Short Form Work Paper WPSDGENRLG0080

**Revision 5**

**San Diego Gas & Electric**

**Energy Efficiency Engineering**

**LED High-Bay and Low-Bay Fixtures**

**Implementation IDs: 467563-467586 (Delivery Type = UpDeemed)**

**467587-467610 (Delivery Type = DnDeemed)**

**467611-467634 (Delivery Type = DnDeemDI)**

**June 14, 2019**

# SDG&E LED High/Low Bay Fixtures Short Form Workpaper

## Introduction

This short form workpaper documents the adoption of PG&E’s interim approved High-Bay and Low-Bay Lighting workpaper (PGECOLTG178 Rev4) for calculating ex-ante savings impacts and cost-effectiveness values used for LED High-Bay and Low-Bay lighting fixtures. The delta watt savings and costs values have been adopted from PG&E’s ex-ante data tables and SDG&E has created specific energy impacts and cost records that are unique to SDG&E service territory.

Exceptions and Clarifications

1. SDG&E Ex-ante data includes “Com” building type, but all reporting shall be based on actual installation site building type and climate zone. SDG&E reporting will not include “Com” building type for claims purposes.
2. SDG&E is in the process of simplifying its internal Ex-ante data and tracking data warehouse. Part of that process requires that there be savings values for all potential climate zone and building type combinations, however, PG&E’s latest workpaper did not include statewide IOU impacts for all climate zone and building type permutations. As a remedy, SDG&E generated Ex-ante energy savings impacts to include all possible climate zones and building types, within SDG&E’s service territory. This includes generating records for ECC, EUn, Nrs, Hsp, and WRf building types that typically are missing climate zone 15, and also include climate zones 8 and 14 for WRf building type. SDG&E used DEER/PEAR support table “2016 Lighting Summary” for “Com-Indoor-HB” for interactive effects (IE), and adopted SCE interactive effects (IE) for ECC, EUn, Nrs, Hsp, and WRf, for climate zone 15, and climate zones 8 and 14 for WRf (building type).
3. SDG&E adopted PG&E labor and material costs and created separate Cost IDs for Measure Cost and Standard Cost. Refer to Section 4 for more details on costs.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| SDG&E MeasureID  WPSDGENRLG0080-Rev05-MsrXXX | Measure Description | Measure Cost ID | |  | | --- | | Standard Cost ID | | IMC |
| Rev05-Msr001 | InGen-HB-LED\_fixt-LED HighBay luminaire rated from 4500 to < 5400 lumens and >= 110 LPW and < 130 LPW | LEDFixt(45w)\_Msr | LEDFixt(58.4w)\_Std | $23.70 |
| Rev05-Msr002 | InGen-HB-LED\_fixt-LED HighBay luminaire rated from 5400 to < 6500 lumens and >= 110 LPW and < 130 LPW | LEDFixt(54.1w)\_Msr | LEDFixt(67.4w)\_Std | $23.58 |
| Rev05-Msr003 | LED HighBay luminaire rated from 6500 to < 7800 lumens and >= 110 LPW and < 130 LPW | LEDFixt(65w)\_Msr | LEDFixt(75.3w)\_Std | $17.90 |
| Rev05-Msr004 | LED HighBay luminaire rated from 7800 to < 9400 lumens and >= 110 LPW and < 130 LPW | LEDFixt(78.2w)\_Msr | LEDFixt(95.7w)\_Std | $27.67 |
| Rev05-Msr005 | LED HighBay luminaire rated from 9400 to < 11800 lumens and >= 110 LPW and < 130 LPW | LEDFixt(96.4w)\_Msr | LEDFixt(119.4w)\_Std | $33.48 |
| Rev05-Msr006 | LED HighBay luminaire rated from 11800 to < 14800 lumens and >= 110 LPW and < 130 LPW | LEDFixt(120.9w)\_Msr | LEDFixt(136.3w)\_Std | $31.39 |
| Rev05-Msr007 | LED HighBay luminaire rated from 14800 to < 18500 lumens and >= 120 LPW and < 130 LPW | LEDFixt(138.7w)\_Msr | LEDFixt(168.7w)\_Std | $47.45 |
| Rev05-Msr008 | LED HighBay luminaire rated from 18500 to < 23100 lumens and >= 120 LPW and < 130 LPW | LEDFixt(173.3w)\_Msr | LEDFixt(199w)\_Std | $37.31 |
| Rev05-Msr009 | LED HighBay luminaire rated from 23100 to < 30000 lumens and >= 125 LPW and < 135 LPW | LEDFixt(212.4w)\_Msr | LEDFixt(244.7w)\_Std | $59.50 |
| Rev05-Msr010 | LED HighBay luminaire rated from 30000 to < 39000 lumens and >= 125 LPW and < 135 LPW | LEDFixt(276w)\_Msr | LEDFixt(303w)\_Std | $41.65 |
| Rev05-Msr011 | LED HighBay luminaire rated from 39000 to < 50700 lumens and >= 125 LPW and < 135 LPW | LEDFixt(358.8w)\_Msr | LEDFixt(406.6w)\_Std | $64.09 |
| Rev05-Msr012 | LED HighBay luminaire rated from 50700 to < 65900 lumens and >= 125 LPW and < 135 LPW | LEDFixt(466.4w)\_Msr | LEDFixt(525.7w)\_Std | $99.39 |
| Rev05-Msr013 | LED HighBay luminaire rated from 4500 to < 5400 lumens and >= 130 LPW | LEDFixt(38.1w)\_Msr | LEDFixt(58.4w)\_Std | $35.32 |
| Rev05-Msr014 | LED HighBay luminaire rated from 5400 to < 6500 lumens and >= 130 LPW | LEDFixt(45.8w)\_Msr | LEDFixt(67.4w)\_Std | $36.86 |
| Rev05-Msr015 | LED HighBay luminaire rated from 6500 to < 7800 lumens and >= 130 LPW | LEDFixt(55w)\_Msr | LEDFixt(75.3w)\_Std | $36.23 |
| Rev05-Msr016 | LED HighBay luminaire rated from 7800 to < 9400 lumens and >= 130 LPW | LEDFixt(66.2w)\_Msr | LEDFixt(95.7w)\_Std | $25.50 |
| Rev05-Msr017 | LED HighBay luminaire rated from 9400 to < 11800 lumens and >= 130 LPW | LEDFixt(81.5w)\_Msr | LEDFixt(119.4w)\_Std | $61.50 |
| Rev05-Msr018 | LED HighBay luminaire rated from 11800 to < 14800 lumens and >= 130 LPW | LEDFixt(102.3w)\_Msr | LEDFixt(136.3w)\_Std | $28.34 |
| Rev05-Msr019 | LED HighBay luminaire rated from 14800 to < 18500 lumens and >= 130 LPW | LEDFixt(128.1w)\_Msr | LEDFixt(168.7w)\_Std | $45.42 |
| Rev05-Msr020 | LED HighBay luminaire rated from 18500 to < 23100 lumens and >= 130 LPW | LEDFixt(160w)\_Msr | LEDFixt(199w)\_Std | $68.20 |
| Rev05-Msr021 | LED HighBay luminaire rated from 23100 to < 30000 lumens and >= 135 LPW | LEDFixt(196.7w)\_Msr | LEDFixt(244.7w)\_Std | $72.90 |
| Rev05-Msr022 | LED HighBay luminaire rated from 30000 to < 39000 lumens and >= 135 LPW | LEDFixt(255.6w)\_Msr | LEDFixt(303w)\_Std | $75.10 |
| Rev05-Msr023 | LED HighBay luminaire rated from 39000 to < 50700 lumens and >= 135 LPW | LEDFixt(332.2w)\_Msr | LEDFixt(406.6w)\_Std | $73.86 |
| Rev05-Msr024 | LED HighBay luminaire rated from 50700 to < 65900 lumens and >= 135 LPW | LEDFixt(431.8w)\_Msr | LEDFixt(525.7w)\_Std | $133.96 |

