LED Linear Tube Lamp Replacements

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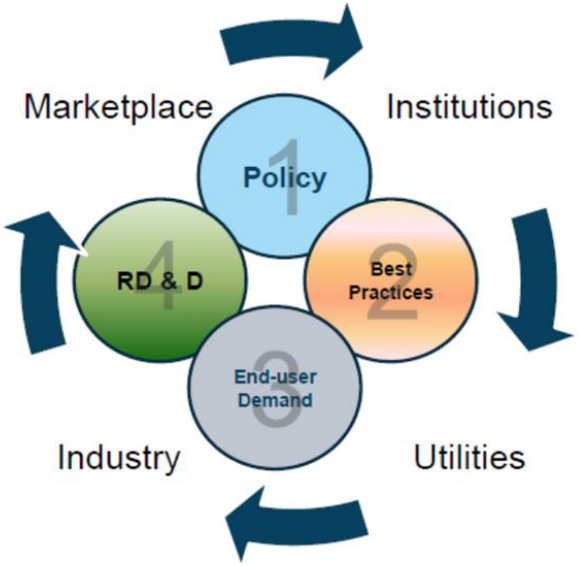
Presentation Overview

Objective: Seeking TF approval of draft abstract

- Measure Description
- Feedback from CS Consultants and Concerns
- IOU Proposed Implementation Approaches
- Key Field Trials Parameters Considerations

Lighting Action Plan (LAP)

- Goal 1 – Develop and implement coordinated policies, procedures, and other market interventions that
  - eliminate barriers,
  - accelerate lighting market transformation in CA, and
  - provide incentives for best practice lighting technologies and systems.



LED Incentive Options

Product	Features	Pros	Challenges
Linear Replacement Lamps	• Plug-and-play • Uses existing ballast	• Lowest cost • Easy to install; no rewiring	• Persistence • Ballast life • Compatibility
Retrofit Kits	• Uses existing housing • Replaces lamp & ballast	• Versatility • Better Savings	• Requires electrician
Luminaires (troffers/panels)	• Replaces entire fixture	• Most efficient • Designed for LEDs	• Higher 1st cost

Measure Description

Base Case

T8 Linear Fluorescents

- 4-foot T8 32W IS Ballast
- 4-foot T8 28W RS Ballast
- 4-foot T8 25W RS Ballast

Measure Case

LED T8 Linear Tubes

- 4-foot LED T8 23W
- 4-foot LED T8 19W
- 4-foot LED T8 16W

- Note: All new lamps will use existing ballasts

PG&E Proposed Implementation Approach

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Existing Condition		New LED Energy Efficiciency Measure				
Category	Description	Linear LED Replacement Lamp	Linear LED Retrofit Kits			Dedicated LED Luminaries
			Linear Lamp Style Kits	Fixture Retrofit Kits	Troffer Style Retrofit Kits[1]	
System Factors to Consider						
Ballast	Magnetic T12	⊗	●	●	●	●
	Works with emergency battery back-up	⊗	□	□	□	●
Light Levels	Should not be reduced	⊗	□	□	□	●
	Reductions of 10% or more are okay	●	●	●	●	●
Dimming	No dimming required	●	●	●	●	●
	Dimming is required	⊗	□	□	□	□
System Types to Consider						
Linear Fixtures	Strip	●	●	●	N/A	●
	Industrial w/ reflector	●	●	●	N/A	●
	Cove	●	●	●	N/A	●
	Linear High Bay	⊗	□	□	N/A	●
Wrapped Lens (Ceiling or Wall mount)	Corridor	●	●	●	N/A	●
	Wide Body	●	●	●	N/A	●
Indirect / Direct (Wall Mount or Suspended)	Indirect	●	□	□	N/A	●
	Indirect/Direct	□	□	□	N/A	●
Troffer	Flat Prismatic Lens	●	□	□	●	●
	Indirect/Direct Basket	⊗	⊗	⊗	●	●
	Parabolic Louvers	⊗	⊗	⊗	●	●
	High Performance Troffer	□	□	⊗	□	□

Symbol Key	
⊗	*Not recommended*
□	*Consider other options*
●	*Suggested solution*

Footnotes:
1. Specialized Retrofit Kit for Troffers including a new High Performance Lens

- Run measure through 3rd party DI programs only
- Targets small commercial customers
- Will wait on ED feedback before going deemed or custom.

