Short Form Work Paper WPSDGENRLG0106

**Revision 6**

**San Diego Gas & Electric**

**Energy Efficiency Engineering**

**Integral LED Lamps**

**May 1, 2018**

# SDG&E Integral LED Lamps

## Introduction

This short form workpaper (WP) documents the updates addressing the March 1, 2018 screw-in lamp savings methods lighting disposition issued by CPUC Energy Division. The updates include creating new measure codes that are based on EISA bins and CEC specification for general service lamps (GSL). The bins also define new lumens-per-watt (LPW) requirement and delta watt methodology for A-lamps. Changes to the measure and baseline costs for A-lamps are also included. For reflector, PAR, Candelabra, and globe lamps, there were updates to savings, and both measure and standard costs.

* SDG&E adopts all savings impacts and measure IDs from PEAR database with start dates of 07/01/2018.
* All cost data is adopted from various PG&E workpapers:

1) PGECOLTG164 R7 LED Globes 2) PGECOLTG141 R9 LED PARs

3) PGECOLTG163 R7 LED Candelabra 4) PGECOLTG177 R6 R-BR

5) PGECOLTG165 R6 LED A19

Exclusion:

* This submission does not include the CPUC Energy Division May 1, 2018 “2018 SCREW-IN SAVINGS METHODS DISPOSITION-CORRECTED A-LAMP WATTAGE REDUCTION REVISION 1”.
* SDG&E will provide a revised Ex-ante submission for LED A19 lamps by the designated May 15, 2018 date.

## Document Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 02/17/2012 | Charles Harmstead/SDGE | Original work paper adapted from SCE work paper WPSCNRLF0106 -1. For SDG&E climate zones and DEER V 3.02 Interactive effects |
| 1 | 6/25/2012 | Charles Harmstead/SDGE | Revised NTGR to DEER 2011. Revised Wattage Savings per CPUC ED direction. Added attachment defining revised incremental costs |
| 2 | 01/30/2014 | Phillip Hasley/Hasley Consulting | Updated to new Template.  -Added PAR-20, Globe, Candelabra and R-30 lamps  -Revised measure savings calculation methodology per CPUC ED Disposition  -Updated EUL per CPUC ED Disposition |
| 3 | 06/25/2014 | Phillip Hasley/Hasley Consulting | -Updated energy and demand savings calculations using the DEER 2014 Lighting HVAC Interactive Effects workbook [D] and updated measure wattages based on May 30, 2014 lighting disposition for all applicable integral LED installation applications.  -Updated GSIA ID and Load Shape ID  -Updated EUL discussion to reference EUL IDs provided by the CPUC |
| 4 | 12/29/2016 | Kelvin Valenzuela/SDG&E & Mark McNulty Consulting | -Updated integral LED lamp impacts from READI.  -Updated integral LED lamp impacts with supporting documentation, where data is not available in READI  -Updated costs |
| 5 | 6/30/2017 | Kelvin Valenzuela/SDG&E | -Updated for May 26, 2017 screw-in lighting disposition.  -Created new measure codes, savings, and costs to account for EISA bin and CEC Specification  -Adjusted savings and baseline costs for “reflector” lamps based on revised WRR  -SDG&E used actual MSRP costs from contracted manufacturer/distributor to create new measure costs  -Updated NTG values |
| 6 | 4/30/2018 | Eduardo Reynoso/ SDG&E | * Updated for March 1, 2018 screw-in Lighting Disposition issued by CPUC ED. * Created new measure codes by adopting PEAR database DEER Measure IDs with start dates of 07/01/2018. * Adopted PG&E’s proposed measures and standard cost that align with both EISA bin and CEC Specification for all General Service Lamps (GSL). * Adopted and updated all LED screw-in lamps NTG ID = “All-Ltg-ScrwInLED” (= 0.91) with 07/01/2018 start date. |

