**DISPOSITION FOR WORKPAPERS COVERING LED LAMPS AND FIXTURES**

**THAT USE WATTAGE REDUCTION RATIO SAVINGS METHODS**

**California Public Utilities Commission, Energy Division**

July 22, 2016

**Review Scope**

This disposition includes a review of workpapers submitted since December 2015 supporting LED lighting measures that utilize wattage reductions ratios (WRR) as the method for calculating the difference in baseline and measure wattage. Refer to Table 1 for a list of recently submitted PA workpapers that support these types of measures. All revisions are further documented in the attached workbook “WRR\_LightingLED\_Disposition-22Jul2016.xlsx” (disposition workbook).

Table - LED Lamp Workpapers

|  |  |  |  |
| --- | --- | --- | --- |
| **Workpaper ID** | **Rev** | **Workpaper Title** | **Official Submittal Date** |
| **SCE** |  |  |  |
| SCE13LG103 | 3 | Interior LED Downlight Fixtures | 12/21/2015 |
| SCE13LG106 | 3 | MR16, PAR20, PAR30, PAR38, A, Candelabra, Globe Lamps, and Residential LED Lamp Giveaway | 12/21/2015 |
| SCE13LG109 | 1 | Exterior LED Lamp Replacement | 12/21/2015 |
| SCE13LG115 | 1 | Residential LED Interior Fixtures | 12/7/2015 |
| SCE13LG119 | 0 | Residential LED Exterior Fixtures | 12/7/2015 |
| **PG&E** |  |  |  |
| PGECOLTG139 | 8 | LED Surface, Pendant, Track, Accent, and Recessed Downlight | 1/4/2016 |
| PGECOLTG140 | 5 | LED MR-16 | 1/4/2016 |
| PGECOLTG141 | 5 | LED PAR Lamp | 1/4/2016 |
| PGECOLTG163 | 4 | LED Candelabra Replacements | 1/4/2016 |
| PGECOLTG164 | 4 | LED Globe Lamps | 1/4/2016 |
| PGECOLTG165 | 2 | LED A-Lamps | 1/4/2016 |
| PGECOLTG175 | 2 | LED Residential Recessed Downlight | 1/4/2016 |
| PGECOLTG177 | 3 | LED R-BR Lamps | 1/4/2016 |

**Critical Review Issues**

1. **Ex ante data errors:** The ex-ante review team (EAR team) corrected several errors in submitted ex ante data. SCE included duplicate measures and implementations with identical technical specifications, but different IDs and different inputs for descriptive fields. However, these measures and implementations result in identical cost effective values (CEVs) and appear to only reference different programs. PG&E included records with incorrect net-to-gross references and also appeared to include some implementations that could only be used until December 31, 2015.
2. **Uniform ex ante measure definitions:** The EAR team has developed uniform statewide definitions for the submitted measures as well as associated technologies.
3. **Some wattage range measures are incorrectly defined:** Some measures defined with a range of measure wattages do not correctly define the measure as having the lowest wattage in the range. The EAR team has developed approved alternative values for this limited set of measures.
4. **LED fixture measures require code baselines:** The use of the WRR value of 2.96 for LED fixtures is not approved. It is likely that Title 24 would require high efficacy fixtures in the event of new construction (NC), replace-on-burnout (ROB) and early retirement (ER) second baseline installations. CPUC staff approves a WRR value of 2.42 for calculating the code baseline for LED fixtures.
5. **Cost revisions:** The EAR team observed several problems with SCE’s submitted cost values. For screw-in and MR16 lamps, the EAR team has updated all approved cost records to have uniform statewide definitions and identifications values, generally following PG&E’s cost methods. For fixtures, the EAR team accepts PG&E’s cost values as submitted. The EAR team updated labor costs in SCE’s cost records to be the same as PG&E’s. LED fixture measure revisions described in item 4 above mean that PAs must develop and submit new cost records for some measures as the approved measure or baseline technology definitions have changed as a result of this disposition.
6. **Prospective review effective date and expiration date:** The revisions directed in this disposition shall be effective for program claims for the first quarter of 2017.
7. **Additional research, analysis and workpaper development is required:** PAs shall perform additional workpaper development activities that address the need to: a) update wattage reduction measures; and b) refine measure definitions to consider product efficacy; and c) develop uniform cost values across all PAs. CPUC staff, including staff responsible for ex ante review as well as ex post evaluations, will provide further explicit direction in the near future, however, CPUC encourages the PAs to be proactive in addressing concerns and issues discussed in more detail below.
8. **Attached supporting documents and approved ex ante data:** All directed revisions are noted in the attached Excel spreadsheet “WRR\_LightingLED\_Disposition-22Jul2016.xlsx” (disposition workbook). The EAR team has uploaded all approved ex ante data to the Preliminary Ex Ante Review Database (PEARdb) accessible via the READIv2.4.3 interface.
9. **CPUC staff will consider alternative values:** CPUC staff are open to alternatives proposed by the PAs that are supported by additional research, analysis or program requirements.