## Document Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 3/1/2009 | Prepared By: Daryl DeJean, Project Manager/Emerging Technologies Associates, Inc  A. Y. Ahmed/San Diego Gas and Electric | Emerging Technologies Program Application Assessment Report |
| **1** | **7/1/2009** | Lucie Sidibe /SDGE | 1. Run hours was reduced to accommodate for Deer 08 changes 2. Saving calculation was redone to include interactive effect and negative therm data 3. Demand Saving was corrected by adding the coincidence demand factor 4. NTG was adjusted to support Deer08 update |
| 2 | 3/24/2014 | Judelson Enriquez/RMS | 1. Original work paper template for 2013-2014 program cycle. Adopted from PG&E Work paper PGECOLTG178 rev0. 2. Created using updated format and referenced workpaper WPSDGENRLG0999 instead of attaching calculation sheet. 3. Added Measures table with product codes and measure requirements, DEER Difference Summary table, Code Summary table, EUL ID table, NTG ID table, and GSIA ID table. 4. Added Measure Wattage Summary table using values derived from PG&E’s workpaper calculation file; utilized Energy Division’s (ED) technology codes if values existed. 5. Added Building Types and Load Shapes table to match PG&E’s workpaper calculation file. 6. Updated PGE’s cost sheet using SDG&E’s DEER Material and Labor cost multipliers. 7. Added Product Code for 59 W 2L Fluorescent to 2x2 22 W – 39 W LED fixture |
| 3 | 6/25/2014 | Judelson Enriquez/RMS | Incorporated measure wattages from May 30, 2014 lighting disposition and updated to new DEER2014 IE/hours of operation methodology approach. |
| 3.1 | 11/14/2014 | Charles Harmstead/SDG&E | Updated High-bay and low-bay cost sheet for Product codes LM-11 and LM-21 |
| 4 | 6/1/2018 | Eduardo Reynoso/ SDG&E | 1. Adopted Short Form workpaper template for adopting DEER database data values for pure PEAR measures, impacts and cost. 2. Updated LED lighting fixtures requirements to align with PG&E workpaper (PGECOLGT178 Revision 3, LED High-Bay and Low-Bay Fixtures) interim solution for High-Bay /Low Bay. 3. Updated SDG&E’s Implementations based on the CPUC Energy Division Disposition for High-Bay and Low-Bay interim approval. Adopted DEEER PEAR database Measures IDs and Cost IDs. |
| 5 | 6/14/2019 | Eduardo Reynoso/ SDG&E | 1. Updated Measure Application Type per CPUC Resolution E-4952/E-4818. 2. Updated measures definitions to align with PG&E’s latest workpaper revision (PGECOLTG1178 Revision 4), for adding TLED lamps in the baseline savings and cost. 3. Removed legacy “sunset” measures and ex-ante data records, to align with CPUC lighting disposition (dated May 13, 2019) and Resolution E-4952. 4. Adopted and created new measure definitions based on lumen bins per fixture structure, to align with PG&E’s latest workpaper revision. 5. SDG&E to sunset all legacy ex-ante data by 7/31/2019, associated with previous workpaper revision. 6. SDG&E workpaper (WPSDGENRLG0080 Revision 5) and ex-ante data, for given submission, has an effective start date of 8/1/2019 and expiry date of 12/31/2019. 7. Adopted PG&E’s delta watts calculations methodology for LED High/Low Bay lighting fixtures, as stated in CPUC Staff disposition dated May 13, 2019 for PGECOLTG178 Rev4. A total of 3,888 new Impact records have been generated using DEER/PEAR lighting support tables for 2016 Commercial Lighting “Com-Indoor-HB” interactive effects tables. 8. Adopted PG&E measure and standard cost values and created new SDG&E Measure and Standard Cost IDs. 9. SDG&E created new Implementations IDs:   467563-467586 (Delivery Type = UpDeemed)  467587-467610 (Delivery Type = DnDeemed)  467611-467634 (Delivery Type = DnDeemDI) |