SCE Proposed Implementation Approach

- Goal: Have this measure go deemed if possible along with allowing LED rebates for lamp style and linear retrofits
- Will consider going direct install and/or custom to gather appropriate data to meet ED's expectation
- Recommended Program Requirement:
  - Make sure there is a label on the LED tubes clearly showing ballast compatibility

SDG&E Proposed Implementation Approach

Program Implementation

- Run measure through SDG&E's Lighting Innovation Program (LIP) Pilot
  - Funding will come from resource programs and savings will be claimed thru LIP
  - The LIP pilot will run thru the end of 2015 where results will be reported to the CPUC
  - T8 LEDs will be implemented thru DI and EEBI and an early opinion review request will be submitted

Program Requirements

- Establishing Appropriate Baselines
  - Require a pre-inspection prior installation in order to confirm baselines and gather the necessary info for the LIP pilot study
  - Baseline for the LIP will be T8 32 Watts with instant start normal light output ballast
- Quality and Serviceability
  - TLEDs from the top tier product list as defined by DLC, joint group, and/or CALTF
- Measure Life
  - Field test to confirm product performance and ballast failure rate

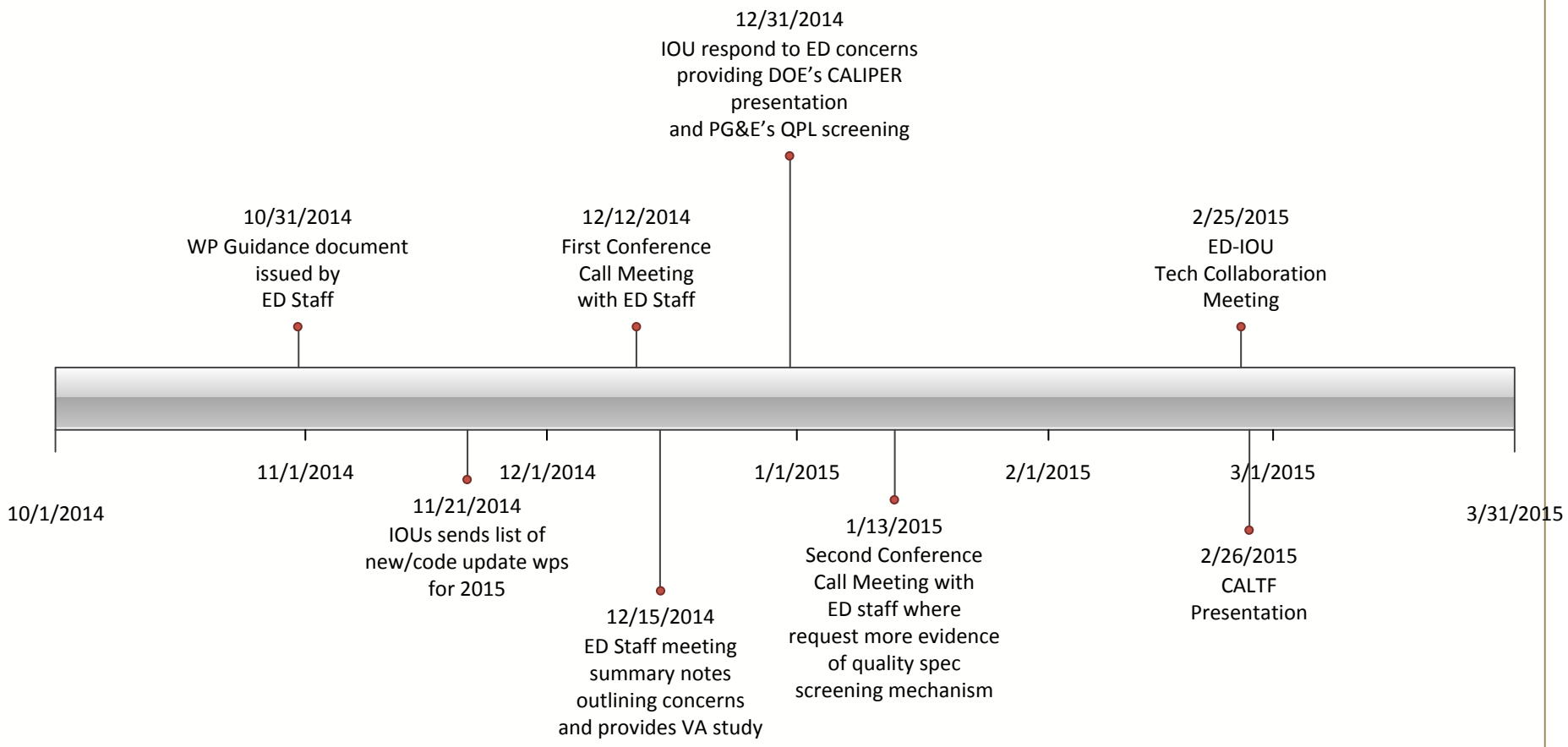
- Midstream opportunities for TLEDS will be evaluated in the near future.

