PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

ITEM 11 (Rev. 3)
AGENDA ID: 16804
ENERGY DIVISION **RESOLUTION E-4952**
October 11, 2018

R E S O L U T I O N

Resolution E-4952. Approval of the Database for Energy-Efficient Resources updates for 2020 and revised version 2019 in Compliance with D.15-10-028, D.16-08-019, and Resolution E-4818.

PROPOSED OUTCOME:

- Revise DEER2019 Update (effective 1/1/2019)
- DEER2020 Update (effective 1/1/2020)
- Revise the DEER Peak Period definition (effective 1/1/2020)

SAFETY CONSIDERATIONS:

- This Resolution has no impact on safety.

ESTIMATED COST:

- This Resolution is not expected to immediately result in additional cost, however, revisions to the DEER Peak Period definition may have cost implication that cannot be known at this time.

By Energy Division's own motion in Compliance with D.15-10-028.

SUMMARY

This Resolution approves updates to the Database for Energy-Efficient Resources (DEER) for program year (PY) 2020 and a revised version of DEER for PY 2019 in Compliance with D.15-10-028 and Resolution E-4818. This update also adjusts the DEER Peak Period definition to be used in energy efficiency portfolio planning, reporting and evaluation.

All of the updated DEER assumptions, methods, values and supporting documentation are available on the DEEResources.com website.[1]

BACKGROUND

DEER Peak Period Definition
CPUC Decision 06-06-063 first adopted the DEER Peak Period definition for use in energy efficiency portfolios.

> "Until further notice of this Commission, the definition of peak kilowatt (kW) contained in the 2005 Database for Energy Efficient Resources (DEER) shall be used for the purpose of verifying energy efficiency program and portfolio performance. As discussed in this decision, DEER defines peak demand as the average grid level impact for a measure between 2 p.m. and 5 p.m. during the three consecutive weekday period containing the weekday temperature with the hottest temperature of the year."[2]

DEER2008 version 2.05, adopted by CPUC Decision 09-09-047,[3] updated the definition of demand reduction to clarify and expand the method used to select the Peak Period and to remove the alternate three consecutive weekday period that was used for some educational facilities.[4] The Peak Period definition in DEER2008 has not since been updated and is summarized below.

> The current DEER demand reduction is defined as the average kWh reduction over a 9-hour window. The nine-hour window is from 2p.m. to 5 p.m. over a three consecutive weekday "heat wave". The three consecutive weekday "heat wave" is chosen based on these criteria:
>
> - occurs between June 1st and September 30th,

[1] See Main Menu→DEER Versions→DEER2020 on http://DEEResources.com
[2] CPUC Decision 06-06-063 OP 1.
[3] DEER2008 was first adopted by CPUC Decision 09-09-047 OP 48, and was reaffirmed by CPUC Decision 10-12-054 OP 1, and again by CPUC Decision 11-07-030 OP 1.
[4] 2008 DEER Update - Summary of Measure Energy Analysis Revisions, December 2008, Version 2008.2.05 for 2009-2011 Planning/Reporting, http://deeresources.com/files/deer0911planning/downloads/DEER2008UPDATE-EnergyAnalysisMethodsChangeSummaryV9.pdf

- does not include weekends or holidays,
- has the highest value for the sum of:
    - the average temperature over the three-day period, plus
    - the average temperature from noon to 6 p.m. over the three-day period, plus
    - the peak temperature over the three-day period.

The weather data utilized for selecting the three consecutive weekday period is data specified for energy use calculation in the California Energy Commission (CEC) adopted Title 24 Building Energy Efficiency Standards (Title 24).[5] Title 24 weather data sets represent a typical year of weather with a specified year to use to establish the day-of-week sequencing. Title 24 typical weather data, including the year for the day-of-week sequencing, was updated for the 2013 Title 24.[6] The 2013 Title 24 became effective July 1, 2014. The adopted DEER2014 version was updated to reference the updated weather data.[7]

Resolution E-4795, issued on August 18, 2016, approved the DEER updates for 2017 and 2018 and reaffirmed the definition of the Peak Period. However, the Resolution recognized the comments from the California Independent System Operator Corporation (CAISO) that suggested the 2 p.m. to 5 p.m. hour range in the DEER definition "is no longer technically accurate as the Peak Period is now observed to be later in the day" and inconsistent with the period used in other CPUC proceedings.[8] PG&E's comments on the Resolution also indicated support for updating the definition of demand reduction and suggested record development on the issue. Resolution E-4795 affirmed that some shift in the 2 p.m. to 5 p.m. time range may be appropriate but that the methodology of selecting the three consecutive weekday period appeared to still be accurate.[9]

Resolution E-4867, issued August 24, 2017, which approved the DEER2019 update and revisions to DEER2017 and DEER2018, ordered the utilities to

---

[5] California Code of Regulations, Title 24 Part 6 and the associated administrative regulation of Part 1.

[6] 2013 Reference Appendices, The Building Energy Efficiency Standards for Residential and Nonresidential Buildings.

[7] DEER2014* — Codes and Standards Update for the 2013-14 Cycle, February 2014. "CTZ2 weather files replaced with CZ2010, as specified in the 2013 Title-24"

[8] Resolution E-4795 at 6

[9] Resolution E-4795, Attachment Section 6.3.

establish a working group to propose adjustments to the definition of the Peak Period.

> The utilities shall initiate a working group process to develop one or more proposals on how the DEER Peak Period methodology should be adjusted. The proposals shall be served on the following service lists by Dec 20, 2018. The working group should consider what existing Commission policy directives in various related proceedings* are most relevant to the DEER Peak Period proposal update.
>
> *Including but not limited to: Resource Adequacy proceeding, Time-of-Use OIR, GRC Phase 2 proceedings[10]

This working group convened two meetings, which occurred April 3 and 16, 2018, and produced a report on May 4, 2018.[11]

The working group's report recommends defining the Peak Period for each climate zone within California as 4 p.m. to 9 p.m. on the three costliest days of the year as determined through the Avoided Cost Calculator. This recommendation allows for non-consecutive costliest days and would rely on the annually adopted avoided cost data. The current version of the avoided cost calculator uses a different recent year of weather rather than a typical year.

The working group also recommends a longer-term adjustment, called a "no-peak" methodology, which would involve eliminating the peak kilowatt savings reporting. The approach would rely upon the measure electric benefit calculation from the cost effectiveness calculator to provide accurate relative valuation of measures. However, the accuracy of this approach is limited by the availability of measure hourly savings profiles for the range of measures in the portfolio.

Two stakeholders, Natural Resources Defense Council (NRDC) and 350 Bay Area, submitted comments to the working group's report.[12] NRDC emphasizes that the current hourly measure savings profiles are relatively aggregated, which can result in inaccurate predictions of demand savings, because measures could have very different hourly savings profiles rather than the characterized single

[10] CPUC Resolution E-4867. Ordering Paragraph 3.
[11] "Refreshing DEER's Peak Period." May 4, 2018. https://pda.energydataweb.com/#!/documents/2036/view
[12] https://pda.energydataweb.com/#!/documents/2036/comments/list

hourly profile. NRDC states that these hourly profiles should be updated and expanded, and agrees with the working group's assessment that the Peak Periods should be based on "when energy savings are most valuable to the grid," as "determined through the avoided cost calculator."[13] 350 Bay Area agrees with some of the working group's recommendations. However, they express dissent regarding the recommended definition of the Peak Period as described above, favoring a Peak Period between 3 p.m. and 6 p.m. Their proposed definition would also be based on the annual costliest days determined using the avoided cost calculator.[14]

DEER2020 Update and DEER2019 Revisions

DEER updates flow into the portfolio development process by providing new savings estimates for program design. New savings estimates, and underlying assumptions, methods, and values inform the direction of current programs. These allow Program Administrators (PAs) to shift program eligibility requirements and incentive support mechanisms to deliver cost-effective savings. DEER updates may also reflect new market conditions. Program Administrators are required to factor in new assumptions and values by a) knowing there is an update, b) understanding the fundamental assumptions for the update, and c) identifying necessary shifts to their programs to capture cost effective savings. Updates to DEER methods apply in workpaper development and custom project savings estimates as well as program deployment decisions.

Decision D.15-10-028, Ordering Paragraph 17: "Commission Staff shall propose changes to the Database of Energy Efficient Resources once annually via Resolution, with the associated comment/protest period provided by General Order 96-B. However, Commission staff may make changes at any time without a Resolution to fix errors or to change documentation." Decision D.15-10-028, retains the direction from D.12-05-015 that DEER values be updated to be consistent with existing and updated state and federal codes and standards while incorporating these changes into the annual DEER update.[15] Decision

[13] NRDC Comments on DEER Peak Period Report, May 18, 2018.

[14] Comments on "Refreshing the DEER Peak Period.", 350 Bay Area, May 18, 2018.

[15] D.16-10-28, at 80, states "D.12-05-015 allowed additional mid-cycle changes if there are new state and federal codes and standards that affect DEER values. Specifically, the decision stated in Conclusion of

D.15-10-028 also retains previous direction on Commission staff latitude in updating DEER.[16] Additionally Resolution E-4818 Ordering Paragraph 26 required Commission staff to make any necessary updates to the DEER savings estimates to reflect the baseline policy summarized in this Resolution.

DISCUSSION

1. Updates Based on New Peak Period Definition

The timing of peak load is modified to 4:00 p.m. to 9:00 p.m. without a change in methodology to calculate days for which the savings values are averaged over the peak hours.

The working group's report on proposals for adjusting the DEER definition of demand reduction focuses on two distinct aspects of the DEER definition methodology:

- Changes to the range of hours during which peak demand savings is determined;
- Changes to the days over which the savings values during the range of hours are averaged.

All participants in the activity agreed that a change in the hours was appropriate. Two recommendations were presented: 4 p.m. to 9 p.m. and 3 p.m. to 6 p.m. Most participants preferred the 4 p.m. to 9 p.m. alternative while some participants favored the 3 p.m. to 6 p.m. alternative.

The report discusses several alternatives for selecting the days over which the values during the range of hours are averaged. The report favors using the three costliest days of the year as determined through the Avoided Cost Calculator, allowing for non-consecutive costliest days and potentially updating the selected

---

Law 84: "We generally agree with parties' request that ex ante values should be adopted and held constant throughout the portfolio cycle. However, mid-cycle updates of ex ante values are warranted if newly adopted codes or standards take effect during the cycle."

[16] D.16-10-28, at 80, quotes from D.12-05-015: "Conclusion of Law 80 states: 'Our Staff should have significant latitude in performing DEER and other policy oversight functions and, absent specific directives to the contrary, should not be required to consult with or otherwise utilize any other groups to perform this work."

days annually. NRDC agrees with the report that the selection of days should be based on "when energy savings are most valuable to the grid," as "determined through the avoided cost calculator."[17]

The change in peak load timing is influenced by two important considerations. First, there is the consideration of grid resources, both generation resources and transmission and distribution resources. The transmission and distribution resource requirements are generally driven by the gross demand on the grid which varies regionally but is generally in the very early evening.[18] The generation resources energy efficiency savings should target are fossil generation sources thus focusing on obtaining a reduction in GHG emissions. This priority means that any Peak Period selection must consider the grid net load which occurs later than the gross grid load.[19, 20]

Second, the Investor-Owned Utilities (IOUs) each employ time-of-use pricing, as required by the Commission, applying the highest rates during the "on-peak" periods.[21] For the largest customer sectors Peak Period generally coincide with the later time proposed by the working group. Examples of these rate are PG&E residential[22] and small business,[23] SCE residential[24] and small business,[25] and SDG&E residential[26] and small Business.[27] For these reasons, we agree with the 4 p.m. to 9 p.m. hour range for the DEER demand reduction definition proposed by the working group and adopt this Peak Period.

---

[17] NRDC Comments on DEER Peak Period Report. Mohit Chhabra. May 18, 2018.

[18] The peak gross load is the peak of the total load delivered through the electric grid to customer meters from all generation sources. CAISO data confirms that this peak is currently generally occurring between 5 p.m. and 6 p.m. http://www.caiso.com/planning/Pages/ReliabilityRequirements/Default.aspx#Historical

[19] The net grid load is the total load delivered though the electric grid to customer meters from non-renewable generation sources.

[20] http://www.caiso.com/planning/Pages/ReliabilityRequirements/Default.aspx#Historical

[21] http://www.cpuc.ca.gov/General.aspx?id=12194

[22] https://www.pge.com/en_US/residential/rate-plans/rate-plan-options/time-of-use-base-plan/not-enrolled.page

[23] https://www.pge.com/en_US/business/rate-plans/rate-plans/time-of-use/time-of-use.page

[24] https://www.sce.com/wps/portal/home/residential/rates/Time-Of-Use-Residential-Rate-Plans

[25] https://www.sce.com/wps/portal/home/business/rates/time-of-use/

[26] https://www.sdge.com/residential/pricing-plans/about-our-pricing-plans/time-use-plans

[27] https://www.sdge.com/businesses/pricing-plans/time-use-tou-pricing-plans-business

The adjustments to definition methodology for selecting the days as recommended by the working group does not lend itself to the purposes of the DEER, which must be readily extensible for new measures and workpapers, as well as calculation tools for custom projects. The method of selection should be stable for program planning, implementation, and evaluation. The use of a normalized weather year has provided stability and proven readily calculable for measures once hourly usage profiles are generated. Furthermore, the requirement that peak days be consecutive weekdays based on weather rather than avoided cost has ensured coincidence with the types of peaks which strain the grid, without over-valuing the demand savings. **Thus, the current methodology for selecting peak days is better aligned with the purpose of the demand savings estimation.** Finally, a limited adjustment to the hour range would be reasonably simple to implement within the year, allowing the update of the DEER, the utilities and third-party implementers to update all workpapers, the update of custom calculation methods, as well as the necessary education of the large number of individuals involved in delivering and evaluating the energy efficiency portfolio in time for program planning for 2020.

Additionally, the report suggests that the CPUC consider a "no peak" option, which would eliminate the reporting of demand reduction values. The values of demand reduction under this option would be embedded in the cost effectiveness calculation which would utilize hourly savings profiles along with hourly electric avoided costs applied to the annual savings. While many participants advocated for this solution, the group acknowledged numerous technical barriers to implementing it at this time. In light of these technical barriers we will not consider this change at this time. However, this option should be further investigated, and action should be taken to improve the available hourly efficiency measure savings profiles for use in the cost effectiveness calculations. These steps were ordered in Decision 06-06-063 and are reiterated here.[28]

2. DEER 2020 Update

Pursuant to D.15-10-28, the Energy Division published a scoping memo on the proposed list of updates for DEER2020 and revised DEER2019 on May 9, 2018.

[28] CPUC Decision 06-06-063 OP 11, 12, 13 and 14.

Based upon the scoping memo and comments received on the scoping memo, the priority updates are summarized below and as described in detail in the Attachment to this Resolution:

A. Addition of New Measures

A new set of measures has been added for both residential and commercial building types to consider the energy savings due to the use of an electrically commutated motor (ECM) in a furnace unit instead of a permanent split capacity (PSC) motor. This measure was considered as both a stand-alone motor replacement and in combination with a furnace efficiency upgrade.

New measures have also been added for liquid chilling machine (chiller) efficiency. In previous DEER versions chiller efficiency measures were defined for specific tier levels, and the application of the DEER values resulted in challenges for equipment that did not exactly match the tier level efficiencies. Consequently, a new calculation workbook is developed to enable PAs to calculate DEER impacts for a wide range of efficiency values. In addition, a new chiller measure has been added in which only the lead chiller in the chiller plant is upgraded to a higher efficiency level. Also, in response to requests from PAs, a new extended hours building prototype has been added to DEER for the chiller measures to capture the higher savings per unit of chiller capacity for an industrial building with high load activity areas and long hours of operation.

B. Updates to Underlying Methodology or Correction of Errors

Since changing the Peak Period definition requires updating all active DEER measures, a number of other methodology changes are implemented that had previously been deferred due to the significant effort required. The most significant of these changes is the reconfiguration of the commercial building prototypes based on the evaluation of lighting M&V and California Commercial Saturation Survey (CSS) data that was done in conjunction with DEER2016. The activity area types and distribution for each prototype have been updated for DEER2020 based on the findings of the DEER2016 update.

A second major methodology change for DEER2020 is the consolidation of building vintage definitions and updates to vintage values. The primary change is the definition of a "median" vintage, which represents buildings with lighting and HVAC systems that cover the range of their effective useful life (EUL) values. The median vintage is the basis for the "existing" building in the

DEER2020 database. The age range for the median vintage is 1995 to 2005 for mobile homes and 2002 to 2016 for all other building types. As a part of the vintage consolidation, several characteristics of multi-zone and central plant HVAC systems were updated to account for equipment upgrades that would likely have occurred in those buildings. All motor efficiencies and controls, supply air temperature controls, and duct insulation levels have been updated for the oldest two vintages to bring them up to the level of the 1996 vintage.

Three error corrections were implemented in the DEER2020 update. These corrections were not implemented into DEER2019 as staff did not consider the errors of sufficient magnitude to justify updating all impacted measures at the time, but instead chose to include these into DEER2020 since all values require updating due to other mythological changes. The first is a change to occupant density and outdoor air ventilation requirements based on specifications in the California Title 24 Alternative Compliance Manual. The correction results in a median decrease of occupant density of 25% and increase in ventilation requirement of 50%.

The second error correction pertains to the area of windows in the residential prototypes, which were oversized by 18% in DEER2017.

The third error correction also applies only to residential prototypes, and comprises a 15% increase in fan power for two speed air conditioner and heat pump measures operating in the low speed mode.

C. New Code Revisions or Code Revisions Not Covered in Previous DEER Updates

Residential hot water heater measures are updated in DEER2020 based on code pertaining to the previously effective change to the federal standard for the rating of residential hot water heaters.

Additional updates in the 2019 Title-24 requirements for commercial buildings include expanded ventilation (outdoor-air flow) rates by activity area, increased exhaust-air flow rates for some activity areas and increased values for cooling tower efficiency. These updates, which have been incorporated into the 2020 DEER building vintage and the new construction DEER building vintage prototype models, are expected to have minor effects on measure savings.

Updates in the 2019 Title-24 requirements for residential buildings include changes to the roof insulation configuration in single-family buildings along with

lower framed wall U-value for single-family buildings and improved window specifications for single-family and multi-family buildings.

D. Updates Based on Evaluation Study Results

Commission Staff reviewed recent Evaluation, Measurement, and Verification (EM&V) findings and updated net-to-gross (NTG) values where they indicate a substantial difference from current DEER values. Additionally, pursuant to Commission Decision 16-08-019 and Resolution E-4818, Commission Staff assessed available data sources for updates to add appropriate NTG values for use in accelerated replacement (AR) and normalized metered energy consumption (NMEC) measure and project installations.[29] These updates followed methods and assumption adopted for use in establishing energy savings goals for the IOUs as adopted in D.17-09-025 which differentiated the above-code and to-code net savings values.[30]

Custom measures and projects rely upon PA-, implementer-, or customer-developed gross savings estimates for both the payment of incentives as well as PA ex ante savings claim filings to the Commission. The Commission adopted a custom measure and project review process in Decision 11-07-30 to provide Commission staff the opportunity to review proposed savings values prior to the PA entering into payment agreements with customers.[31] However, since Commission staff only reviews a small percentage of custom measures and projects, a default gross realization rate (GRR) was adopted to account for the fact that the ex ante custom gross savings claims were generally over-estimated compared to ex post evaluation results. The default GRR direction and values, set to 0.90 for kW, kWh, and therm savings for all utilities, are found in Attachment B of D.11-07-030.[32] There has been no update to the default GRR values since 2011, although D.12-05-015 noted that the 2006-2008 evaluation results were substantially lower than the default values adopted by

[29] Prior DEER version do not specify applicability of NTG values to AR or NMEC measures or projects. CPUC Decision 16-08-019 Finding of Fact 23 "AB 802's requirements related to normalized metered energy consumption will necessitate some changes to the EM&V activities." Resolutions E-4818 also references AR and NMEC measures and projects and classifies NMEC as a custom activity.

[30] CPUC Final Decision 17-09-025, Appendix 1, pages 17-20.

[31] CPUC Decision 11-07-030 Attachment A.

[32] D.11-07-030, Attachment B, at B6.

D.11-07-030.[33] A more recent analysis based on current evaluation results, summarized in Section 5.3 of the Attachment to this Resolution, indicates a consistent discrepancy between the default and evaluated GRR values across several years. An update to the default GRR values is within the scope of this Resolution; however, the values defined in D.11-07-030 must be modified through a process outside this Resolution.[34]

Other Consideration for the DEER2020 Update

CPUC Decision 12-05-015 noted "that similar measures delivered by similar activities should have single statewide values unless recent evaluations show a significant variation between utilities and that difference is supported by a historical trend of evaluation results."[35] The Decision directed Commission Staff to "strive for uniform statewide Net-to-Gross planning values that represent typical expected results in the DEER update for the next planning cycle for measures in which the variation between utilities is not significant."[36] In response to this direction, Commission Staff determined that DEER ex ante values shall not be updated if the change is less than five percent in one year. However, values can be updated if there is evidence from two or more consecutive evaluations that the change represents a directional shift that will persist into the future rather than normal year-to-year variance in participation or measure mix.

DEER updates and adjustments considered comments received from the stakeholders. This Resolution approves the final updates for DEER2020 and revised DEER2019. The final updated measures are listed in Table 1 with a more detailed description of the changes and additions provided in the Attachment to this Resolution. Complete documentation and supporting material on the updated assumptions and methods, a summary response to comments on the

[33] D.12-05-015 at 343 listed values varying by utility and kW, kWh and therm from 0.54 to 0.79
[34] Solicitation for Comments on Scope – Database of Energy Efficiency Resources (DEER). May 9, 2018. Section 5.2.
[35] D.12-05-015 at 54.
[36] Ibid.

scoping memo, and all updated DEER values are available at DEEResources.com.[37]

[37] Supporting material is available under the main menu/DEER Version/DEER2020. The updated values are in the ex-ante database and accessible for review and download via the Remote Ex Ante Data Interface (READI) tool which is also available for download.

Table 1 - DEER Update Measures

DEER Version	Area of Update	Sector		Tech Group					Ex Ante Value		
		Residential	Non-Res	Lighting	HVAC	HW	Envelope	Plug/Proc	ES Baseline	UES Methods	Measure Definition
Updates Based on new Peak Period Definition											
2020	DEER measures	X	X		X	X	X			X	
	Lighting HVAC interactive effects	X	X	X						X	
New Measures											
2020	Efficient fan motor/fan controller	X	X		X				X	X	
	Expanded HVAC savings methods	X	X		X					X	X
	Extended-hours prototype		X	X	X				X	X	
Updates Based on Methodology or Correction of Errors											
2019	HVAC chiller peak demand and performance map				X					X	
2020	Commercial prototype update		X	X					X	X	
	Building vintage consolidation	X	X						X		
	Commercial building outside air		X	X					X	X	
	Residential window area	X					X		X		
	Minimum power on 2 speed residential HVAC measures	X			X					X	X
Updates Based on Code Changes											
2019	LED indoor and outdoor lighting	X	X	X					X		X
	DHW rating change	X	X					X	X		
2020	Commercial HVAC specifications		X		X						
	Residential shell specifications	X					X				
Policy Directed Updates Supported by Prior Evaluation Reports and Findings											
2019 and 2020	HVAC Net-to-gross values				X						
	Other Net-to-gross values	X	X	X	X	X	X	X			
	Effective Useful Life	X	X	X	X	X	X	X			
	Custom Project/Measure GRR	X	X	X	X	X	X	X		X	

COMMENTS

Public Utilities Code section 311(g)(1) provides that this Resolution must be served on all parties and subject to at least 30 days of public review and comment prior to a vote of the Commission. Section 311(g)(2) provides that this 30-day period may be reduced or waived upon the stipulation of all parties in the proceeding.

