	N/A	Develop filters for dashboards that are specific to individual users. The dashboards and filters shall only be viewable by a specific user, as determined by the user's log-in credentials. as specified. Filters include end use, sector, and delivery type.	-	Release 2.4 2022
23	X	Slight	Update the measure data model to include a new field for delivery type, so that it can be filtered on. Delivery type shall be added to the table of measures on the user's dashboard.	-	Release 2.4 2022
24	X	N/A	Allow an editor to sort Value Tables based upon any column (parameter or value) and save that sort to embed that sort into a characterization field.	-	Release 2.4 2022
25	X	N/A	Implement the ability for an editor to transpose value tables. This applies to both static (RTE) tables and dynamic (embedded) tables. In the case of an embedded value table, this display configuration only applies to the table in the characterization, and does not affect the underlying value table (located in the Supporting Data page of the measure)	-	Release 2.4 2022
26	X	N/A	Design new table styles (to be added to existing "Zebra" and "Plain" table style options). One example new style is a table with smaller font and narrower column widths. Enable measure editors to set a table style to both static (RTE) and dynamic (embedded) tables.	-	Release 2.4 2022

Enhancements					
No.	**E-5082**	**Priority**	**Criterion**	**Compliance**	**Due date[67]**
27	X	Slight	Implement functions that assign a reference to a value table row.	Yes	-
28	X	N/A	Add ability for users to hide columns and rearrange columns based on individual session needs.	-	Release 2.4 2022
29	X	N/A	Allow users to save their permutation table preferences for next time (including sorting, filtering, hiding columns, etc.)	-	Release 2.4 2022
30	X	N/A	Add capability to show calculated values in value tables	-	Release 2.4 2022
31	X	Slight	Support the Boolean type, with TRUE and FALSE displayed/imported/exported instead of 0 and 1.	-	Release 2.4 2022
32	X	N/A	Implement enhancement to the equation editing interface to allow editors to type directly into the editing bar (including autocomplete suggestions) without having to click (+) to see the list of terms to choose from.	-	Release 2.4 2022
33	X	N/A	When viewing calculations, implement a way to provide insight as to the source of a calculation's variable – which could be a value table, parameter or another calculation – and a link to travel to the object detail page.	-	Release 2.4 2022
34	X	N/A	Add capability to have global or imported calculations. Global calculations are calculations that are used in more than one measure.	-	Release 2.4 2022
35	X	N/A	In the configure permutation fields panel, fields that are not mapped will be color-coded so that they are easier to see and correct.	-	Release 2.4 2022
36	X	N/A	Pre-map values from shared parameters/shared value tables to data spec field.	-	Release 2.4 2022
37	X	N/A	Add capability for users to filter and sort permutation table. When filtered, system would automatically hide the rows that are no longer unique due to missing columns	-	Release 2.4 2022

Enhancements					
No.	**E-5082**	**Priority**	**Criterion**	**Compliance**	**Due date[67]**
38	X	N/A	Include ability to hide columns of the permutation table that user may consider unnecessary. Column-hiding functionality should also hide duplicate rows if columns being hidden were distinguishing columns to unique permutations	-	Release 2.4 2022
39	X	Moderate	In the exclusion table, implement a visual design for exclusion table rows that are NOT excluded (e.g. unchecked), so that they are easier for editors to scan in the table.	-	Release 2.4 2022
40	X	Critical	Implement feature that allows range-checking on value tables. An editor would be able to specify a maximum value, minimum value, allowable data type (such as text or number only) and/or "cannot be empty" validation on a value table column. Value table cells that do not meet the validation criteria would be flagged to the measure developer or measure reviewer. --Prior to implementing this feature, ensure that error-checking features to be developed for eTRM are consistent with and at least as robust as the error-checking features for CET and CEDARs. --Note: This does not apply to static (RTE) tables.	-	Release 2.3 2021
41	X	Moderate	Implement text comparison and redlining feature for all measure text fields so textual differences between different versions of a measure are readily apparent. This feature shall allow an editor to compare two versions of a measure, selected by the editor, marked up with differences.	-	Release 2.3 2021
42	X	Moderate	Once necessary license with the WebSpellChecker CKeditor plugin is obtained, ensure it is used as the spell-checking source for all rich text fields in the eTRM.	-	Release 2.3 2021
43	X	Slight	Reference file download green rectangle element is reduced in footprint for an individual reference and when seen in a long list of references.	Yes	-