## Measure Summary

Table : Measure Summary Table

| **Section** | **Value** |
| --- | --- |
| **Summary & Purpose** | This short form workpaper (WP) documents the updates addressing the March 1, 2018 screw-in lighting disposition issued by CPUC Energy Division. The updates include creating new measure codes that are based on EISA bins and CEC specifications for A-lamps as well all General Service Lamps (GSL). The bins also define new LPW requirement and delta watt methodology for A-lamps, PAR20, PAR30, PAR38, R-BR, Candelabra and Globe lamps. Updates and changes to the measure and baseline costs for LED screw-ins are also addressed. |
| **1.1 Measure & Baseline Data** | Refer to Ex-ante data tables entitled “20180501\_LED\_r2.accdb” for SDG&E Implementation source documentation and adoption of DEER Measure IDs.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **LED Lamp Type** | **Sector** | **Measure Description** | **Baseline Standard Description** | **UseSubCategory** | | A19 | Residential &  Commercial | LED Lamp: A19, EISA Bin 100, 120 LPW  LED Lamp: A19, EISA Bin 100, 110 LPW  LED Lamp: A19, EISA Bin 100, 100 LPW  LED Lamp: A19, EISA Bin 100, 90 LPW  LED Lamp: A19, EISA Bin 75, 120 LPW  LED Lamp: A19, EISA Bin 75, 110 LPW  LED Lamp: A19, EISA Bin 75, 100 LPW  LED Lamp: A19, EISA Bin 75, 90 LPW  LED Lamp: A19, EISA Bin 60, 120 LPW  LED Lamp: A19, EISA Bin 60, 110 LPW  LED Lamp: A19, EISA Bin 60, 100 LPW  LED Lamp: A19, EISA Bin 40, 120 LPW  LED Lamp: A19, EISA Bin 60, 90 LPW  LED Lamp: A19, EISA Bin 40, 110 LPW  LED Lamp: A19, EISA Bin 40, 100 LPW  LED Lamp: A19, EISA Bin 40, 90 LPW  LED Lamp: A19, EISA Bin 40, 80 LPW | Refer to Section 2, Table 2 (∆Watts)  Total = 75% LED +, 25% CFL | * InCommon * InGen-CFL * OutCommon * OutGen | | PAR20 | Residential &  Commercial | LED Lamp: PAR20, 13 Watts  LED Lamp: PAR20, 10 Watts, non-dimmable  LED Lamp: PAR20, 9 Watts, non-dimmable  LED Lamp: PAR20, 8 Watts, non-dimmable  LED Lamp: PAR20, 7 Watts, non-dimmable  LED Lamp: PAR20, 6 Watts, non-dimmable  LED Lamp: PAR20, 5.5 Watts, non-dimmable  LED Lamp: PAR20, 4 Watts, non-dimmable | Total Watts = 3.21 x Msr Watts | * InCommon * InGen-CFL | | PAR30 | Residential &  Commercial | LED Lamp: PAR30, 21 Watts, non-dimmable  LED Lamp: PAR30, 20 Watts, non-dimmable  LED Lamp: PAR30, 19 Watts, non-dimmable  LED Lamp: PAR30, 18 Watts, non-dimmable  LED Lamp: PAR30, 17 Watts, non-dimmable  LED Lamp: PAR30, 16 Watts, non-dimmable  LED Lamp: PAR30, 15 Watts, non-dimmable  LED Lamp: PAR30, 14 Watts, non-dimmable  LED Lamp: PAR30, 13 Watts, non-dimmable  LED Lamp: PAR30, 12 Watts, non-dimmable  LED Lamp: PAR30, 11 Watts, non-dimmable  LED Lamp: PAR30, 10 Watts, non-dimmable  LED Lamp: PAR30, 9 Watts, non-dimmable  LED Lamp: PAR30, 8 Watts, non-dimmable  LED Lamp: PAR30, 7 Watts, non-dimmable  LED Lamp: PAR30, 6 Watts, non-dimmable  LED Lamp: Exterior PAR30, 15 Watts, non-dimmable  LED Lamp: Exterior PAR30, 12 Watts, non-dimmable  LED Lamp: Exterior PAR30, 6 Watts, non-dimmable | Total Watts = 2.34 x Msr Watts | * InGen-CFL * OutCommon * OutGen | | PAR38 | Residential Commercial | LED Lamp: PAR38, 27 Watts, non-dimmable  LED Lamp: PAR38, 26 Watts, non-dimmable  LED Lamp: PAR38, 25 Watts, non-dimmable  LED Lamp: PAR38, 24 Watts, non-dimmable  LED Lamp: PAR38, 23 Watts, non-dimmable  LED Lamp: PAR38, 22 Watts, non-dimmable  LED Lamp: PAR38, 21 Watts, non-dimmable  LED Lamp: PAR38, 20 Watts, non-dimmable  LED Lamp: PAR38, 20.1 Watts, non-dimmable  LED Lamp: PAR38, 19 Watts, non-dimmable  LED Lamp: PAR38, 18 Watts, non-dimmable  LED Lamp: PAR38, 17 Watts, non-dimmable  