**Detailed Review**

**1. Ex ante data errors**

The EAR team observed and corrected a number of errors in the submitted ex ante data. Categories of data errors and related corrections are further described below. The CPUC staff approved ex ante data has been added to the Preliminary Ex Ante Review database:

1. Mismatch in delivery type and net-to-gross reference: PG&E submitted 47 implementation records that listed “Any” as the delivery type and “Res-Default>2” as the net-to-gross ID. However, the selected NTG ID is only applicable to upstream delivery types. The EAR team revised the delivery type in these records to “PreRebUp.”
2. Out of date net-to-gross references: PG&E submitted 6 implementation records with out of date net-to-gross reference for measures with a delivery type of “DirInstall.” These records used the NTG reference “Res-Default>2” and appeared to be duplicates of other records that are identical except use the correct NTG reference “Res-sAll-MLtgLED-Deemed.” These 6 records are assumed to be typos and not uploaded to the PEARdb.
3. Implementations that don’t differentiate residential versus commercial sectors: PG&E provided a large group of implementations where the ID was identical for residential and commercial sectors. However, the ‘Sector’ database field is not a primary key; therefore, Implementation IDs cannot be the same. The EAR team revised the Implementation IDs for these records by appending either “Res” or “Com” to the end of the Implementation ID.
4. Duplicate measure definitions used in different implementations: SCE appears to have developed definitions for residential indoor general lighting measures that are only used in multi-family direct install implementations. Then, SCE has different measure IDs for identical measures used in all other residential interior general lighting implementations. However, the principle measure definition characteristics (use subcategory, technology type, technology wattage, baseline wattage reduction ratio) are identical to the measures used in other general lighting measure definitions. While the EAR team was careful not to change the definitions for any implementations, SCE should review the implementations to ensure that final ex ante data reflects SCE actual program offerings. provides an example of the duplicate measures.
5. Duplicate implementations: SCE has developed several duplicate implementations that are identical except for the ID, sector, and description. Implementations that result in identical sets of cost effectiveness values (CEVs) are not allowed as they can potentially cause the generation tens of thousands of identical cost effectiveness values in the ex ante database. The EAR team has identified all duplicate implementation records and reassigned them to a single implementation ID.

Table - Example of Duplicate Residential Measures

|  |  |  |
| --- | --- | --- |
| **Workpaper ID: SCE13LG106** | | |
| **Solution Codes** | **IOU Measure Description** | **Measure ID** |
| LT-72183 | 13 Watt to < 14 Watt A-Lamp (Dwelling Area) LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts | R-In-LED-A19(13w)-dWP25 |
| LT-90243 | 13 Watt to < 14 Watt A-Lamp LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts | R-In-LED-A19(13w)-dWP25 |