Enhancements					
No.	**E-5082**	**Priority**	**Criterion**	**Compliance**	**Due date[67]**
44	X	Slight	Explore adding a drag-to-resize image capability to measure characterization rich text fields. If that solution is not recommended or stable, add up to two new image styles. One desired new style is a small stamp-size image style.	-	Release 2.4 2022
45	X	Moderate	Ability for a reference to be associated with a measure, value table, parameter or calculation by a specific page or table number. This eliminates the need to duplicate references in the reference library.	Yes	-
46	X	N/A	Add a field to the reference data model for Publication Date. Add a filter to the manage references list that allows filtering by publication date.	-	Release 2.4 2022
47	X	N/A	Add "Year" field to search matrix for reference search	-	Release 2.4 2022
48	X	N/A	References that have file attachments will display an attachment icon in the manage references list. Implement the ability to filter the manage references list by "has attachment".	-	Release 2.4 2022
49	X	N/A	Implement a list of common reference sponsor organizations. When adding or editing a reference, a user can select a sponsor organization from the list or add their own.	-	Release 2.4 2022
50	X	N/A	Add an API endpoint that provides a master list of value tables across latest published versions of all measures and including the shared data library.	-	Release 2.4 2022
51	X	Moderate	Added API endpoint that provides a master list of permutations across latest published versions of all measures.	Yes	-
52	X	Slight	Add an API endpoint that provides a master list of all references. The list can be filtered by reference type.	-	Release 2.3 2021
53	X	N/A	Include "at a glance" capability for viewing tables without clicking into them (using mouse-over or hover-enabled popup).	-	Release 2.4 2022
54	X	Slight	Added pagination selector to all paginated eTRM lists (except panel lists), offering pagination by 25, 50, 100 objects.	Yes	-

Enhancements					
No.	**E-5082**	**Priority**	**Criterion**	**Compliance**	**Due date[67]**
55	X	Slight	Design and implement a new reference detail page. --This reference detail would be viewable through site search, including the ability to include/exclude reference results from the search results list. All references shall be accessible through site search.	-	Release 2.3 2021
56	X	N/A	Design and implement a new calculation detail page. Implement the addition of shared value tables, shared parameters and shared calculations being accessible through site search.	-	Release 2.4 2022
57	X	N/A	Modify home page to allow view access without login. Such anonymous access would deny user features such as subscriptions, saved preferences, etc., that rely on a registrant's email address.	-	Release 2.4 2022
58	X	Critical	Add additional fields to the "Configure permutation fields" panel, "Data spec" tab.	TBA	Release 2.2 2021
59	X	Slight	Ability to download the measure characterization PDF separately from the full measure download package. Only the PDF is contained in the download.	Yes	-
60	X	N/A	Allow ability to perform 8,760-hour array calculations (for example, developing annual carbon impact using hourly values that can be summed over full year), as well as over measure lifetime.	-	Release 2.4 2022
61	X	Slight	Add measure name and version number to the characterization PDF file name.	Yes	-
63	X	Slight	Update parameter .csv files to identify which values from shared parameters are selected for measure.	-	Release 2.4 2022
64	X	Slight	Add ≥ and ≤ to the list of available symbols in the rich text editor toolbar.	TBA	Release 2.2 2021
65	X	Slight	Applies to site search, measure list, manage measure list. Ensure the statewide measure ID is always displayed next to the measure name when viewing a list of measures.	-	Release 2.3 2021
66	X	N/A	Allow ability to calculate Greenhouse Gas impacts using 8,760-hour GHG lookup data and 8,760-hour measure energy savings.	-	Release 2.4 2022

