**Summary of Changes - Linear Fluorescent**

September 15, 2014

Part 2 (of 3): Linear Fluorescent lighting Systems including 342 measures from 11 IOU workpapers.

1. **Early Retirement of T/U12 technologies:** 140 measures involve the retrofit of T12 or U12 lamps and magnetic ballasts to more efficient T5, T8 or U6 lamps and electronic ballasts. All measures that utilize pre-existing T12 or U12 equipment as a baseline must be considered early retirement as that equipment utilizes pre-existing equipment as the baseline[[1]](#footnote-2),[[2]](#footnote-3) and utilizes wattage above the adopted DEER[[3]](#footnote-4) code baseline wattage value[[4]](#footnote-5). Therefore, staff has reviewed all of these measures to ensure that they are correctly defined for both early retirement and ROB/NC implementations and include correct code baseline technologies that are consistent with the adopted DEER requirements. Commission staff identified a group of measures where the code baseline and measure case are identical and thus are classified as “to-code” measures. In the case of to-code measures, if eligible, savings can only be claimed for the RUL period[[5]](#footnote-6). However, CPUC policy requires that utility energy efficiency incentive based programs only support projects which exceed the minimums required by codes, standards and regulations; exceptions to this policy involve specifically authorized to-code programs. These ER measures being required by current codes, standards, or regulations implies they should not be eligible for Program participation. Commission staff directs the PAs to remove these to-code measures from their portfolios no later than one month from the release of this document and to install alternative measures which exceed minimum code requirements. Any projects whose applications have been advanced to PA management level and have management signature approval by **October 15, 2014** may proceed. Commission staff additionally makes the strong point that claiming an early retirement measure invokes the requirement for documentation of the pre-existing condition as well as evidence that program intervention caused the early retirement project (per D.12-05-015). For downstream deemed measures the workpapers have not met the burden of preponderance of evidence to support an early requirement claim. Commission staff directs that until such time as the ER evidence requirements have been met, reviewed and approved, deemed ER measures can only be utilized in direct install programs in cases where the adopted ER requirements are met. For some measures, the measure and pre-existing conditions matched those of a measure already included in DEER. For these, staff ensured that the code baseline matched the DEER code technology. Other disposition items, that are dependent on the pre-existing or measure technology descriptions, are listed below:
   1. T12 to T8 lamp retrofits using lamps of the same length: Staff ensured that code baselines consisted of 2nd generation T8 lamps, normal light output electronic ballasts and the same number of lamps as the measure fixture.
   2. T12 to T5 lamp retrofits using lamps of the same length[[6]](#footnote-7): It is generally considered that T5 technologies are more efficient light sources than T12 and some T8 technologies. However comparing T5 and T8 technologies on a per lamp basis is difficult due to the higher pre lamp light output as well as higher per lamp wattage of T5 versus T8 lamps. At this time, due to the relative performance comparison issues between T5 and T8 systems, there is not supporting research that can be used to establish a T8 technology that would represent a reasonable code baseline for these measures. Therefore staff has ensured that the code baseline of these T5 measures is identical to the measure technology. Many of the measures as defined in workpapers had already set the measure and code baseline technologies to be the same. This dispositions expands that approach to all T5 measures. An alternative, possible for custom projects done post the 71//2014 Title 24 changes which require permits for most program supported area retrofits, would be to utilize the actual Title 24 lighting power density (LPD) for the project. However, deemed measure cannot utilize project specific code requirements.
   3. U12 to 2’ T8 lamp retrofits: These measures retrofit fixtures with U-shaped lamps to linear T8 lamps with an overall shorter lamp length. Staff ensured that code baselines consisted of 2’ T8 lamps, normal light output electronic ballasts and the same number of lamps as the measure fixture.
   4. U12 to T5 lamp retrofits: These measures retrofit fixtures with U-shaped lamps to linear T8 lamps with an overall shorter lamp length. Similar to item b., above, staff ensured that code baseline technologies are identical to measure technologies.
   5. 8’ T12 to 4’ T8 lamp retrofits: Consistent with item a., above, Staff ensured that code baselines consisted of 2nd generation T8 lamps, normal light output electronic ballasts and the same number of lamps as the measure fixture.