The 30-day public review period for the draft of this Resolution was neither waived nor reduced. Accordingly, the draft Resolution was mailed to parties for comments on August 28, 2017.

Thirteen stakeholders, including all four IOUs, submitted a total of 66 comments to the draft Resolution. Below are the issues raised most frequently in the comments:

- The proposed removal of the default net-to-gross ratio for programs which target Hard-to-Reach customers;
- The application of an adjustment factor for below-code savings for Accelerated Replacement measures;
- The updated definition of the peak period hours for demand savings estimation;
- The application of a net-to-gross ratio for Normalized Metered Energy programs and projects

We respond to comments on each of these topics, as well as those regarding less commonly raised issues, in Section 7 of the Attachment to this Resolution. All substantive changes to the Resolution in response to comments are also highlighted in Section 7.

FINDINGS

1. Decision D.15-10-028 requires that Commission Staff propose changes to the Database of Energy Efficient Resources once annually via Resolution, with the associated comment/protest period provided by General Order 96-B.
2. Decision D.15-10-028 retains the direction from D.12-05-015 that DEER values be updated to be consistent with existing and updated state and federal codes and standards.

3. Decision D.15-10-028 also states that Commission staff may make changes at any time without a Resolution to fix errors or to change documentation.
4. The proposed updates to the DEER values are a result of a) Updates Based on The Recent Commission Resolution on Existing Baselines, b) New Code Update or Code Update Not Covered in Previous DEER Updates, c) Updates to Underlying Methodology or Correction of Errors, d) Addition of New Measures, e) Updates Based on Evaluation Study Results, and f) the update to the peak demand definition.
5. Decision 16-08-019 requires that the adopted baseline policy apply to energy efficiency programs and projects beginning January 1, 2017.[38]
6. The time of peak demand has shifted later in the day since the DEER definition of demand reduction was adopted in D.06-06-063.
7. The current DEER definition of demand reduction based on 2 p.m. to 5 p.m. is poorly aligned with either the peak grid net load time period or the rate schedule on-peak time period for most IOU customers. A time focused on the peak grid net load reduction rather than just gross load reduction provides better alignment with state GHG reduction goals. A time period focused on customer highest costs provides better alignment with providing the highest energy efficiency value to customers.
8. A shift in the time period used in the DEER definition of demand reduction from 2 p.m. to 5 p.m.to 4 p.m. to 9 p.m. is both feasible and reasonable.
9. A shift in the selection of days in the DEER definition of demand reduction is not feasible in the time available, or the resources and information available for a January 1, 2020 effective date. Additionally, such a shift is not adequately supported by the record at this time.
10. There is a consistent discrepancy between the evaluated GRR and default GRR values adopted in D.11-07-030 across several years for custom measures and projects.

[38] Decision 16-08-019 Conclusions of Law 37 and Ordering Paragraph 3.

THEREFORE IT IS ORDERED THAT:

1. Effective January 1, 2020 the DEER demand reduction shall be defined as the average demand impact as would be "seen" at the electric grid level for a measure averaged across 15 hours from 4 p.m. to 9 p.m. during the three consecutive weekday period containing the highest algebraic sum of: the average temperature over the three-day period, the average temperature from noon to 6 p.m. over the three day period, and the peak temperature within the three-day period. The three Peak Period days shall not include a holiday, and shall fall within the dates of June 1 through September 30, inclusive. Holidays within the possible peak dates include the nearest weekday to the Fourth of July, and Labor Day. A Peak Period shall be selected for each of the 16 California climate zones, based on the most current weather data sets and day-of-week sequencing adopted for the California Title 24 Building Energy Efficiency Standards, as published by the California Energy Commission.
2. The DEER2020 and Revised DEER2019 Updates, listed in Table 1, as described in the Attachment and supporting documentation available on the DEEResources.com website, are approved with effective dates as listed.
3. Pacific Gas and Electric Company (PG&E), Southern California Electric Company (SCE), Southern California Gas Company (SoCalGas), and San Diego Gas & Electric (SDG&E), the San Francisco Bay Area Regional Energy Network (BayREN), Southern California Regional Energy Network (SoCalREN), Tri-County Regional Energy Network (3CREN), Local Government Sustainable Energy Coalition (LGSEC), Lancaster Choice Energy (LCE), and Marin Clean Energy (MCE) must use the updated assumptions, methods and values for 2019 savings claims and 2020 planning, implementation and reporting.

This Resolution is effective today.

I certify that the foregoing Resolution was duly introduced, passed and adopted at a conference of the Public Utilities Commission of the State of California held on October 11, 2018; the following Commissioners voting favorably thereon:

_____
ALICE STEBBINS
Executive Director

Attachment
DEER2020 and Revised DEER2019 Update Statement

Contents

1. Update to the DEER Peak Demand Definition and Methodology

1.1. Background

Resolution E-4795 examined recent CAISO load data and noted that some shift in the DEER Peak Period may be warranted, but also, that such an adjustment requires a thorough process with broad stakeholder input. That Resolution noted that the analysis of adjustments to the Peak Period definition is a complex and highly technical task. Implementing such changes would result in DEER, workpaper and custom project calculation changes as well as changes to energy efficiency goals and likely changes to program implementation details.

As ordered by Resolution E-4867, the utilities initiated a working group process to develop one or more proposals on how the DEER peak demand period methodology should be adjusted. The utilities served a report, published on Energy Division's Public Document Area (PDA) covering the activities of that working group including alternatives and recommendations.[1] Comments on the report filed May 18, 2018, are available on the PDA.[2] Considering prior DEER Resolutions, the recommendations and the related issues discussed in the report and the comments filed by the parties on the working group report, a DEER peak demand period definition adjustment has been considered and adopted by this DEER update Resolution. The adopted definition update will be applicable to all DEER measures, all workpaper measures, all custom measure and project calculations as well as future potential and goals studies.

1.2. Update to the DEER peak demand Definition

The DEER Peak Period demand definition is updated to shift the peak hours from 2 p.m.-5 p.m. to 4 p.m.-9 p.m. Aside from the adjusted times during which peak demand savings is calculated, the methodology for selecting the peak days is unchanged from Resolution E-4795. The full, updated definition is below:

- Peak Demand Savings is the average demand impact as would be "seen" at the electric grid level for a measure averaged across 15 hours from 4 p.m. to 9 p.m. during the three consecutive weekday period containing the highest algebraic sum of:
    - The average temperature over the three day period,
    - The average temperature from noon to 6 p.m. over the three day period, and
    - The peak temperature within the three-day period.
- The Peak Period shall fall within the dates of June 1 through September 30, inclusive.
- The three Peak Period days shall not include a holiday. Holidays within this window of dates include The Fourth of July, or the nearest weekday to July 4th, and Labor Day.

---

[1] DEER Peak Hours Workshop Report was served by Southern California Edison, lead for the working group, to parties of R.14-08-013, R.14-10-003, R.15-12-012, R.16-02-007 R.13-11-005 on 05/04/2018.

[2] The DEER Peak Period Report is available at https://pda.energydataweb.com/#/ and parties comments are available in the Comments area.

- A Peak Period shall be selected for each of the 16 California building climate zones, based on the most current weather data sets and day-of-week sequencing adopted for the California Title 24 Building Energy Efficiency Standards as published by the California Energy Commission.

1.3. Update of the kW impacts for DEER Measures

Peak demand savings for DEER measures were re-evaluated based on a decision by the CPUC to update the Peak Period definition. All previous DEER measures with no expiration date, or with an expiration date after December 31, 2019 have peak demand savings based on the new Peak Period definition. These measures include:

- Commercial HVAC Measures
- Commercial Lighting Measures
- Commercial Water-heating Measures
- Residential HVAC Measures
- Residential Lighting Measures
- Residential Exterior Wall and Attic Insulation Measures
- Residential Water-heating Measures

Updated measure analysis software (MASControl3) was used to determine the new peak demand savings.[3] The figures below show how the DEER demand savings changed based on the new peak demand definition as well as the other updates and fixes described in this document. The figures show the above pre-existing Peak Period demand savings for an HVAC measure. Figure 1 shows the demand impacts for a 1985 vintage small office building across all climate zones. The differences between the DEER2020 (2 p.m. to 5 p.m.) and the Previous DEER data are due to updates and error corrections applied to the small office prototype for DEER2020. These changes are described in detail in the following sections of this document. The differences between the DEER2020 (2 p.m. to 5 p.m.) and the DEER2020 (4 p.m. to 9 p.m.) data are due to the Peak Period shift from the 2 p.m. to 5 p.m. period in previous versions of DEER to the 4 p.m. 9 p.m. period in the updated Peak Period definition.

[3] MASControl3 is a new updated version of the DEER measure analysis software, which was used to run all of the DEER2020 simulations. The software is included in the file MASControl3.zip in the DEER2020 supporting files.

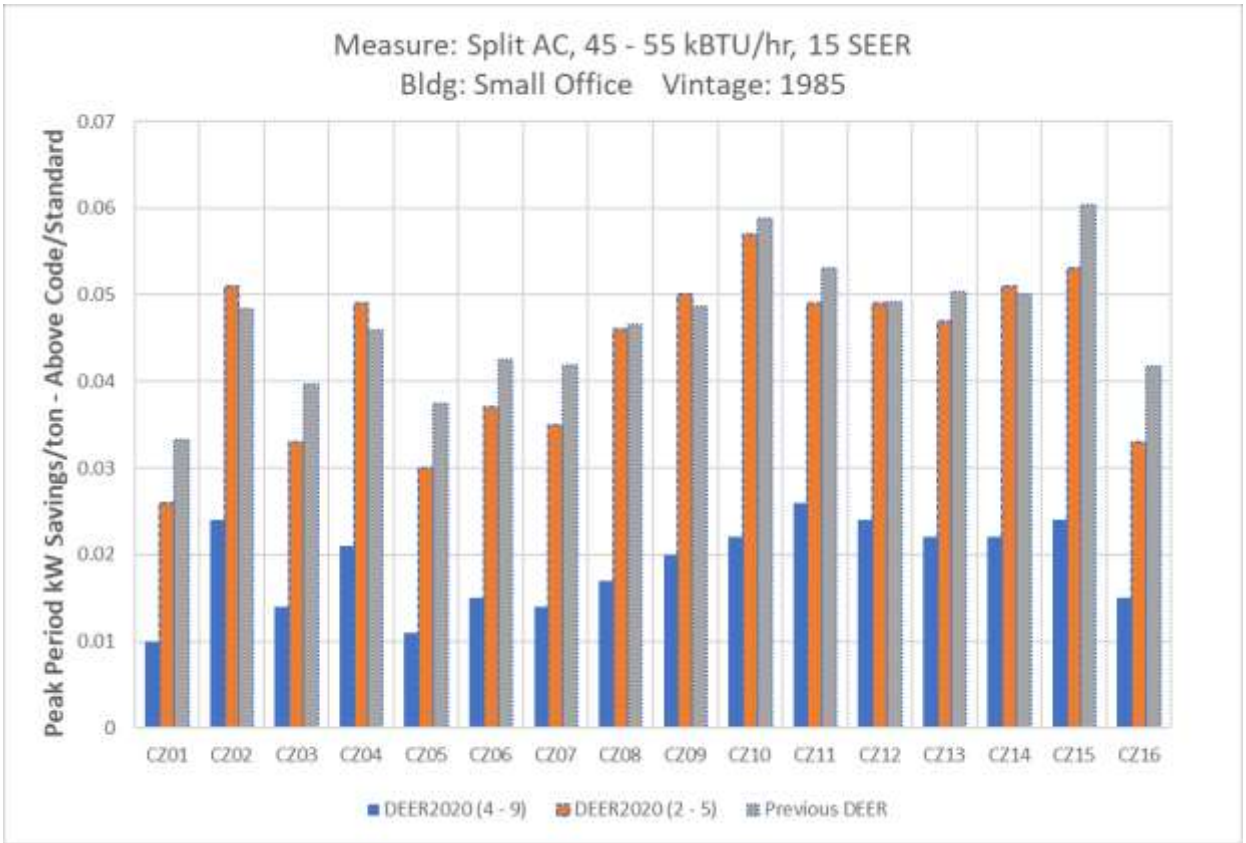

Figure 1. Example of Peak Period Savings Update, All Climate Zones

As expected, the office building prototypes have larger HVAC peak demand impacts from 2 p.m. to 5 p.m. than from 4 p.m. to 9 p.m. Other building types have less of a dramatic change. Figure 2 shows the same sets of data for all building types in climate zone 10.

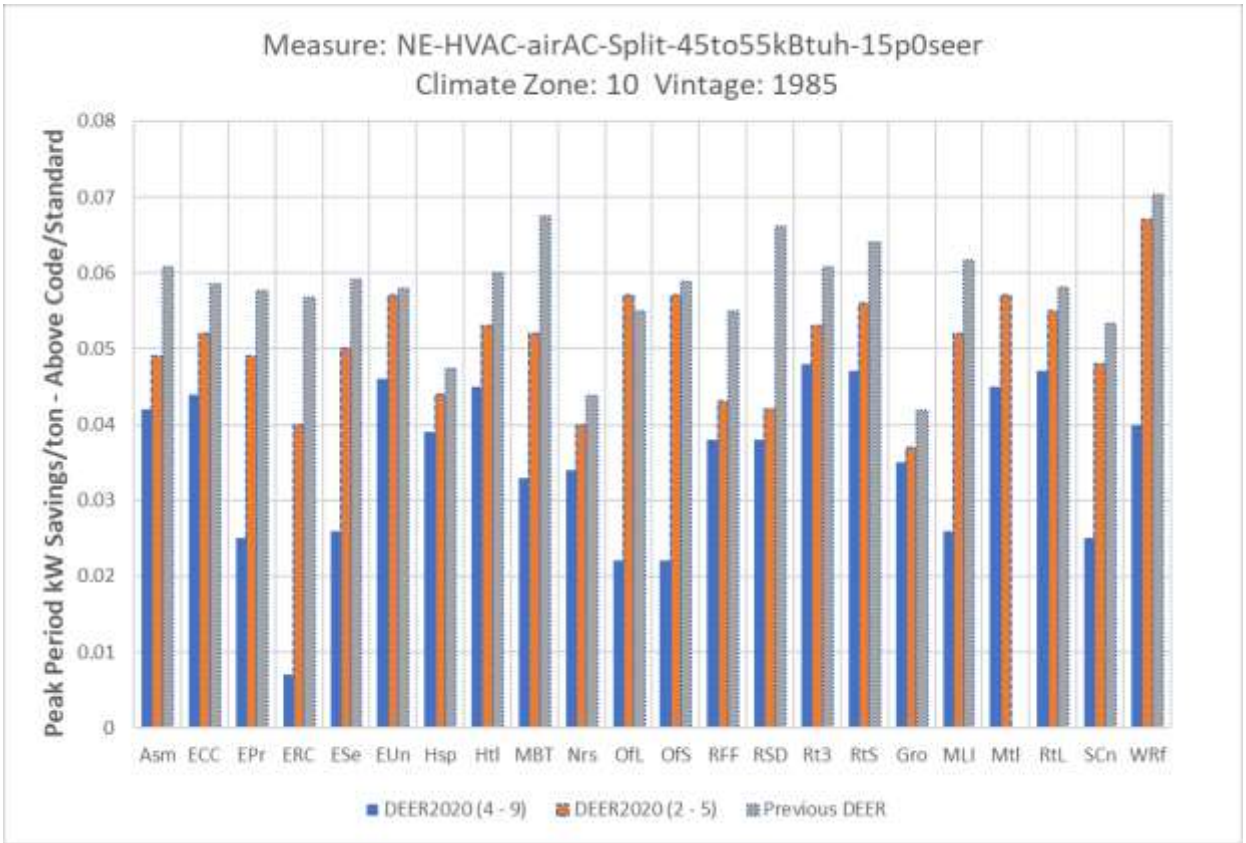

Figure 2. Example of Peak Period Savings Update, All Building Types

The reduction in peak demand savings for commercial building types varies from about 10% in the department store (Rt3) to nearly 60% in office buildings (OfL and OfS), with the relocatable classroom (ERC) having an even larger reduction (the ERC building is essentially unoccupied during the updated peak demand period).

1.4. Update of the DEER Lighting HVAC Interactive Effects Values

The lighting interactive effects (IE) values were updated based on the new Peak Period definition and other updates and fixes applied to the simulation prototypes.[4] The IE tables have been updated for 2020 and now include the following lighting categories:

- Screw-In: previously referred to as "CFL", this category includes CFL, LED and other lighting lamp technologies that utilize the common screw-in (and pin) base.
- Hardwired: previously referred to as "Linear Fluorescent", this category is for hard-wired fixtures and their lamps mounted at a height of 15 feet or less.

[4] Lighting HVAC IE values can be viewed and downloaded from the DEER READI tool from the applicable Lighting Summary table found on the Support Tables tab.

- High bay: this category is for hard-wired fixtures and their lamps mounted at a height greater than 15 feet.

Prior to this update, high-bay lighting systems utilized the same HVAC IE values as the hard-wired (a.k.a. the linear fluorescent) lighting system. Note that the commercial lighting systems measures no longer include exit lighting, as high-efficiency exit lighting has become standard practice due to state and federal building code changes that were enacted in January 2006.

The figures below show an example of the changes in the HVAC interactive effects values from the previous version. For the large office building, the overall kWh IE values have not changed significantly from the previous DEER2016 values, as shown in Figure 3.

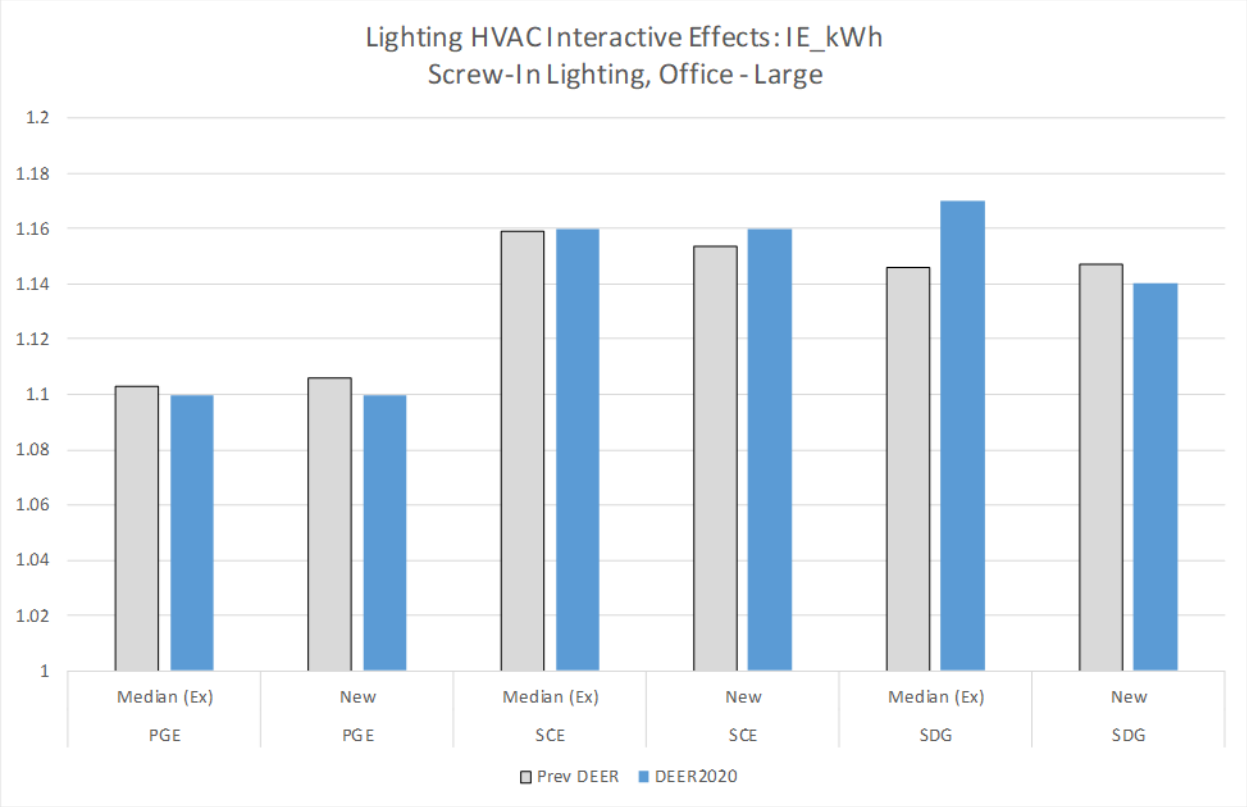

Figure 3. Comparison of IE_kWh values to DEER2016 values (Large Office)

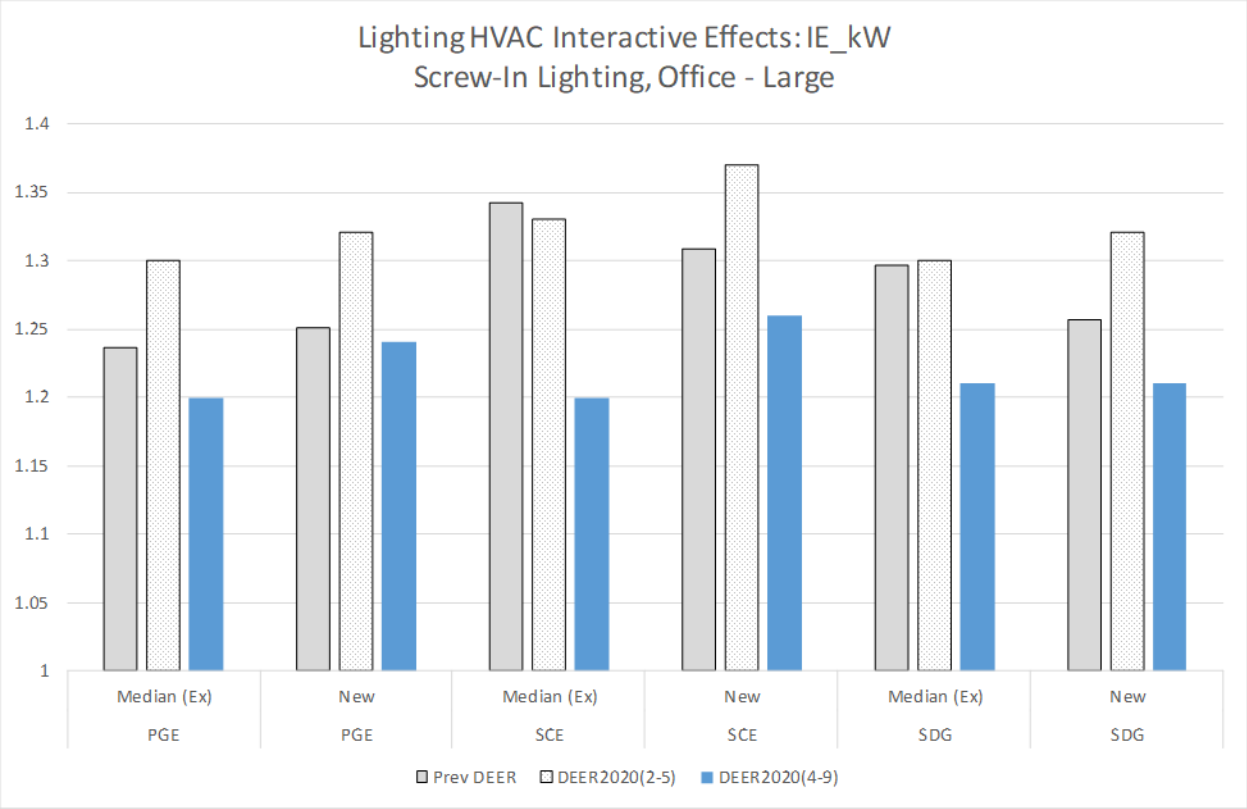

Figure 4. Comparison of IE_kW values to DEER2016 values (Large Office)

The Peak Period demand IE values, however, did change significantly for the large office building, as shown in Figure 4. While the Peak Period values increased using the old Peak Period definition (from 2 p.m. to 5 p.m.), the values decreased using the new Peak Period definition. Other building types, such as retail building types, have the opposite trend, with the new Peak Period definition increasing the peak demand IE values compared to the previous Peak Period definition. Figure 5 shows the comparison of peak demand interactive effects weighted across all building types, where the differences between the two Peak Period definitions are relatively small.