Enhancements					
No.	**E-5082**	**Priority**	**Criterion**	**Compliance**	**Due date[67]**
67	X	Slight	Reconsider all places where an API name is presented to the user and consider the use of a friendly name instead. If we pursue a friendly name, effort includes: --Ability for users to manage the friendly name --Effort to migrate existing measures to use their friendly name, eliminating the need for Cal TF to update all measures	TBA	Release 2.2 2021
68	X	Critical	Provide necessary enhancements to fulfil the CPUC's updated eTRM Workpaper workflow process once it is complete (develop workpaper management backend and front end infrastructure, CPUC user roles, workpaper and parameter-level version control management, integrated communication tools, user interface design, and other requirements as needed).		
69	X	N/A	Develop infrastructure as needed to ensure CEDARS can eventually use a live eTRM data connected for claims and reporting purposes.		
70	X	N/A	Provide the framework that would allow the eventual sunsetting of the PEAR/Ex-Ante database, at which point the CPUC user roles may absorb all administrative permissions		
71	X	Critical	Develop unanticipated enhancements that the CPUC determines essential within Phase 2 but did not foresee during the publication of this appendix		
72	X	Moderate	Creation of workpaper space for PAs to submit "Workpaper in Development" with ability for CPUC to provide early feedback on workpapers prior to submittal.		
73	X	Moderate	Add ability for the eTRM to generate a workpaper revision history by parameter	-	Release 2.3 2021
74	X	Critical	Create a dedicated schema on the server where views for all of the shared tables that will be read by CEDARS can be created, stored and modified. Provide assistance on how to make the 21 existing views work with the JSON tables, which includes the two new tables for 'source_status' and 'Measure'.	-	Release 2.3 2021

Enhancements					
No.	**E-5082**	**Priority**	**Criterion**	**Compliance**	**Due date[67]**
75	X	N/A	Ability for PAs to assign their measure/solution codes to eTRM measures and permutations	TBA	Release 2.2 2021
100		Slight	Ability to download Multi-measure CET import file	TBA	Release 2.2 2021
101		Critical	Ability for a CPUC Administrator to Add/Change a "Sunset Date" for a published measure (that does not change the version). Part of this would be to append a line of text in the "Change Description" field.	Yes	-
102		Slight	PDF direct download - improve user experience	-	Release 2.4 2022
103		Critical	Auto-sync CPUC Support Tables to Shared Data Library	TBA	Release 2.2 2021
104		N/A	#51, Unique field validation	-	Release 2.4 2022
105		N/A	#47, Ability to note that a health warning has been checked	-	Release 2.4 2022
106		Slight	#46, Data health warning should identify not just that a difference exists, but also that it affects this measure.	-	Release 2.4 2022
107		Moderate	#45, Dashboard should include your measure role	-	Release 2.4 2022
108		N/A	#44, Update API-Single measure to match other API endpoints	TBA	Release 2.2 2021
109		Slight	#43, Information indicating shared objects have changed should be viewable by limited group	-	Release 2.4 2022
110		Critical	#42, Measure's Version History panel presents start/end dates	-	Release 2.4 2022
111		Critical	#41, Default view of measure should be the active measure	-	Release 2.4 2022
112		Critical	CPUC would like eTRM to offer the following reports: 1. A report of measure log entries (report for CPUC team would only include CPUC viewable items and report for measure development would only include utility viewable items) 2. Weekly digest (high priority) 3. Workpaper status report (high priority) 4. Monthly workpaper submission plan	-	Release 2.3 2021