1. Additional Miscellaneous Errors: The disposition workbook includes the worksheets listed below. These worksheets contain portions of ex ante data submitted by the PAs along with columns which indicate corrections made to the data by the EAR team. Miscellaneous errors are illustrated in these columns and should be noted and corrected for future workpaper submissions. The EAR team has uploaded all approved ex ante data to the PEARdb accessible via the READIv2.4.3 interface.
   * Disposition-Implementation: EAR team revisions to PA submitted implementation records
   * Disposition-Measure: EAR team revisions to PA submitted measure records

**2. Uniform Measure Definitions and Measure Identification Values**

The EAR team reviewed all measures covered by the workpapers and identified all identical measures. These measures were assigned the same measure ID. Also, submitted measure descriptions have been revised to include the uniform measure description developed by the EAR team. If PAs wish to keep their unique measure descriptions, the EAR team suggests that this measure description be incorporated into the implementation description field since all implementation records are unique to each PA. The EAR team has provided suggested implementation descriptions in Disposition-Implementation sheet of the disposition workbook. Within each PA’s data submission, the EAR team removed resolved duplicate implementations (those that resolve to identical sets of CEVs) to a single implementation and updated the description to be more generic. If PAs wish to make adjustments to their Implementation Descriptions, they should submit only the Implementation table to the WPA along with a narrative describing the scope of the submission. Implementation tables for any workpapers covered by this disposition may be included in a single submission file.

**3. Measures Defined Using Ranges of Measure Lamp Wattages**

As directed in the disposition for lighting workpapers submitted during the 2013-2014[[1]](#footnote-1) program cycle (2013-2014 disposition), measures defined in wattage ranges shall use the lowest wattage of the range for calculating savings. Most wattage range measures followed this direction. There were a limited number of measures that did not use the lower end of the range. These have been corrected and noted in the disposition workbook. For measures where there is a maximum wattage but no minimum wattage, the direction in the 2013-2014 disposition was to select the lowest available wattage based on research of the products currently available in the market place. The EAR team observed several problems for measures defined with a maximum wattage but no minimum wattage, as described below:

1. Wattage too high for the range: The 2013-2014 disposition directed measures defined using ranges of wattages to use the smallest wattage in that range. For example, a measure with a wattage range of “>6w and <=10w” must use a measure input power of 7 watts. For all measures that fall into this category, the EAR team has revised any measures that did not meet this requirement.
2. Inconsistent measure definitions when high wattage, but no low wattage is specified: There are many measures with a high wattage boundary, but no low wattage boundary. In these cases, the 2013-2014 disposition directed that the measure wattage be the lowest wattage available for purchase in that wattage range. Our review of the LED workpapers showed several duplicate measures where a duplicate is defined as follows: a) the measures cover a single technology (e.g. PAR30 LED lamp); and b) the measures are defined with no lower wattage boundary; and c) the measures may have differing high wattage boundaries; and d) the measure wattage proposed in the workpapers may differ. Using these 4 criteria, there are several sets of duplicate measures, both within a single PA’s submission and across PG&E and SCE. The 2013-2014 disposition requires that a single measure definition be utilized statewide with the same measure wattage, regardless of the higher wattage boundary. The EAR team reviewed all groups of duplicate measures that fall into this category and revised measure wattages as needed to be the lowest measure wattage in each group.
3. Overlapping wattage ranges: Cases of overlapping wattages in the measure description are noted in the disposition workbook. For all measures that fall into this category, the EAR team has included the following two alternative measure descriptions and associated measure wattage values:
   1. A measure description for which the proposed measure wattage is valid OR
   2. A measure description that resolves the measure overlap and changes the measure wattage so to remove the overlap.

The example below illustrates a pair of overlapping measures. lists the alternative descriptions that the EAR team has made available for the PAs to use.