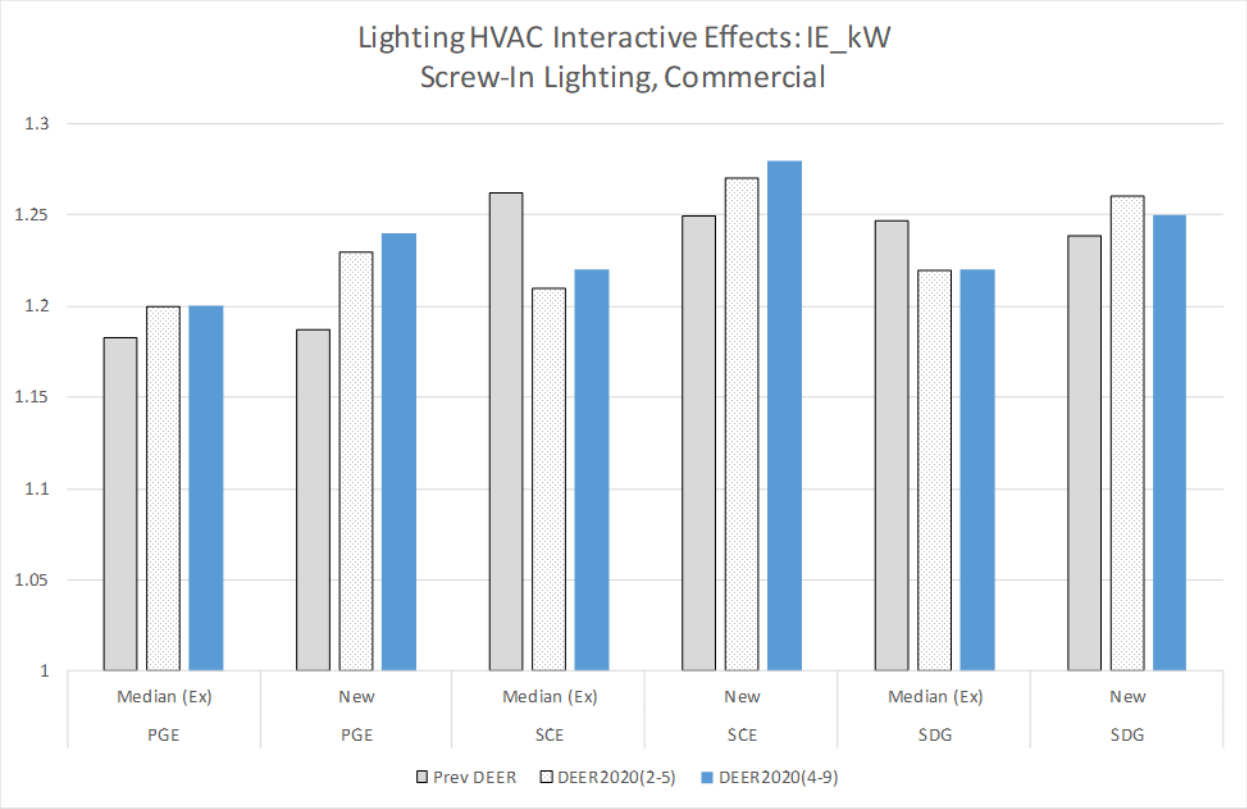

Figure 5. Comparison of new kW IE values to DEER2016 values (Commercial)

The following three figures show the overall DEER2020 HVAC commercial building interactive effects for all three lighting system types. An updated HVAC Interactive Effects workbook with all of the values is available on the DEER website.

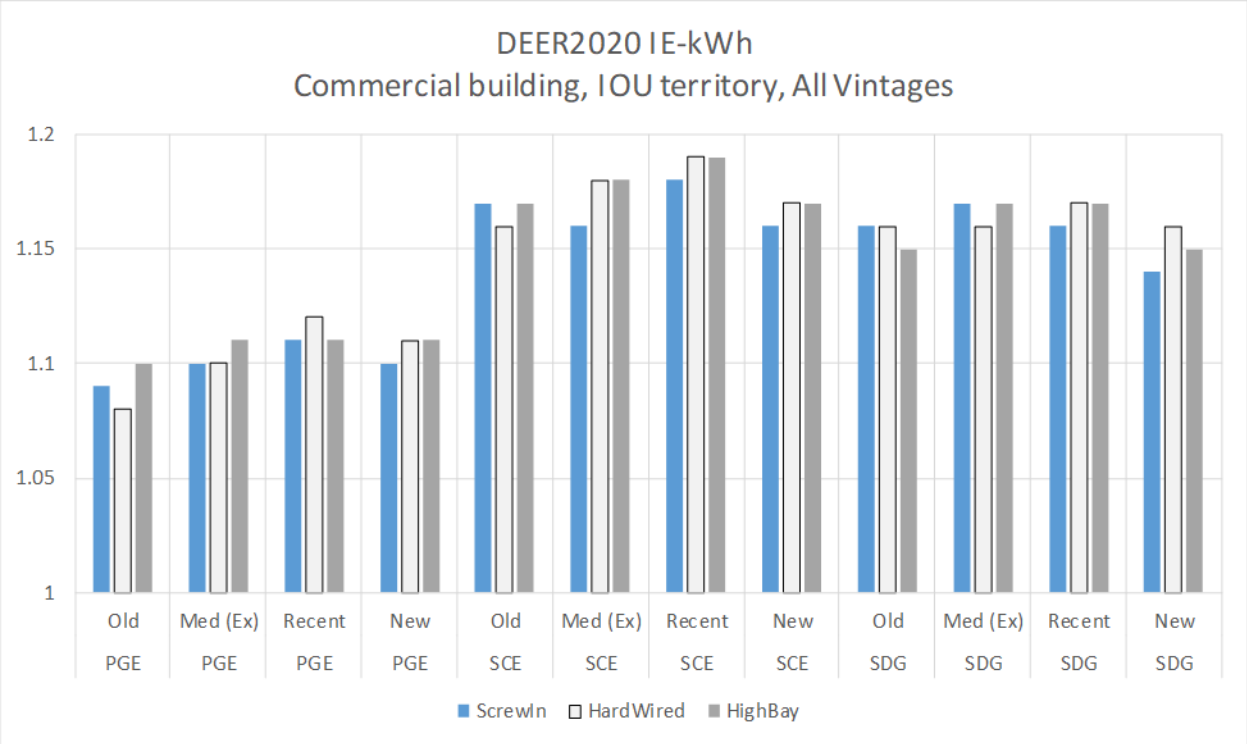

Figure 6. Weighted DEER2020 IE-kWh values for Commercial Buildings

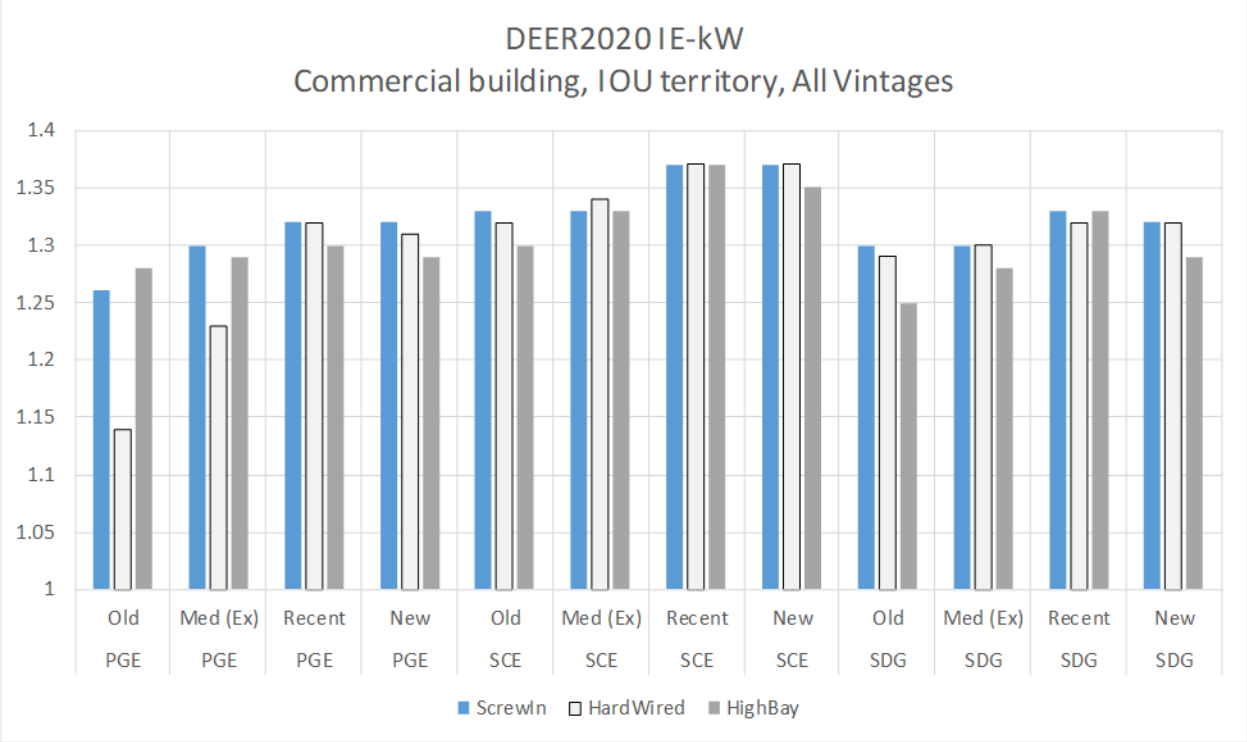

Figure 7. Weighted DEER2020 IE-kW values for Commercial Buildings

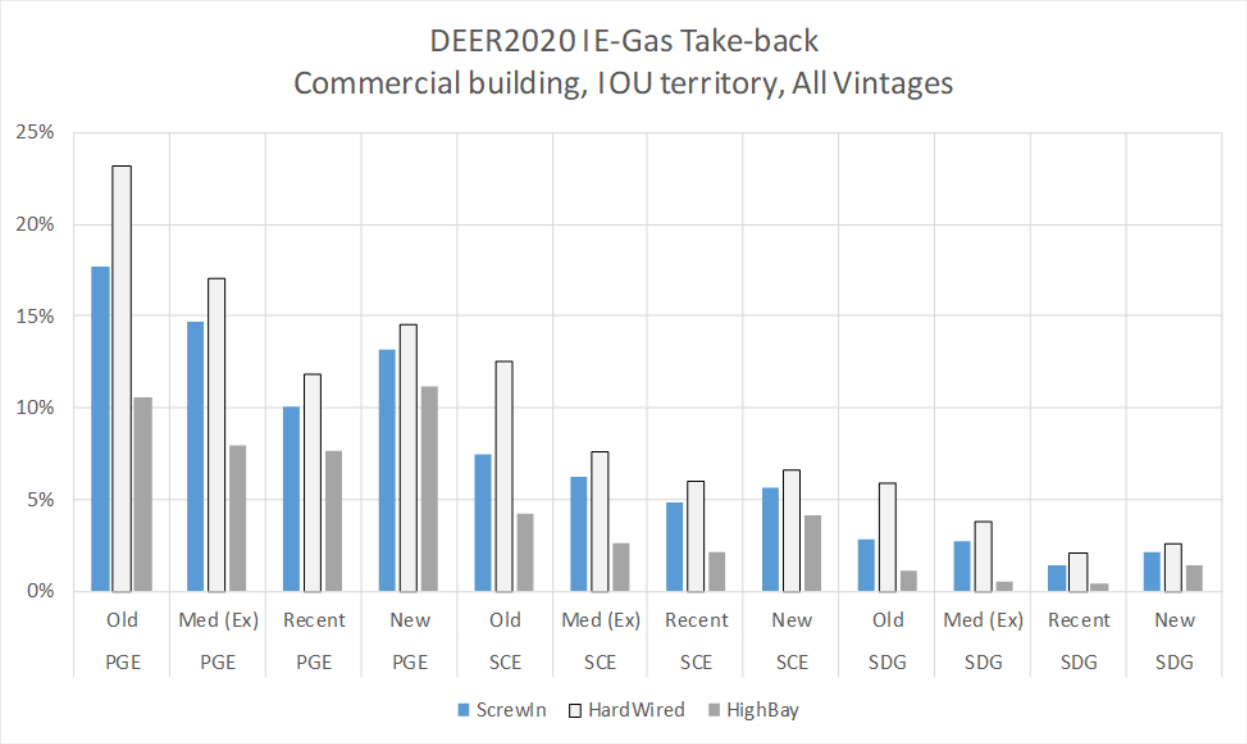

Figure 8. Weighted DEER2020 IE-therm (Gas take-back) values for Commercial Buildings

The figures below show residential IE factors for DEER2017 and DEER2020. On average, annual electric IE factors (Figure 9 and Figure 12) have decreased by 1.3%, and Peak Period kW IE factors (Figure 10 and Figure 13) have decreased by 4.7%, including the change in Peak Period definition. The average change for heating takeback is an increase of 8.4% (Figure 11 and Figure 14). Factors affecting the changes in residential IE factors include the correction to window area and the energy code updates to residential building envelope for 2019.

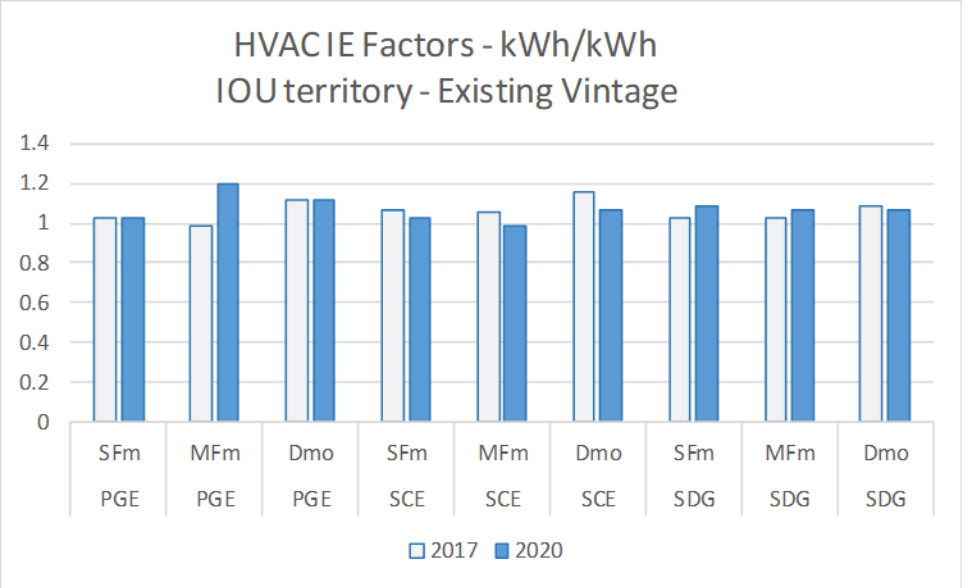

Figure 9. Weighted DEER2020 IE-kWh values for Existing Residential Buildings

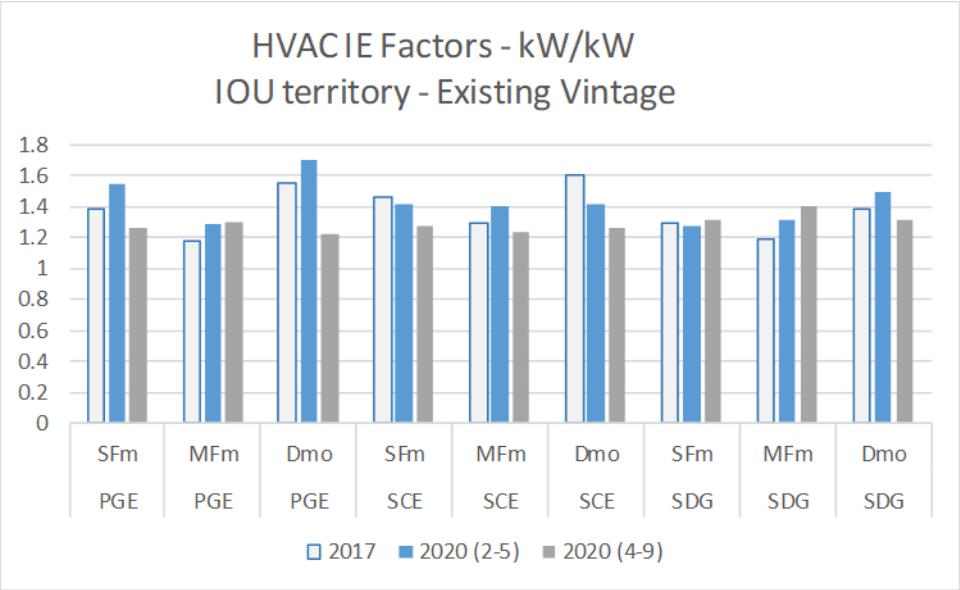

Figure 10. Weighted DEER2020 IE-kW values for Existing Residential Buildings

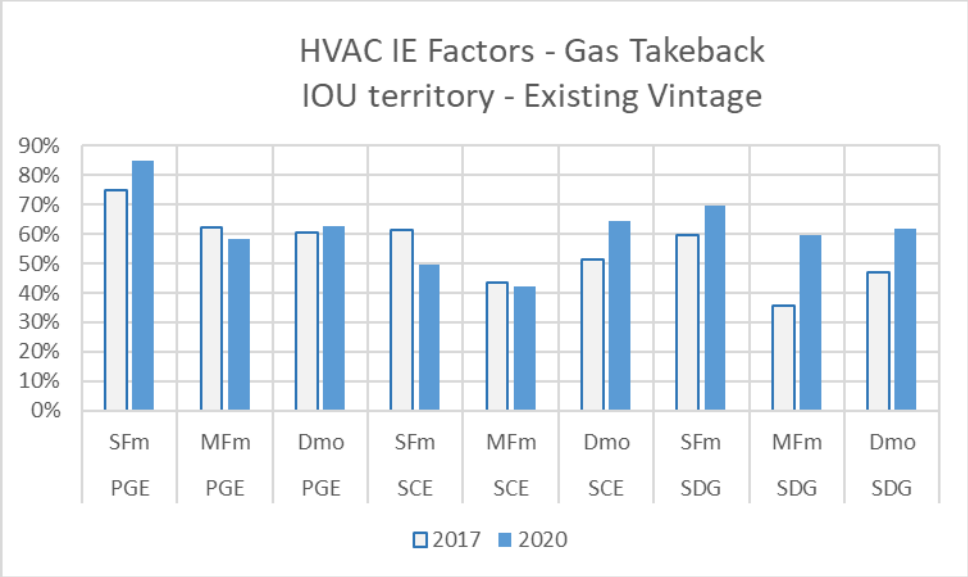

Figure 11. Weighted DEER2020 IE-therm (Gas take-back) values for Existing Residential Buildings