Field Trial Considerations

- Restrict measure to certain applications – restrict LED tubes going into troffers
- Measuring light levels pre and post task IES standards and requirements? How many areas? Normal sampling techniques
- Collect data future wp to address EUL/RUL
  - Set minimum level for DLC Quality – DLC minimum CRI 80, CCT 3500, Lumen Output 100 lumens/watt,
  - Establish which lamp should be in there
- Survey customer acceptance

Appendix Slides

Timeline of Interactions



Program Implementation

- **Units:** per lamp

- **Measure Application and Delivery Type**
  - Downstream Deemed (Early Retirement per CPUC Lighting Disposition)
  - Direct Install (ER)
  - Custom (ER)

- **Eligibility**
  - Climate Zones: All
  - Building Types: All

- **Target Market**
  - Commercial Office Buildings

- **Market Potential**
  - CA Commercial Large & Small Offices: 4,331 GWh/yr energy consumption (CEUS 2006)

Abstract Data and Methods: Baseline

- Baseline data collection
  - DOE's CALiPER Study
  - Prior WPs
- Baseline methodology
  - Generation 2 T8 linear fluorescents

Questions for the TF on Baseline

- For deemed only: Should 100% pre-inspection be required?
- For deemed only: Should a baseline pilot study be initiated?

Abstract Data and Methods: Measure

- Measure data collection
  - DOE's CALiPER Study
  - DLC, Lighting Facts, PG&E's Qualified Products List
    - LM-79 Photometric Testing
    - LM-80 Lumen Maintenance Testing (conducted in labs recognized by E-star labs)
    - In-Situ Temperature Measurement Testing (ISTMT)

- Measure methodology
  - T8 LED Linear Tube Replacements
    - Lumens per watt, CRI, CCRT,

Questions for the TF on Measure

- How else should PAs filter the top 50% of the LED tube lamp replacement market
- Once installed, what cost-effective ways can PAs ensure persistence?

Additional Proposed Parameters

- **Measure Costs**
  - Baseline cost (material + labor): $20.39
  - Measure cost: $42.98
  - Incremental cost: $22.59
  - Source: DEER and MFG catalog

- **EUL**
  - 5-years
  - Source: The lighting disposition for the 2013-2014 cycle

- **NTG**
  - 0.7 (DEER EUL ID: All-Default<=2yrsSource)
  - 0.85 ? (DEER EUL ID: Com-Default-HTR-di)

Questions for the TF on these Parameters

- Can we comfortably use a NTG value of 0.85 even for DI programs?
- Can the PAs live with a 5 year RUL?
  - Espen 7 year warranty

Summary of Parameters

Parameter	Value (or Range)	Confidence Level (High, Medium, Low)
kWh/year	22-35 kWh	High
kW/year	0.00569-0.00876	High
Therms/year	(0 to -5.215)	High
RUL	5	High
IMC	$22.59-$23.45	High
NTG	0.70-0.85	High

Estimated TRC: 0.86
Assumes $1 rebate per lamp

CS Consultant Concerns

- Baseline
  - DI Programs: mechanism for recording that information for future verification would be required.
  - Deemed Programs: Baseline Pilot Research to arrive at technology baseline mix
- Equivalent Level of Service
  - Consumer acceptance studies?
  - Pre and post task light metering for all projects?
- Measure Life
  - Require manufacturers to provide longer warranties?
  - How to consider lamps that are installed in poor maintained fixtures?
- Quality Specs
  - Anything beyond DLC, QPL, and Lighting Facts?

DLC Technical Requirements Table

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The DesignLights Cons ×

www.designlights.org/Content/QPL/ProductSubmit/CategorySpecifications

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DESIGNLIGHTS CONSORTIUM

DLC Stakeholder Meeting 2014 July 29-30 | San Diego

content ▸ QPL ▸ ProductSubmit ▸ How to Submit a Product

How to Submit a Product

Manufacturer Application Process

- Are Your Products Eligible?
  - Technical Requirements Table
  - Category Definitions
  - Category-Specific Requirements
    - Linear Replacement Lamps
    - Retrofit Kits
- Application Instructions
  - Single Products
  - Family Groupings
  - Private Labeling
  - Dimming Information
  - LED Lighting Facts
- Lab Testing
- FAQs
- Logo Guidelines
- Manufacturer Login

Technical Requirements Table v2.1

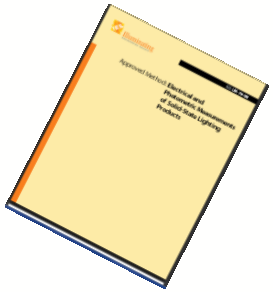
DesignLights Consortium® Qualified Products List- Non-Residential Applications —
Submit any or all of the following product Information and Testing Results to DesignLights for qualification
please make note that it is ONE per submission
PDF Download