Example Workpaper: SCE13LG109 - Exterior LED Lamp Replacement

LT-35653: Up to 17 Watt Exterior PAR38 (Dwelling Area) LED replacing PAR38 Basecase, Total Watts = 3.81 x Msr Watts

Proposed Measure Watts: 16

LT-70912: Up to 25 Watt Exterior PAR38 (Dwelling Area) LED replacing PAR38 Basecase, Total Watts = 3.81 x Msr Watts

Proposed Measure Watts: 19

EAR team observations:

* 1. Since these measures are for identical technology types (PAR38) and have upper limits of the wattage range but no lower limits, they are really the same measure even though their upper limits are different. Since these measures have different upper wattage limits, the measures overlap.
  2. The 2013-2014 disposition requires the use of the lowest available wattage in the range. The EAR team performed a preliminary we search and found that the lowest available wattage for PAR38 lamps is 11 Watts. In both cases, the proposed measure wattage is larger than lowest observed available wattage of **11 Watts.**

Table - Example of Overlapping Wattage Ranges

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Revisions that meet direction and keep proposed measure wattage** | | **Revisions that resolve measure wattage overlap and assign wattage that meets direction** | | |
| **SCE Measure** | **Description** | **Watts** | **Description** | **Watts** | **Rationale** |
| LT-35653 | >15w and <19w Exterior PAR38 LED Lamp | 16 | <=17 Watt Exterior PAR38 LED Lamp | 11 | Lowest observed wattage available for exterior rated PAR38 LED lamps |
| LT-70912 | >=19w and <=25w Exterior PAR38 LED Lamp | 19 | >17w and <=25w Exterior PAR38 LED lamp | 18 | Lowest end of wattage range |

**4. Code Baseline for LED Fixtures**

PGECOLTG139, SCE13LG115, and SCE13LG119 cover replacement of existing fixtures with permanently wired LED fixtures. Under the 2013 version of Title 24, fixture replacements meet the definition of alterations to existing buildings and are covered by either section 141.0 or section 150.2. PG&E and SCE include different information on code baseline, but both propose that a code baseline is not appropriate and that the application of the WRR for A19 lamps issued in the 2012 LED workpaper disposition is appropriate baseline. However, there are many measures for which Title 24 requires high efficacy (HE) fixtures or compliance with lighting power limits. Table 4 lists general categories of measures and the applicable Title 24 requirements.