Enhancements					
No.	**E-5082**	**Priority**	**Criterion**	**Compliance**	**Due date[67]**
113		Critical	Repurpose the measure data spec field Workbook Excel file for the workpaper cover sheet. This field will work like the current Workbook Excel File measure field and allow the following file types. Repurpose the measure data spec field Characterization source file for the workpaper plan. This field will work like the current Characterization source file measure field and allow the following file types. .doc .docx .pdf	TBA	Release 2.2 2021
114		Critical	Implement the ability for a user to assign a measure to another user. When a measure is assigned to a user, they will receive an email notification.	-	Release 2.3 2021
115		Critical	Ability to attach files to measure log entry. A user who has permission to view the log entry may download the file attachment. Ability to filter the measure log listing by "has attachment". This feature does not refer to the current workpaper package (attachment of workpaper references, cover sheet, or measure characterization). Implement the ability for a user to assign a measure to another user. When a measure is assigned to a user, they will receive an email notification.	TBA	Release 2.2 2021
116		Moderate	Implement the ability for a user to assign a measure to another user. When a measure is assigned to a user, they will receive an email notification.	-	Release 2.4 2022
117		N/A	(merged with 115)	-	-
118		Moderate	The CPUC/EAR team desires a dashboard that would show all measures in the CPUC review workflow. Dashboard contents to be determined by CPUC/EAR team, but could include: ● Measures in CPUC review: - Hyperlinks to latest draft - Measure status - List of measure contributors - Last log entry ● Hyperlinks to CPUC status reports - Weekly digest - Workpaper submission status - Others, TBD	-	Release 2.3 2021

Enhancements					
No.	**E-5082**	**Priority**	**Criterion**	**Compliance**	**Due date[67]**
119		Moderate	A user with appropriate permissions will be able to take assignment of a measure, create a draft, and insert comments directly into the measure characterization. Additional stakeholder input will determine if ability to insert comments to value tables and calculations is needed. • Comment feature similar to Word – user and timestamp of each comment, ability for multiple replies • Comments will not be shown when version is published • All comments will be viewable and retained in draft versions • Comments will be viewable by any user with a measure contributor role (i.e., measure development and CPUC review will be able to see comments/replies)	-	Release 2.3 2021
120		Slight	Workflow - Assignment restriction	Deleted	-
121		b. Moderate	Workflow - Status transitions / Additional emails	-	Release 2.4 2022
122		Critical	Workflow - Measure log notifications / Daily digest (Measure log notifications; now notifications are instantaneous; this will provide the option to have an option to have a daily notification instead)	-	Release 2.3 2021
123		N/A	Increase the number of measures returned per call to "Measures" method; we need all eTRM measures	-	Release 2.3 2021
124		Slight	Provide a method to get the current, active, published version by measure ID, without specifying a version number (this will be important if users are not permitted to select older versions)	-	Release 2.3 2021
125		N/A	Provide a single method to get all shared data versions, parameters, and value tables; alternatively, provide a method to get all measure parameters and value tables, like the "Measure Package" download in the eTRM UI	-	Release 2.3 2021
126		N/A	Provide filtered access to measure permutations; this is a critical update to avoid serious and unnecessary performance problems	-	Release 2.3 2021
127		N/A	Ability to improve the application performance. (in Sprint 6)	TBA	Release 2.2 2021

Enhancements					
No.	**E-5082**	**Priority**	**Criterion**	**Compliance**	**Due date[67]**
128		Critical	Limit the edit permissions of start date and end date fields to CPUC administrator	-	Release 2.4 2022
129		Moderate	Rename "sunset date" to "end date"	-	Release 2.4 2022
130		Critical	Require that a version is committed when it is submitted to the CPUC Review workflow (i.e., when a measure status is changed to "Submitted")	-	Release 2.4 2022
131		Slight	Add a pop up to verify action when a user changes status to "Submitted to CPUC", "Resubmitted to CPUC", "POU Ready", "CPUC Approval", "Cancelled" to confirm that's what they really want to do	-	Release 2.4 2022
132		Moderate	Add a pop up to verify action when a user chooses to make a measure log entry "open" to confirm that's what they really want to do	-	Release 2.4 2022
133		Slight	Add the date that measure status changed to "Submitted to CPUC" in the right-hand detail panel, below "Last Status Change"	-	Release 2.4 2022
134		Slight	Add the last date that measure status changed to "Resubmitted to CPUC" in the right-hand detail panel, below "Last Status Change"? (below Submitted to CPUC date as per #6)	-	Release 2.4 2022
135		Critical	Rename Measure Packet to Measure Package (as per OMBU: This would be a global change to the measure UI, so the sidebar of all measure versions would read Measure Package instead of Packet. If this work is approved, then we will audit the system for any use of the word "packet" to make sure no references sneak through.)	TBA	Release 2.2 2021
136		Slight	Add list of measure contributors (name, role) to the measure log at a glance	-	Release 2.4 2022
137		Moderate	Limit publishing to only be available when a measure is in "POU Ready" or "CPUC Approved" status	-	Release 2.4 2022
138		N/A	Send the user an email when they are assigned a measure contributor role	-	Release 2.4 2022
139		Slight	Allow selection of multiple attributes for table column filtering	-	Release 2.4 2022