**Catalog Description**

*Light Emitting Diode (LED) High-Bay and Low-bay Lighting*

Requirements:

* Must replace a lumen equivalent lamp/fixture of higher wattage. (Please refer to Table 1)
* Must be on the Design Lights Consortium (DLC) qualified product list (QPL).
* Technical Requirements table under the General Category “High Bay” and under the Primary Use Designations as follow:
  + High-Bay Aisle Luminaires
  + High-Bay Luminaires for Commercial and Industrial Buildings
  + Low-Bay Luminaires for Commercial and Industrial Buildings
  + Retrofit Kits for High-Bay Luminaires for Commercial and Industrial Buildings
  + Retrofit Kits for Low-Bay Luminaires for Commercial and Industrial Buildings

Measure Offering Restrictions are as follows:

* + Fixtures listed under specialty categories on the DLC QPL do not qualify for the deemed rebate.
  + Horticultural installations do not qualify for this rebate.
  + Exterior installations do not qualify for this rebate.
  + Self-ballasted screw-based lamps do not qualify.
  + Must meet the minimum efficacy and wattage range listed for the appropriate measure codes in Table 1.

|  |  |  |  |
| --- | --- | --- | --- |
| Table 1 - LED High-Bay and Low-Bay Fixtures Base and Measure Wattages | | | |
| **\* PG&E Code** | **SDG&E Msr ID** | **Measure Description** | **Standard Base Description** |
| LT514 | Rev05-Msr001 | LED HighBay luminaire rated from 4500 to < 5400 lumens and >= 110 LPW and < 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy |
| LT515 | Rev05-Msr002 | LED HighBay luminaire rated from 5400 to < 6500 lumens and >= 110 LPW and < 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy |
| LT516 | Rev05-Msr003 | LED HighBay luminaire rated from 6500 to < 7800 lumens and >= 110 LPW and < 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy |
| LT517 | Rev05-Msr004 | LED HighBay luminaire rated from 7800 to < 9400 lumens and >= 110 LPW and < 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy |
| LT518 | Rev05-Msr005 | LED HighBay luminaire rated from 9400 to < 11800 lumens and >= 110 LPW and < 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy |
| LT519 | Rev05-Msr006 | LED HighBay luminaire rated from 11800 to < 14800 lumens and >= 110 LPW and < 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy |
| LT520 | Rev05-Msr007 | LED HighBay luminaire rated from 14800 to < 18500 lumens and >= 120 LPW and < 130 LPW | 10 Pct LF Fixt & 10Pct TLED & 80Pct LED 25th Percentile Efficacy |
| LT521 | Rev05-Msr008 | LED HighBay luminaire rated from 18500 to < 23100 lumens and >= 120 LPW and < 130 LPW | 10 Pct LF Fixt & 10Pct TLED & 80Pct LED 25th Percentile Efficacy |
| LT522 | Rev05-Msr009 | LED HighBay luminaire rated from 23100 to < 30000 lumens and >= 125 LPW and < 135 LPW | 10 Pct LF Fixt & 10Pct TLED & 80Pct LED 25th Percentile Efficacy |
| LT523 | Rev05-Msr010 | LED HighBay luminaire rated from 30000 to < 39000 lumens and >= 125 LPW and < 135 LPW | 100Pct LED 25th percentile Efficacy |
| LT524 | Rev05-Msr011 | LED HighBay luminaire rated from 39000 to < 50700 lumens and >= 125 LPW and < 135 LPW | 100Pct LED 25th percentile Efficacy |
| LT525 | Rev05-Msr012 | LED HighBay luminaire rated from 50700 to < 65900 lumens and >= 125 LPW and < 135 LPW | 100Pct LED 25th percentile Efficacy |
| LT526 | Rev05-Msr013 | LED HighBay luminaire rated from 4500 to < 5400 lumens and >= 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy |
| LT527 | Rev05-Msr014 | LED HighBay luminaire rated from 5400 to < 6500 lumens and >= 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy |
| LT528 | Rev05-Msr015 | LED HighBay luminaire rated from 6500 to < 7800 lumens and >= 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy |
| LT529 | Rev05-Msr016 | LED HighBay luminaire rated from 7800 to < 9400 lumens and >= 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy |
| LT530 | Rev05-Msr017 | LED HighBay luminaire rated from 9400 to < 11800 lumens and >= 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy |
| LT531 | Rev05-Msr018 | LED HighBay luminaire rated from 11800 to < 14800 lumens and >= 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy |
| LT532 | Rev05-Msr019 | LED HighBay luminaire rated from 14800 to < 18500 lumens and >= 130 LPW | 10Pct LF Fixt & 10Pct TLED & 80Pct LED 25th Percentile Efficacy |
| LT533 | Rev05-Msr020 | LED HighBay luminaire rated from 18500 to < 23100 lumens and >= 130 LPW | 10Pct LF Fixt & 10Pct TLED & 80Pct LED 25th Percentile Efficacy |
| LT534 | Rev05-Msr021 | LED HighBay luminaire rated from 23100 to < 30000 lumens and >= 135 LPW | 10Pct LF Fixt & 10Pct TLED & 80Pct LED 25th Percentile Efficacy |
| LT535 | Rev05-Msr022 | LED HighBay luminaire rated from 30000 to < 39000 lumens and >= 135 LPW | 100Pct LED 25th percentile Efficacy |
| LT536 | Rev05-Msr023 | LED HighBay luminaire rated from 39000 to < 50700 lumens and >= 135 LPW | 100Pct LED 25th percentile Efficacy |
| LT537 | Rev05-Msr024 | LED HighBay luminaire rated from 50700 to < 65900 lumens and >= 135 LPW | 100Pct LED 25th percentile Efficacy |
| Note: 1) \* The PGE Measures Code are provided so the reader can cross reference the measures description between utilities. 2) Norm Units are per Fixture. | | | |

