Million LED Challenge – Phase 2

Providing high-quality LED lights with informed product selection, great price & ease of purchase

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Today's Speakers

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Today's Goal & Objectives

- Goal
  - Provide an overview of the Million LED Challenge (MLC) Phase 2 Program

- Objectives
  - Introduce MLC Phase 2 Partners
  - Review Quality Specification Requirements
  - Discuss MLC Program Cost & Energy Savings

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Today's Speakers

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Today's Agenda

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- Overview of MLC Program & Frequently Asked Questions
  - What is the Million LED Challenge Program?
  - What's the difference between Phase 1 & Phase 2?
  - What is the Phase 2 quality specification?
  - Are Phase 2 products cost effective?
  - What should I do to address Title 24?
  - How do I start my MLC2 project?
- Future Vendor Presentation Schedule
- Questions?

Million LED Challenge Overview

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What is the Million LED Challenge Program?

- The University of California spearheaded statewide effort to procure high-quality, energy-efficient light sources at great prices.

- The UC is collaborating with
  - California Community College system,
  - California State University system,
  - California Department of General Services, and
  - Other organizations interested in participating (including National Rural Electric Cooperative Association (NRECA))

UNIVERSITY OF CALIFORNIA Carbon Neutrality Initiative

CSU The California State University

FOUNDATION for CALIFORNIA COMMUNITY COLLEGES

CALIFORNIA REPUBLIC

NRECA America's Electric Cooperatives

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What's the difference between Phase 1 and Phase 2?

- **Phase 1 (Launched in 2018)**
  - Screw base lamps and downlights
  - Products selected based on California Energy Commission's Voluntary Quality Specification & competitive pricing in 2018

- **Phase 2 (Launching today!)**
  - Retrofit solutions for linear fluorescent lamps
    - Linear LED lamps
    - Retrofit kits
    - New luminaires
  - Products selected based on CLTC's recent research outcomes & pricing in 2021

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Why is MLC2 needed?

CLTC studies identified the following issues with linear LED retrofit solutions in today's market:

- Poor optics
- Longevity
- Low efficiency
- Interoperability with controls
- Poor color rendition
- Electrical architecture concerns

FUNDING PROVIDED BY THE CALIFORNIA ENERGY COMMISSION

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Why is MLC2 needed?

Lighting system replacement is about much more than initial cost and reducing wattage.

Choosing lights can be challenging. Retrofits can require trial and error to find the light source that works well, looks good and keeps occupants happy.

Important Considerations:

- **Electrical Architecture:** Can I add controls? Is it dimmable? Is it efficient? Is it safe?
- **Light Output:** How much light is necessary for what tasks being performed in the spaces?
- **Efficacy:** Now that I know how much light I want - how do I make sure I save energy, too?
- **Dimming:** Do you want to tune the lights over time and for different occupants? Allowing for deeper savings?
- **Flicker:** How do I prevent my new lighting system from causing eye strain and headaches?
- **Color Quality:** How do colors appear in my space? Natural or distorted?
- **Distribution:** How do I make sure the light is being distributed to the same areas as my fluorescent system?
- **Driver Size:** Will the driver fit inside of my light fixture?

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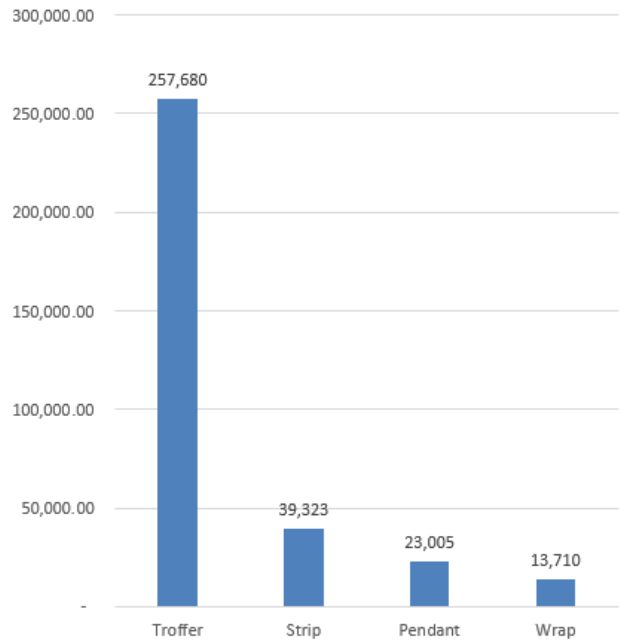
Why is MLC2 needed?