All above items are covered by direction given in DEER2011 or in D.12.05.015, which adopted DEER2011. Therefore, the disposition direction outlined above is effective for the entire program cycle, starting January 1, 2013. PAs are responsible for implementing workpaper ex ante values that are covered by previous Decisions or adopted DEER direction, regardless of whether those values are reviewed and explicitly addressed through a disposition.

1. **“High Efficiency” Fixture Replacements and Retrofits**: A number of measures involve the replacement or retrofit of fixtures from T8 or T12 technologies to T8 or T5 technologies that are considered high efficiency. Staff relied on information from workpapers in an effort to develop a definition for high efficiency, including the following technology features:
   1. Installation of high light output (HLO) or very high light output (VHLO) ballasts: This will increase the light output per lamp compared to the lamps equipped with normal light output ballasts that DEER defines as the code baseline. This allows a reduction in lamp count compared to standard retrofits.
   2. Incorporation of reflectors or other modifications to the fixture that increase the overall light output from a fixture compared to normal (and the pre-existing) linear fluorescent fixtures without these physical modifications or features. This allows a reduction in lamp count compared to standard retrofits.
   3. Use of NEMA “Premium” ballasts and lamps: These are lamps and ballasts that meet the Consortium for Energy Efficiency (CEE) specifications for high efficiency lamps and ballasts. Technologies that meet the CEE specifications will have lower input wattage ratings compared to DEER code baseline technologies producing the same light output.

At this time, subject to the direction on update requirements outlined below, staff accepts the workpaper proposals that lighting retrofits using these lighting technologies will result in total installed lighting power that is less than current Title 24 limits. However, staff also points out that there is no research currently available that examines typical fixture retrofit or replacement projects of this type that compares those projects to applicable code requirements. The December version of the disposition added code baseline technologies as defined in DEER that include second generation T8 lamps with normal light output electronic ballasts and the same number of lamps as the measure fixture, which resulted in zero or negative above code savings values for many measures. After further discussion with program administrators, staff has revised code baseline technologies for this group of measures as described below:

1. Retrofits and Replacements of T12 Technologies: For these measures, the code baseline has been revised to be 2nd generation T8 lamps with normal light output electronic ballasts and the same number of lamps as the pre-existing technology. In order to claim savings above the pre-existing condition, these measures must be treated as early retirement measures that must meet additional requirements as described in item 1, above.
2. Retrofits and Replacements of T8 and T5 Technologies: For these measures, the pre-existing technology is assumed to meet DEER code baseline requirements and therefore can become the code baseline (as a higher wattage or “regressive” baseline is not permitted by policy). Therefore, these measures may be treated as ROB/NC measures with full savings claimed for the full EUL period.

These dispositions apply for the periods both before and after 7/1/2014. To address the uncertainty surrounding the establishment of code baseline, staff directs the PAs to investigate and propose an approach for establishing code baselines for all of these measures as well as the specific value to use. Under custom approaches, it would be acceptable to determine the Title 24 compliant lighting power allowance with the above code savings calculated above this level. However, deemed measures require selection of a technology as the code baseline. The determination of this code baseline likely involves the analysis of expected lighting power levels across a set of DEER building types and determining typical code compliant technologies that provide the same level of lighting performance for a range of commonly encountered pre-existing technologies.

1. **Relamping Measures with Per Lamp Savings:** 38 measures involve replacing 32w T8 lamps with either 28w or 25w T8 lamps and calculated savings per lamp. Workpapers assume that these measures are implemented through a variety of mechanisms including upstream and downstream incentives as well as direct install programs. PG&E and SCE workpapers assume a baseline of a two lamp fixture with second generation T8 lamps and one instant start normal light output electronic ballast. SDG&E workpapers assume the wattage reduction is equal to the wattage reduction in the lamp. Additional IOU specific assumptions are described below:

SCE: SCE has two workpapers that cover relamping measures, and each uses different assumptions for the measure case. The primary core workpaper does not provide specific documentation supporting the wattage for the measure fixture, however, measures wattages appear to be more in line with those associated with Programmed Rapid Start (PRS) ballasts, which generally results in lower wattage compared to the use of IS ballasts. According to the descriptions in the workpaper, these measures do not assume a ballast replacement, therefore it is likely that savings are overestimated. The second workpaper includes a review of typical wattage ratings for ballast and lamp combinations and appears to select wattage ratings that are in the higher end (greater wattage ratings) of the available manufacturers data. It is not clear why similar, and possibly identical, measures were covered by two different workpapers with such different savings values proposed.