*\* +/-10% tolerance is applied on the minimum light output as per DLC technical requirements V4.3*

***Program Restrictions and Guidelines***

This work paper details the savings associated with implementation of energy efficient LED High-Bay/Low-Bay fixtures and retrofit kits. The delivery methods allowed include Downstream, Midstream, and Direct Install Programs for non-residential customers.

The LED fixture or retrofit kit must be meet the most recent version requirements listed on Design Lights Consortium Qualified Product List (QPL), at the time of installation, under the General Category “High Bay” and under the Primary Use Designations as follow

* High-Bay Aisle Luminaires
* High-Bay Luminaires for Commercial and Industrial Buildings
* Low-Bay Luminaires for Commercial and Industrial Buildings
* Retrofit Kits for High-Bay Luminaires for Commercial and Industrial Buildings
* Retrofit Kits for Low-Bay Luminaires for Commercial and Industrial Buildings

DLC Standard requirements for the high-bay and low-bay categories include:

* 5-year warranty
* 50,000-hour L70 Lumen Maintenance
* ≥ 70 Color Rendering Index (CRI)
* ≥ 110 lumens/Watt (LPW)\*

DLC Premium requirements for the high-bay and low-bay categories include:

* 5-year warranty
* 36,000/50,000-hour L90/L70 Lumen Maintenance
* ≥ 70 Color Rendering Index (CRI)
* ≥ 130 Lumens/Watt (LPW)\*
* ≤ 5700 Kelvin Correlated Color Temperature (CCT)
* ≥ 5,000 Lumen light output +/- 10% (applied to minimum light output only)

\*Specific measure case efficacy requirements listed in measure code descriptions in Table 1.

**Terms and Conditions:**

The customer must be a non-residential SDG&E electric customer.

**Market Applicability:**

The customer must be a non-residential SDG&E electric customer.

## As cited by PG&E workpaper (PGECOLTG178 R4 High-Bay and Low-Bay Fixtures) and adopted in sdg&e workpaper wpsdgenrlg0080 rev5.

## Technical Description

The following is a short excerpt from the CALiPER Snapshot for Industrial Luminaires[[1]](#endnote-1) that gives a high-level overview:

*“Industrial” luminaires are prevalent in both the commercial and industrial sectors, providing economical ambient lighting in large, open indoor spaces such as warehouses, manufacturing facilities, and big-box retail stores.  Industrial luminaires are divided into two categories: low-bay and high-bay. Typically, low-bay fixtures are used for heights up to 20 feet, whereas high-bay fixtures are used where ceilings exceed 20 feet. Given the space demands, high-lumen-output luminaires are required, with low-bay options typically emitting between 5,000 and 20,000 lumens per fixture and high-bay options emitting between 15,000 and 100,000 lumens per fixture.*

Historically, high-bay fixtures have used high-intensity discharge (HID) lamps (e.g., metal halide and high-pressure sodium) as the predominant light source, and low-bay fixtures have traditionally used both HID and fluorescent light source. Linear fluorescent high-output systems (e.g. T5/HO or F32T8 with VHLO ballasts) became a popular energy-efficiency measure in the early 2000’s for both high and low bay fixtures due to their superior lumen maintenance, lack of restrike delay, and ability to switch with occupancy sensors.