Enhancements					
No.	**E-5082**	**Priority**	**Criterion**	**Compliance**	**Due date[67]**
140		Critical	Display SW ID (and version if applicable) with measure name in all eTRM views (exception is user-configured tables)	-	Release 2.4 2022
141		Critical	Sync staging test environment with production ("live") application data to enable validation of data.	TBA	Release 2.2 2021
142		N/A	API to allow PAs to upload implementation data into the PA workspace.	-	Release 2.4 2022
143		Critical	Ability for users to select measures and filter by permutations for use in CET. This feature will limit output to 100,000 records for at least one measure.	-	Release 2.4 2022
144		Slight	Ability for System Admin or CPUC Admin to modify fields without changing the Source Description (e.g., measure package ID + version.sub-version)	-	Release 2.4 2022

Table A-10-4 reiterates the phase 2 requirements that were established in Resolution E-5082 and the status of the eTRM's compliance.

Table A-10-4. Phase 2 data field requirements assessments

Description	PEAR/ExAnte field	eTRM field	Compliance	Due date
DEER Measure ID	MeasureID	DEER Measure IDS	Yes	-
HVAC system type description	BldgHVACDesc	Description	Yes	-
Climate zone description	BldgLocDesc	Description	Yes	-
Building type description	BldgTypeDesc	Description	Yes	-
Building vintage bin description	BldgVintDesc	Description	Yes	-
Coincident demand factor	CDF	CDF	Yes	-
Flag for values available for claims reporting	ClaimSpec		TBA	Release 2.2 2021
Date record created	Created		TBA	Release 2.2 2021
Record creator	CreatedBy		TBA	Release 2.2 2021
Record documentation source	CreatedCitation		TBA	Release 2.2 2021
Default equivalent full-load hours	defEFLH	Default EFLH (HR/YEAR)	Yes	-

Description	PEAR/ExAnte field	eTRM field	Compliance	Due date
Delivery type description	DeliveryTypeDesc	Description	Yes	-
NTG ID description	Desc	Description	Yes	-
Energy Impact Profile	EnergyImpactProfile	Electric Impact Profile ID	Yes	-
Interactive effects factor for kW savings	IE_kW	IEkW (Ratio)	Yes	-
Interactive effects factor for kWh savings	IE_kWh	IEkWh (Ratio)	Yes	-
Interactive effects factor for therm savings	IE_therm	IETherm (Ratio)	Yes	-
Flag for values available for percent filing	FilingSpec		TBA	Release 2.2 2021
Notice of planned studies	FutureComment		TBA	Release 2.2 2021
Gas impact profile	GasImpactProfile	Gas Impact Profile ID	Yes	-
Gross savings & installation adjustment type	GSIAType	GSIA-BLDG Type	Yes	-
Gross savings & installation adjustment type description	GSIATypeDesc	Description	Yes	-
Gross savings & installation adjustment factor	GSIAValue	GSIA (Ratio)	Yes	-
Hours of use	HOU		TBA	Release 2.2 2021
Hours of use categories	HOU_cat	Hours-of-Use Category	Yes	-
Flag indicating DEER building type	IsDEERBldg		TBA	Release 2.2 2021
Proposed content flag (not yet approved)	IsProposed	PROPOSED FLAG	Yes	-
Date of last modification to record	LastMod		TBA	Release 2.2 2021
Party last modified record	LastModBy		TBA	Release 2.2 2021
Supporting documentation for last modification to record	LastModCitation		TBA	Release 2.2 2021
Comment regarding last modification to record	LastModComment		TBA	Release 2.2 2021
Lighting category	LightingType	Lighting Types	Yes	-
Measure Application type (MAT) description	MeasAppTypeDesc	Description	Yes	-
Measure impact calculation Type description for DEER measures	MeasImpactCalcDesc	Description	Yes	-
Normalizing unit description	NormUnitDesc	Description	Yes	-