Table - Title 24 Requirements for LED Fixtures

| **Application** | **Requirements** | **Code Citation** | **Application Notes** |
| --- | --- | --- | --- |
| Any new construction project | Full Title 24 compliance |  | Residential new construction projects must be either HE or have automatic controls. Nonresidential must meet LPD and controls requirements. It is not clear how NC projects will be identified. |
| Interior fixtures in low-rise residential dwellings | Kitchen: 50% of wattage shall be HE  Bathroom: At least one HE fixture; all others either HE or controlled with vacancy sensors  Garage, laundry room, utility room: HE fixtures with vacancy sensors  All others: Either HE or controlled with vacancy sensor | 150.2(b)1 – refers to 150.0(a) through (q), which includes 150.0(k)3,5,6,7 | Large quantity of program incented fixtures likely will be installed where the code requires HE fixtures since no vacancy sensor is installed. |
| Exterior fixtures permanently attached to low-rise residential buildings on a site | HE fixtures or controlled with both motion and solar controls. | 150.2(b)1 – refers to 150.0(a) through (q), which includes 150.0(k)9A | Large quantity of program incented fixtures likely will be installed where the code requires HE fixtures since the combination of motion and solar controls may not exist. |
| Interior common areas in low-rise residential buildings with floor area < 20% of total floor area | HE fixtures or controlled with occupancy sensors | 150.2(b)1 – refers to 150.0(a) through (q), which includes 150.0(k)12A |  |
| Interior common areas in low-rise residential buildings with floor area > 20% of total floor area | Meet lighting power density requirements of 140.6 and be controlled with occupancy sensors | 150.2(b)1 – refers to 150.0(a) through (q), which includes 150.0(k)12B | These are classified as low-rise residential installations, they are not covered by Section 141.0 and would never be categorized as “luminaires modified-in-place.” |
| Interior fixtures in high-rise residential dwellings | Same as low-rise residential dwellings | 141.0(b)2 requires compliance with applicable requirements of 120.8 through 130.5. 130.0(b)1 requires high-rise dwelling units to meet 150.0(k). | 141.0(b)2 precedes 141.0(b)2I (the section with allowances for “luminaires modified-in-place”) therefore these fixtures cannot be categorized as “luminaires modified-in-place.” |
| Outdoor fixtures attached to high-rise residential buildings and controlled from inside a dwelling unit | Same as low-rise residential dwellings | 141.0(b)2 requires compliance with applicable requirements of 120.8 through 130.5. 130.0(b)2 requires high-rise dwelling units to meet 150.0(k). | Same as low-rise residential dwellings |
| **2013 Title 24 Requirements** |  |  | **Notes based on MeasAppType:**  New Construction: A WRR that includes incandescent is likely incorrect for NC since installations are covered by Title 24 LPD requirements.  Replace-on-Burnout: Likely not possible to know scope of project (and therefore the applicable code requirements) for rebate and upstream/midstream incentives.  Early Retirement: 2015 lighting guidance memo allowed ER claims only in direct install programs[[2]](#footnote-2). Title 24 documentation is needed for all DI projects in order to ascertain code baseline requirements. The workpaper proposed WRR may be reasonable for the pre-existing installed power, but not for the code or second baseline. |
| Nonresidential where <10% of fixtures are “luminaires modified-in-place” | No requirements | Table 141.0-F |
| Nonresidential <40 “luminaires modified-in-place” | Existing lighting power and controls permitted |
| Nonresidential >40 “luminaires modified-in-place” | Either <85% of LPD allowance or < LPD allowance and meet all control requirements |
| **2016 Title 24 Revisions** |  |  |
| Existing luminaires are replaced with new luminaires and no other space redesign | replacement luminaires in each office, retail, and hotel occupancy shall have at least 50 percent,  and in all other occupancies at least 35 percent, lower rated power at full light output compared to  the existing luminaires being replaced | 141.0(b)2Iii |

The proposed value of 2.96 as the WRR for LED fixtures is based on the 2012 disposition for LED A19 measures. The disposition calculated this WRR assuming that the pre-existing condition was equally split between incandescent and CFL lamps. This is likely a reasonable assumption as the pre-existing case for early retirement applications. However, for all other applications, there is not enough information available to confidently estimate the code baseline. For residential applications, there is no information available regarding the installation of controls that would allow fixtures that aren’t high efficacy to be installed. If this information were known, the operating hours of these fixtures would likely be lower with the required controls, which would reduce baseline energy use. For commercial installations, no information is available that helps to estimate what portion of installations would be covered by the various levels of control and LPD requirements for luminaires modified-in-place.

As a preliminary estimate, CPUC staff analyzed field data from the 2010 California Lighting and Appliance Saturation Study (CLASS) to estimate the possible code baselines for typical residential installations. The CLASS data includes detailed installed lighting information from 1,987 single family, multi-family and manufactured homes. The lighting data includes information on location, quantity, lamp-type, lamp base type (e.g.; screw-in, pin-based, etc.), whether the fixture is hard-wired or plug-in and lamp or fixture power. To derive the typical code baseline, all CLASS data records for high efficacy fixtures were removed from consideration, based on the assumption that new high efficacy fixtures would not replace existing high efficacy fixtures[[3]](#footnote-3). Next, CLASS data was categorized by the Title 24 residential space types listed in along with the total installed wattage of non-high efficacy lighting technologies within each space category. An estimate of the code baseline was developed for each space category depending on the Title 24 requirements for each space category. The fraction of wattage for screw-in CFLs was considered equal to the code baseline wattage, assuming that a high efficacy fixture and screw-in CFL would have similar performance. Savings were calculated based on the Title 24 requirements that apply to each space category. Total code baseline watts and total measure watts were then summed. The final above code wattage reduction ratio is the total code baseline watts divided by the total measure watts. The full development of the above code WRR for LED fixtures is included in the attached workbook “2010\_Class\_Data\_Added\_Analysis\_22Jul2016.xlsx.” The analysis resulted in an above code WRR of 2.42 for LED fixtures. Staff approves this value for ROB, NC and Normal Replacement (NR) measures. This value is also approved as the second baseline for all ER measures. (**NOTE:** This revision to the baseline requires all baseline costs for LED fixtures to be recalculated and resubmitted as discussed in the next section on costs.)