Light emitting diodes (LEDs) first entered this market circa 2009 but early-generation LED high-bay luminaires lacked the lumen output to compete in the market.  LEDs have since improved significantly making them an efficient and reliable lighting technology successfully replacing many lighting sources. Improvements in LED performance makes LED an ideal replacement of HID and fluorescent light fixtures.

Though only 6% of all industrial luminaire installations were LED in 2015, market penetration is expected to grow to 86% by 2035. According to LED Lighting Facts, by 2014 LED efficacy had surpassed the HID and fluorescent technology with very competitive pricing.  LED Lighting Facts currently lists more than 8,000 industrial products, “41% of which emit between 5,000 and 15,000 lumens and 55% of which emit more than 15,000 lumens.” About “168 LED retrofit kits for these applications are currently listed with Lighting Facts.” A majority of listed industrial fixtures have comparable lumen output and higher luminous efficacy than their metal halide and fluorescent counterparts. “And in terms of color quality and power quality, LED industrial fixtures almost all offer the same performance as their metal halide and fluorescent counterparts.”

LED fixtures under this workpaper are assigned a measure code according to efficacy and wattage, which describes the energy savings associated with their replacement of linear fluorescent fixtures and less efficient LED fixtures.

Measure Summary

Table 1: Measure Summary Table

| **Section** | **Value** |
| --- | --- |
| **Summary & Purpose** | This short form workpaper documents ex-ante load impacts and cost-effectiveness values for LED High/Low Bay Lighting Fixtures. All measure, impact and cost parameters have been adopted by SDG&E, from interim approved PG&E workpaper PGECOLTG178 Rev4 E as noted in this short form workpaper. |
| **1.1 Measure & Baseline Data** | SDG&E adopted the following interim approved measures descriptions as stated per 2019 May 13 CPUC Energy Disposition for High-Bay and Low-Bay.   |  |  |  | | --- | --- | --- | |  |  | | | High-Bay and Low-Bay LED Measures | | | | SDG&E Measure ID | Measure Description | Standard Base Description | | Rev05-Msr001 | LED HighBay luminaire rated from 4500 to < 5400 lumens and >= 110 LPW and < 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy | | Rev05-Msr002 | LED HighBay luminaire rated from 5400 to < 6500 lumens and >= 110 LPW and < 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy | | Rev05-Msr003 | LED HighBay luminaire rated from 6500 to < 7800 lumens and >= 110 LPW and < 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy | | Rev05-Msr004 | LED HighBay luminaire rated from 7800 to < 9400 lumens and >= 110 LPW and < 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy | | Rev05-Msr005 | LED HighBay luminaire rated from 9400 to < 11800 lumens and >= 110 LPW and < 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy | | Rev05-Msr006 | LED HighBay luminaire rated from 11800 to < 14800 lumens and >= 110 LPW and < 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy | | Rev05-Msr007 | LED HighBay luminaire rated from 14800 to < 18500 lumens and >= 120 LPW and < 130 LPW | 10 Pct LF Fixt & 10Pct TLED & 80Pct LED 25th Percentile Efficacy | | Rev05-Msr008 | LED HighBay luminaire rated from 18500 to < 23100 lumens and >= 120 LPW and < 130 LPW | 10 Pct LF Fixt & 10Pct TLED & 80Pct LED 25th Percentile Efficacy | | Rev05-Msr009 | LED HighBay luminaire rated from 23100 to < 30000 lumens and >= 125 LPW and < 135 LPW | 10 Pct LF Fixt & 10Pct TLED & 80Pct LED 25th Percentile Efficacy | | Rev05-Msr010 | LED HighBay luminaire rated from 30000 to < 39000 lumens and >= 125 LPW and < 135 LPW | 100Pct LED 25th percentile Efficacy | | Rev05-Msr011 | LED HighBay luminaire rated from 39000 to < 50700 lumens and >= 125 LPW and < 135 LPW | 100Pct LED 25th percentile Efficacy | | Rev05-Msr012 | LED HighBay luminaire rated from 50700 to < 65900 lumens and >= 125 LPW and < 135 LPW | 100Pct LED 25th percentile Efficacy | | Rev05-Msr013 | LED HighBay luminaire rated from 4500 to < 5400 lumens and >= 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy | | Rev05-Msr014 | LED HighBay luminaire rated from 5400 to < 6500 lumens and >= 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy | | Rev05-Msr015 | LED HighBay luminaire rated from 6500 