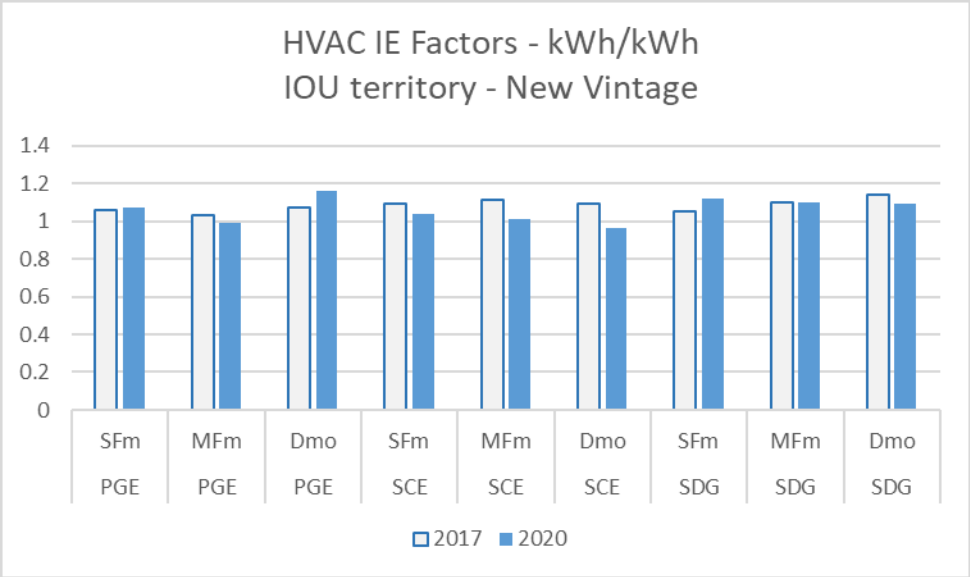

Figure 12. Weighted DEER2020 IE-kWh values for New Residential Buildings

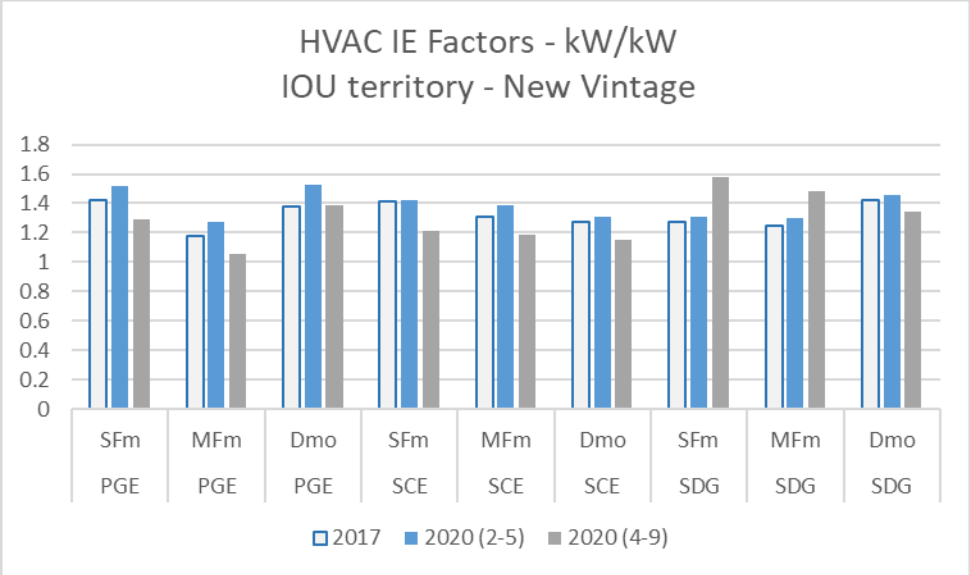

Figure 13. Weighted DEER2020 IE-kW values for New Residential Buildings

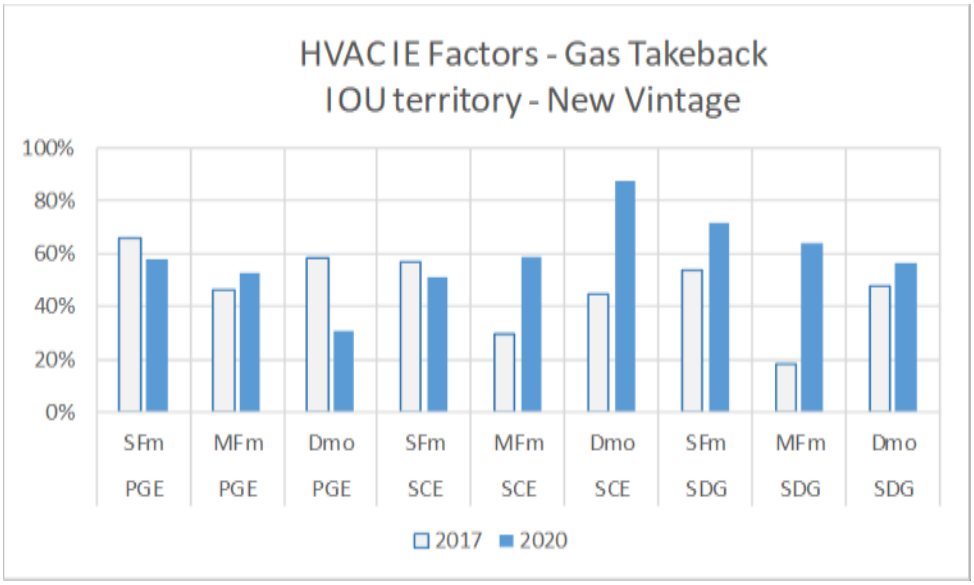

Figure 14. Weighted DEER2020 IE-therm (Gas take-back) values for New Residential Buildings

2. Updates to Add New Measures

2.1. Furnace Fan Efficiency and Efficient Fan Operation

The commercial and residential furnace measures were updated and augmented to include the option of higher efficiency supply-air fan motors. The previous furnace efficiency measures include only impacts to the gas consumption of the higher-efficiency furnace. The DEER2020 furnace efficiency measures include:

- Furnace burner efficiency only: Annual Fuel Utilization Efficiency (AFUE) of 90 through 98
- Furnace burner efficiency and Electronically Commutated Motors (ECM) supply fan motor: AFUE 90 through 98
- ECM supply fan only

The updated DEER measures have a start date of January 1, 2020.

The ECM furnace fan motor was estimated to save 18% on average compared to the baseline Permanent Split Capacitor (PSC) motor. The derivation of this estimate is provided in the DEER supporting files.[5]

Sample results for the furnace measures are shown in Figure 15 and Figure 16. In general, impacts for a given efficiency tier have increased compared to previous DEER. When the furnace efficiency measure is combined with the ECM measure, there is an added electrical

[5] DEER supporting files: DEER2020_FurnaceFan.xlsx

impact and a somewhat reduced gas impact, due to the reduction in motor heat into the system supply air.

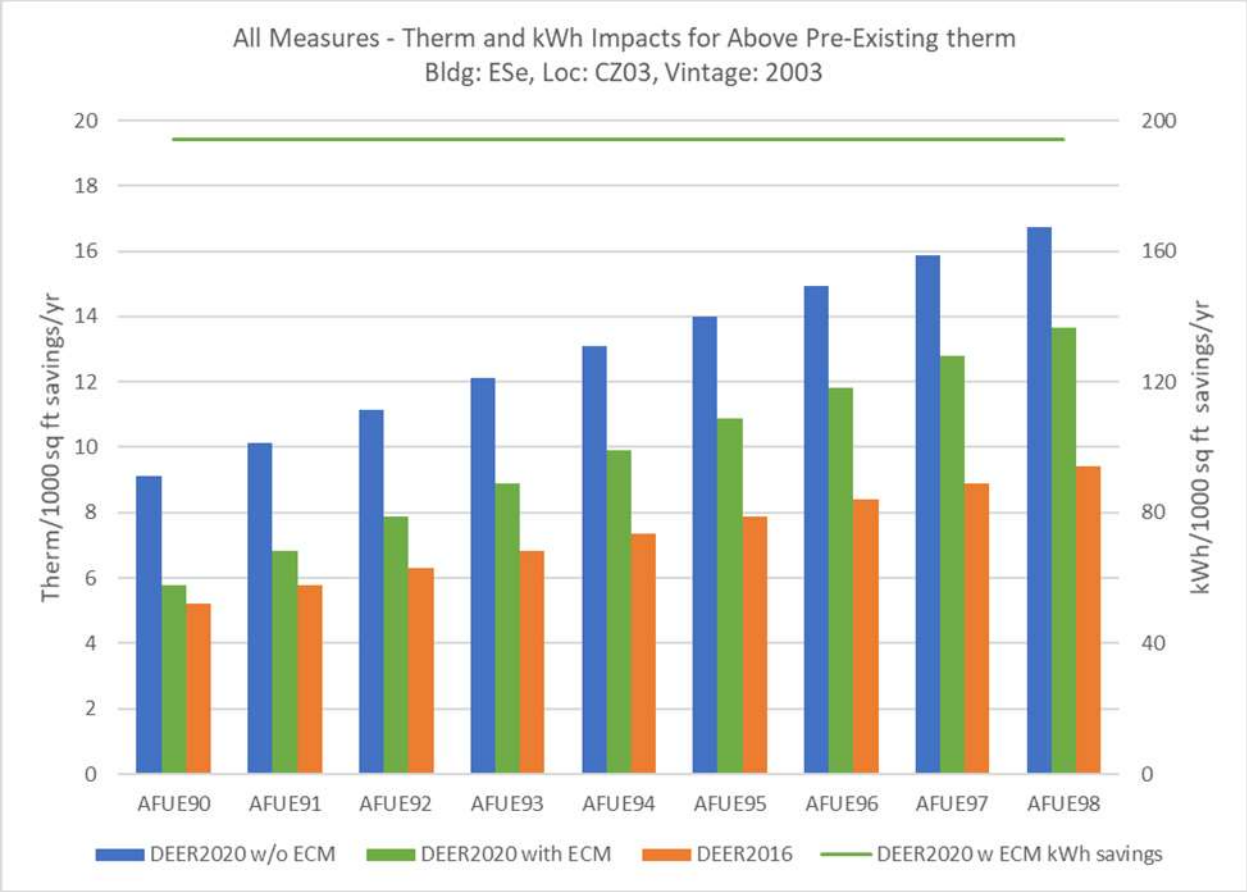

Figure 15. Furnace Efficiency Measure Impacts for Secondary School Prototype

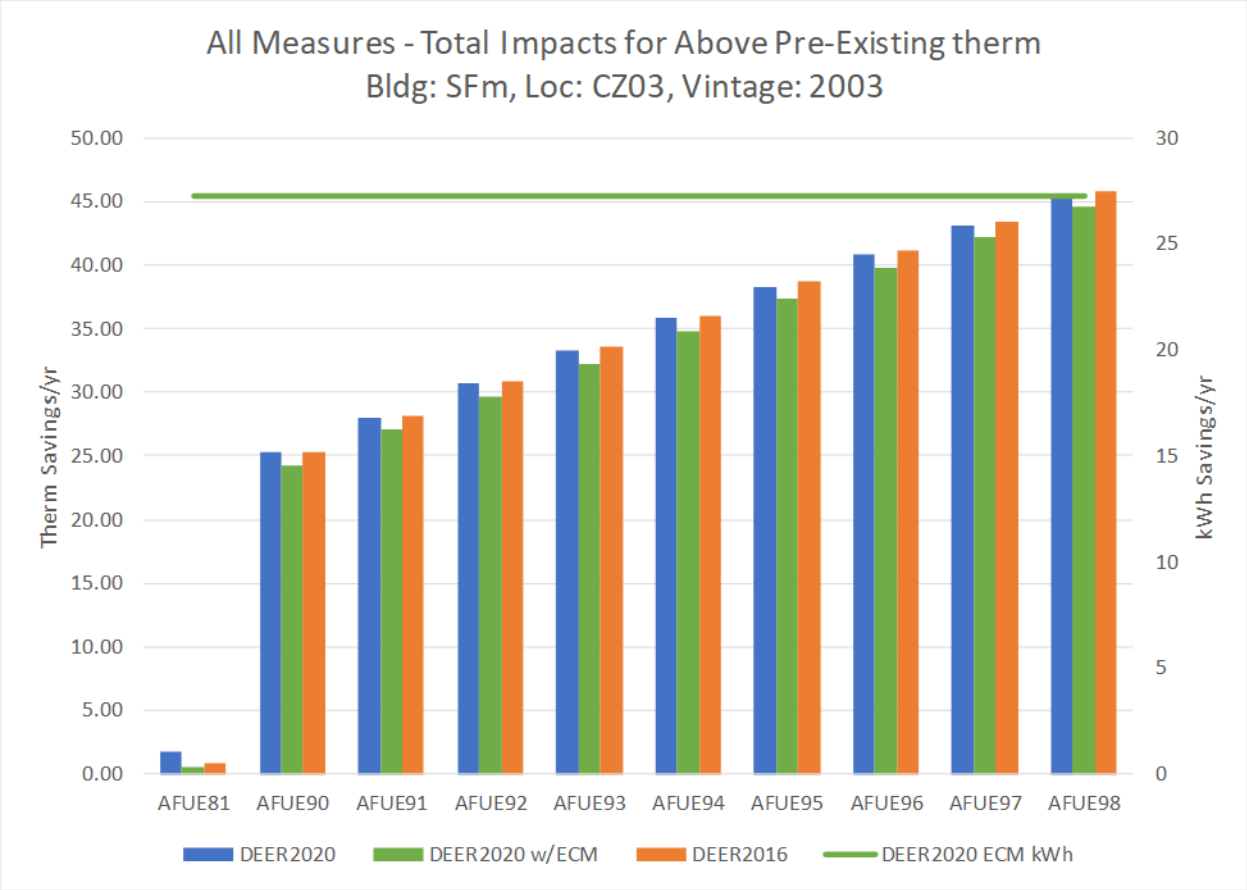

Figure 16. Furnace Efficiency Measure Impacts for Single Family Prototype

An efficient fan controller measure that optimizes the operation of the supply fan to maximize the heating/cooling recovered from the thermal mass after the burner/compressor has cycled off was also considered for this DEER update. Commission staff determined that additional time and resources would be needed to properly characterize the savings of this technology in the context of a deemed measure.

2.2. Expanded HVAC Savings Methods

DEER includes HVAC measures for liquid chilling machines (chillers) defined with fixed incremental increases in efficiency over minimum Title 24 requirements. DEER currently includes two tiers of chiller measures: 10 and 15 percent better than Title 24 requirements. DEER also includes a requirement that all chiller measures, including custom projects and non-DEER deemed measures supported by workpapers, must have efficiency levels of at least ten percent better than Title 24 minimum efficiency requirements. PAs have commented that the fixed measure definitions limit flexibility for either deemed or custom programs to offer measures

that are slightly different than the DEER measures.[6] Since many chillers covered by the program have very large capacities and are large energy users, small increases in energy efficiency over the DEER measure definitions (e.g. 12% vs 10%) can represent significant absolute energy savings that cannot be claimed (or incented).

To support development of alternative measure definitions for chillers, and to extend the DEER chiller savings calculation methods to custom projects, DEER now includes a chiller savings calculation workbook. The DEER Chiller Savings Workbook ("DEER2020_Chiller_Workbook-v1.xlsx") utilizes the DEER chiller simulation results to develop savings of chiller measures that incorporate the following non-DEER measure characteristics:

- Primary operating or typical operating chiller (see below for additional requirements)
- Mixtures of building types and building vintages
- Full-load (kW/ton or EER) and blended part-load (IPLV or NPLV) rated values that differ from the specific DEER measure, code/standard practice or existing technology definitions
- Chiller rating conditions that are different from those used in the DEER simulation methods
- Explicit specification for existing chillers for use in accelerated replacement measure application types

The workbook includes all simulation results used to develop the DEER2020 chiller measures. Results for user input chillers (measure, code/standard practice, existing) are developed by scaling the DEER results by the difference in user input full-load efficiency and the full-load efficiency used to generate the DEER results. Scaled simulation results are then subtracted to determine savings for the user input chiller definitions. Detailed guidelines for project inputs, chiller inputs and calculation results are provided the document "DEER2020_Chiller_Workbook Guide."

A set of chiller efficiency measures has been added for the scenario in which a single chiller in a multi-chiller cooling plant is replaced with a higher efficiency unit, and that unit is operated as the lead chiller throughout the year. The "lead chiller" has much higher operating hours and therefore these measures will have higher savings per ton. Lead chiller measures may only be

[6] Decision 12-05-015
OP 143: "Pacific Gas and Electric Company, Southern California Edison Company, San Diego Gas & Electric Company, and Southern California Gas Company shall utilize Database for Energy Efficient Resources (DEER) assumptions, methods, and data in the development of non-DEER values whenever appropriate, and shall follow Commission Staff direction relating to the determination of appropriate application of DEER to non-DEER values."
OP 147 "Pacific Gas and Electric Company, Southern California Edison Company, San Diego Gas & Electric Company, and Southern California Gas Company shall ensure that custom measure and project calculation tools or methods are consistent with the adopted Database of Energy Efficient Resources values and assumptions as applicable."

utilized in custom programs and shall not be used in deemed downstream rebate, upstream incentive or direct install programs. Custom programs for lead chiller measures shall include pre- and post-installation measurement and verifications that support the measure chiller is installed and operating as the lead chiller.

2.3. Extended-hours Prototype

A new commercial building prototype was contemplated to be added to DEER which would include extended hours of operation of high load activity areas, such as clean rooms, a manufacturing process or a data center, and which utilizes a central chiller as the main cooling source. However, this prototype was not included in the final DEER2020 release.

3. Updates Based on Methodology and Correction of Errors

3.1. Correction to Commercial Building Activity Areas

The commercial building prototypes were updated to align with the DEER2016 commercial lighting hours-of-use update. The DEER2016 update expanded the definition of activity areas in the commercial building prototypes and distinguished the hours-of-use of high-bay lighting systems from low-bay and screw-in lighting systems. The DEER2016 effort was limited to an update of lighting hours-of-use and coincident demand values, delivered as several tables in a workbook. Time and resource limitations prevented the update of the underlying commercial building prototypes for the DEER2016 release. For the DEER2020 update, the commercial energy simulation prototypes were updated to account for all the lighting systems and activity areas defined in the DEER2016 update. The lighting systems were also updated to accommodate the lighting power density (LPD) and baseline updates described in section 3.2 below.

Development of the updated prototypes also led to several changes to the building model assumptions. Some of these changes were needed to support the expanded activity area definitions and others are a result of the more flexible modeling framework of the new prototypes. The notable changes include:

- The assembly building has a larger total area; this is needed to accommodate the greater number of activity areas defined in the DEER2016 update.
- The following building types no longer require the entire model to be repeated with different orientations to make them orientation neutral: all education prototypes, hospital, nursing home, hotel, motel, and both restaurant prototypes.

The extensive re-development of the prototypes also led to critical review and updates of several model parameters. These changes, which are listed in the DEER supporting files, generally will have relatively minor effects on measure impacts.[8]

3.2. Consolidation of Building Vintage Definitions

The DEER modeling process has used building vintages to distinguish the differing building and building system characteristics associated with the age of relevant buildings stock being served by an IOU. Each adopted DEER version has included changes to the definition of the new building vintage, based upon code updates and updated standard practice, as well as typical retrofit activity for the lighting and HVAC system characteristics of older vintages supported by evaluation data. With many DEER updates over the past 15 years a new building vintage was defined and existing building vintage definitions were updated. This has led to defining unique characteristics for as many as 10 distinct building vintages for a single building type, as described in Table 2.

Table 2. DEER Building Vintages

Code	Description
Commercial and Residential	
1975	Before 1978
1985	1978 – 1992
1996	1993 – 2001
2003	2002 – 2005
2007	2006 – 2009
2011	2010 – 2013
2015	2014 – 2016
2017	2017 – 2019
2020	After 2019
New	New Construction
Mobile Homes only:	
MH72	before 1976
MH85	1976 – 1994
MH00	1995 – 2005
MH06	2006 – 2014
MH15	after 2014

[8] DEER Supporting Files: DEER2020_Prototype_Changes.xlsx, sheet MscChanges.

For all but a few building shell measures in DEER, the vintage-specific energy impacts of a measure are rolled up into a single building vintage, referenced as the *Existing* building vintage (as opposed to a *New* building vintage, which represents new construction not yet built). The vintage-specific measure energy impacts that are determined from energy simulations are rolled up based on the estimated total area of a given building type associated with each building vintage. Since the total area associated with the more recent vintages for any building type is always small compared to the total area of the older vintages for the same building type, the existing vintage is overwhelmingly representative of the older building vintage energy impacts.

While the older building vintages play the dominant role in determining the existing vintage measure energy impacts, the building and system characteristics associated with the older vintages are the most difficult to determine. For the older vintages (1996 and earlier) the age of the building itself is greater than the effective useful life (EUL) of all the lighting and HVAC system components within the building. As such, the older vintage buildings are defined with HVAC and lighting systems that are at or past their EUL. For example, the oldest building vintage represents buildings more than 40 years old and includes HVAC and lighting systems that are assumed to have been installed or upgraded 15 to 20 years ago. . For these oldest vintages, only the building shell is assumed to be typical of 40-year old construction. However, the building shell may also have been updated in remodeling and retrofit activities, especially in residential building types.

The DEER team recognizes that the level of detail used to specify the vintage-specific building characteristics exceeds what is reliably known about the actual building stock. Moving forward, as represented in DEER2020, the reported vintage-specific measure impacts are reduced to four vintage definitions, as listed in Table 3.

Table 3. Updated Vintage Definitions

Vintage	Non-Mobile Homes	Mobile Homes
Old	Before 2002	before 1995
Median	2002 - 2016	1995 - 2005
Recent	2017 - current	2006 - present
New	New Construction	New Construction

The median vintage is defined with lighting and HVAC systems that cover the range of their respective EULs. As such, the median vintage is the most appropriate vintage to utilize for claims of measures that are applied to buildings whose age is unknown or undocumented.

The DEER2020 measure energy impacts for the new vintage definitions are derived by weighting the results of the more detailed previous vintage specifications within each new vintage definition. Table 4 shows which previous vintages make up the new vintage definitions. The building weights from DEER2017 are used to weight the results for the previous vintage definitions into the new vintage results. Future DEER updates can concentrate on defining the

typical building system characteristics of only the four vintage categories, while the actual definition of the old, median and recent vintage categories may change.

Note: In the DEER2020 database, the median vintage is specified using the "Ex" vintage code, making it compatible with current claims specifications and the reporting of previous DEER measure results.

Table 4. Previous and Updated DEER Vintages

Previous Code	DEER Vintages Description	New DEER Vintage
1975	Before 1978	Old
1985	1978 - 1992	Old
1996	1993 – 2001	Old
2003	2002 – 2005	Median (Ex)
2007	2006 – 2009	Median (Ex)
2011	2010 – 2013	Median (Ex)
2015	2014 – 2016	Median (Ex)
2017	2017 – 2019	Recent
2020	After 2019	Recent
New	New Construction	New
Double-wide Mobile Homes only:		
MH72	before 1976	Old
MH85	1976 - 1994	Old
MH00	1995 - 2005	Median (Ex)
MH06	2006 - 2014	Median (Ex)
MH15	after 2014	Recent

As a part of the vintage consolidation, several characteristics of multizone and central plant HVAC systems were updated to account for equipment upgrades that have typically occurred in those buildings. All motor efficiencies and controls, supply air temperature controls, and duct insulation levels have been updated for the oldest two vintages to bring them up to the level of the 1996 vintage. Details are provided in the DEER supporting files.[9]

3.3. Commercial Building Outside Air Specifications

The outdoor air ventilation requirements of the commercial building prototypes are based on an adjustment to the required outdoor air flow per person along with the code-based egress

[9] DEER Supporting Files: DEER2020_Prototype_Changes.xlsx, sheet VintageUpdates

requirements that specify the design area per person,[10] the code recommended adjustment to the egress-based occupancy rates differs from the adjustment used in the development of previous DEER versions. This correction has been applied to both occupant density and outdoor air ventilation requirements to be consistent with the code requirements. The new values used for DEER2020 and the previous DEER values are listed in the DEER2020 supporting files.[11] The median change in occupant density is a decrease of 25%, and the median change in ventilation requirement is a 50% increase as compared with previous DEER versions. This will tend to increase heating and cooling loads, which will result in somewhat greater savings for HVAC measures, and greater takeback for lighting measures.

3.4. Residential Window Area

Residential windows in DEER2017 were oversized by 18% due to an error in the application of window frame width. The correction will tend to reduce peak cooling and heating loads, and may increase overall heating in some climates due to a reduction in solar gain.

3.5. Residential Two Speed Fan Power

The fan power relationship for two speed AC and HP measures was incorrect in DEER2017. The correction for DEER2020 results in fan power reduction in the low speed mode of approximately 15%.

3.6. Chiller Peak Demand Savings and Performance Maps

DEER2017 chiller measures included peak demand savings based on an out-of-date demand period. Additionally, the performance map for the variable speed screw chiller included an error in the development of the performance curve that sets the chiller power input as a function of part-load-ratio, entering condenser temperature and leaving chilled water temperature. The corrections to the DEER2017 chiller measures are covered in the following files, available from DEEResources.com:

- "DEER2017-2018ErrorCorrection-v1-ChillerMeasures_28Sep2018.xlsm" includes updated impacts for all chiller measures included in the DEER2017 update adopted in 2016.
- "DEER2017-2018ErrorCorrection-v2-ChillerMeasures_28Sep2018.xlsm includes updated impacts for all chiller measures included in the DEER2017 June 2017 update adopted in 2017

[10] 2019 Title 24 Draft Nonresidential Compliance Manual, Chapter 4, Table 4-12, Footnote 1a.
[11] DEER2020 Supporting Files: DEER2020_Ventilation.xlsx

- "DEER2017-2018ErrorCorrectionChillerModels.7z" includes all eQUEST batch processing directives and simulation files used to generate chiller impacts.