PG&E: PG&E original workpapers state that wattages are based on instant start normal light output electronic ballasts. Measure wattages were based on values included in Appendix B (Standard Wattage Table) of the 2012 Statewide Customized Offering Procedures Manual. For 28w and 25w lamps, the Standard Wattage Table only includes wattages for lamps combined with Programmed Rapid Start (PRS) ballasts, and the use of PRS ballasts generally results in lower wattage compared to the use of IS ballasts. According to the descriptions in the workpaper, these measures do not assume a ballast replacement, therefore it is likely that savings are overestimated.

SDG&E: SDG&E savings values assumed that the wattage difference equals the wattage difference of the lamps.

Thus the various workpapers proposed differing savings values for measures with very similar or identical definitions and descriptions. Workpapers do not include a discussion of program requirements that mirror their workpaper assumptions nor do the workpapers include program historical equipment installation data to support their varying workpaper assumptions. For example, the proposal that upstream delivery program approaches utilize the same assumptions as downstream and direct install, does not consider the likelihood of replacements of lamps with the same wattage due to burnouts which would result in no savings from some fraction of upstream claims. Additionally, it is expected that the NTG value for upstream lamp delivery would not be the same as other delivery approaches. Commission staff requires that the workpaper assumptions be either based on program requirements or historical data that is updated annually. At this time Commission staff is addressing these issues by combining the approach of all the workpapers into a common set of assumptions that are then applied to all the workpapers. Several past lighting disposition have dealt with these measures imperfectly.[[7]](#footnote-8) Ex ante consultants reviewed all workpapers and the submitted information and developed the following values assuming normal light output electronic ballasts:

* 1. 32w to 28w lamp: delta watts = 3
  2. 32w to 25w lamp: delta watts = 7

Additionally, per CPUC guidance on measure which modifies existing equipment without replacing that equipment (such as an add-on retrofit), relamping measures are considered retrofit measures with an EUL equal to RUL of the modified, or pre-existing, fixture. This EUL value requirement is applicable to the entire program cycle. The December disposition initially directed that these adjusted delta watts values apply retroactively to January 1, 2013. However, in consideration of comments from the IOUs and the small contribution of these measure savings to the portfolio, CPUC staff agreed to an exception to policy for these measures so as to delay the implementation of the wattage revisions in the December disposition until July 1, 2014, even though the changes would have increased savings values for some measures. However, Staff has additional significant concerns with measures in this group and the group described in the next item 4, below:

Use as a “Companion” Measure: In some cases, workpapers identify that relamping measures may be combined with T12 to T8 or T5 retrofit measures with the reduced wattage lamp, such as a 25w T8 or 49w T5, accounting for additional savings over a standard wattage lamp, such as a 32w T8 or 54w T5. For example, a measure that retrofits a 2 lamp T12 fixture to a 2 lamp 32w T8 fixture is covered by one workpaper, and the installation of lower wattage 28w or 25w T8 lamps as part of the same retrofit are covered by a second workpaper. The second workpaper then uses the same measure assumptions for the companion measure and a measure that truly does remove one lamp and replace it with another. For companion measures, PAs then report two measures in their claims that in practice represent a single retrofit. In these cases staff believes there is no appropriate way to calculate either the savings or the cost correctly if a single measure is reported as two. This is because each measure has its own baseline (both pre-existing and code) that cannot be reliably coordinated to make the sum of two measures have the same savings and cost as the real retrofit/replacement happening. Staff directs the PAs to revise their workpapers and reporting practices by January 1, 2015 in a way that relamping measures combined with other fixture retrofits are defined and claimed as a single measure.