to < 7800 lumens and >= 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy | | Rev05-Msr016 | LED HighBay luminaire rated from 7800 to < 9400 lumens and >= 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy | | Rev05-Msr017 | LED HighBay luminaire rated from 9400 to < 11800 lumens and >= 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy | | Rev05-Msr018 | LED HighBay luminaire rated from 11800 to < 14800 lumens and >= 130 LPW | 20Pct LF Fixt & 20Pct TLED and 60Pct LED 25th percentile Efficacy | | Rev05-Msr019 | LED HighBay luminaire rated from 14800 to < 18500 lumens and >= 130 LPW | 10Pct LF Fixt & 10Pct TLED & 80Pct LED 25th Percentile Efficacy | | Rev05-Msr020 | LED HighBay luminaire rated from 18500 to < 23100 lumens and >= 130 LPW | 10Pct LF Fixt & 10Pct TLED & 80Pct LED 25th Percentile Efficacy | | Rev05-Msr021 | LED HighBay luminaire rated from 23100 to < 30000 lumens and >= 135 LPW | 10Pct LF Fixt & 10Pct TLED & 80Pct LED 25th Percentile Efficacy | | Rev05-Msr022 | LED HighBay luminaire rated from 30000 to < 39000 lumens and >= 135 LPW | 100Pct LED 25th percentile Efficacy | | Rev05-Msr023 | LED HighBay luminaire rated from 39000 to < 50700 lumens and >= 135 LPW | 100Pct LED 25th percentile Efficacy | | Rev05-Msr024 | LED HighBay luminaire rated from 50700 to < 65900 lumens and >= 135 LPW | 100Pct LED 25th percentile Efficacy | |
| **1.2 Technical Description** | Refer to Technical Description page 9 located herein by reference and per PG&E workpaper (PGECOLTG178 Rev4 High-Bay and Low Bay Fixtures). |
| Requirements | As referenced herein on pages 6-8 and per PG&E workpaper (PGECOLTG178 Rev4 High-Bay and Low Bay Fixtures). |
| Measures | As stated per CPUC Energy Division’s Disposition for “High-Bay and Low-Bay Interim approval of PGE Workpaper PGECOLTG178 Revision 4” released on May 7, 2018.  *“Disposition Approving Pacific Gas & Electric ’s LED High‐Bay and Low‐Bay Fixtures Workpaper  PGECOLTG178 Rev 4 “* |
| Code for All Measures | As stated per PG&E workpaper (PGECOLTG178 R3 High-Bay and Low-Bay Fixtures)  ***Title 20:*** The ballast efficiencies of metal halide lighting systems are regulated under 2016 Title 20 Appliance Efficiency Regulations, section 1605.3(n)[[2]](#endnote-2), but these products have been entirely removed from the base case of this workpaper.  ***Title 24:*** Neither the source technology nor the fixture selection for these measures falls under Title 24 [2016] [[3]](#endnote-3) of the California Energy Regulations. However, the Lighting Power Densities (LPD) in watts/ square feet of both measure and base case are capped by Title 24. Given the enormous range in high bay spacing, with 25 and 30 foot spacing possible, any eligible fixture under this measure (capped at 283 W/fixture) could meet appropriate LPDs listed in Table 140.6-C of Title 24. The bases of the 2016 standards for high and low bay occupancies are pulse start metal halide.  The 2019 Title 24 standards will be based on all LED designs.  ***Federal Standards:*** These measure case fixtures do not fall under Federal DOE or EPA Energy Regulations. Metal Halide fixtures are no longer part of this workpaper base case mix. |
| **1.3 Installation Type and Delivery Mechanisms** |  |
| Installation Type | * Normal Replacement (NR) |
| Delivery Mechanisms | * DnDeemed - Downstream Rebate – Deemed * DnDeemDI – Downstream Direct Install - Deemed * UpDeemed – Upstream /Midstream - Deemed   Notes   1. SDG&E Business Energy Solution (BES) program contracts with third party implementers for the installation of these measures. The customer participation includes a copay and financial incentive buy-down. The delivery type has been determined to be “DnDeemed” due to customer copay to third party implementer. Traditionally this program is eligible for Direct Install delivery method absent a customer copay option. 2. SDG&E Mid-Stream Lighting Programs (3223L, 3233L and 3239L) has contracted with local Lighting Distributors to provide a discounted luminaire (incentive to others) for providing customer site address and customer utility account. The end-use customer to benefit from a discounted luminaire given that customer information is being collected. The Delivery Type has been determined to be a Mid-Stream with Delivery Type = “UpDeemed” solution for the given case mentioned. |
| **1.4.1 DEER Data** |  |