LED Lamp: PAR38, 16 Watts, non-dimmable  LED Lamp: PAR38, 15 Watts, non-dimmable  LED Lamp: PAR38, 14 Watts, non-dimmable  LED Lamp: PAR38, 13 Watts, non-dimmable  LED Lamp: PAR38, 12 Watts, non-dimmable  LED Lamp: PAR38, 11 Watts, non-dimmable  LED Lamp: PAR38, 10 Watts, non-dimmable  LED Lamp: PAR38, 9 Watts, non-dimmable  LED Lamp: PAR38, 8 Watts, non-dimmable  LED Lamp: PAR38, 7 Watts, non-dimmable  LED Lamp: Exterior PAR38, 19 Watts, non-dimmable  LED Lamp: Exterior PAR38, 17 Watts, non-dimmable  LED Lamp: Exterior PAR38, 7 Watts, non-dimmable | Total Watts = 2.60 x Msr Watts | * InCommon * InGen-CFL * OutCommon * OutGen | | R-BR | Residential &  Commercial | LED Lamp: R-BR, 22 Watts, non-dimmable  LED Lamp: R-BR, 20 Watts, non-dimmable  LED Lamp: R-BR, 19 Watts, non-dimmable  LED Lamp: R-BR, 18 Watts, non-dimmable  LED Lamp: R-BR, 17 Watts, non-dimmable  LED Lamp: R-BR, 16 Watts, non-dimmable  LED Lamp: R-BR, 15 Watts, non-dimmable  LED Lamp: R-BR, 14 Watts, non-dimmable  LED Lamp: R-BR, 13 Watts, non-dimmable  LED Lamp: R-BR, 12 Watts, non-dimmable  LED Lamp: R-BR, 11 Watts, non-dimmable  LED Lamp: R-BR, 10 Watts, non-dimmable  LED Lamp: R-BR, 9 Watts, non-dimmable  LED Lamp: R-BR, 8 Watts, non-dimmable  LED Lamp: R-BR, 7 Watts, non-dimmable  LED Lamp: R-BR, 6 Watts, non-dimmable | >= 14 Watts: Total Watts = 2.97 x Msr Watts  >=11 Watts and <14 Watts:  Total Watts = 3.28 x Msr Watts  <11 Watts: Total Watts = 4.17 x Msr Watts | * InGen-CFL | | Candelabra | Residential &  Commercial | LED Lamp: Candle, 5 Watts, non-dimmable  LED Lamp: Candle, 4 Watts, non-dimmable  LED Lamp: Candle, 3 Watts, non-dimmable  LED Lamp: Candle, 2 Watts, non-dimmable  LED Lamp: Candle, 1.8 Watts, non-dimmable  LED Lamp: Candle, 1 Watts, non-dimmable | Total Watts = 4.61 x Msr Watts | * InCommon * InGen-CFL | | Globe | Residential &  Commercial | LED Lamp: Glb, 10 Watts, non-dimmable  LED Lamp: Glb, 9 Watts, non-dimmable  LED Lamp: Glb, 8 Watts, non-dimmable  LED Lamp: Glb, 7 Watts, non-dimmable  LED Lamp: Glb, 6 Watts, non-dimmable  LED Lamp: Glb, 5 Watts, non-dimmable  LED Lamp: Glb, 4 Watts, non-dimmable  LED Lamp: Glb, 3 Watts, non-dimmable  LED Lamp: Glb, 2 Watts, non-dimmable  LED Lamp: Glb, 1 Watts, non-dimmable | >=3 Watts Total Watts = 3.10 x Msr Watts  <3 Watts Total Watts = 4.68 x Msr Watts | * InGen-CFL | |
| **1.2 Technical Description** |  |
| Measures | Adopted PEAR database “2018Phase1ScrewInLampDisposition” measure description for A-lamps, PAR20, PAR30, PAR38, R/BR, Candelabra, and Globe types. |
| Code for All Measures | Halogen Incandescent or CFL A-lamp |
| Requirements | **A-Lamp requirements as of July 1, 2018:**   * Must replace an incandescent, incandescent halogen, or CFL A-lamp * Must be on the ENERGY STAR qualified product list and be listed with the Department of Energy Lighting Facts Program. * Close to or meets full CEC Spec by meeting the following requirements:   + Luminous Efficacy ≥ 80 Lumens per Watt till 12/31/2018   + Reported CCT of 2200K, 2500K, 2700K, 3000K, 3500K, 4000/4100K, 5000K, or 6500K   + Combined Efficacy Score (efficacy in LPW + 2.3 × CRI) ≥ 297\* (“best in lamp class and channel”)\*\*   + CRI ≥ 82 and individual color scores for R1-R8 ≥72   + R9 > 0   + Omnidirectional light distribution meeting ENERGY STAR version 2.0 requirement   + Chromaticity and color consistency meeting requirements of Table 1 of Annex B of ANSI C78.377-2015   + Rated life ≥ 15,000 hours   + Power Factor ≥ 0.7   + Standby Power ≤ 0.2 Watts. Lamps without integral controls shall not draw power in the off mode.   + If Manufacturer claims dimmability or incandescent equivalence, the product must meet the applicable California Quality Specification requirements for Product Packaging, flicker and noise * Must either be on THE ENERGY STAR Qualified Products List (QPL), or have begun ENERGY STAR Rated Life testing, and continue in testing until the product is accepted for the QPL. * Must be listed on the QPL within 9 months of the applicable IOU's allocation begin/confirmation date. Must be listed on the Department of Energy LED Lighting Facts Product List within 9 months of the applicable IOU's allocation begin/confirmation date. * Meets ENERGY STAR Plus lamp specifications, plus at least:   + Luminous Efficacy ≥ 80 Lumens per Watt for CRI < 90   + Combined Efficacy Score (efficacy in LPW + 2.3 × CRI) ≥ 297\* (“best in lamp class and channel”)\*\*   + CRI ≥ 82 and individual color scores for R1-R8 ≥72   + Chromaticity and color consistency meeting requirements of Table 1 of Annex B of ANSI C78.377-2015   + Power Factor ≥ 0.7   + Standby Power ≤ 0.2 Watts.   + If Manufacturer claims dimmability or incandescent equivalence, the product must meet the applicable California Quality Specification requirements for Product Packaging, flicker and noise   \* For Rebate Programs effective 1/1/2018, efficacy minimum is 80 LPW and combined efficacy score of 297.  \*\*Best in lamp class and channel - Utility managers will choose the products that are “best in class”. What represents “best in class” will change depending on the specific product and channel. Furthermore, channels with more choices of energy efficient lighting (i.e. large home improvement stores) will be held to a higher standard than other categories with fewer options (i.e. mom and pop hardware stores).  **R/BR requirements as of July 1, 2018**   * Must replace an incandescent or CFL R/BR lamp * Must be on the ENERGY STAR qualified product list and be listed with the Department of Energy Lighting Facts Program * Close to or meets full CEC Spec by having at least:   + CA beam shape requirements   + CCT of 2700K or 3000K   + CRI>=90   + R9>0 (“best in lamp class and channel”)\*   + Dimmable * Must either be on THE ENERGY STAR Qualified Products List (QPL), or have begun ENERGY STAR Rated * Life testing, and continue in testing until the product is accepted for the QPL. * Must be listed on the QPL within 9 months of the applicable IOU's allocation begin/confirmation * date. * Must be listed on the Department of Energy LED Lighting Facts Product List within 9 months of the applicable IOU's allocation begin/confirmation date.   **Meets ENERGY STAR Plus lamp specifications, plus at least:**   * + CA beam shape requirements   + CCT of 2700K or 3000K   + CRI>=80 (“best in lamp class and channel”)   + R9>0 (“best in lamp class and channel”)   + Dimmable * Must either be on THE ENERGY STAR Qualified Products List (QPL), or have begun ENERGY STAR Rated * Life testing, and continue in testing until the product is accepted for the QPL. * Must be listed on the QPL within 9 months of the applicable IOU's allocation begin/confirmation * date. * Must be listed on the Department of Energy LED Lighting Facts Product List within 9 months of the applicable IOU's allocation begin/confirmation date.   \*Best in lamp class and channel - Utility managers will choose the products that are “best in class”. What represents “best in class” will change depending on the specific product and channel. Thus, categories with a greater number of high-CRI products available (i.e. PARs and retrofit kits) will be held to a higher standard than other categories with fewer options (i.e. A-Lamps and BRs). Furthermore, channels with more choices of energy efficient lighting (i.e. large home improvement stores) will be held to a higher  standard than other categories with fewer options (i.e. mom and pop hardware stores). |