**5. Cost Revisions**

1. Uniform Cost Definitions and Cost Identification Values for Screw-in and MR16 lamps: PG&E and SCE in many cases have used identical cost values for the same technologies. The EAR team has revised all submitted cost records to have uniform definitions and cost identification values. Except where new cost records are required under 5d, below, all implementation records in the PEARdb reference these revised cost IDs. Generally, the EAR team followed PG&E’s convention for creating cost identification values.
2. SCE LED Fixture Costs: Labor costs submitted by SCE for LED fixtures appear to be based on needing less than 10 minutes to install a hard-wired fixture. The EAR team has revised the labor costs for fixtures to be based on 30 minutes of installation time, which is the value PG&E has used for its LED fixture measures. (**NOTE:** Material costs for LED fixture measures submitted by SCE are typically more than 50% higher than costs submitted by PG&E for similar wattages. For this reason, the PAs are directed to coordinate cost research and provide a uniform set of costs for LED fixtures. See item 7a below.)
3. Costs for Different Delivery Types: Since all labor costs are identical for the baseline (or code baseline) and measures cases, there is no need to use different cost records for different MeasAppType or DeliveryType[[4]](#footnote-4) entries. The EAR team has revised the table of cost records to include only one record for each technology.
4. New Costs for Revised Measure Definitions: This disposition includes revised technologies and measure definitions for a large number of the proposed measures (see tab Disposition-Measure columns G, AB, and AH). The EAR team did not develop costs for new technologies. Instead, SCE and PG&E are directed to develop and submit these cost records in time for reporting claims for the first quarter of 2017. Required new cost records are noted in the attached disposition workbook in the tab called “Disposition-Required New Costs.”

**6. Prospective Review Effective Date and Expiration Date**

The revisions directed in this disposition shall be effective for program claims starting the first quarter of 2017. As discussed in the next section, this disposition requires the PAs to perform additional research and analysis that may result in further changes to savings values. Recent updates to Title 24 covering lighting alterations may also indicate a revision to the code baseline for LED fixtures. Rapid changes in available LED products also mean that savings values for these products require more frequent revision than other lighting products that have longer historical presence in the market.

**7. Required Additional Research, Analysis and Workpaper Development**

PAs shall perform additional workpaper development to be included in revised workpapers to be submitted that addresses the following:

1. Uniform Cost Values: Material costs for LED fixture measures submitted by SCE are typically more than 50% higher than costs submitted by PG&E for similar wattages. For this reason, the PAs are directed to coordinate cost research and provide a uniform set of costs for LED fixtures.
2. Measure Specifications and Wattage Reduction Ratios for Screw-in and MR-16 Lamps: A recently published report[[5]](#footnote-5) (Navigant), sponsored by the PAs, indicates that revisions to baseline and performance criteria are needed. Two key observations from this research are:
   * + 1. Current WRR values may be too high: The Navigant report examined product and sales information to estimated WRR values based on estimated purchases and found that current standard practice may include higher fractions of CFLs than estimated in the CPUC staff disposition from 2012. For example, is from the Navigant report and shows that estimated WRRs are lower for all reflector lamp technologies except MR-16 lamp types.

