



Energy Solutions

LED Accelerator Program

PRODUCT QUALIFICATION REQUIREMENTS

2017

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Prepared for

Pacific Gas and Electric Company
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Prepared by

Energy Solutions
449 15th Street, Suite 400
Oakland, California 94612
510-482-4420

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1. Summary

1.1 LED Accelerator Program

The Energy Solutions LED Accelerator Program (LEDA) is a Third Party program funded through the Pacific Gas and Electric Company (PG&E) which serves large multisite commercial businesses receiving electric service from PG&E, with a particular emphasis on retail, retail affiliated garages, offices, grocery, restaurants, warehouses, banks and medical offices.

1.2 Measures

LEDA incents the following measures:

- A. MR Lamps
- B. PAR Lamps
- C. LED Omnidirectional Lamps
- D. Track Mono-point
- E. Recessed Downlights
- F. Linear Ambient direct/indirect
- G. Highbays
- H. Lowbays
- I. Outdoor Parking Lot
- J. Outdoor Wall Mounted
- K. Outdoor Flood and Spot*
- L. Outdoor pole mounted*
- M. Parking Garage
- N. UL Type C 4' LED Tubes
- O. Controls – Daylighting
- P. Controls – Occupancy Sensors
- Q. Controls – Timeclock/Scheduling
- R. Controls – Task Tuning
- S. Controls – Install Lighting EMS
- T. Controls – Demand Response
- U. Controls – Networked Controls
- V. Controls – Embedded Controls
- W. Controls – HVAC Controls on Lighting System
- X. OLEDs

Other LED technologies must be approved by PG&E program manager

** Exterior lighting is eligible only with networked lighting controls. Exterior lighting projects that include affiliated retail stores takes precedence over other exterior lighting projects.*

1.3 Incentive Calculations

LEDA provides incentives for LED retrofits based on first-year kilowatt-hour (kWh) energy savings, and kilowatt (kW) demand savings associated with the eligible retrofit measures. The kWh savings are calculated by taking the difference between wattages of the existing fixtures or lamps and their LED replacements and multiplying the difference by the average hours for the project building type (DEER). The kW savings are calculated as the difference between the Title 24 baseline (or existing kW baseline) and the retrofit kW.

Interactive effects are the impacts on other energy-using systems as a result of switching to more efficient lighting technologies. LEDs emit less heat than CFLs or incandescent lights because they are much more efficient at converting electricity into visible light. Therefore, buildings that are retrofitted for LEDs will have to increase the energy spent on heating to compensate for the lack of heat coming from the new lights.

Coincident factor describes the distribution of load across an entire system. It is defined as the peak load of the system divided by the sum of peak loads for each individual system component. The closer a coincident factor is to 1, the more each system components are peaking at the same time.

Example Calculation

kW Saved = Lower of [T24 code baseline or existing kW baseline] – retrofit kW

kWh Saved = Lower of [T24 code baseline or existing kW baseline] – retrofit kW retrofit × DEER hours

Control kWh Saved = kW retrofit × DEER hours × (1 – (controls savings 1 % × controls savings 2%....))

Tier I lights receive (\$0.17/kWh × kWh saved × energy interactive effects) + (\$150/kW peak demand × kW × demand interactive effects × coincident factor)

Tier II lights receive (\$0.24/kWh × kWh saved × energy interactive effects) + (\$150/kW peak demand × kW saved × demand interactive effects × coincident factor)

PG&E Core LEDs which don't meet LEDA specs or advanced controls receive (\$0.08/kWh × kWh saved + \$150/kW peak demand × kW saved × coincident factor)

If early retirement can be proven by submitting past lighting retrofit invoices, maintenance contract agreements or distributor inventory invoicing then the actual existing or industry standard is used as the baseline instead of T24.

Table 1 – LEDA Incentive Levels

Incentive Level	Energy Incentive	Demand Incentive
Tier II	\$ 0.24 / kWh	\$ 150 / kW
Tier I	\$ 0.17 / kWh	
LEDA Standard	\$ 0.08 / kWh	

Note: ENERGY STAR® or DesignLights Consortium certified LEDS are only eligible for incentives if over 50% of the load consists of interior lighting or Tier I or Tier II LED products. These products will be incentivized at the PG&E non-residential calculated incentive currently at \$0.08/kWh saved plus \$150/kW saved.