4. Updates Based on Energy Code (2019 or 2020)

4.1. Water Heater Ratings Change

In June of 2017, federal requirements for rating of small and residential use water heaters changed from Energy Factor (EF) to Uniform Energy Factor (UEF).[12] At the time of issuance of the DEER update Resolution E-4867 in August 2017, available product databases published by the CEC and The Air Conditioning Heating and Refrigeration Institute (AHRI) did not include sufficient quantities of UEF rated water heaters to develop typical code baseline and measure level performance criteria. Therefore, DEER measure definitions were not revised at that time and instead were left using the older, now obsolete EF ratings.

CPUC staff issued a Phase 1 disposition of workpapers for 2018 that directed PAs to use UEF for code/ standard practice baseline and measure definitions for small gas storage and small instantaneous water heaters.[13] At the time of the development of the disposition, there were sufficient numbers of UEF rated water heaters listed in available databases to develop reasonable code/ standard practice baseline and measure performance criteria for the following water heater classes:

- 30, 40 and 50 gallon residential gas storage water heaters with medium and high draw ratings
- Small residential gas tankless water heaters with low, medium and high draw ratings

Based upon the change in rating procedures and the Phase 1 disposition direction it is appropriate to consider adding UEF rated water heater measures to DEER database in place of

[12] The Uniform Energy Factor (UEF) is based on a new method of testing of a water heater that is different from older methods used to establish an Energy Factor (EF) Similar to EF, UEF methods require a 24-hour simulated use test (SUT), but unlike the EF method of testing, the new method uses one of four draw patterns (very low, low, medium, and high) to determine a water heater's UEF. The draw pattern varies in the following ways: number of draws, length of draws, timing, and flow rates. The appropriate draw pattern to be used for testing is determine based on a maximum gallon per minute (tankless water heaters) or first-hour rating test (storage water heaters). The UEF method also uses a 125 deg. F tank setpoint compared to 135 deg. F required for the older EF method. The UEF test methods have also been expanded over the EF methods to cover many additional products including heat pump and light commercial water heaters.

[13] DEER2020 incorporates analysis used to develop the 2018 Phase 1 disposition for water heaters rated with Uniform Energy Factor (UEF). The methodology is documented in the Phase 1 disposition "2018ResidentialWaterHeaters-1March2018.pdf" included in the full disposition archive "2018ResidentialWaterHeaters-1March2018.zip" available at http://deeresources.net/ on the Workpaper Disposition Archive page. Search for "D2018-ResidentialWaterHeaters".

existing obsolete measures. Additionally, the DEER team reviewed available databases of water heater specifications to determine if additional UEF rated water heater types, updated code/standard practice and measure performance characteristics and measure efficiency tiers should be added to DEER. The DEER2020 update includes the following technologies and measure tiers:

- EnergyStar 30, 40 and 50 gallon residential gas storage water heaters with minimum and high draw ratings
- Residential gas tankless water heaters with low, medium and high draw ratings
    - EnergyStar rated
    - Code/ standard practice efficiency level[14]

The DEER2020 version of the water heating workbook calculates savings based on UEF, which will support the PAs efforts to develop addition non-DEER water heating measures. The DEER2019 water heating analysis is covered in the workbook DEER-WaterHeater-Calculator-v3.2_rev25Sep2018.xlsm. The DEER2020 water heating analysis is covered in the following files:

- "DEER2020 CEC+AHRI_water_heater_binning_for_UEF_calcs.xlsx": Analysis of CEC and AHRI databases to determine Code/ standard practice and Measure technology performance characteristics
- "DEER-WaterHeater-Calculator-v3.2.xlsm": Water heater impacts calculation workbook. This workbook has been updated to reflect revised measure technology definitions and updated DEER2020 building population weights by building type, climate zone and Program Administrator (PA) service territory

4.2. Lighting Baseline Update and Lighting Power Density in Commercial Buildings

The recently adopted 2019 California Title 24 Building Energy Standards reduces interior lighting power allowances based largely on the use of LED technologies.[15] The 2016 DEER update revised the second baseline, used in accelerated replacement measure applications for all exterior lighting, to be LEDs. The proposed 2019 Title 24 updates indicate that the second baseline, used in accelerated replacement measure applications for interior lighting, should also be revised to LEDs.[16]

---

[14] DEER includes measures for Code/ISP level tankless water heaters with a baseline of a storage water heaters. Savings from these measures are largely attributable to tankless water heaters not having a storage tank (and operating "on demand") therefore eliminating standby by losses between the storage tank and the surrounding space. Since the measure technology efficiency is equal to the Code/ISP level, little or no savings is due to improved burner efficiency. Therefore, the savings are due to a change in technology, rather than improvement of efficiency over the baseline technology.

[15] See Title 24 2019 Section 140.6 tables B, C, and D, and Section 140.7 tables A and B.

[16] Ibid, Note: the second baseline for accelerated replacement is the code effective or standard practice expected at the end of the remaining useful life of the replaced equipment.

Recent Commission staff workpaper dispositions for many types of LED lighting technologies and collaborative efforts between CPUC staff and PG&E have resulted in the establishment of all LEDs, (or a significant fraction of LEDs) as the standard practice baseline for Normal Replacement (NR), New Construction (NC), Capacity Expansion (CE), and Replace-on-Burnout (ROB) measures in exterior, interior high-bay and interior low-bay lighting applications.[17] This direction was effective January 1, 2018 for exterior and parking garage lighting measures, and April 1, 2018 for interior high and low bay lighting measures. Recent Commission staff workpaper disposition also updated standard practice baselines for screw-in lamps and can-retrofits to include fractions of LEDs, effective July 1, 2018.[18] Furthermore, the CPUC staff direction on baselines for NR, NC and ROB measure application types is applicable to both custom and deemed measures. Development of revised baselines for exterior fixtures is covered in the workbook "DEER2020-OutdoorLtgGarageUpdate-27Aug2018.xlsx". Development of revised baselines for interior high-bay and low-bay lighting fixtures is included in the workbook "DEER2020-HighLowBayLtgUpdate-27Aug2018.xlsx".

Prior to this DEER update, most values for annual operating hours of exterior lighting were developed through workpapers and were not included in DEER. Only general exterior lighting for residential building types (single family, muti-family and manufactured home) was included in DEER. For the DEER2020 update, approved workpaper values other exterior lighting are adopted as part of DEER. Annual operating hours are added for 2019, and coincident demand factors (CDF) are added for 2020 that align with the revised peak demand period. Development of outdoor lighting operating hours and CDF values is included in the workbook "DEER2020-ExtLtgUpdate-27Aug2018".

The DEER2019 update incorporates the standard practice baselines from the recent dispositions covering exterior, interior low-bay, interior high-bay, screw-in and can-retrofit lighting. Measures that are currently identified in the Preliminary Ex Ante Review database (PEARdb) will be migrated to the Ex Ante database (EAdb) and identified as DEER2019 measures. In addition to incorporating measures covered by recent workpaper dispositions, DEER2019 updates the standard practice baseline for all other NR, NC, ROB and AR measures to be based on LED technologies. This includes LED ceiling, troffer and retrofit kits measures that have previously been defined with T8 linear fluorescent baselines.

The code/ standard practice baseline for ceiling fixture, grid fixtures and retrofit kits assumes a performance equal to the 25th percentile, in terms of all fixtures in the Lighting Facts database.[19] This is the same performance level assumed in the Phase 1 disposition for outdoor and parking garage lighting. Table 5 shows the results of the performance analysis of six different types of LED technologies from the Lighting Facts database. Nearly all available technologies exceed an

[17] See www.deeresources.net file names: "D2018-OutdoorLighting.7z" and "2018OutdoorLightingPhase1-22May2018-Correct.zip".

[18] See www.deeresources.net file names: "D2018-ScrewInLampSavingsMethods.7z"

[19] See https://www.lightingfacts.com/products, the data used for Table 5 was download 20 July 2018

efficacy level of 100 lumens per watt. Therefore, the code/ standard practice baseline for hard-wired fixtures that were not previously covered by 2018 Phase 1 dispositions shall be 100 lumens per watt. This level shall apply to all measure application types including accelerated replacement, normal replacement, and new construction starting January 1, 2019. The detailed development of the baseline efficacy for ceiling fixtures, grid fixtures and retrofit kits included in the workbook "DEER2020-LtgFactsAnalysis-TrofferRetroKit-24Aug2018.xlsx".

Table 5. Performance Analysis of LED Fixtures

Technology	Size	Calculation	Percentile	Output Range (lumens)					
				0 to 2000	2001 to 3000	3001 to 4000	4001 to 5000	5001 to 6000	>6000
Fixture	1x4	Percentile	25	99	98	96	101	106	102
			50	108	106	103	109	119	114
			75	113	115	112	118	127	123
			90	118	123	125	126	132	129
		Quantity Under	25	13	58	148	135	47	27
			50	26	115	296	270	92	53
			75	39	172	445	405	136	79
			90	46	207	530	486	163	95
		Quantity Over	25	38	172	442	405	136	79
			50	26	115	295	270	93	53
			75	14	58	150	135	47	27
			90	6	23	59	54	19	11
Fixture	2x2	Percentile	25	97	92	94	101	107	106
			50	105	101	102	109	116	116
			75	111	114	114	120	127	128
			90	121	125	126	127	132	135
		Quantity Under	25	20	185	407	274	64	45
			50	40	370	814	548	127	89
			75	56	553	1220	818	187	133
			90	68	663	1465	982	224	159
		Quantity Over	25	57	554	1220	819	187	133
			50	40	376	814	548	125	89
			75	19	185	407	273	63	45
			90	10	74	164	110	25	18
Fixture	2x4	Percentile	25	123	99	100	98	102	100
			50	126	108	111	106	111	112
			75	127	119	128	123	125	126
			90	129	130	132	130	131	133
		Quantity Under	25	2	23	182	305	225	292
			50	3	45	357	610	448	583
			75	4	67	543	914	672	879
			90	4	82	646	1097	807	1049
		Quantity Over	25	4	67	539	914	673	874
			50	3	45	357	612	448	583
			75	2	23	183	305	224	295
			90	1	11	78	122	92	117

Technology	Size	Calculation	Percentile	Output Range (lumens) 0 to 2000	2001 to 3000	3001 to 4000	4001 to 5000	5001 to 6000	>6000
Retrofit Kit	1x4	Percentile	25	109	110	111	111	115	113
			50	117	120	117	117	132	118
			75	124	130	132	134	133	120
			90	135	135	134	134	135	123
		Quantity Under	25	5	9	10	8	7	2
			50	10	18	20	15	13	4
			75	17	27	30	22	20	6
			90	20	32	37	28	24	7
		Quantity Over	25	15	27	30	22	19	6
			50	10	18	20	15	13	4
			75	6	9	10	8	8	2
			90	3	4	6	5	4	1
Retrofit Kit	2x2	Percentile	25	109	100	103	105	108	116
			50	116	111	112	111	123	122
			75	124	122	127	126	132	128
			90	125	127	132	130	137	129
		Quantity Under	25	14	51	52	25	8	4
			50	28	103	103	50	15	7
			75	42	152	154	73	22	10
			90	50	182	184	87	27	13
		Quantity Over	25	42	152	154	73	22	10
			50	28	109	103	50	15	7
			75	14	51	52	25	8	6
			90	6	21	21	10	3	3
Retrofit Kit	2x4	Percentile	25	84	117	110	110	116	120
			50	92	131	126	124	127	127
			75	100	143	134	131	135	136
			90	105	144	142	136	142	140
		Quantity Under	25	1	18	61	63	42	31
			50	1	35	122	126	84	63
			75	1	54	184	188	128	94
			90	1	63	219	226	153	110
		Quantity Over	25	1	52	183	188	126	92
			50	1	35	122	126	84	62
			75	1	18	62	63	43	32
			90	1	8	25	26	18	13

2019 Codes and Standards Study – Indoor Lighting Power Densities.[20] As part of the 2019 update to Title 24, the IOU's Codes and Standards Indoor Lighting Power Densities study revised lighting power densities for all building and space types as listed in Table 6. While the 2013 Codes and Standards Study "Indoor Lighting Controls" assumed the use of high performance lighting technologies including "high performance" linear fluorescent lamps and reduced light output ballasts, the 2019 Study assumes LED technology for all lighting and as a result the proposed lighting power density have been significantly reduced. The study not only proposed to revise lighting power densities, it also proposed to include new building types (e.g. "Sports arena") as well as new space types (e.g. for "Aging Eye/Low-vision). The lighting power densities were determined using on target foot-candles based on guidance form ASHRAE 90.1-2016, ASHRAE 189.1-2017, the IES handbook and the IES Recommended Practices. The 2019 Study proposals were adopted into 2019 Title 24.

Table 6. Luminaire Description by Building Type[21]

Building Type	Space Type Description	Luminaire Description
All Buildings	Medical/Industrial Research Laboratory	Narrow linear LED surface/suspended
	Education Laboratory	Narrow linear LED surface/suspended
	Corridor/Transition	Downlight
	Classroom/Lecture/Training	Linear LDE lensed troffer
	Electrical/Mechanical	Industrial LED channel – surface or suspended
	Dining Area	Downlight
	Food Preparation	Narrow linear LED surface/suspended
	Lounge/Recreation	Linear LED lensed troffer
	Stairway	Wall mount linear LED (up/down light)
	Stairway	Linear LED lensed troffer
	Restrooms	Wall mount linear LED (up/down light)
	Lobby	Indirect pendant – Linear LED
	Office – Enclosed	Linear LED direct/indirect troffer
	Office – Open plan	Linear LED suspended direct/indirect distribution

[20] Codes and Standards Enhancement (CASE) Initiative, 2019 California Building Energy Efficiency Standards, Indoor Lighting Power Densities – Final Report, August 2017

[21] Ibid, Table 4.

Building Type	Space Type Description	Luminaire Description
All Buildings (continued)	Conference Meeting/Multipurpose	Narrow linear LED surface/suspended
	Active Storage	Industrial LED channel – surface or suspended
Auditorium	Audience/Seating Area	PAR downlight flood
Auditorium	Audience/Seating Area	Wall washer
Automotive Facility	Garage Service/Repair	Downlight
Bank Customer Area		Industrial LED channel – surface or suspended
Barber & Beauty Parlor		Linear LED lensed troffer
Convention Center	Exhibit Space	High-bay
	Audience/Seating Area	Downlight
Court House	Audience/Seating Area	Downlight
	Courtroom	Indirect pendant – LED Modules
	Judge's Chambers	Narrow linear LED recessed or suspended
Family Dining	Dining Area	Downlight
Fitness Center	Audience/Seating Area	Linear LED lensed troffer
	Fitness Area	Indirect pendant - LED Modules
Gymnasium	Audience Seating/Permanent Seating	Low-bay (130W)
	Playing Area	Low-bay (88W)
	Fitness Area	Indirect pendant – LED Modules
Gymnasium/Fitness Center	Locker Room	Linear LED lensed troffer
Hospital/Healthcare	Exam/Treatment	Linear LED High Performance lensed troffer
	Hospital/Medical Supplies	Linear LED lensed troffer
	Hospital – Nursery	Linear LED direct/indirect troffer
Hospitals	Nurse station	Linear LED suspended direct/indirect distribution
	Physical therapy	Linear LED suspended direct/indirect distribution
	Patient Room	Linear LED direct/indirect troffer

Building Type	Space Type Description	Luminaire Description
Hospitals (continued)	Pharmacy	Linear LED lensed troffer
	Radiology/Imaging	Linear LED direct/indirect troffer
	Operating Room	Linear LED High Performance lensed troffer
	Recovery	Linear LED High Performance lensed troffer
	Active storage	Industrial LED channel – surface or suspended
	Laundry – Washing	Linear LED lensed troffer
Hotel/Conference Center – Conference/Meeting		Indirect pendant – LED Modules
Laundry-Ironing & Sorting		Linear LED lensed troffer
Library	Stacks	Narrow linear LED Bat-Wing distribution
Lounge/Leisure Dining	Dining Area	MR16 downlight flood
Manufacturing Facility	General Low Bay	Low-bay
	General Low Bay	Low-bay
	General High Bay	High-bay
	Extra High Bay	Industrial super high-bay LED High Output
Motion Picture	Audience/Seating Area	Downlight
Motion Picture	Lobby	Downlight
Museum	General exhibition	MR16 downlight flood
	Restoration	Linear LED High Performance lensed troffer
	Active Storage	Industrial LED channel
Office	Banking Activity Area	Linear LED direct/indirect troffer
Parking Garage	Parking	Parking structure LED luminaire
Performing Arts Theatre	Audience/Seating Area	Downlight
	Lobby	Downlight
Religious	Audience/Seating Area	Downlight flood
	Worship – pulpit, choir	Downlight flood
Retail	Department Store Sales Area	2x2 Low brightness direct/indirect troffer

Building Type	Space Type Description	Luminaire Description
Retail (continued)	Supermarket Sales Area	Narrow linear LED surface/suspended
	Mass Merchandising Sales Area	2x4 LED low-brightness direct/indirect basket
	Mall Concourse	Downlight flood
	Dressing/Fitting Room	Downlight
	Merchandising Sales Area	Downlight
Sports Arena	Audience/Seating Area	Indirect pendant – LED Modules
	Class 1 – Court Sports Area	High-bay
	Class 2 – Court Sports Area	High-bay
	Class 3 – Court Sports Area	Low-bay (130W)
	Class 4 – Court Sports Area	Low-bay (236W)
Transportation	Air/Train/Bus – Baggage Area	Narrow linear LED surface/suspended
	Terminal – Ticket counter	Narrow linear LED surface/suspended
Warehouse	Fine Material	Industrial LED channel – surface or suspended
	Medium/Bulky Material	High-bay
Workshop	Workshop	Industrial LED channel – surface or suspended

2019 Codes and Standards Study – Outdoor Lighting Power Allowances.[22] As part of the 2016 update to Title 24, the IOU's Codes and Standards Enhancement (CASE) program proposed revisions to Title 24 outdoor lighting power allowances (2016 CASE Outdoor Study). The report proposed that all lighting power allowances (LPA values) in Title 24 be reduced based on the standard practice usage of LED technologies. The final adopted Title 24 requirements only incorporated the recommendations for general hardscape lighting and did not reduce allowances for additional specialty lighting use categories such as vehicle service stations, outdoor sales lots, building facades, canopies and tunnels. Rejection of some of the changes was due to a lack of cost-effectiveness. However, now, all changes proposed in the most recent CASE Study are cost effective. The proposed changes include general hardscape lighting power allowance (varying based on the parking surface type for two of the five lighting zones) and for specific applications.

[22] Codes and Standards Enhancement (CASE) Initiative, 2019 California Building Energy Efficiency Standards, Outdoor Lighting Power Allowances – Final Report, August 2017

2019 Codes and Standards Study- Indoor Lighting Alterations.[23] As part of the 2019 update to Title 24, the IOU's Codes and Standards Lighting Alterations report proposes that the power of replacement lighting fixtures, where the entire lighting system is not being redesigned in all building types be at least 50 percent lower at full light output compared to the replaced luminaires rather than 50 percent only in office retail and hotel and 35 percent in all other occupancies in 2016 update.

4.3. Update to Commercial HVAC Specifications

Updates in the 2019 Title-24 requirements for commercial buildings include expanded ventilation (outdoor-air flow) rates by activity area, increased exhaust-air flow rates for some activity areas and increased values for cooling tower efficiency. These updates, which have been incorporated into the 2020 DEER building vintage and the new construction DEER building vintage prototype models, are expected to have minor effects on measure savings. Details of the updated values are listed in the DEER supporting files.[24]

4.4. Update to Residential Building Shell Specifications

Updates in the 2019 Title-24 requirements for residential buildings include changes to the roof insulation configuration in single-family buildings along with lower framed wall U-value for single-family buildings and improved window specifications for single-family and multi-family buildings.[25] These updates have been incorporated into the 2020 DEER building vintage prototype models. Overall, wall insulation increases about 7%, and window performance increases about 5%. Attic radiant barrier requirements have been removed from several climate zones, and roof insulation requirements are slightly more stringent, and will result in reduced savings from duct loss measures. Details of the updated values are listed in the DEER supporting files.[26]

4.5. Net-to-Gross for Lighting Measures

As discussed in Section 4.2, DEER updates and several workpaper dispositions have updated the code and standard practice baselines for lighting measures to include all or a significant fraction of LEDs. Prior to the DEER2019/2020 update, these updates have covered screw-in lamps, exterior lighting fixtures, interior high-bay fixtures and interior low-bay fixtures. At this time, other fixtures such as linear fluorescent retrofit kits, ceiling mounted LED fixtures and

[23] Codes and Standards Enhancement (CASE) Initiative, 2019 California Building Energy Efficiency Standards, Nonresidential Indoor Lighting Alterations – Final Report, August 2017

[24] DEER Supporting Files: DEER2020_CodeUpdate.xlsx and DEER2020_Ventilation.xlsx

[25] See insulation requirements of Title 24 2019 in Section 150.1(c)1. A. Roof and Ceiling and Section 150.1(c)1. B. Walls.

[26] DEER Supporting Files: DEER2020_CodeUpdates.xlsx

ceiling grid fixtures have savings estimates based on linear fluorescent code or standard practice baselines. This DEER version updates, effective January 1, 2019, baselines for these remaining lighting fixture types to be entirely LED technologies. With this change, it is reasonable to raise the NTG value for these measures to 0.91, which is the same value directed by 2018 Phase 1 workpaper dispositions for exterior, interior high-bay and interior low-bay fixtures. This NTG value is allowed for only normal replacement (NR) and new construction (NC) measure application types, and is considered the above-code NTG as described in Section 5.4. Below-code savings are subject to the NTG adjustment factor described in Section 5.4.

5. Policy-Directed Updates Supported by Prior Evaluation Findings

5.1. Net-to-Gross for HVAC Measures

Updates to reflect recent ex post evaluations: Since the last DEER update, two new HVAC evaluation reports have become available for consideration in the DEER2020 update (HVAC1[27] and HVAC3[28]). HVAC1 reports a NTG value result of 0.64 for commercial upstream package HVAC programs, while the current DEER value is 0.75. HVAC3 reports an overall NTG for commercial HVAC maintenance measures of 0.42. In DEER, commercial maintenance measures receive an NTG of 0.73 for refrigerant charge adjustment and the default of 0.60 for all other maintenance measures. It a review of SDG&E residential maintenance programs, HVAC3 also notes that NTG for most residential QM programs is not significantly different from zero. For residential programs, Commission staff does not believe evaluation results for a single PA should drive a revision any dramatic reductions to NTG values. Therefore, Commission staff removes NTG values for residential QM programs, and directs the use of the DEER default value of 0.55. Table 7 summarizes the revisions to DEER HVAC NTG values.

[27] Impact Evaluation of 2015 Upstream HVAC Programs (HVAC 1), prepared for California Public Utilities Commission, prepared by DNVGL, CALMAC ID CPU0116.03, April 4, 2017.

[28] Impact Evaluation of 2015 Commercial Quality Maintenance Programs (HVAC3), prepared for California Public Utilities Commission, prepared by DNVGL, CALMAC ID CPU0117.03, April 7, 2017.