Figure - Reflector Wattage Reduction Ratios[[6]](#footnote-6)



1. Additional performance specifications may be needed to properly account for savings: CPUC staff and PAs acknowledge that the WRR values may be encouraging incentives for higher wattage lamps as a way of increasing reported savings. However, the Navigant research indicates that there are a wide range of available efficacy ratings (lumens per watt) for similarly performing lamps. For example, shows that the typical output for “60 watt equivalent” LED A19 lamps is about 800 lumens, but the input power for these lamps ranges from 8 to 14 watts. If the range of lamps in this category provides the same level of service in actual installations, then an 8 watt lamp represents the greatest opportunity for savings, but the WRR for these lamps assigns greater savings to the 14 watt lamp. It may be reasonable to use higher WRR values, giving higher savings, for higher efficacy lamps. At this time, the EAR team is not aware of any sales data or performance research that would indicate purchaser preference for lower or higher wattage lamps. This is an area of needed research to ensure the higher savings (and perhaps higher incentives) for higher efficacy lamps don’t lead to promotion of products that have lower life or are removed early due to purchaser dissatisfaction with lamp performance. Nevertheless, the Navigant report highlights a potentially significant opportunity to promote higher efficacy lamps that would increase savings over the practices occurring under current programs.

Figure - Average A-Line Lumen Output by Wattage and EISA Bin[[7]](#footnote-7)



**8. Supporting Documents and Approved Ex Ante Data**

The EAR team attempted to document all revisions in the attached Excel spreadsheet “WRR\_LightingLED\_Disposition-22Jul2016.xlsx” (disposition workbook). The EAR team has uploaded all approved ex ante data to the Preliminary Ex Ante Review database accessible via the READIv2.4.3 interface.

Also, EAR team analysis of the LED fixture wattage reduction ratio is provided in the attached Excel spreadsheet “2010\_Class\_Data\_Added\_Analysis\_22Jul2016.xlsx.”

**9. CPUC Staff Consideration of Alternative Values**

This disposition includes revisions to savings values and ex ante data, as well as direction for the PAs to resubmit a limited number of new cost records. These revised values are approved by CPUC staff for use for claims starting in the first quarter of 2017. CPUC staff is open to alternatives proposed by the PAs that are supported by additional research, analysis or program requirements. CPUC staff is particularly interested in additional program requirements placed on implementers or rebate applicants that would help in the identification of the appropriate code baseline as well as provide evidence of early retirement.

1. Workpaper Disposition for Lighting Retrofits California Public Utilities Commission, Energy Division, March 1, 2013 [↑](#footnote-ref-1)
2. 2015 Workpaper Guidance – Lighting Retrofits, California Public Utilities Commission, Energy Division, January 27, 2015. [↑](#footnote-ref-2)
3. The DEER 2016 update for CFLs changed the baseline to include observed standard practice of replacing CFLs with CFLs, which had the effect of reducing WRR (and savings) for most CFLs by 30-40%. For this disposition, the ex ante team chose not to consider any high efficacy fixtures as part of the pre-existing baseline since these technologies are relatively new in the programs and because high efficacy fixtures made up only about 17% of the total installed lighting power observed in CLASS. [↑](#footnote-ref-3)
4. For direct install delivery types, it is acceptable to reference the same cost records as for downstream or upstream incentive deliveries. For measure costs, however, the actual costs, including payments made to installers by both the PA and the customer, shall be submitted with claims. Estimated baseline costs are required for direct install measures; however, care should be taken to ensure that baseline costs are less than actual measure costs so that incremental measures costs are greater than zero. [↑](#footnote-ref-4)
5. (Navigant 2015) California LED Workpaper Update Study, Prepared for: Southern California Edison, Pacific Gas & Electric, and San Diego Gas & Electric, Navigant Consulting, Inc., August 28, 2015. [↑](#footnote-ref-5)
6. See Navigant 2015, Figure 4-4 p.4-5 [↑](#footnote-ref-6)
7. See Navigant 2015, Figure 4-9 p.4-11 [↑](#footnote-ref-7)