| Net-to-Gross Ratio  GSIA Value | NTG ID: Com-InHB-Ltg-LEDFixt (0.91)   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | NTG\_Measure\_Type | NTGR\_kWh | NTGR\_therm | BldgType | BldgVint | NTG\_Qualifier | | Commercial Interior Hi/Low Bay LED Fixtures, For NR, ROB and NC Measure Application Types only. Not applicable to ER or AR | 0.91 | 0.91 | Any | Any | For NR, ROB and NC Measure Application Types only. Not applicable to ER or AR |   GSIA ID: Def-GSIA (GSIA =1.0) |
| Effective and Remaining Useful Life | EUL/RUL IDs:   |  |  | | --- | --- | | Technology | EUL ID | | High-Bay | ILtg-Com-LED-50000hr | | Low-Bay | ILtg-Com-LED-50000hr | |
| **Section 2. Calculation Methodology** | Measures will be processed using SDG&E’s unique Impact IDs, Implementation IDs by building type and Building Location. All measure claims will be processed and claimed using “Existing” vintage. |
| Energy Savings/Peak Demand Reduction – All Measures | Adopted PG&E’s delta watts calculations methodology for LED High/Low Bay lighting fixtures, as stated in CPUC Staff disposition dated May 13, 2019 for PGECOLTG178 Rev4. A total of 3,888 new Impact records have been generated using DEER/PEAR lighting support tables for 2016 Commercial Lighting “Com-Indoor-HB” interactive effects tables. For more information, please refer to ex-ante data table submission.  Electrical Energy (**∆**Watts/fixture) Savings formula:    Annual Energy Savings calculation:    Demand Reduction calculation:    Annual Gas Savings calculation: |
| **Section 3. Load Shapes** | ElecImpactProfile: “DEER:Com:Indoor\_Non-CFL\_Ltg” (DEER)  GasImpact Profile ID: “Annual” |
| **Section 4. Costs** |  |
| **Section 4.1 Modeled Costs** |  |
| Standard Base Cost | |  |  |  |  | | --- | --- | --- | --- | | SDGE  Measure ID | Measure Description | Standard  Base Cost ID | Nominal  Standard Cost  (labor + material)  [labor/fixture = $187.14] | | Rev05-Msr001 | LED HighBay luminaire rated from 4500 to < 5400 lumens and >= 110 LPW and < 130 LPW | LEDFixt(58.4w)\_Std | $382.37 | | Rev05-Msr002 | LED HighBay luminaire rated from 5400 to < 6500 lumens and >= 110 LPW and < 130 LPW | LEDFixt(67.4w)\_Std | $331.79 | | Rev05-Msr003 | LED HighBay luminaire rated from 6500 to < 7800 lumens and >= 110 LPW and < 130 LPW | LEDFixt(75.3w)\_Std | $349.10 | | Rev05-Msr004 | LED HighBay luminaire rated from 7800 to < 9400 lumens and >= 110 LPW and < 130 LPW | LEDFixt(95.7w)\_Std | $390.33 | | Rev05-Msr005 | LED HighBay luminaire rated from 9400 to < 11800 lumens and >= 110 LPW and < 130 LPW | LEDFixt(119.4w)\_Std | $369.73 | | Rev05-Msr006 | LED HighBay luminaire rated from 11800 to < 14800 lumens and >= 110 LPW and < 130 LPW | LEDFixt(136.3w)\_Std | $429.49 | | Rev05-Msr007 | LED HighBay luminaire rated from 14800 to < 18500 lumens and >= 120 LPW and < 130 LPW | LEDFixt(168.7w)\_Std | $460.90 | | Rev05-Msr008 | LED HighBay luminaire rated from 18500 to < 23100 lumens and >= 120 LPW and < 130 LPW | LEDFixt(199w)\_Std | $525.83 | | Rev05-Msr009 | LED HighBay luminaire rated from 23100 to < 30000 lumens and >= 125 LPW and < 135 LPW | LEDFixt(244.7w)\_Std | $567.40 | | Rev05-Msr010 | LED HighBay luminaire rated from 30000 to < 39000 lumens and >= 125 LPW and < 135 LPW | LEDFixt(303w)\_Std | $583.96 | | Rev05-Msr011 | LED HighBay luminaire rated from 39000 to < 50700 lumens and >= 125 LPW and < 135 LPW | LEDFixt(406.6w)\_Std | $650.17 | | Rev05-Msr012 | LED HighBay luminaire rated from 50700 to < 65900 lumens and >= 125 LPW and < 135 LPW | LEDFixt(525.7w)\_Std | $696.15 | | Rev05-Msr013 | LED HighBay luminaire rated from 4500 to < 5400 lumens and >= 130 LPW | LEDFixt(58.4w)\_Std | $382.37 | | Rev05-Msr014 | LED HighBay luminaire rated from 5400 to < 6500 lumens and >= 130 LPW | LEDFixt(67.4w)\_Std | $331.79 | | Rev05-Msr015 | LED HighBay luminaire rated from 6500 to < 7800 lumens and >= 130 LPW | LEDFixt(75.3w)\_Std | $349.10 | | Rev05-Msr016 | LED HighBay luminaire rated from 7800 to < 9400 lumens and >= 130 LPW | LEDFixt(95.7w)\_Std | $390.33 | | Rev05-Msr017 | LED HighBay luminaire rated from 9400 to < 11800 lumens and >= 130 LPW | LEDFixt(119.4w)\_Std | $369.73 | | Rev05-Msr018 | LED HighBay luminaire rated from 11800 to < 14800 lumens and >= 130 LPW | LEDFixt(136.3w)\_Std | $429.49 | | Rev05-Msr019 | LED HighBay luminaire rated from 14800 to < 18500 lumens and >= 130 LPW | LEDFixt(168.7w)\_Std | $460.90 | | Rev05-Msr020 | LED HighBay luminaire rated from 18500 to < 23100 lumens and >= 130 LPW | LEDFixt(199w)\_Std | $525.83 | | Rev05-Msr021 | LED HighBay luminaire rated from 23100 to < 30000 lumens and >= 135 LPW | LEDFixt(244.7w)\_Std | $567.40 | | Rev05-Msr022 | LED HighBay luminaire rated from 30000 to < 39000 lumens and >= 135 LPW | LEDFixt(303w)\_Std | $583.96 | | Rev05-Msr023 | LED HighBay luminaire rated from 39000 to < 50700 lumens and >= 135 LPW | LEDFixt(406.6w)\_Std | $650.17 | | Rev05-Msr024 | LED HighBay luminaire rated from 50700 to < 65900 lumens and >= 135 LPW | LEDFixt(525.7w)\_Std | $696.15 | |