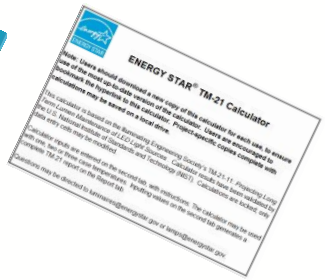
Application	Minimum Light Output	Zonal Lumen Density	Minimum Luminaire Efficacy	Allowable CCTs (ANSI C78.377-2011)	Minimum CRI	L70 Lumen Maintenance	Warranty (click here for more information)
Outdoor Applications—New, Fully Integrated Luminaires							
1) Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1,000 lm	≥100%: 0-90°, ≤10%: 80-90°	70 lm/W	≤5700K	65	50,000 hrs	5 years
2) Outdoor Pole/Arm-Mounted Decorative Luminaires	1,000 lm	≥65%: 0-90°	60 lm/W	≤5700K	65	50,000 hrs	5 years
3) Outdoor Wall-Mounted Area Luminaires	300 lm	≥100%: 0-90°, ≤10%: 80-90°	70 lm/W	≤5700K	65	50,000 hrs	5 years

DLC QPL: Manufacture Application

Testing & Reporting Requirements

- Photometric & Electric Properties
  - IES LM-79 Electric & Photometric
    - Output & color: Integrating Sphere
    - Light Distribution: Goniophotometer
- Lumen Maintenance
  - LED Package/Module/Array Testing
    - IES LM-80 Lumen Maintenance
  - Luminaire-level Testing
    - ISTMT (ANSI/UL 1598)
  - L_{70} Determination
    - IES TM-21 Projecting Lumen Maintenance





Lumen Maintenance Requirements

- Lumen Maintenance for Lumen Maintenance
- Lumen Maintenance for Measure Life?

- L_{70} requirements by category
- Most categories: ≥ 50,000 hours
- Display-case, high/low-bay luminaires: ≥ 35,000 hours

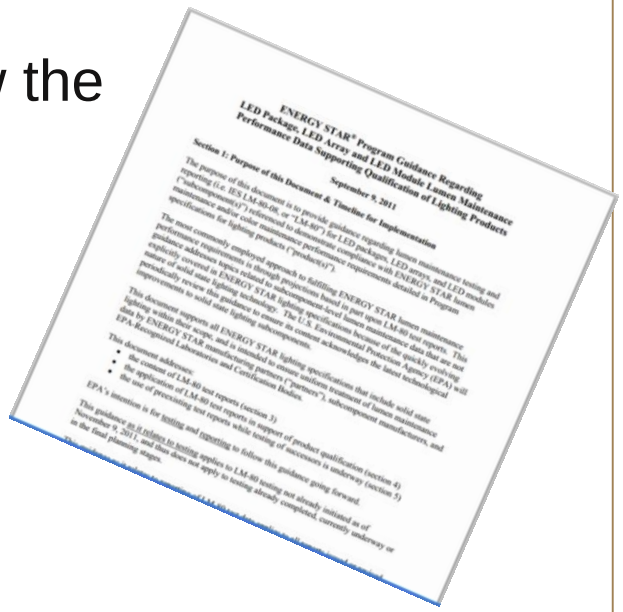
How does the DLC evaluate L_{70}?

"Option 1"

- LM-80 testing on the package/module/array
  - Long-term lumen maintenance of LEDs
  - Minimum 6,000 hours of testing; preferably longer
- *In-Situ* Temperature Measurement Test (ISTMT)
  - Thermal testing of LED, derived from ANSI/UL 1598
- TM-21 Lumen Maintenance Projection
  - Using ENERGY STAR TM-21 Calculator
  - www.energystar.gov/tm21calculator

LM-80 Requirements

- Conducted in a lab recognized by EPA/ENERGY STAR
- Rules for reporting and applicability follow the ENERGY STAR Program Guidance
  - Need at least one case temp [above ISTMT]
  - Allowable variations in arrays/COB
  - CCT Applicability
  - Successor Devices



ENERGY STAR® Program Guidance Regarding
LED Package, LED Array and LED Module Lumen Maintenance
Performance Data Supporting Qualification of Lighting Products

September 9, 2011

Section 1: Purpose of this Document & Timeline for Implementation

- https://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/luminaires/ENERGY_STAR_Final_Lumen_Maintenance_Guidance.pdf

ISTMT Requirements

- Acceptable Accreditations
  - OHSA NRTL, Data Acceptance/SNAP, SSL Thermal Testing by ILAC-MRA
- Must be conducted on the hottest LED
  - If you don't know which is the hottest, must measure multiple LEDs
- Must be done with luminaire in appropriate *In-Situ* thermal environment per ANSI/UL 1598
- The purpose of the ISTMT is to relate the LM-80 test conditions to how the LED is actually being used…
  - …So the TMP must be consistent from LM-80 to ISTMT!