Table 7 - DEER2020 HVAC NTG Revisions

Measure	Current Values		DEER2020 Values	
	NTG	Reference	NTG	Reference
Commercial Refrigerant Charge	0.73	NonRes-sAll-mHVAC-RCA	0.45	HVAC3
All Other Commercial HVAC maintenance	0.60	Com-Default>2yrs	0.45	HVAC3
Residential Refrigerant Charge	0.78	Res-sAll-mHVAC-RCA	0.55	Res-Default>2yrs
Residential Duct Sealing	0.78	Res-sAll-mDuctSeal	0.55	Res-Default>2yrs
All Other Residential HVAC maintenance	0.55	Res-Default>2yrs	0.55	Res-Default>2yrs
Commercial Upstream Package HVAC	0.75	NonRes-sAll-mHVAC-DX-up	0.65	HVAC1

5.2. Effective-Useful Life Updates

Behavioral, Operational and Retrocommissioning measures: D.16-08-019 created the Behavioral, Operational and Retrocommissioning (BRO) measure classification with EUL values of one to three years with retrocommissioning assigned a three-year EUL.[29] Resolution E-4818 directed that all measures which utilize a degraded performance baseline and/or are restorative of performance in nature be classified as retrocommissioning.[30] Table 8 provides a list of measures that have their EUL and RUL values changed to be consistent with this policy direction. This list is not all inclusive such that PAs and Commission staff should ensure that all BRO measures follow the policy direction that was effective January 1, 2017.

Table 8. Existing EUL Table Measures Requiring Reclassification as BRO Measures

Description	Sector	Version Source	Existing Values		Corrected Values	
			EUL	RUL	EUL	RUL
Boiler Tune-up	Com	IOU Workpaper	5	1.7	3	1
Clean Condenser Coils - Commercial	Com	DEER	3	1	3	1
Clean Condenser Coils - Residential	Res	DEER	3	1	3	1
Clean Evaporator Coils	Com	IOU Workpaper	3	1	3	1
Door Gaskets on Cooler/Freezer Doors	Com	DEER	4	1.3	3	1

[29] See D.16-08-018 at 46 "Because there is a wide variation in evidence to support various expected useful lives, we will still err on the conservative side and allow a two-year life for behavioral programs in non-residential settings, and a three-year life for retrocommissioning and operational programs."

[30] See Resolution E-4818 at 13-14 and OP 2 "We direct the Program Administrators to ensure that all program activities and installations resulting in performance that does not exceed the nominal efficiency (i.e., rated, intended, or original efficiency) of the pre-existing condition are offered through a behavioral, retrocommissioning or operational program framework, with an effective useful life not to exceed three years."

Description	Sector	Version Source	Existing Values		Corrected Values	
			EUL	RUL	EUL	RUL
Duct Sealing	Res	DEER	18	6	3	1
Duct Sealing - Single Zone Package System	Com	DEER	18	6	3	1
Quality Maintenance	CC	PA workpaper	3	3	3	1
Refrigerant Charge - Residential	Res	DEER	10	3.3	3	1
Repair Economizer	Com	DEER	5	1.7	3	1
Reprogram thermostat	CC	IOU Workpaper	11	3.7	3	1
Residential HVAC assessment report & maintenance contract[1]	Res	IOU Workpaper	5	1.7	n/a	
Rooftop Unit retrocommissioning	Com	IOU Workpaper	5	1.7	3	1
Steam Traps - Space Heating	Com	DEER	6	2	3	1

[1]Measure has no savings life as savings is not allowed

Add-On Equipment (AOE) measures: Resolution E-4818 re-affirmed the long-standing policy that EUL values for add-on equipment measures (including wall, floor and ceiling insulation added to existing insulation) are limited to the RUL values of the host equipment[31]. The only exception to this policy is when the add-on measure is part of a new installation in which case the EUL of the add-on equipment is limited by the EUL of the host equipment. In other words, for newly installed or replaced equipment that includes a new add-on equipment component, the add-on equipment savings may use the EUL rather than the RUL of the host equipment as a limit. In all cases the add-on equipment savings life is also limited by the add-on equipment EUL value. Table 9 provides examples of existing EUL table measures that must be limited by the host RUL values in cases where the add-on is to existing host equipment.

Table 9. Existing EUL Table Entries that Require Use of Host Equipment RUL Values When the Add-On is to Existing Equipment

Description	Sector	Version Source	Existing Values		Typical Host Value
			EUL	RUL	RUL
Refrigeration Insulation for Bare Suction Lines	Com	DEER	11	3.7	5
Milk Transfer Pump Variable Speed Drive	Ag	DEER	15	5	5
Milking Vacuum Pump Variable Speed Drive	Ag	DEER	15	5	5

[31] See Resolution E-4818 at 27 "We also note for the sake of completeness that add-on measures are assigned an existing baseline for the shorter of: a) the EUL of the add-on measure or b) for the RUL of the host equipment. This requirement accounts for the potential shortening of the life of the add-on measure due to replacement or failure of the host equipment."

Description	Sector	Version Source	Existing Values		Typical Host Value
			EUL	RUL	RUL
Well Pump Variable Speed Drive	Ag	DEER	10	3.3	5
Wine Tank Insulation	Ag	DEER	15	5	10
Floor Insulation - Commercial	Com	DEER	20	6.7	10
Roof/Ceiling Insulation - Commercial	Com	DEER	20	6.7	10
Floor Insulation - Residential	Res	DEER	20	6.7	10
Add Economizer	Com	DEER	10	3.3	5
Compressor Heat Recovery (w/electric water heating)	Com	DEER	14	4.7	5
Compressor Heat Recovery (w/electric water heating)	Ag	IOU Workpaper	14	4.7	5
Duct Insulation Material	Com	DEER	20	6.7	5
VSD Supply Fan Motors	Com	DEER	15	5	5
Variable Speed Drive on Process Fan Control	Com	PA workpaper	13	4.33	5
Pipe Insulation - Electric Water Heater	Com	DEER	13	4.3	5
Pipe Insulation - Gas Water Heater - Commercial	Com	DEER	11	3.7	5
Water Heater Tank Wrap - Electric	Com	DEER	7	2.3	5
Water Heater Tank Wrap - Gas	Com	DEER	7	2.3	5
Pipe Insulation - Electric Water Heater	Res	DEER	13	4.3	4.33
Pipe Insulation - Gas Water Heater - Residential	Res	DEER	11	3.7	3.67

LED screw-in A lamps: LED screw-in lamps have a spread of manufacturers rates life values ranging from 25,000 to 50,000 hours with an Energy Star minimum requirement of 25,000 hours. These rating are based upon a specific test method that may not provide results that are a good indicator of expected life in real installation. To get better information on the range of expect life the CPUC undertook its own laboratory testing.[32] The results of this activity show that LED A-lamps are unlikely to obtain their rated life or even the Commission staff approved value of 20,000 hours. Other LED lamp types showed a much better performance than A-Lamps. The overall results are seen in Figure 17 (Figure 15 from the cited report).

[32] LED Lab Test Study Draft Final Report, Itron, September 2017.

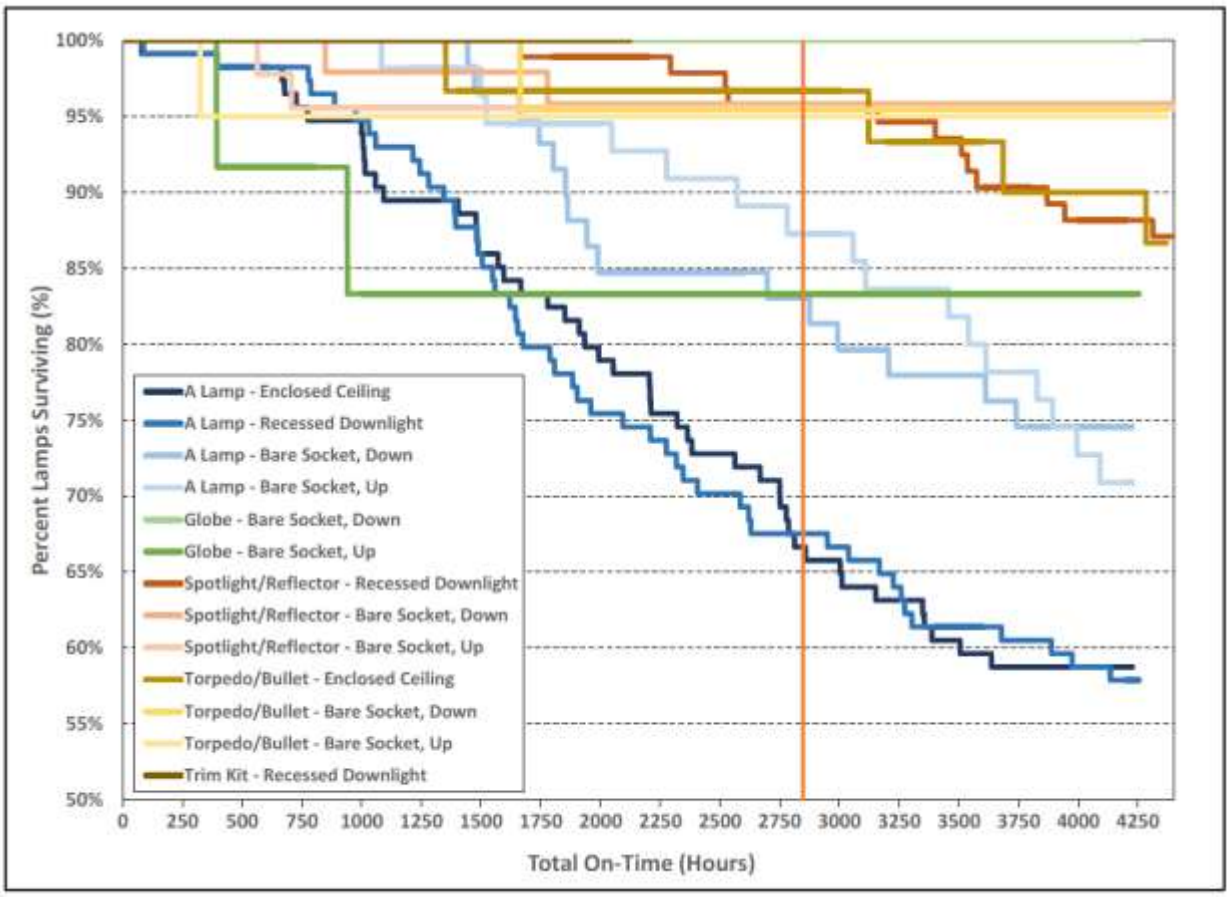

Figure 17 - LED Screw-in Lamp Survival Curves by Lamp Type and Fixture Type Combinations

It must also be pointed out that this lab testing provides a technical life cap since there are other reasons that an installed lamp may be removed from service other than failure. Based on the testing result Commission staff reduces the LED screw-in A-Lamp life from 20,000 hours to 10,000 hours. It should be noted that these values are more appropriate for bare lamp applications rather than installations in partially enclosed or fully enclosed fixtures. However, absent data on the type of fixture placements of typical A-Lamps installation the highest expected values are being adopted. We also note that due to recent code changes and pricing change it is not expected that LED A-lamps should remain in the energy efficiency portfolio after 2018. However, if they do remain these new EUL values shall be effective January 1, 2019.

5.3. Default Gross Realization Rate for Custom Measures and Projects

Decision 11-07-030 set default gross realization rates to apply to all custom projects which do not have an alternate value or specific gross energy savings values set because of an ex ante

review process disposition.[33] This value was chosen for the 2010-2012 program years as the Commission decided there were no recent evaluation results to support an alternate value. Decision 12-05-015 recounted the 2006-2008 overall custom project gross realization rates varied by utility, but were generally between .55 and .80 across energy savings values and utility.[34] However, the use of a single set of evaluation results for the three-year recent program cycle was not considered sufficient evidence considering that the utilities and their implementer may have implemented program changes to address the issue.[35] For these reasons the use of a 0.90 gross realization rate default value was retained for the 2013-2014 program years pending more evaluation results.[36]

Results for the 2010-2012 and 2013-2015 program cycle evaluations are now available, in addition to the 2006-2008 gross realization rate values previously discussed in D.12-05-015. The most recent results, from program years 2013-2015 discussed below, indicate that, overall, the gross realization rates for the custom program activities have not improved but instead have decreased further in some cases.

We also note that there was limited direction in the past on the use of gross realization rates for custom projects. It was generally accepted that projects subject to ex ante review would have the values resulting from that review applied to both customer and implementer incentive payments as well as utility claims filed with the Commission. However, when no ex ante review was performed and the default gross realization rate was applied, the utilities have not used the savings values adjusted by the gross realization rates for any incentive calculation, but rather just for reporting to the Commission. The intention of the ex ante adjustment was to ensure that both reported values were accurate, and that incentive payment were more reflective of the eventual evaluated results.

The most recent, as well as the weighted average of three most recent years' non-residential custom evaluation results for both first year and lifecycle gross realization rates, are in Table 10 below. Each of these values is below the default gross realization rate of 0.90.

---

[33] D.11-07-030 at 37. The CPUC staff recommended values of 0.7-0.8 were not adequately supported by evidence and the IOU recommended value of 1.0 was also not supported by evidence. At the time there were not yet final evaluation reports available for the most recent three years of custom program offering.

[34] See D.12-05-015 at 343 table 1.

[35] D.12-05-015 at 343 "As noted above, in comments the utilities and others claim in their comments that changes have already been made to program rules and implementation activities to raise these values. However, we have not been provided quantitative evidence that supports claims." And at 344 "We expect the utilities to respond to Commission Staff reviews by taking steps to change the program activities to improve both gross and net results. "

[36] D.12-05-015 at 344 "Additionally, we direct the utilities to make programmatic changes to their custom programs per the recommendations and findings in recent evaluation studies. However, we retain the current default Gross Realization Rate (GRR) value of 0.90 for use in the 2013-2014 transition portfolio."

Table 10. 2013-2015 Non-Residential Custom Evaluation Results for Gross Realization Rates

		First Year Gross Realization Rate			Lifecycle Gross Realization Rate		
	IOU	kW	kWh	Therm	kW	kWh	Therm
IALC 2015 Evaluation Results[37]	PG&E	0.64	0.54	0.54	0.50	0.47	0.47
	SCE	0.50	0.55	0.55	0.40	0.41	0.41
	SDG&E	0.77	0.51	0.52	0.73	0.47	0.47
	SoCalGas			0.51			0.50
IALC 2013-2015 Weighted Evaluation Results[38]	PG&E	0.75	0.68	0.68	0.74	0.64	0.64
	SCE	0.54	0.57	0.57	0.46	0.48	0.48
	SDG&E	0.79	0.68	0.68	0.80	0.62	0.62
	SoCalGas			0.61			0.52
Custom Lighting 2015 Evaluation Results[39]	PG&E	0.85	0.79	0.79	0.85	0.84	0.84
	SCE	0.96	0.79	0.79	1.07	0.85	0.85
	SDG&E	0.69	0.74	0.74	0.44	0.67	0.67
Custom Lighting 2013-2015 Evaluation Results[40]	PG&E	0.84	0.79	0.79	0.75	0.72	0.72
	SCE	0.80	0.77	0.77	0.73	0.76	0.76
	SDG&E		0.82	0.82	0.82	0.67	0.67

The primary residential custom activities are through the single family and multi-family home upgrade programs. The results from the most recent evaluations of these programs are presented in Table 11.[41] Although these evaluations also indicate low gross realization rates, residential custom offerings in program shall also retain the 0.90 default value until recent Commission Staff-led evaluation results are available, at which time the DEER will be updated.

[37] 2015 CUSTOM IMPACT EVAL UATION INDUSTRIAL, AGRICULTURAL, AND LARGE COMMERCIAL, Final Appendices, Itron, May 3, 2017

[38] 2013-2015 Ex-Post Evaluation Study for IALC Claims, Itron, 2017-12-18

[39] 2015 Nonresidential ESPI Custom Lighting Impact Evaluation, April 2017

[40] Weighted average of values from 2015 Nonresidential ESPI Custom Lighting Impact Evaluation, April 2017, 2014 Nonresidential Downstream Custom ESPI Lighting Impact Evaluation Report, March 2016, and 2013 Nonresidential Downstream Custom Lighting Impact Evaluation Report, Itron, March 2015

[41] 2015 Home Upgrade Program Impact Evaluation, DNV-GL, June 2017 and 2015 Multifamily Focused Impact Evaluation, DNV-GL, June 2017

Table 11. Residential Home Upgrade 2015 Custom Evaluation Results

Residential		Single Family Home Upgrade			Multi-Family Home Upgrade[1]		
	IOU	kW	kWh	Therm	kW	kWh	Therm
Evaluation Gross Realization Rate	PG&E	0.25	0.12	0.10	0.01	0.00	0.62
	SCE	0.24	0.21		0.48	044	0.36
	SDG&E	0.18	0.24	0.21	0.85	0.85	0.85
	SoCalGas			0.12			0.36
	Statewide	0.25	0.14	0.11	0.19	0.09	0.61

Notes for Table 11: [1] Multi-family evaluation sample included three electric plus gas sites and three gas only sites for PG&E, one electric and gas site for SCE/SCG, two electric plus gas sites for SDG&E.

Although an update to the default gross realization rate for custom measures and projects is within the scope of this Resolution, Staff determined that the values established by Decision 12-05-015 may not be modified through Resolution, thus remain 0.90 at this time.

5.4. Net-to-Gross for Accelerated Replacement Measure

Decision 16-08-019 and Resolution E-4818 established an expanded framework for applying the accelerated replacement dual baseline approach where savings are estimated above the existing baseline for the RUL and above the standard practice or code baseline for the post-RUL period (equal to the EUL minus the RUL of the replaced equipment). Historically, evaluation results at either the measure level or program activity level have been presented as a single net-to-gross value that was not differentiated based on the measure application type (such as accelerated replacement or normal replacement) or baseline (i.e. existing conditions, standard practice or code). The most recent "Energy Efficiency Potential and Goals Study for 2018 and Beyond" (Potential Study) notes that savings for equipment "that is turning over on a regular basis has its below-code savings already captured through [codes and standards]."[42] Next, the Potential Study considers the possibility of free ridership in the below-code savings (the savings occurring during the remaining useful life – or RUL – of the early removed equipment). In other words, some portion of the early replaced equipment (a fraction of the installations and resultant "to-code" savings) was likely influenced by factors other than a PA's efficiency program. The decision to replace equipment prior to the end of its ability to provide the desired

[42] D.17-09-025 OP 1: "We adopt energy efficiency goals for 2018 and beyond based on the modified Total Resource Cost with a greenhouse gas adder that reflects the State's 2030 greenhouse gas reduction goals, referred to as the "mTRC (GHG Adder #1) Reference" scenario in the final draft of the post-2017 Potential Study." Appendix 1: "Energy Efficiency Potential and Goals Study for 2018 and Beyond Final Public Report" prepared for California Public Utilities Commission" by Navigant Consulting, Inc. September 25, 2017. See pages 17-20 for adopted method to address the above-code and to-code portion of a measure NTG value.

service is considered separate from a customer choice to purchase equipment that exceeds code or standard practice efficiency levels. Therefore, the above-code and to-code portion of the savings require separate treatment in the NTG determination. Figure 18, from the Potential Study, illustrates the difference between below-code and above code free ridership.

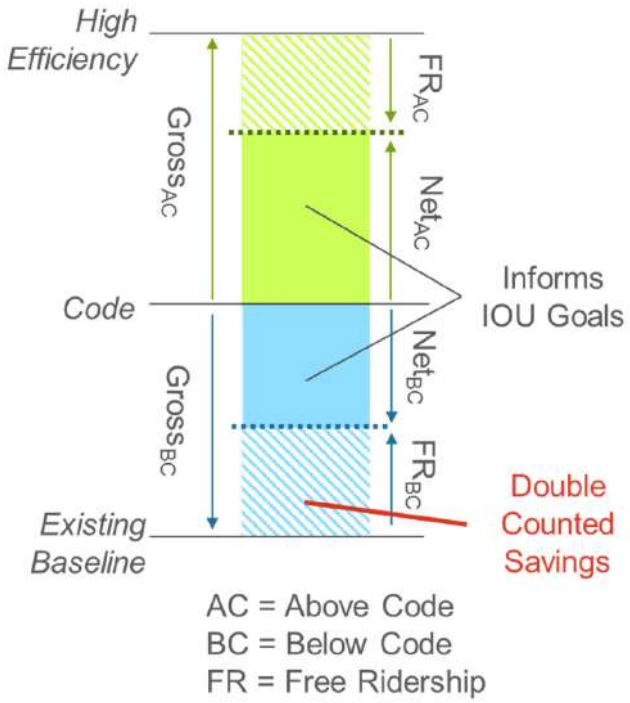

Figure 18 - Below-Code NTG Illustration[43]

PA energy efficiency programs will likely have little influence over a decision toward accelerated replacement if the incentives are small relative to the overall cost of the project, such as HVAC equipment replacements or larger home upgrade projects. On the other hand, programs oriented toward replacement "Stranded Potential" may have a lower incidence of free ridership since the program is targeting a specific population who are not motivated on their own to replace inefficient equipment.[44] Nevertheless, NTG values for below-code savings must

[43] See Figure 7 on page 18: "Energy Efficiency Potential and Goals Study for 2018 and Beyond Final Public Report" prepared for California Public Utilities Commission" by Navigant Consulting, Inc. September 25, 2017.

[44] The Potential Study defines Stranded Potential as "the opportunities for energy efficiency that are not currently captured by either PA rebate programs or codes and standards. Stranded Potential is below-code savings that is not materializing in the market because there is no incentive for the customer to upgrade their existing equipment given current program rebate policy. Under AB802, PAs could start offering rebates for bringing existing equipment up to code thus motivating a whole new subset of customers to install energy efficiency and capturing the Stranded Potential."

represent an average of the entire market, similar to past CPUC methods for developing forward looking NTG values.

The Potential Study included an adjustment factor applied to the below-code savings as shown in the equation below:

$$NTG_{BC} = NTG_{AC} \times NTG_{Adjustment\ Factor}$$

The Potential Study recommended the following below-code adjustment factors:

data centers:	0.25
HVAC:	0.50
Lighting:	0.75
Water Heating:	0.50
All others:	0.50

There are few if any evaluations or analyses that have been focused on identifying specific free-ridership aspects of accelerated replacement decisions. Commission staff recommends a 0.50 default adjustment factor for all measure types. The DEER team notes that direction in Resolution E-4818 retains previous direction that an accelerated replacement assignment may be utilized whenever there is a preponderance of evidence (PoE) that the program activity caused the replacement to be accelerated.

The preponderance of evidence standard requires the examination of evidence in both directions (supporting and refuting the program influence and likely continued in-place service of the equipment to be replaced) and making the determination that the program induced replacement is more likely than not correct. This PoE standard only requires a 50% probability that the accelerated retirement assignment is correct. We thus establish an adjustment factor of 0.75 for accelerated replacement to be applied to all NTG values for the below-code portion of savings. This is a default value, and alternative values may be proposed as part of a workpaper or for a custom project if that project is undergoing an ex ante review by Commission staff.

In both these cases an explicit disposition issued by Commission staff must be provided that accepts the proposed alternate. A proposed alternate is not allowed unless explicitly review and approved by Commission staff. In other words, passed thought workpaper and custom project alternative values are not allowed.