Description	PEAR/ExAnte field	eTRM field	Compliance	Due date
NTG ratio for electric savings	NTG_Elec	NTGRkWh (Ratio)	Yes	-
NTG ratio for gas savings	NTG_Gas	NTGRTherm (Ratio)	Yes	-
Flag for building type parent	ParentType		TBA	Release 2.2 2021
Workpaper revision number	revision		TBA	Release 2.2 2021
Remaining useful life value, years	RUL_Yrs	RUL Years (YR)	Yes	-
Sector description	SectorDesc	Description	Yes	-
End-use sub-category	SubUseCategory	Use Sub-Category	Yes	-
Technology group description	TechGroupDesc	Description	Yes	-
Technology type description	TechTypeDesc	Description	Yes	-
Technology type name	TechTypeName	Technology Type	Yes	-
End-use category description	UseCategoryDesc	Description	Yes	-
End-use sub-category description	UseSubCategoryDesc	Description	Yes	-

New enhancements identified during phase 1 and 2 development have been added to the scope of work for an additional production release, 2.4, in 2022, as described in Table A-10-5.

Table A-10-5. Phase 3 enhancements for release 2.4 in 2022

Number	Description
200	Eliminate timeout issues when generating/exporting shared value tables
201	Eliminate timeout issues when exporting permutation tables
202	Create table for electric generalized load shape parameters in the CPUC Support Table area that is equivalent to the *currentbp.costeff.LoadShapeElec_2022* table in the PEAR database. If a companion shared object is generated, this will be synchronized on a nightly basis with the version in the CPUC Support Table area.
203	Create table for natural gas generalized load shape parameters in the CPUC Support Table area that is equivalent to the *currentbp.costeff.LoadShapeGas_2022* table in the PEAR database. If a companion shared object is generated, this will be synchronized on a nightly basis with the version in the CPUC Support Table area.
204	Create a VersionSource parameter object to supplement the Version table in the CPUC Support Table. This table provides more resolution than the records in the Version table. This will need to be synchronized on a nightly basis with the VersionSource table in the CPUC Support Table area.

Table A-10-6 lists the acceptance criteria that will be used by the Energy Division for data performance (API), data integrity, and system performance prior to the production release of each new eTRM version. More requirements may emerge as needs arise and best practices dictate.

Table A-10-6. Acceptance criteria for system performance

Number	Category	Acceptance Criteria
300	User experience	No page will take more than three seconds to load
301	User experience	Users will not encounter time outs during page loading or data downloads
302	User experience	Emails providing data exports will be transmitted within 5 minutes of request
303	Data integrity	Data validation: 100% agreement of contents of EAD tables for approved workpapers and permutations
304	Data integrity	Data validation: 100% agreement between Shared Data tables and CPUC Support tables
305	Data integrity	The application ensures data quality and consistency
306	Member security	Email address and password storage meet industry standards. Passwords are never stored in plain text. Industry standard password hashing algorithms are to be used at all times and updated as they evolve.
307	Site reliability	The site will be available at all times during the work week (Monday-Friday, between 8 a.m. and 6 p.m.). Site down time occurring outside of the work week will be limited to brief pre-announced windows.
308	Site security	Only current software and dependencies that are actively being security patched are used by the application. At no time will the system operate with known vulnerabilities.
309	Site security	All site permissions (system and user) follow the principle of least privilege.
310	System performance	Application and database performance will not limit the development of features.
311	Acceptance testing	When requested by the test team, production data are synced to the staging environment as new features are deployed to staging for testing.