2. Product Requirements for Eligible Measures/ Hardware

1. Tier I and Tier II products must meet LEDA product performance criteria in the table below. Fixtures must be DLC certified or meet DLC requirements v4.0 and be approved by LEDA. Products must meet or exceed ENERGY STAR® standards when applicable, unless otherwise specified.
2. Products must meet or exceed standards established by PG&E and/or the DesignLights Consortium if no ENERGY STAR® standard currently exists, unless otherwise specified.
3. All product specifications must be verified by an accredited lab from the following list of ENERGY STAR® qualifying certified laboratories:

https://www.energystar.gov/index.cfm?fuseaction=recognized_bodies_list.show_RCB_search_results.

4. When submitting more than one version of a product, all versions must fall within ENERGY STAR® product grouping allowances.¹ The representative model shall be the variation expected to have the greatest difficulty meeting the performance requirements outlined in this specification.
5. Product qualification in LEDA program is in no way a representation by LEDA or PG&E as to the economic or technical feasibility or performance, operational capability, or reliability of such products.

¹ US Department of Energy: ENERGY STAR® *Program for Luminaires Partner Commitments* – Version V1.2 December 21, 2012.

Table 2 – LEDA Product Performance Criteria

Effective January 1st, 2017 LEDA Minimum Equipment Specifications

Tier	Incentive	Technology	Minimum Specifications			Additional Requirements
			Efficacy (lm/w)	CRI	Warranty (yrs)	
Tier II	\$0.24/kWh saved plus \$150/kW saved	Troffer	125	80	5	Controllable Networked Drivers OR New Design Layout
		Highbay	130	70	5	
		Direct Linear Ambient	130	80	5	
		Interior Directional (Downlight and Accent)	90	80	5	
		OLED	45	80	3	
Tier I	\$0.17/kWh saved plus \$150/kW saved	Type C, 4' External Driver Linear Lamp Style Retrofit Kits (bare lamp)	110	80	5	Controllable Networked Drivers
		DLC Premium LED	130	80	5	
		MR	65	90	3	
		PAR	70	90	5	
		A-19	75	90	5	
		Interior Directional	90	80	5	
LEDA Standard	\$0.08/kWh saved plus \$150/kW saved	DesignLights Consortium® LED Fixture and/or EnergyStar® LED Lamp if not Tier II, Tier I or deemed			Must be small portion of project	

1. LED fixtures must be on the [DLC LED QPL](#) and most recent [DLC Networked Lighting Control QPL](#). LEDA can work with manufacturer to approve LED if it meets DLC Premium specifications but is not yet categorized as "DLC Premium"
2. The intent of a New Design Layout is to save energy while maintaining sufficient light and is not a 1-for-1 replacement. Drawings must be submitted with ceiling plan and photometrics
3. LEDA Standard products are eligible at standard incentive rates to enable comprehensive projects and the convenience of going through one program but the majority of the project must include Tier I and/or Tier II products
4. Only Type C, External driver linear lamp style retrofit kit products are eligible for incentives if networked controlled and LED diodes are not visible. If bi-level dimming required, must have ability to dim <50%.
5. If MR16s are low voltage or less than 5 watts, there is no power factor requirement, consistent with ENERGY STAR®
6. Warranties must guarantee L70 and L90 lifetimes and cover the complete luminaire or retrofit kit/replacement lamp when applicable. Warranties that only cover certain components of the luminaire or retrofit kit/replacement lamp do not qualify
7. Direct linear ambient and downlight retrofit kits are eligible and must meet same technical criteria for a new fixture of the same LED type
8. Direct linear ambient and troffer retrofit kits must remove the existing ballast, tombstones and new source components (driver, LED chips and lens) must be assembled in the housing and LED diodes must not be visible
9. LED fixtures must meet zonal lumen density requirements listed on the [DLC Technical Requirements Table V4.0](#).
10. OLEDs do not require controls