It should be noted that the overall lifecycle NTG for accelerated replacement project will depend on the combination of first and second period savings, the RUL and EUL and the above-code NTG and the accelerated replacement NTG adjustment factor. So there are no overall accelerated replacement NTG values in the NTG table as this value would be calculated, automatically, using the above-code NTG, the adjustment factor and the other savings values mentioned previously.

5.5. Net-to-Gross for Normalized Metered Energy Consumption Projects

Projects that use Normalized Metered Energy Consumption (NMEC) to calculate energy savings are authorized to utilize an existing conditions baseline for energy savings

calculations.[45] For NMEC projects which install a combination of measures, the following default NTG values apply.

Non-Residential:	0.95
Residential Single-Family:	0.85
Residential Multi-Family:	0.55

After adding the 5% spillover established in Decision 12-11-015, the net-to-gross value for non-residential projects effectively counts all savings, consistent with California Public Utilities Code Section 381.2.[46] The values for residential single-family and multi-family projects consider the evaluation results of the single-family Home Upgrade Program and multifamily whole-building programs for IOUs and RENs.[47, 48, 49] These net-to-gross values may be revised in future DEER updates based on new evaluation results.

Consistent with the Rolling Portfolio approach, Program Administrators may develop Implementation Plans for new NMEC programs that are expected to demonstrate significantly lower free-ridership than the previously evaluated approaches, with documentation supporting any proposed alternative net-to-gross values.

5.6. Net-to-Gross for Expanded Measure Application Types

This version of DEER clarifies that DEER NTG values shall apply to all delivery and measure application types, including those described in E-4818. Default values shall be used where there is no explicit match of measure, delivery type and measure application.

Some energy savings calculation methods as well as program activities have adopted NTG treatments. For example, strategic energy management (SEM) programs and projects or programs using randomized control trial (RCT) or experimental design savings calculation methods utilize a NTG value of 1. However, use of these classifications each have specific Commission staff review and approval requirements.

The available delivery types, measure application types, and energy savings calculation types, including those added by Resolution E-4818, are listed below.

Table 12: Delivery Types

Delivery Type	Abbreviation
Upstream deemed	UpDeemed

[45] See Resolution E-4818, Page 4, Table 1

[46] See Ordering Paragraph 37 of D.12-11-015.

[47] Final Report: 2015 Home Upgrade Program Impact Evaluation. DNV GL. June 23, 2017. CALMAC ID CPU0162.01.

[48] 2015 Multifamily Focused Impact Evaluation. DNV GL. June 14, 2017. CALMAC ID CPU0149.01.

[49] 2013-2015 Regional Energy Networks Multifamily Programs Impact Evaluation Final Report. Itron. June 30, 2017. CALMAC ID CPU0150.

Delivery Type	Abbreviation
Downstream deemed	DnDeemed
Downstream custom	DnCust
Downstream deemed direct install	DnDeemDI
Downstream custom direct install	DnCustDI
Codes and Standards (C&S advocacy and related programs)	C&S

Table 13: Measure Application Types

Measure Application Type	Abbreviation
New construction	NC
Capacity Expansion	CE
Normal Replacement (includes Replace on Burnout)	NR
Accelerated Replacement	AR
Add-On Equipment	AOE
Building Weatherization (building shell and related components)	BW
BRO-Behavioral	BRO-Bhv
BRO-Retro-commissioning	BRO-RCx
BRO-Operational	BRO-Op

Table 14: Measure Savings Calculation Types

Measure Savings Calculation Type	Abbreviation
Custom Generic – generic site-specific calculation using approved tool or method	Cust-Gen
Custom NMEC – uses normalized metered energy consumption (NMEC) method following CPUC staff issued guidance and an approved M&V/analysis plan	Cust-NMEC
Custom SEM – uses a strategic energy management method	Cust-SEM
Custom RCT – uses a randomized control trial (RCT) or experimental design method	Cust-RCT
Deemed DEER – uses DEER adopted values	Deem-DEER
Deemed-WP – uses values from an approved workpaper	Deem-WP

- Note on **deemed** values: a deemed must be taken from a DEER version or workpaper effective at the earlier of permit issuance (if the installation requires a permit or approval from a regulatory agency) or installation completion.

5.7. Net-to-Gross for Direct-Install Delivery to Hard-to-Reach Customers

Decision 18-05-041 reaffirmed the Resolution G-3497 clarified definition of hard-to-reach customers[50] and added a second geographic criteria to that definition[51] with the currently adopted version of the definition as recounted below. It must be noted that the definition of hard-to-reach is for a customer not a building. Thus, the designation of business versus residential refers to the customer not the installation site. For example, a multi-family building may be occupied by residential customer while the building is owned by a business. If a measure is installed into a site owned by a business while occupied by either one or more business or residential customers, the ratepayer customer who pays for the energy use impacted by the measure installation is the customer to consider when applying the hard-to-reach definition below.

Decision 18-05-014 definition of hard-to-reach customers

Specific criteria were developed by staff to be used in classifying a customer as hard-to-reach. Two criteria are considered sufficient if one of the criteria met is the geographic criteria defined below. There are common, as well as separate, criteria when defining hard-to-reach for residential versus small business customers. The barriers common to both include:

- Those customers who do not have easy access to program information or generally do not participate in energy efficiency programs due to a combination of language, business size, geographic, and lease (split incentive) barriers. These barriers to consider include:
  - Language – Primary language spoken is other than English, and/or
  - Geographic –
    1) Businesses or homes in areas other than the United States Office of Management and Budget Combined Statistical Areas of the San Francisco Bay Area, the Greater Los Angeles Area and the Greater Sacramento Area or the Office of Management and Budget metropolitan statistical areas of San Diego County; or
    2) Businesses or homes in disadvantaged communities, as identified by CalEPA pursuant to Health and Safety Code Section 39711.
- For small business added criteria to the above to consider:
  - Business Size – Less than ten employees and/or classified as Very Small (Customers whose annual electric demand is less than 20kW, or whose annual gas consumption is less than 10,000 therm, or both) , and/or

[50] D.18-05-041 at 42.
[51] D.18-05-041 at 48 and FOF 14.

  - Leased or Rented Facilities – Investments in improvements to a facility rented or leased by a participating business customer
- For residential added criteria to the above to consider:
  - Income – Those customers who qualify for the California Alternative Rates for Energy (CARE) or the Family Electric Rate Assistance Program (FERA), and/or
  - Housing Type – Multi-family and Mobile Home Tenants (rent and lease)

Notes to hard-to-reach definition

The United States Office of Management and Budget (OMB) has designated a 12-county Combined Statistical Area (CSA) titled the San Jose-San Francisco-Oakland, CA Combined Statistical Area which includes the nine counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma which border the San Francisco Bay plus the three counties of San Joaquin, Santa Cruz, and San Benito that are economically tied to the nine counties that that border the San Francisco Bay.

The OMB definition of this CSA includes Los Angeles, Orange, San Bernardino, Riverside and Ventura counties.

The OMB definition of this CSA includes Sacramento, Yolo, El Dorado, Placer, Sutter, Yuba, and Nevada counties.

Information on the CalEnviroScreen tool used to identify SB 535 disadvantaged communities can be found at

https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30

and the current map of disadvantaged communities can be found at

https://oehha.maps.arcgis.com/apps/webappviewer/index.html?id=4560cfbce7c745c299b2d0cbb07044f5

Discussion of evaluation results relating to direct install to hard-to-reach customers

Since the 2008 version, DEER has included a higher NTG value of 0.85 for direct-install deemed measures into hard-to-reach customers.[52] The NTG label itself, hard-to-reach (HTR), implies that the markets underserved by the utility energy efficiency programs relative to other markets. The Commission staff logic in assigning the elevated NTG values grew from the expectation that the PAs' efficiency programs would have greater influence over customer decisions, resulting in lower instances of free-ridership compared to other programs targeting markets that are not underserved. At the time the higher NTG values were adopted there was no evidence (no directed evaluation efforts) to determine the veracity of the higher NTG value for these deemed measures. The elevated value was supported by the DEER team opinion alone.

[52] D.18-05-041 at 41-46 and FOF 14 define hard-to-reach customer classes and COL 27 clarifies that HTR programs "should prioritize the most underserved customers or customer segments, because they are likely hardest to reach."

Commission staff believes the opinion in this matter must be reviewed using the evidence gained thought almost ten years of collected evaluation results. In review of the most recent evaluation results along with overall 2017 deemed claims, Commission staff finds no support for the use of a higher NTG value for direct install programs into HTR markets versus the general market. However, Commission staff retains this NTG value subject to review of future evaluation results.

The recent comprehensive summary of commercial and other nonresidential programs shows that program-wide and statewide NTG results are in the range of current DEER values.[53] For example, Figure 19 shows that shows that statewide results across program groups are only slightly higher than the DEER default of 0.60 for the direct install gross program group. Other program groups such as local government and third party also have direct installation components, but those overall NTG values are slightly lower than the DEER default value.

Figure 19 - Overall Statewide 2013-2015 Commercial NTG Results[54]

Gross Program Group	n Respondents	NTGR MMBtu[11]	PAI-1	PAI-2	PAI-3
Deemed	851	0.49	4.8	4.7	5.0
Direct Installation	670	0.64	5.0	6.7	7.3
Local Government Partnership	487	0.57	4.8	5.9	5.7
Third Party	780	0.58	4.5	5.8	6.3

When looking at customer size, Figure 20 shows that small customers (those most likely to be identified as hard-to-reach) also show an overall NTG slightly less than the DEER default value. A review of 2017 claims shows that over 50% of HTR NTG claims are for lighting lamp or fixture measures.[55] The 2019 revisions to DEER, combined with previous workpaper dispositions, set the NTG value for all LED lighting measures at either 0.85 or 0.91. The remaining claims are split about evenly between residential and commercial/industrial/agricultural sectors.

Figure 20 - Overall Statewide 2013-2015 Commercial NTG Results by Sector[56]

[53] "2013-2015 Program Performance Assessment of the Nonresidential Downstream Programs," prepared for California Public Utilities Commission, prepared by Itron, December 21, 2017

[54] Ibid, table 4-5.

[55] See supporting document 2017-HTRNTG-DeemedClaims-21Aug2018.xlsx

[56] "2013-2015 Program Performance Assessment of the Nonresidential Downstream Programs," prepared for California Public Utilities Commission, prepared by Itron, December 21, 2017, Table 4-4

Sector	n Respondents	NTGR kW	NTGR kWh	NTGR therms	NTGR MMBtu
Agriculture	225	0.47	0.54	0.62	0.57
Commercial	2,295	0.57	0.56	0.46	0.54
Industrial	273	0.58	0.57	0.50	0.57
Small/Medium	1,486	0.56	0.56	0.49	0.55

Overall, the above discussion demonstrates a possible lack of support for an elevated NTG value for direct installation into hard-to-reach (DI-HTR) customer versus the general market. However, as noted earlier, the DI-HTR NTG values will be retained pending further review based on additional evaluation results.

5.8. Net-to-gross Table Format and Simplification Updates

Commission staff have completed a comprehensive review of the DEER NTG values along with NTG values that have been assigned to deemed measures through recent workpaper dispositions. Many NTG values are now revised, removed or combined with other NTG values to reflect most recent workpaper dispositions, evaluation results or code changes. The complete revised table of NTG values are included in the workbook "SupportTable-NTG2020.xlsx". Descriptions of each category of revision are provided below.

Expired NTG values: All NTG values with an expiration date on or before December 31, 2018 have been removed from the NTG table.

Out-of-date measure criteria: Some measures have incorrect measure specifications and in some cases there are no current evaluation results to support an NTG value that is different from the DEER default. One example is the NTG of 0.23 for gas water heaters rated with Energy Factor (EF) values in the range of 0.62 to 0.65. As noted in Section 4.1, EF was superseded by Uniform Energy Factor (UEF) in December of 2017. This NTG value has been removed. Since there have been no recent evaluations of water heater measures, the DEER default values are the most appropriate.

Another example is the NTG values for CFL lamps, where the 2018 Phase 1 dispositions revised all baselines to include larger fractions of LEDs and CFLs and much smaller fractions of incandescent lamps. Additionally, PAs have been directed to remove CFLs from their measure offerings by December 31, 2018. Commission staff has removed CFL NTG values from the NTG table effective January 1, 2019.

Values that are not significantly different from the DEER defaults: In some cases, measure specific NTG values do not differ significantly from the DEER defaults. For example, the DEER NTG value for chillers in downstream applications is 0.58, but the DEER default is 0.60. In previous DEER revisions, Commission staff has noted an intention to simplify the NTG table and remove or combine values where differences are less than 0.05. For the specific case of chillers, the NTG value has been removed, meaning the DEER default becomes the applicable value moving forward.

Lighting NTG values to reflect recent dispositions: The 2018 Phase 1 lighting dispositions updated NTG values for all LED measures. The DEER2019 expands on these dispositions to revise the code/standard practice baseline for all hardwired LED fixtures to be a typical performing LED fixture as discussed in Section 4.5, above. Commission staff have directed the use of these revised standard practice baselines and NTG values for all measure application and delivery types in both deemed and custom measures. Effective January 1, 2019, the NTG values for all LED lighting measures are updated to disposition values of 0.91 for hard-wired fixtures and 0.85 for screw-in lamps, can retrofits and other low-wattage fixtures with savings calculated using a wattage reduction ratio (WRR). These values shall be used for normal replacement, new construction and above-code savings of accelerated replacement measures. The NTG for below-code savings shall be adjusted according to Section 5.4, above.

Table simplification: Commission staff have revised the NTG table to remove most descriptive fields and substituted in direction in the comments section that describes under what circumstances an NTG value shall be used. Criteria include measure type (deemed, custom, etc.), application type (NC, NR, AR, etc.) or delivery type (downstream, upstream, downstream DI, etc) and any measure technology requirements.

6. Comments on DEER2020 Scoping Memo and Commission staff DEER team Responses

On May 9, 2018 Commission staff published to the Energy Efficiency Proceeding R.13-11-005 a memo outlining the intended scope of the planned update to the Database of Energy Efficiency Resources (DEER) and a solicitation of comments on that proposed scope. Comments were filed by Southern California Edison, San Diego Gas and Electric, Southern California Gas, and the International Window Film Association. Those comments are each summarized below with a response from the Commission staff DEER team.

6.1. Peak Demand Update

San Diego Gas and Electric (SDG&E):

The Scope states, "[T]he peak demand savings for DEER measures will be reevaluated in a manner that provides hourly impact details to allow the updating of measure peak demand values." SDG&E requests that the study clarify if the updated hourly impacts details will replace the existing load shapes for the measures as listed on page 4 and if it will be done by building type.

DEER Team response:

Updating the measure impact profiles by building type and climate zone is an important next step with or without an update to DEER peak demand definition. A possible next step after the DEER update is to incorporate the newly created DEER measure impact profile that contains

8,760 (hourly) values for a year of savings into a format that allows integration with the CPUC-approved cost effectiveness calculations (the Cost Effectiveness Tool application).

Southern California Edison (SCE):

MASControl/eQUEST currently reports the highest plant demand for a building simulation. With Commission Staff's update of MASControl/eQUEST, SCE requests that reporting capabilities be expanded to include peak DEER demand for the forthcoming adjusted DEER peak demand definition. Additionally, SCE requests that coincident demand factors for non-DEER measures are also updated to align with the shift in Peak Period(s).

DEER Team response:

The updated MASControl process will store 8,760 hourly demand data based on a weather-normalized year for each climate zone in California and will be capable of determining the peak demand impact for all updated measures.

6.2. Weather Files

San Diego Gas and Electric (SDG&E):

Will 2020 DEER use the current CZ2010 weather files, or will a different set be used such as the weather files used in the development of the adopted Avoided Costs?

DEER Team response:

The DEER2020 update will use the current CZ2010 weather files.

6.3. MASControl3

San Diego Gas and Electric (SDG&E):

The Scope indicates that MASControl3 will be used to determine the new peak demand savings. Will other analysis software be used to support and validate results developed by MASControl3?

DEER Team response:

Initial validation will be accomplished by comparisons to previous DEER versions. Some changes are anticipated due to updates and improvements to baseline assumptions, vintage updates, error corrections, and energy code updates.

The updated MASControl process will store 8,760 hourly demand values based on a weather-normalized year for each climate zone in California. Verification of the calculated peak demand impacts for the defined peak demand period can be done by any party using the data created by the process.

Southern California Edison (SCE):

MASControl currently incorporates 2008 and 2013 code baselines prototypes. SCE recommends adding 2016 and 2019 Title 24 baselines as part of updated prototypes.

DEER Team response:

The DEER 2017 through 2019 updates included 2016 Title 24 baselines. The current update will include 2019 Title 24 baselines.

Southern California Gas (SCG):

In addition to the building vintage consolidation plan addressed in Section 3.3 of the scoping memo, SCG suggests consideration of consolidating the various energy impacts from different program administrators (PAs) that are within the same climate zone. There are 16 climate zone energy impacts represented by 33 impact values due to overlapping climate zones in different PA service territories. For example, CZ05 has three energy impacts for Pacific Gas & Electric Company (PG&E), Southern California Edison (SCE), and SoCalGas; and CZ08 also has three energy impacts for SCE, San Diego Gas & Electric Company (SDG&E), and SoCalGas. The DEER team should evaluate whether it's appropriate to have one energy impact for one climate zone without loss of accuracy.

DEER Team response:

The issue that SCG raises is acknowledged, however there are concerns that a more granular division of impacts by utility for each climate region would greatly increase the complexity of the results and number of values. However, more importantly, the data needed to implement this more granular set of results is not available at this time. This issue should be investigated for the next DEER update.

6.4. Furnace Fan Efficiency and Efficiency Fan Operation

San Diego Gas and Electric (SDG&E):

The Scope states, "The updated DEER measures will have a start date of 1/1/2019." SDG&E recommends that the start date of 1/1/2020 be used instead so that it aligns with "New Measures" in Table 1 DEER date of 2020?

The Scope states, "A separate efficient fan controller measure will be considered that optimizes the operation of the supply fan to maximize the heating/cooling recovered from the thermal mass after the burner/compressor has cycled off." Will existing workpapers for this type of measure become invalid or considered "expired" after the start date of this new DEER measure?

DEER Team response:

The start date for the measure in the text has been changed to January 1, 2020. Measures covered by this measure will need to use the DEER values beginning on the DEER start date.

Southern California Edison (SCE):

SCE requests that this new DEER measures includes both logic-based efficient fan controllers and user-programmable efficient fan controllers in determining the savings and baseline data.

DEER Team response:

The measure will be based on the best-available information at the time that can support a deemed-measure impact. Current investigations involve residential products that are automated and less subject to occupant adjustments such as scheduling.

6.5. Extended Hours Prototype

San Diego Gas and Electric (SDG&E):

The Scope states, "A new commercial building prototype is under consideration to be added that includes 24-hour operation of high load activity areas…" SDG&E recommends that this prototype be applicable to hospitals and prisons as well, since they're also 24-hour operation facilities. Alternatively, another commercial building prototype could be developed for hospitals and prisons if the new prototype will not be applicable to hospitals or prisons.

Southern California Edison (SCE):

SCE recommends inclusion of Indoor Parking Garages as a part of the evaluation of 24-hour operation of high load activity areas.

DEER Team response:

Commission staff envisions a 24-hour prototype that can be used for a broad range of chiller and chiller plant efficiency measures where the cooling load profile reasonably matches the assumptions for the new prototype and will likely be appropriate for many building types. In addition to the savings estimates, CPUC staff plans to include, in the DEER update, requirements and direction for application of the extended hours savings estimates. The DEER prototype for hospital includes continuous operation areas such as wards and emergency rooms. At this time, there are no plans to add additional building types such as prisons or parking garages. D.12-05-015, via Attachment A, incorporates guidelines for PAs to propose new building types.

6.6. Timing of Water Heater Ratings Change

San Diego Gas and Electric (SDG&E):

SDG&E: There was a Phase 1 disposition and change in rating procedures in 2018. If the 2020 DEER updates will account for the EF to UEF conversion but these updates will occur in 2019, then 2020 DEER should clarify if implementers will be able to continue utilizing existing DEER IDs that have EF ratings. If the EF ratings will still be applicable, it would imply that there would be no need to updates to 2018 workpapers until 2019.

DEER Team response:

Since the UEF rating system in the federal requirements have been in place since August 2017, and the Phase 1 disposition was issued on March 1, 2018, implementers are expected to utilize the UEF ratings beginning in 2019.

6.7. Timing of Updates to Commercial Lighting, HVAC and Residential Shell Specifications

Southern California Edison (SCE):

Table 1 identifies four areas that will be updated this year. SCE recommends that only "DHW rating change" should be updated for 2019. The other three areas (LED indoor and outdoor lighting, Commercial HVAC specifications, and Residential shell specifications) are 2019 Title 24 Code changes. Since the 2019 Title 24 Code changes are scheduled to be effective January 1, 2020, SCE recommends that the three other areas be updates for DEER2020 and not 2019 as listed.

San Diego Gas and Electric (SDG&E):

Table 1-Draft DEER Update Priorities shows the Commercial HVAC specifications under the 2019 DEER Version. However, updates to 2019 Title 24 will be effective January 1, 2020. SDG&E requests clarification for the effective date of the updates.

Table 1-Draft DEER Update Priorities shows the Residential Building Shell specifications under the 2019 DEER Version. However, updates to 2019 Title 24 will be effective January 1, 2020. SDG&E requests clarification for the effective date of the updates.

DEER Team response:

Commission staff acknowledges that 2019 Title 24 updates are effective January 1, 2020. At a minimum, second baselines for AR measures will be updated to incorporate these changes. However, Commission staff will consider Title 24 updates and other available research in updating standard practice baselines, effective January 1, 2019, for all measure application types including AR, NR and NC. Commission staff notes that D.12-05-015 specifically considers the possibility that standard practice may exceed and, in those case, should be reflected in the baseline assumptions.

Since recent Commission staff workpaper dispositions specify changes to standard practice baselines effective January 1, 2018 for exterior high bay lighting and April 1, 2018 for interior low bay and high bay lighting, the DEER update for lighting is appropriately scheduled for 2019.

The commercial HVAC and residential shell updates for the 2019 Title-24 were incorrectly identified as changes for DEER 2019 and will be re-categorized as DEER 2020.

6.8. Net-to-Gross

Southern California Edison (SCE):

SCE recommends that findings from Opinion Dynamics' PY2015 California Statewide On-Bill Finance Impact Evaluation Study (CALMAC Study ID CPU0181) should be considered to adjust the net-to-gross (NTG) values for On-Bill Financing (OBF) projects.

SCE suggests that the NTG values for OBF should be increased, per the findings in the Impact Evaluation Study noted above, which noted that the level of customer engagement, influence, and additional diligence that the customer must undertake warrant an increase in the NTG.

"By PA, NTGRs range from 0.64 for SCE to 0.68 for SDG&E (Table 1-6)," the study notes. "PG&E has a higher NTGR for lighting projects, while SCE has a higher NTGR for non-lighting projects (both differences are statistically significant at 90% confidence)."[57]

Since many measures use a default NTGs ranging from 0.55 to 0.60, OBF projects are worthy of a higher NTG to match study findings.