| **1.3 Installation Type and Delivery Mechanisms** |  |
| Installation Type | Replace on Burn-out (ROB) |
| Delivery Mechanisms | Upstream Incentives  Downstream Rebate  Direct Install |
| **1.4.1 DEER Data** |  |
| Net-to-Gross Ratio | In SDG&E/SCG bi-weekly call, the Commission Staff provided details to their PEAR database values, including new NTG values reflective of the screw-in disposition. These NTG IDs are used for both A-lamps, PARs, R-BR, Candelabra, and Globes LED Lamp types.  Expire on 6/30/2018   1. NonRes-sAll-mLEDARefl for nonresidential LED A-lamp and screw-in reflector, 0.91 2. Res-sAll-mLEDARefl for residential LED A-lamp and screw-in reflector, 0.91   Start on 7/1/2018   1. “All-Ltg-ScrwInLED” for all LED lamps and Can Retrofits, 0.91 |
| Effective and Remaining Useful Life | ILtg-Com-LED-20000hr; Varies based on READI linking  ILtg-Res-LED-20000hr; 16 years |
| **Section 2. Calculation Methodology** | Based on the March 1, 2018 screw-in lighting disposition, this table represents the minimum LPW requirement per EISA bin  **Table 1 – Minimum Efficacy Requirements**   |  |  |  | | --- | --- | --- | | **EISA Wattages (W)** | **2018 efficacy (LPW)** | **2019 efficacy (LPW)** | | 40 | 80 | 95 | | 60 | 90 | 100 | | 75 | 90 | 110 | | 100 | 90 | 110 |   Based on these requirements, the disposition generated revised savings at each new measure definition.  **Table 2 – Approved LED A-Lamp Measure Definitions**   |  |  |  | | --- | --- | --- | | EISA Bin | LPW | ∆Watts | | 40 | 80 | 0.7 | | 90 | 0.8 | | 100 | 1.0 | | 110 | 1.1 | | 120 | 1.5 | | 60 | 90 | 1.3 | | 100 | 1.3 | | 110 | 1.5 | | 120 | 1.8 | | 75 | 90 | 1.5 | | 100 | 1.7 | | 110 | 1.9 | | 120 | 2.3 | | 100 | 90 | 1.7 | | 100 | 2.0 | | 110 | 2.4 | | 120 | 2.6 | |
| Energy Savings/Peak Demand Reduction – All Measures | SDG&E adopts energy efficiency savings impacts (Kwh, Kw and therm) as specified in PEAR data base DEER Measures with Source Description = “2018Phase1ScrewInLampDisposition”. Refer to Ex-ante data tables entitled “20180501\_LED\_r2.accdb” for SDG&E Implementation adoption of DEER Measure IDs. |
| **Section 3. Load Shapes** | Varies – per READI linking |
| **Section 4. Costs** | All cost data was developed according to CPUC Energy Division Disposition and SDG&E adopts PG&E cost data as referenced herein in on page 2 Introduction.  All cost data is adopted from various PGE workpaper revisions:  1) PGECOLTG164 R7 LED Globes 2) PGECOLTG141 R9 LED PARs  3) PGECOLTG163 R7 LED Candelabra 4) PGECOLTG177 R6 R-BR  5) PGECOLTG165 R6 LED A19 |
| **Section 4.1 Base and Measure Costs** | **A-Lamps**   * Starting 7/1/2018 the baseline is revised to be 25% CFLs, 75% LEDs, and 25% halogens. * SDG&E adopts PG&E’s workpaper cost data from PGECOLTG165 R6 LED A19   **Reflector Lamps (PARs, BR/R)**   * 10% CFL, 40% LED and 50% incandescent. * SDG&E adopts PG&E’s workpaper cost data from PGECOLTG141 R9 LED PARs and PGECOLTG177 R6 R-BR.   **Globes and Candelabras**   * 5% CFL, 35% LED and 60% incandescent. * SDG&E adopts PG&Es workpaper cost data from PGECOLTG164 R7 LED Globes and PGECOLTG163 R7 LED Candelabra. |
|  | Cost IDs are included in the Ex-ante data cost table found in “20180501\_LED\_r2.accdb”. |
|  | See Excel Ex-ante data tables entitled “20180501\_LED\_r2.accdb” for SDG&E sourced cost documentation. |