Wattage Assumptions: There is very little, if any, field research to support the typical lamp and ballast combinations and their corresponding wattage ratings of actual installations. Staff is concerned that wattage ratings of measure technologies, including those that have been issued in the dispositions, assume the most energy efficient cases and that typical applications may be different and likely lower. Staff will be examining data and research and will likely revise the measure case wattage ratings, with resultant savings for these measures likely being reduced as a result. Thus PA’s should expect a follow-up disposition on this matter and updates to these measure expecteds to be effective by 1/1/2015.

Code Baselines Do Not Account for Lower Light Output: The use of reduced wattage lamps, such as 25w and 28w T8 lamps, results in a fixture with lower overall light output than a fixture equipped with 32w T8 lamps and the same type of ballast. CPUC policy defines energy efficiency to be the installation of technologies that results in reduced energy consumption for the same level of service. At this time, DEER uses a code baseline of 2nd generation T8 lamps with normal light output electronic ballasts, which will have higher light output than fixtures with lower wattage lamps and the same ballasts. This means that both DEER and PA measures of this type likely do not align with CPUC policy – energy efficiency savings credit is being given for a measure that provides a reduced service level; the baseline for these measures may need to be adjusted to take service level into consideration. This is not a problem for custom measure approaches, since it is acceptable to determine the Title 24 compliant lighting power allowance with the above code savings calculated above this level. However, deemed measures require selection of a technology as the code baseline. The determination of this code baseline likely involves the analysis of expected lighting power levels across a set of DEER building types and determining typical code compliant technologies that provide the same level of lighting performance for a range of commonly encountered pre-existing technologies.

1. **Relamping Measures with Savings Per Fixture:** 36 measures involve replacing T5 or T8 lamps with lower wattage lamps of the same diameter and savings calculated per fixture, as opposed to per lamp like those measures covered by item 3 above. For the 2013-2014 cycle, Commission staff has accepted the pre-existing technologies as meeting Title 24 restrictions on installed lighting power. In some cases in both the December and March dispositions, code baselines were different than the pre-existing technology. Staff has revised these code baselines so that they all match the pre-existing technology. Additionally, per CPUC guidance on any measure which modifies existing equipment without replacing that equipment (such as an add-on retrofit), relamping measures are considered retrofit measures with an EUL equal to RUL of the modified, or pre-existing, fixture. Refer to additional staff concerns, under item 3, above for a summary of additional disposition work that will be performed by staff for a planned January 1, 2015 effective date.
2. **Retrofits from Code Compliant to More Efficient Technologies:** 50 measures involve retrofit of existing T8, T5 or U6 lamps and electronic ballasts to higher efficiency lamps and ballasts, maintaining the same number of lamps. Some of these measures also include reduced lighting output technologies such as 28w T8 lamps, 25w T8 lamps or reduced light output ballasts. At this time, DEER uses a code baseline of 2nd generation T8 lamps with normal light output electronic ballasts, which will have higher light output than fixtures with lower wattage lamps and the same ballasts. This means that both DEER and PA measures of this type likely do not align with CPUC policy – energy efficiency savings credit is being given for a measure that provides a reduced service level; the baseline for these measures may need to be adjusted to take service level into consideration. Because of this DEER definition of code baseline staff determined that pre-existing technologies meet current DEER code baseline requirements. Staff reviewed SCE measures and determined that, for all measures, neither the December nor the May disposition values were consistent with the DEER code baseline definitions. Instead, most measure definitions in the March disposition were retained and, for a small number of measures, staff accepted the workpaper values. Staff did not review PG&E’s measures in the March disposition, however, staff has determined that these measures are consistent with DEER code baseline definitions and approved them as defined in the workpapers. SDG&E’s measures were revised slightly to align with the SCE measures covered in the March disposition. All measures may be treated as ROB/NC measures with full savings claimed for the full EUL period.
3. **Permanent De-lamping:** 16 measures involve permanent de-lamping of T8 or T12 fixtures. In earlier dispositions, the code baseline had been assigned the same technology as the measure (de-lamped) technology, which is in conflict with DEER. To be consistent with DEER and CPUC policies for early retirement, the measures have all been corrected so that savings are calculated above the pre-existing technology. Additionally, per CPUC guidance on measure which modifies existing equipment without replacing that equipment (such as an add-on retrofit), de-lamping measures are considered retrofit measures with an EUL equal to RUL of the modified, or pre-existing, fixture.
4. **Summary of effective dates and measure listed as “Expires” previously:** Of the 342 measures covered in the disposition, 38 measures are revised effective July 1, 2014. Those measures are the T8 re-lamping measures discussed in item 3 above. All other measures are defined in such a way as to be applicable for the periods both before and after 7/1/2014. The 38 relamping measures covered under item 3, above were originally defined in the December disposition and are effective starting 7/1/2014. All other measures shall be covered by the final dispositions as discussed above for the entire 2013-2014 program cycle.