3. Table 3 - General Product Criteria

General Product Criteria	All LEDA Tiers
1. Allowable Lamp Bases	Must be a lamp base listed by ANSI, if applicable.
2. Color Maintenance	Luminaire change in chromaticity coordinates from 0-hour measurement, at any measurement point during operation, shall be \leq a total linear distance of 0.007 on the CIE 1976 u'v' diagram.
3. Color Spatial Uniformity	The variation of chromaticity in different directions (i.e., with a change in viewing angle) shall be within 0.006 from the weighted average point on the CIE 1976 (u',v') diagram.
4. Dimming	Lamps may be dimmable or non-dimmable. Product packaging must clearly indicate whether the lamp is dimmable or not dimmable. Manufacturers qualifying dimmable products must maintain a Web page providing dimmer compatibility information Minimum efficacy, light output, CCT, CRI, and power factor of dimmable lamps will be confirmed with the lamp operated at full power. The luminaire and its components shall provide continuous dimming from 100% to 20% of total light output. Step dimming, if employed, shall provide at least two discrete light output levels \geq 20% of total light output and not including 100% output.
5. Electromagnetic and Radio Frequency Interference	Must meet FCC 47 CFR Part 15 (remote) or 18 (integral) emission limits
6. Incompatibility and Application Exceptions	Must clearly state any known incompatibility with photo controls, occupancy sensors, or timing devices. In addition, packaging should state specific application exceptions, such as totally enclosed fixtures, insulated air-tight (ICAT) recessed downlights, damp locations, and any other application restrictions.
7. Low-Voltage Compatibility	Products intended for use on low-voltage circuits must state compatibility with low-voltage transformers.
8. Maximum Off-State Power	0 W Exceptions - Luminaires with integral motion sensors, occupancy sensors or photosensors, or connected functionality may draw up to 0.5 watts in standby mode. Luminaires with energy saving features i.e. integral motion sensors, occupancy sensors or photosensors and connected functionality may draw up to 1 watt in standby mode. Power supplies connected to multiple luminaires may draw up to 1.5 watts in standby mode. External power supplies (EPS) employed to power luminaires shall meet the level V or higher performance requirements under the International Efficiency Marking Protocol and include the level V or higher marking on the EPS
9. Minimum Operating Temperature	≥ -20 °C
10. Noise	Class A sound rating
11. Operating Voltage	Must operate at rated nominal voltage of 120, 240 or 277 VAC, or at 12 or 24 VAC or VDC.
12. Output Operating Frequency	≥ 120 Hz
13. Physical Size	In general, should not exceed target dimensions as per applicable ANSI specifications.
14. Thermal Management	Shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management.
15. Transient Protection	Ballast or driver shall comply with ANSI/IEEE C62.41.1-2002 and ANSI/IEEE C62.41.2-2002, Category A operation. The line transient shall consist of seven strikes of a 100 kHz ring wave, 2.5 kV level, for both common mode and differential mode.

16. Toxic Reduction Requirements	Luminaires and lamps shall not exceed hazardous substance concentrations set for in the European Union's (EU) Restriction of the Use of Certain Hazardous Substances (RoHS) Directive, 2003.
17. Start Time	Light source shall remain continuously illuminated within 1 second of application of electrical power.
18. Zonal Lumen Density	Downlight luminaires: Luminaire shall deliver a minimum of 75% of total lumens within the 0-60° zone (axially symmetric about the nadir) Accent lights: Luminaire shall deliver a minimum of 80% of total initial lumens within the 0-60° zone (axially symmetric about the center of the beam).
19. Correlated Color Temperature (CCT)	The luminaire, retrofit kit, or replaceable LED light engine shall be capable of providing at least one of the following nominal correlated color temperatures (CCTs): 2700 Kelvin; 3000 Kelvin; 3500 Kelvin; 4000 Kelvin; 5000 Kelvin The luminaire, retrofit kit, or replaceable LED light engine or module chromaticity shall also fall within the corresponding 7-step chromaticity quadrangles as defined in ANSI/NEMA/ANSI C78.377-2011.
20. Color Rendering Index (CRI)	The luminaire, retrofit kit, or LED light engine shall be capable of meeting or exceeding $R_a \geq 80$ and $R_9 > 0$. Exception – Outdoor luminaires
21. Lumen Maintenance	The LED package(s)/module(s)/array(s), including those incorporated into luminaires, retrofit kits and LED light engines, shall meet the following L_{70} rated lumen maintenance life values, in situ: $L_{70}(6k) \geq 25,000$ hours for indoor $L_{70}(6k) \geq 35,000$ hours for outdoor $L_{70} \geq 50,000$ hours for inseparable luminaires The LED luminaires, retrofit kits, and LED light engines, shall meet the following L_{70} rated lumen maintenance life values, in situ: $L_{70} \geq 25,000$ hours for indoor $L_{70} \geq 35,000$ hours for outdoor $L_{70} \geq 50,000$ hours for inseparable luminaires
22. Power Factor	Total luminaire input power ≤ 5 watts: $PF \geq 0.5$; Total luminaire input power >5 watts: $PF \geq 0.7$
23. Light Source Replaceability	LED light engines or retrofit kits shall make use of electrical interconnects that allow for consumer replacement of the engine or kit without the cutting of wires or the use of solder. Wire nuts and other reusable connectors are allowed. Exemption - Inseparable SSL Luminaires
24. Ballast/Driver Replaceability	Ballasts or drivers shall be accessible and removable by an electrician without the cutting of wires and without damage to the luminaire housing, trim, decorative elements or the carpentry (e.g., ceiling drywall) to which the luminaire is attached. Instructions shall be provided with the luminaire, detailing guidance on ballast or driver replacement by a "qualified electrician". Exceptions - luminaires employing self-ballasted lamps; line voltage directional track lights; solid state cove mount luminaires; under cabinet luminaires; retrofit kits
25. Warranty	The warranty must cover the complete luminaire, or retrofit kit for a period of at least 5 years. Warranties that only cover certain components of the luminaire or retrofit kit/replacement lamp are not sufficient to meet the requirement. MR lamps must have a 3 year warranty. PAR, and A lamps must have 5 year warranties.