Southern California Gas (SoCalGas):

SoCalGas agrees on the Net-To-Gross (NTG)updates with most recent CPUC impact evaluation findings available. However, in addition to "2015 Nonresidential Downstream ESPI Deemed Pipe Insulation Impact Evaluation" listed, SoCalGas suggests examining the 2014 Nonresidential Downstream Deemed ESPI Pipe Insulation Impact Evaluation Report in addition to 2015 impact evaluation as each study presents accurate and substantiated values. SoCalGas recommends consolidating the results of both studies if an update is to be considered.

DEER Team response:

Commission staff agrees that OBF activity may have an impact on NTG and is examining the OBF results for compatibility with other evaluation NTG results.

Commission staff will review all recent evaluation results for possible inclusion into the DEER update.

6.9. Gross Realization Rate

Southern California Gas (SoCalGas):

Changes to the Gross Realization Rate (GRR) for custom measures and projects based solely on 2015 custom impact evaluation reports may be premature based on changes being made by PAs to energy efficiency programs which affect both ex-ante savings claims and ex-post evaluation (e.g., NMEC, 3rd party focus, etc.).

If the GRR is to be considered for updates, use of the 2015 Custom Impact Evaluation Industrial, Agricultural, and Large Commercial (IALC) evaluation report referenced in the DEER 2020 Scoping Memo should consider the granularity of IOU-specific values as the 2015 IALC report was designed and reports on IOU-specific values instead of an aggregate statewide value.

[57] See CALMAC Study ID CPU0181, p. 6. Also see Table 1-5, p. 6.

Aggregation of gas and electric results may be problematic and does not support the preference for increased granularity indicated in Decision (D.) 11-07-030 which set the current default GRR value. [D.11-07-030, p. 35, Table 1 and p. 37] The aggregation of all natural gas savings (therms) results presented in the 2015 IALC report may lead to less precise results. [2015 Custom Impact Evaluation Industrial, Agricultural, and Large Commercial (IALC) Final Report, p. 1-7, Table 1-4. See sampling strategy discussion based on combined MMBtu contribution for combined fuel utilities PG&E and SDG&E on page 2-3 of the 2015 IALC Report. This limits the number of gas only points that can be included in the sample.]

Given the changes in the evaluation cycles and the desirability of expanding the sample size across years, results contained in the 2015 evaluation report for years prior to 2015 (2010-12, 2013, and 2014) should be considered in any updates. This may be accomplished with a simple (vs. weighted) average. Other considerations would be to employ a conservative approach, as used in D.11-07-030, and use values that are the averages over the four evaluation periods of the upper values in the 90% confidence intervals presented in the 2015 IALC report, especially considering the high error ratios for all evaluation results.

DEER Team response:

Commission staff agrees that default GRR values should reflect the expected results for each IOU if recent evaluations indicate a significant differential. Commission staff will recommend differential values by IOU, or activity type, if the sample and analysis of the recent evaluation results support such differentiation. Any adjustments to the default values established through Decision 11-07-030 will be made through a process separate from this Resolution.

6.10. Effective Useful Life (EUL) of Window Films

International Window Film Association (IWFA):

Proposes increase of window film EUL from 10 to 15 years. Also proposes increase of window EUL from 20 years to 30 years as it relates to the fact that the RUL of the window limits the EUL of the window film product. See IWFA memo for background supporting these changes.

DEER Team response:

The DEER values must represent typical expected values. There will be a variation in expected performance persistence or degradation among products and also the market factors influencing implementing customers. These types of add-on measures also have an element of accelerating customer action - that the customer would take action at a later date whereas the program accelerated that action.

7. Comments on the Draft Version of This Resolution

Thirteen parties submitted a total of 66 comments in response to the public draft of this resolution. Energy Division staff organized these comments by subject, below. Where possible, we respond to groups of comments. Unique concerns, however, are addressed individually. Our responses are presented in by the number of comments submitted in regards thereto.

7.1. Removal of the Default Net-to-Gross for Direct-Install to Hard-to-Reach Customers

The Draft Resolution proposes to remove the default net-to-gross ratio for Direct-Install programs and projects targeting Hard-to-Reach customers. The history of the default value is presented in Section 5.7 of this attachment. Without a default net-to-gross, savings estimates would use the net-to-gross ratios defined at a measure level for non-Hard-to-Reach applications.

The City and County of San Francisco, Synergy Companies, the Joint Parties, Rising Sun, SCE, SDG&E, SoCalGas, the California Energy and Demand Management Council, and the Public Advocates Office submitted a total of 12 comments regarding the proposed removal of the default net-to-gross ratio for programs targeting Hard-to-Reach customers. Many of these comments express dissatisfaction with the justification for removing the default value. Several commenters observe that there has not been an impact evaluation which studies Hard-to-Reach customers as a group, and the evaluation of downstream commercial programs cited as partial justification for the change was not designed to draw conclusions about the category. Additionally, commenters note that the definition of the Hard-to-Reach category has changed since the evaluation was conducted. Others remarked upon the expected impact on the programs which serve Hard-to-Reach populations, and the communities that benefit from these programs. The Public Advocates Office supports the proposed change, noting that the best available information suggests that the net-to-gross for direct install Hard-to-Reach customers is not substantially different from the general population.

While we remain convinced that there is insufficient evidence to suggest the default net-to-gross of 0.85 is correct, we recognize that, because there have been no studies of the net-to-gross for Direct-Install to Hard-to-Reach customers, and because the definition of Hard-to-Reach has changed, we retain the default for this update of the DEER.

7.2. Net-to-Gross for Accelerated Replacement Measures

The Draft Resolution proposes to apply an adjustment factor of 0.5 to the net-to-gross ratio for below-code savings of Accelerated Replacement measures. The proposed framework for calculating savings for Accelerated Replacement aligns with the Commission's Potentials and Goals Study, incorporates which uses varying below-code adjustment factors based on the measures installed.

CLEAResult, Rising Sun, the Joint Parties, PG&E, SCE, and SoCalGas submitted a total of nine comments on the subject of the below-code net-to-gross adjustment factor for Accelerated Replacement measures. All comments reflect opposition to the implementation generally of a savings framework which distinguishes between below-code and above-code savings, and specifically of the net-to-gross adjustment factor of 0.5. Several comments argue that the framework used in the Potentials and Goals study was not intended and is not appropriate for the ex-ante process, and that it adds unnecessary complication to evaluation.

We disagree that the savings framework used in the Potentials and Goals study was intended to be limited to savings forecasting and planning purposes, and that the split between above-code and below-code savings is unnecessarily complicated. Instead, we affirm that the framework was developed with both savings potential and program implementation in mind. We agree

that the adjustment factor value of 0.5 is substantial and not supported by evaluation data. However, we maintain that the above/below-code framework is useful and necessary for accurate savings accounting, and that a net-to-gross adjustment is appropriate. Thus, we set the adjustment factor for below-code savings for Accelerated Replacement measures to 0.75, rather than 0.5.

7.3. Net-to-Gross Ratio for Normalized Metered Energy Consumption Projects

The Draft Resolution proposes to apply project-level net-to-gross ratios for Normalized Metered Energy Consumption (NMEC) based on weighted, aggregated estimated savings for the installed measures. The weighted values would be based on the net-to-gross ratios for the remaining useful life of the equivalent Accelerated Replacement measures with an existing conditions baseline.

CLEAResult, the Joint Parties, the California Efficiency and Demand Management Council, PG&E, and SCE each submitted a comment about the application of a net-to-gross ratio for NMEC projects. CLEAResult suggests that NMEC programs are still new and should be allowed to innovate before applying the same rules as custom projects. CLEAResult, as well as the Joint Parties, the Council, and SCE suggest that the issue should be deliberated in proceeding A.17-01-013 et al, rather than this Resolution. PG&E recommends applying a default net-to-gross ratio for NMEC, rather than an aggregated measure-based approach.

We agree with PG&E's recommendation, and observe that a default net-to-gross will facilitate easier implementation and evaluation. We disagree, however, with the comments suggesting to discuss the net-to-gross in the Energy Efficiency proceeding, as reasonable values and methodologies are needed in the interim as the issue is discussed. Thus, we update the proposed framework from the Draft Resolution to apply sector-level default net-to-gross ratios for NMEC projects as discussed in Section 5.5. We believe this framework is consistent with prior Commission direction, and will allow program implementers to innovate and demonstrate the utility of NMEC as a savings calculation tool.

7.4. Updating Load Shapes for New Peak Period

The Draft Resolution introduces an update to the peak period used for calculating peak kW savings. While previous versions of the DEER applied a peak period of 2:00 pm to 5:00 pm on the three hottest consecutive weekday, this update would shift the peak times to between 4:00 pm and 9:00 pm, while using the same methodology to calculate the peak days. This update had been discussed in a series of workshops with multiple stakeholders earlier in 2018, but isn't identical to the approach the working group recommended, which would have changed the methodology to select the three non-consecutive costliest days as determined from the Avoided Cost Calculator.

CLEAResult, SCE, and SDG&E, and the Pubic Advocates Office submitted a total of 5 comments about the peak period update. The comments generally agree that the update is appropriate, but could be improved. Some comments reflect the need to update the load shapes for all measures. Others reiterate the working group's recommendation to use the costliest, rather than hottest days.

The peak demand values are obtained from the measure impact profile 8760 and that profile is not affected by the change of the peak hours. However, the measure impact profile is developed by subtracting the measure 8760 use profile from the baseline use profile to create the impact profile 8760. Since the DEER prototypes, measure definitions and weather files have changed since the last DER impact profile update it is reasonable to undertake to update those 8760 profiles. This can be done by processing the DEER measure impact profiles into typical profiles for groups very similar measure. Previously the number of DEER impact profiles was very limited due to their use in cost effectiveness tools implemented into excel workbooks. Space limitation were a major constraint. However, the current cost effectiveness tools are implemented in a database format that should allow greatly expanding the number of profiles available to better match the profiles with the range of measures. Developing these new profiles will take substantial effort, but that work should be able to be completed by the next DEER update allowing the new profile to be available by the time the updated peak demand definition is in use for 2020.

We retain the methodology for selecting the peak days from previous DEER periods for a number of reasons. We believe it is better-aligned with the goals for peak reduction in an energy efficiency context than the costliest days, maximizing program benefits to both customers and utilities. We also believe the existing methodology allows for better program stability across years by basing the peak savings on load shapes normalized to the Title 24 typical weather year, while the Avoided Cost Calculator is not normalized, thus peak savings would vary drastically from year to year. For these reasons, we adopt the peak period definition as presented in the Draft Resolution.

7.5. Effective-Useful Life for Behavioral, Retrocommissioning, and Operational Measures

The Draft Resolution reclassifies several measures as Behavioral, Retrocommissioning, and Operational measures, resulting in decreased effective-useful life of at most 3 years to several measures as listed in Section 5.2.

CLEAResult, Synergy Companies, the California Efficiency and Demand Management Council, and SoCalGas submitted a total of 5 comments in response to the new effective-useful life values. These comments focus on the consideration that physical interventions such as duct sealing, pipe insulation, and gasket installation have expected useful lives significantly longer than the 3 years for retrocommissioning measures as required in Decision 16-08-019. The California Efficiency and Demand Management Council observes that the Decision invites Program Administrators to provide evidence to support a higher effective-useful life. The Council also recognizes that the Draft Resolution intends to remind of an existing requirement rather than propose a new value, and requests the proposed text be removed as insubstantial.

We agree with the comments that certain physical measures are useful longer than the effective-useful life mandated in D.16-08-019. However, Commission Staff notes that Program Administrators have repeatedly miscategorized such measures and attempted to claim a longer effective-useful life of a non-retrocommissioning intervention. Consequently, we find that it is important and necessary to include full text of the Draft Resolution.

7.6. Net-to-Gross Ratio for HVAC Measures

The Draft Resolution proposes updated net-to-gross values for residential and commercial refrigerant change measures, residential duct sealing, commercial upstream package HVAC, and other commercial HVAC maintenance. These updates are responsive to the most recent residential and commercial HVAC impact evaluations.

CLEAResult, Synergy Companies, SCE, and SoCalGas each submitted a comment pertaining to the proposed net-to-gross ratios in the Draft Resolution. CLEAResult and SoCalGas recommend that the most recent impact evaluation results for the residential and commercial HVAC Quality Maintenance Program not be used in establishing DEER values, pointing to incompleteness in the studies and flaws in the study designs. Similarly, SCE recommends that further study be performed prior to updating the net-to-gross ratio for residential and commercial HVAC programs. Synergy Companies specifically expresses concerns about reducing the net-to-gross ratio for duct sealing measures.

Despite the commenters' concerns, we are confident that the results of the cited impact evaluations are applicable as proposed in the Draft Resolution. We therefore adopt the updated values as proposed and presented in Section 5.1.

7.7. The Process by which the DEER is Updated

CLEAResult, the Joint Parties, the California Efficiency and Demand Management Council, and Lancaster Choice Energy submitted comments regarding the DEER update process. These comments are varied and are addressed individually.

Lancaster Choice Energy notes that the annual DEER Resolutions are finalized after the Program Administrators submit their Annual Budget Advice Letters (ABALs), and recommends that the timing of the Resolution process be revised to allow the Program Administrators to incorporate changes prior to submitting the Advice Letters. We note that the ABALs submitted prior to finalizing this update to the DEER are for program year 2019, and that this Resolution primarily concerns program year 2020. We note, however, that updates to the DEER for 2019 included in this Resolution are disruptive to the programs they impact. The Commission's intent in these updates is to correct errors, and we strive to keep late changes to a minimum.

The Joint Parties recommend that the Commission review and adopt best practices from other regions, and reflecting processes already implemented for energy efficiency evaluation within California, to improve transparency and accuracy in the annual ex ante savings parameters update processes. The Commission appreciates the Joint Parties' comment, and may consider certain possible process adjustments for future program years.

CLEAResult recommends limiting the DEER update to five specific items: the DEER peak period, DEER values for new measures, updates in response to new codes and standards, correcting errors in DEER values and documentation, and updates in response to evaluation results. They further recommend that changes to baselines without supporting market evidence, reclassification of measures resulting in reduced effective-useful life, and "savings derating factors, such as the to-code NTG adjuster" should be omitted in this Final Resolution. We

believe that changes made to this Resolution based on other comments are responsive, in part, to this, though some issues remain unresolved. In the case of the lighting baseline, we believe the updates are reasonable and in alignment with both the newest Title 20 standards and the projected market for 2020. In regards to the matter of reduced effective-useful life, we observe that this update only reiterates prior Commission guidance in Decision 16.08.019, which determined both the categorization and the effective-useful life of Behavioral, Retrocommissioning, and Operational measures.

The California Efficiency and Demand Management Council similarly suggests that the Draft Resolution includes policy decisions which go beyond its scope, particularly with respect to updated effective-useful life values, net-to-gross ratios for Accelerated Replacement measures and Normalized Metered Energy Consumption projects, and expanded measure application types. As with CLEAResult's comment above, we believe changes in this Final Resolution partially address the issues the Council raises. We believe that, while certain technical decisions must be made in lieu of precise data, the DEER update is appropriately within its policy scope.

7.8. Applicability to Codes and Standards, Randomized Control Trials, and Strategic Energy Management

The Draft resolution listed Codes and Standards and Randomized Control Trials among the downstream delivery types added by Resolution E-4818 which would be subject to the proposed updates in net-to-gross. PG&E, SCE, and SDG&E submitted comments to oppose applying a new net-to-gross ratio for Codes and Standards programs, while Oracle, PG&E, and SCE commented in opposition of applying a default net-to-gross for Randomized Control Trial programs. SDG&E further submitted a comment requesting clarification on the applicability of a net-to-gross ratio for Strategic Energy Management, in response to the inclusion of Normalized Metered Energy Consumption on the same list.

The DEER update was not intended to over-ride the default net-to-gross ratios for Codes and Standards, Randomized Control Trial, and Strategic Energy Management programs, and the values will remain unchanged from prior versions of the DEER. We further clarify that the net-to-gross ratios for Emerging Technologies programs are also unchanged. We have revised Section 5.6 to clarify.

7.9. Updates to the Construction Dates and Characteristics of Building Simulation Prototypes

The Draft Resolution proposes a number of alterations to the building prototypes, including revised building vintage categories and assumed equipment. CLEAResult and SCE submitted comments in response to the prototype definitions, and they are addressed separately, below.

CLEAResult expresses concern that the use of supply air temperature and chilled water temperature reset control strategies assumed in the pre-1996 building vintage prototype is unsubstantiated and does not reflect actual building characteristics.

The DEER prototype baselines do not impact custom measures in cases where the custom project can use an existing conditions baseline, and the existing controls are different than the DEER prototype baseline. The DEER prototype baseline does not render HVAC controls

measures ineligible for deemed treatment. Eligibility of such measures would be determined by other factors, such as code requirements, ISP studies or CPUC policy regarding repairs, baselines.

SCE recommends that the "median" building vintage should exclude 2007, 2011, and 2014 vintages.

The DEER building weights for vintages 1996 and earlier represent 74-80% of the existing building stock. For this reason, the previous "existing" vintage included in DEER represented mostly a 20 plus year old building and thus there was no representation of the 5-20 year old buildings. The purpose of separating the existing vintage into the older and median groups would be defeated by including the 1996 vintage into the median building vintage. Such a change would cause the median vintage to be more representative of 20-plus year old buildings. However, excluding vintages 2007 and 2011 for installations in 2020 and beyond, would exclude building from 9-13 years old which is not reasonable. It may be reasonable to exclude 2014; however, that exclusion would not change the median vintage values more than a few percent and would require substantial reworking of the DEER results. It is thus neither practical nor appropriate at this time. The median vintage definitions may be revisited for the next DEER update.

7.10. Reporting Requirement Consistency with Commission Databases

SDG&E one comment regarding the integration of the Commission's data and reporting requirements. In particular, SDG&E requests that the Commission ensure consistency across its data systems, particularly CEDARS, and that they are updated according to the DEER updates in time to allow proper reporting.

Energy Division staff are aware of the data reporting implications of this Resolution and will endeavor to ensure the Commission's data systems are updated accordingly in a timely fashion.

7.11. LED Baseline for Lighting Measures

The Draft Resolution proposes revising most baselines for interior and exterior lighting to the lowest performing LEDs currently in the marketplace and also raises the net-to-gross to 0.91 in acknowledgement that nearly all high efficiency LED upgrades, above an LED baseline, are program induced. Current evaluated net-to-gross values range from 0.45 for outdoor LED lighting to 0.60 for indoor LED lighting.

Rising Sun and PG&E submitted comments to express concern that an all-LED baseline is not practical, as it is not yet standard practice. Setting the baseline in advance of full adoption will disallow some savings as the market transitions to LED.

We first note that all net-to-gross values for lighting are based on the assumption that the standard practice baseline is older technologies such as high pressure sodium for exterior lighting, and T8 linear fluorescents and pulse start metal halide for interior lighting.

The proposed baselines for 100% LED lighting were directed in 2018 Phase 1 dispositions for outdoor lighting and interior high bay and low bay lighting. The DEER update expands the 100% LED baseline along with the increased net-to-gross value to cover all hard-wired lighting including interior ambient fixtures such as ceiling- and grid-mounted troffers. Removing the

baseline change would also require removal of the increased net-to-gross value since baselines would revert back to out-of-date assumptions. Furthermore, all current LED lighting measures would expire at the end of 2018 and program administrators would have to submit new workpapers that included revised baselines and savings calculations. The proposed baseline and NTG values will ensure that approved values will be in place for the coming program year and that the gross baseline and net-to-gross values are aligned.

The proposed DEER baseline of 100% LED net-to-gross value of 0.91 applies to normal replacement and new construction measure application types. Program Administrators may submit workpapers or custom project proposals for accelerated replacement measures where the existing baseline is of higher energy use than the DEER standard practice or code baseline. These proposals shall include all evidence, documentation and analysis to support the claim of accelerated replacement.

7.12. Gross Realization Rate for Custom Programs

CLEAResult and SCE each submitted a comment regarding the gross realization rates for custom programs. The two comments are addressed separately below.

CLEAResult expresses support of the Draft Resolution's proposed deferral of a default gross realization rate, while recommending further examination if realization rates do not improve in future cycles. The Commission appreciates the recommendation and will take it into consideration in planning evaluations and preparing future DEER updates.

SCE recommends that the DEER apply gross realization rates for custom measures at the Program Administrator level, rather than statewide. While we refrain from implementing this change in the current DEER update, we will consider it in future updates.

7.13. Required efficiency over Title 24 baseline for Chiller Full and Partial Loadings

The Draft Resolution proposes to continue a requirement from previous versions of the DEER that HVAC measures for liquid chilling machines be rated at least 10% more efficient than Title 24 minimum efficiency requirements both at full-loading and as indicated by the Integrated Part Load Value.

In one comment, SCE recommends reevaluating this requirement, instead allowing lower full-load efficiency for "Path B" compliant equipment.

Staff determined that establishing a threshold for efficiency based on the Integrated Part Load Value alone would required considerable new research which is impractical for this update. Future evaluations may recommend a methodology for establishing such a threshold, or propose alternative requirements, but for the Final Resolution we adopt the requirements for chillers as proposed in the Draft.

7.14. Lancaster Choice Energy requests to be included in Evaluation Planning Process

Lancaster Choice Energy submitted a comment expressing interest in participation in the Evaluation, Measurement, and Verification (EM&V)planning process, in order to ensure any studies of net-to-gross for Direct Install commercial programs are designed appropriately.

Lancaster Choice Energy is welcome to attend the EM&V stakeholder meetings held quarterly, and may contact stakeholders including staff directly to get information about joining the proper planning team.

7.15. Corrections and Clarifications

SDG&E requests corrections of errors identified in the draft DEER update, and clarifications on certain issues. These are discussed individually below.

1. SDG&E provided a set of clarifying questions to Commission Staff prior to its September 10, 2018 webinar discussing the draft resolution. SDG&E appreciates Commission Staff's responses to all of SDG&E's questions. SDG&E recommends Commission Staff provide filtering capability for the "Source Description" field to allow users to identify all updates resulting from this resolution. Below are summaries of the Commission's response to SDG&E's questions/clarifications during the webinar and in follow-up discussions that should be reflected in the final resolution and DEER2020.

   Response: The source description column in the Measure table in READI can be filtered for multiple values to get all of the DEER2019 and DEER2020 updates.

2. An error was identified in the PEAR database that shows chiller measures for 2020 with a start date of 1/1/2018 and Status = Proposed. It will be corrected in the final release to a start date of 1/1/2020."

   Response: Chiller StartDate and ExiryDate corrected in PEAR database on 9-11-2018

3. The PEAR database legacy DEER 2015/2017 measures based on EF rating still reflect a Status = Available with no expiry date. SDG&E recommends that this be clarified in the final DEER.

   Footnote #13, which only mentions Residential UEF, should be updated to clarify whether this is applicable to Non-Residential measures.

   Response: NTG values were updated on September 20, 2018.

4. For Table 5 Performance Analysis of LED Fixtures, the "NormUnits" have changed from "Kilolumen" to "Fixture" or "Lamp." Commission Staff has clarified that the PEAR database will be updated to Kilolumen.

   Response: Normalizing units for these measures were updated on September 9, 2018.