In the May disposition, 174 measures were listed as “Expires 6-30-2014.” The final disposition removes the expiration for all but the 38 re-lamping measures for the following reasons:

* 1. Staff believes added research and/or analysis is required for high-efficiency fixture retrofits and replacements[[8]](#footnote-9) covered in item 2, above to support the development or confirmation of appropriate code baselines. Staff has directed the PAs to collaborate on the investigation of this issue and to propose appropriate code baselines for these measures as soon as practical and hopefully by the start of 2015.
  2. Staff identified measures that needed to be corrected to be consistent with DEER measure definitions or code baseline requirements, such as T12 and U12 retrofits covered in item 1, above. Staff directs these values be corrected and effective retroactive to January 1, 2013.
  3. Some measures were listed as expiring in error and are acceptable for the entire cycle.

1. D.11-07-030, attachment B at B13 and amplified by D.12-05-015 at 346 states that pre-existing replaced equipment can only be used as the savings calculation baseline when the preponderance of evidence establishes that the replacement was induced by the program. [↑](#footnote-ref-2)
2. D.12-05-015 at 351 notes that “regressive” baselines and like-equipment replacements would not normally be allowed for energy efficiency upgrades. [↑](#footnote-ref-3)
3. DEER2011 adopted for use in 2013-2013 program by D.12-05-015 set the code baseline equivalences for all linear florescent measures. See the DEER2011 document “Appendix A-1:DEER Measure Database Updates Measure content, modeling method, model input parameter, and database format changes” at A-1-12 and D.12-05-015 Attachment A at 10. [↑](#footnote-ref-4)
4. CPUC early retirement policy requires that a second baseline be determined that represents the likely system to be installed at the end of the remaining useful life (RUL) of the pre-existing system. With recent Title 24 changes that became effective on 7/1/2014, all lighting system replacements must meet restrictions on lighting power density. Any code baseline approach for deemed lighting, must consider the impact of these Title 24 revisions on the expected installed lighting power and the lighting technologies that will likely meet those requirements. Alternatively, projects may be implemented via calculated approaches where permit information and supporting documentation show the installed lighting power allowed under new Title 24 requirements. [↑](#footnote-ref-5)
5. Commission staff notes that there are specific adopted RUL limits for T12 lighting technologies in DEER2011. [↑](#footnote-ref-6)
6. T5 lamps are shorter than T8 and T12 lamps. 46” T5 lamps are used in retrofits of 4’ (48”) T8 and T12 lamps; 34” T5 lamps replace 3’ (36”) T8 and T12 lamps; and 22” T5 lamps replace 2’ (24”) T8 and T12 lamps. For the purposes of this disposition, replacement T5 lamps are considered the same length as the pre-existing lamps if they are 2” shorter or less. [↑](#footnote-ref-7)
7. The March 2013 lighting disposition addressed SCE and PG&E measures, but not SDG&E measures. Additionally, the March 2013 disposition included errors in the assignment of wattage values for the assigned technologies such that the actual savings values for these measures were not always directly revised by the disposition nor were wattage assignments consistent across all similar measures. CPUC staff attempted to correct these errors in the December 2013 disposition by applying a uniform values across all measures in all workpapers. [↑](#footnote-ref-8)
8. Refer to Footnote 1 regarding CPUC staff guidance on developing an approach for determining code baselines for high efficiency linear fluorescent fixture replacements and retrofits. [↑](#footnote-ref-9)