4. Product Specification Background

4.1 Luminaire Efficacy

LED luminaire and lamp tier efficacy and CRI requirements were developed by analyzing the best in class or top 20% of products from the January 2017 ENERGY STAR® and DesignLights Consortium products database. DLC Premium specifications were used to define Tiers 2 and 1, and Tier 2 requires networked controls (or a new lighting design layout) as set by DLC's controls specifications. Specifications for downlights and lamps were set based on the performance of the top 20% of products in the databases. LEDA offers a standard tier in order to make the program more comprehensive and convenient for customers who do not want to go through multiple incentive or rebate program.

4.2 Driver ISTMT

The luminaire passes the driver ISTMT requirements if the measured temperature at the TMP_{ps} is less than or equal to the allowable operating temperature specified by the power supply manufacturer. Drivers shall be tested *in-situ* under steady-state operating conditions, with case temperature measured at the designated TMP.

One or more additional thermocouples are attached to the power supply/driver at the TMP_{ps} . For off-the-shelf remote power supplies, manufacturers typically provide a measurement location (case temperature designated by a "dot" adjacent to a (t_c) symbol) for warranty purposes. In situations where the TMP_{ps} is not designated by the manufacturer, or where power supplies are integrated with the LED package(s), array, or module(s), fixture manufacturers should identify the TMP_{ps} to be used for warranty purposes. Note that this includes situations where the driver/power supply is not purchased from an outside vendor, and where the driver/power supply is integrated into the luminaire or lamp.

The thermocouple tolerance shall conform to ASTM E230 Table 1 "Special Limits" ($\leq 1.1^\circ\text{C}$ or 0.4%, whichever is greater).

Appendix A: Product Submission Requirements²

1) Product Specification Sheet

- a) Product description, including model number, accessories, and intended applications
- b) Electrical characteristics
 - i) Maximum power usage of product (Watts)
 - ii) Chip current (milli-amperes; mA)
 - iii) Operating voltage range (Volts)
 - iv) Off-state power usage (Watts)
 - v) Dimming capability
- c) Optical characteristics
 - i) Total luminous output of product (Lumens)
 - ii) Luminous efficacy (Lumens/ Watt)
 - iii) Color Rendering Index (CRI)
 - iv) Correlated Color Temperature (CCT)
- d) Other characteristics
 - i) Product rated life
 - ii) Product L70 and L90, if different than rated life
 - iii) Operating temperature range (°F or °C)
- e) Additional recommended information (as applicable)
 - i) Physical dimensions of product, if non-standard
 - ii) Center beam candle power
 - iii) Optical beam angle
 - iv) Optical distribution type

2) LM-79 Test Results

- a) Electrical Data
 - i) Input voltage (Volts)
 - ii) Current (Amperes)
 - iii) Power (Watts)
 - iv) Power Factor
 - v) Total Harmonic Distortion (amperage)
 - vi) Light Output
 - vii) Total luminous output (Lumens)

- viii) Luminous efficacy (Lm/W)
- b) Light Distribution
 - i) Zonal Lumen Summary, including optical distribution type and cutoff rating if applicable
 - ii) Candela Distribution
 - iii) Polar Graph
 - iv) Spacing Criteria
 - v) Coefficient of Utilization (CU) and
 - vi) Isoilluminance plot
 - vii) Glare Rating
- c) Color characteristics
 - i) Correlated Color Temperature (CCT)
 - ii) Color Rendering Index (CRI)
 - iii) R9
 - iv) Chromaticity Coordinates
 - v) Additional recommended information
 - vi) Spectral Power Distribution (SPD)