| Measure Cost and IMC | All costs are adopted from PGE interim approved workpaper (PGECOLTG178 Revision 4) per May 13, 2019 CPUC Energy Division Lighting Disposition for High-Bay and Low-Bay.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | SDGE  Measure ID | Measure Description | Measure Cost ID | Full Measure Cost (FMC = labor + material)  [labor/fixture = $187.14] | Incremental Measure Cost (IMC) | | Rev05-Msr001 | LED HighBay luminaire rated from 4500 to < 5400 lumens and >= 110 LPW and < 130 LPW | LEDFixt(45w)\_Msr | $406.07 | $23.70 | | Rev05-Msr002 | LED HighBay luminaire rated from 5400 to < 6500 lumens and >= 110 LPW and < 130 LPW | LEDFixt(54.1w)\_Msr | $355.37 | $23.58 | | Rev05-Msr003 | LED HighBay luminaire rated from 6500 to < 7800 lumens and >= 110 LPW and < 130 LPW | LEDFixt(65w)\_Msr | $367.01 | $17.90 | | Rev05-Msr004 | LED HighBay luminaire rated from 7800 to < 9400 lumens and >= 110 LPW and < 130 LPW | LEDFixt(78.2w)\_Msr | $418.01 | $27.67 | | Rev05-Msr005 | LED HighBay luminaire rated from 9400 to < 11800 lumens and >= 110 LPW and < 130 LPW | LEDFixt(96.4w)\_Msr | $403.21 | $33.48 | | Rev05-Msr006 | LED HighBay luminaire rated from 11800 to < 14800 lumens and >= 110 LPW and < 130 LPW | LEDFixt(120.9w)\_Msr | $460.88 | $31.39 | | Rev05-Msr007 | LED HighBay luminaire rated from 14800 to < 18500 lumens and >= 120 LPW and < 130 LPW | LEDFixt(138.7w)\_Msr | $508.35 | $47.45 | | Rev05-Msr008 | LED HighBay luminaire rated from 18500 to < 23100 lumens and >= 120 LPW and < 130 LPW | LEDFixt(173.3w)\_Msr | $563.14 | $37.31 | | Rev05-Msr009 | LED HighBay luminaire rated from 23100 to < 30000 lumens and >= 125 LPW and < 135 LPW | LEDFixt(212.4w)\_Msr | $626.90 | $59.50 | | Rev05-Msr010 | LED HighBay luminaire rated from 30000 to < 39000 lumens and >= 125 LPW and < 135 LPW | LEDFixt(276w)\_Msr | $625.62 | $41.65 | | Rev05-Msr011 | LED HighBay luminaire rated from 39000 to < 50700 lumens and >= 125 LPW and < 135 LPW | LEDFixt(358.8w)\_Msr | $714.26 | $64.09 | | Rev05-Msr012 | LED HighBay luminaire rated from 50700 to < 65900 lumens and >= 125 LPW and < 135 LPW | LEDFixt(466.4w)\_Msr | $795.54 | $99.39 | | Rev05-Msr013 | LED HighBay luminaire rated from 4500 to < 5400 lumens and >= 130 LPW | LEDFixt(38.1w)\_Msr | $417.69 | $35.32 | | Rev05-Msr014 | LED HighBay luminaire rated from 5400 to < 6500 lumens and >= 130 LPW | LEDFixt(45.8w)\_Msr | $368.65 | $36.86 | | Rev05-Msr015 | LED HighBay luminaire rated from 6500 to < 7800 lumens and >= 130 LPW | LEDFixt(55w)\_Msr | $385.33 | $36.23 | | Rev05-Msr016 | LED HighBay luminaire rated from 7800 to < 9400 lumens and >= 130 LPW | LEDFixt(66.2w)\_Msr | $415.84 | $25.50 | | Rev05-Msr017 | LED HighBay luminaire rated from 9400 to < 11800 lumens and >= 130 LPW | LEDFixt(81.5w)\_Msr | $431.23 | $61.50 | | Rev05-Msr018 | LED HighBay luminaire rated from 11800 to < 14800 lumens and >= 130 LPW | LEDFixt(102.3w)\_Msr | $457.83 | $28.34 | | Rev05-Msr019 | LED HighBay luminaire rated from 14800 to < 18500 lumens and >= 130 LPW | LEDFixt(128.1w)\_Msr | $506.32 | $45.42 | | Rev05-Msr020 | LED HighBay luminaire rated from 18500 to < 23100 lumens and >= 130 LPW | LEDFixt(160w)\_Msr | $594.04 | $68.20 | | Rev05-Msr021 | LED HighBay luminaire rated from 23100 to < 30000 lumens and >= 135 LPW | LEDFixt(196.7w)\_Msr | $640.30 | $72.90 | | Rev05-Msr022 | LED HighBay luminaire rated from 30000 to < 39000 lumens and >= 135 LPW | LEDFixt(255.6w)\_Msr | $659.07 | $75.10 | | Rev05-Msr023 | LED HighBay luminaire rated from 39000 to < 50700 lumens and >= 135 LPW | LEDFixt(332.2w)\_Msr | $724.03 | $73.86 | | Rev05-Msr024 | LED HighBay luminaire rated from 50700 to < 65900 lumens and >= 135 LPW | LEDFixt(431.8w)\_Msr | $830.11 | $133.96 | |  | | | | | |

1. [↑](#endnote-ref-1)
2. [↑](#endnote-ref-2)
3. [↑](#endnote-ref-3)