3) Product Lifetime Data

- a) Product rated life
 - i) Written statement of product rated life based on system reliability (time to failure)
 - ii) Documentation of reliability and/or Mean Time To Failure of all product components (driver, optics, chips, etc)
- b) Lumen depreciation (L70)
 - i) OPTION 1 – Component performance
 - (1) IES LM-80 test report for LED package, array, or module; minimally including light output measured every 1,000 hours and recorded for a minimum of 6,000 hours at 55°C, 85°C and a third temperature at the discretion of the manufacturer.
 - (2) In-Situ Temperature Measurement Test report indicating the temperature of both the highest temperature LED and the power supply at thermal equilibrium in accordance with ANSI/UL 1598-04

² For more information, contact Energy Solutions or see ENERGY STAR® *Program Requirements for Lamps (Light Bulbs) Partner Commitments* – Version V2.0 December 31, 2015.

(hardwired) or ANSI/UL 153-05 (corded).

(3) Written explanation of how L70 and L90 lifetime of product is determined using the LM-80 and In-situ temperature measurement tests.

ii) OPTION 2 – Luminaire performance

(1) IES LM- 79 test results for entire luminaire at 0 hours, and at 6000 hours after continuous operation in the appropriate UL1598/153 environment

4) Product Warranty

- a) The warranty must cover the complete luminaire, or retrofit kit/replacement lamp (including light source, driver, optics, and power supply, etc.) over the warranty period. Warranties that only cover certain components are not sufficient to meet the requirement. The warranty must guarantee lumen maintenance at L70 and L90 during the warranty period. We encourage manufacturers to address color shift in the warranty.
- b) Driver warranty from manufacturer indicating the maximum power supply case temperature for which warranty is offered is recommended

5) UL Listing

- a) UL certification document

6) LM-63 Data File [.IES]

- a) Absolute photometric testing data in IES LM-63 electronic file format.

7) Driver ISTMT Test Results

- a) Test report from a lab that meets DLC's Laboratory Requirements for ISTMTs. The report must include the measured temperature from the TMP_{ps}.
- b) A picture of the TMP_{ps} location with an arrow indicating the thermocouple attachment point.
- c) Documentation from the driver manufacturer that indicates the maximum case temperature for which the driver is designed to last ≥50,000 hours, as well as the TMP location it designates for thermal testing.
 - i) Custom and integrated drivers must provide equivalent documentation as drivers from third-party vendors. Manufacturers must supply documentation indicating the maximum acceptable temperature for the driver for 50,000 hour life, as well as the TMP to be used during thermal testing and evaluation.

8) Proof of ENERGY STAR or Designlights Consortium submittal

- a) Statement of submission (or intent to submit) to ENERGY STAR or Designlights Consortium for listing on the respective QPLs.

9) Product Qualification Statement

- a) Written statement verifying that the product meets all applicable general and specific criteria.
- b) Written statement verifying that all included information and documentation is representative of the indicated product line.



Appendix B: Product Submission Checklist

Item	Included Check <input checked="" type="checkbox"/>
1. Product specification sheet	<input type="checkbox"/>
2. LM-79 test results*	<input type="checkbox"/>
3. Product lifetime statement and information	<input type="checkbox"/>
AND	AND
OPTION 1: Component performance	
a. LM-80 test results*	<input type="checkbox"/>
b. In-situ temperature measurement test results* (accredited lab)	<input type="checkbox"/>
c. Lifetime determination statement	<input type="checkbox"/>
OR	OR
OPTION 2: Luminaire performance	
a. LM79 test results at 6,000 hrs	<input type="checkbox"/>
4. Product warranty	<input type="checkbox"/>
5. UL certification document	<input type="checkbox"/>
6. LM-63 [.IES] file	<input type="checkbox"/>
7. Driver ISTMT test results	<input type="checkbox"/>
8. Proof of ENERGY STAR or Designlights Consortium submittal (or intent to submit)	<input type="checkbox"/>
9. LEDA Product Qualification Statement**	<input type="checkbox"/>

*Must come from an accredited lab from the following ENERGY STAR[®] qualified list of certified laboratories:

https://www.energystar.gov/index.cfm?fuseaction=recognized_bodies_list.show_RCB_search_results

** Available from <http://ledaccelerator.com>.

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