Total Estimated Luminaires of the Four Most Common Types Installed Across UC



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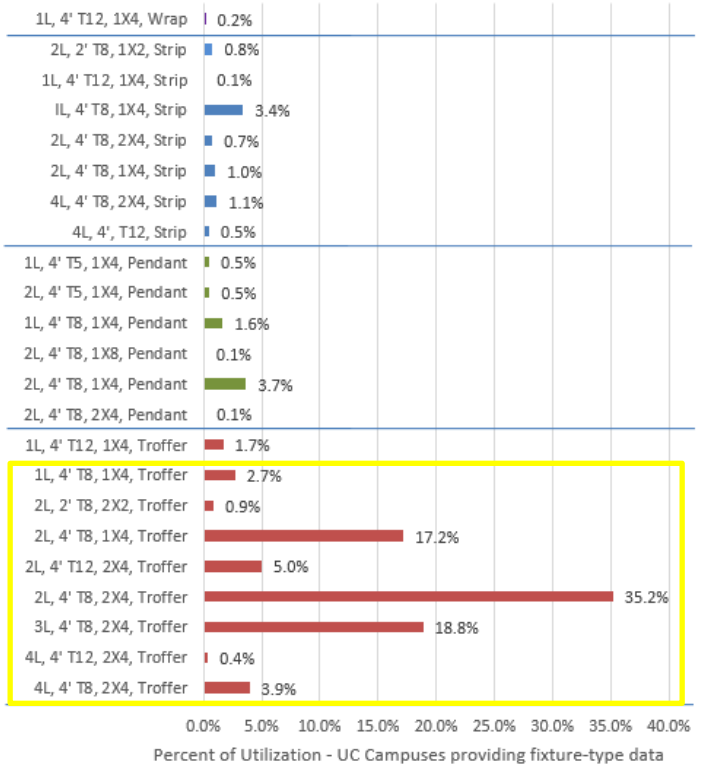
Why is MLC2 needed?

Fixture and lamp type distribution based on MLC survey data collected



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What exactly are the Phase 2 products?

Linear LEDs

Troffer Retrofit Kits

New Luminaires

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What's the quality specification for Phase 2 products?

Linear LED Lamps (TLEDs)

- Electrical architecture, UL Type C
- Light output, bare single lamp light output of 2,250 lumens for 4' lamps and 1,125 lumens for 2' lamps
- System efficacy, at least 120 lumens per Watt (system includes lamp and driver)
- Dimming, dimming level to at least 10 percent of maximum power
- Controllability, be able to pair with lighting control devices **(control-ready)**
- Flicker, produces no greater than 30 percent flicker at 200 Hz or below when paired with control devices
- Color, R_f value greater than or equal to 90 measured by IES TM-30-18
- Distribution, beam angle of at least 220 degrees with no less than 20 percent of total flux emitted in the 100–180 degree zone
- Driver physical dimensions, provide physical dimensions of driver to allow consumers to compare to space in fixture before purchasing.
- All else, meet **DLC Standard minimum criteria**

LED Retrofit Kits & Fixtures

- System efficacy, at least 120 lumens per Watt (system includes light source, driver and lens)
- Dimming, dimming level to at least 10 percent of maximum power
- Controllability, be able to pair with lighting control devices **(control-ready)**
- Flicker, produces no greater than 30 percent flicker at 200 Hz or below when paired with control devices
- Color, R_f value greater than or equal to 90 measured by IES TM-30-18
- Distribution, provide photometric distribution file in IES LM-63 format
- All else, meet **DLC Standard minimum criteria**

What is control-ready?

Control-ready LED retrofit solutions are able to be paired with lighting controls that will allow for control strategies including personal tuning, occupancy sensing, daylight harvesting and automated demand response, where appropriate.

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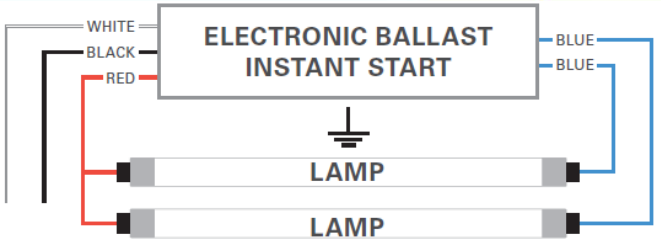
Electrical architecture – why Type C?

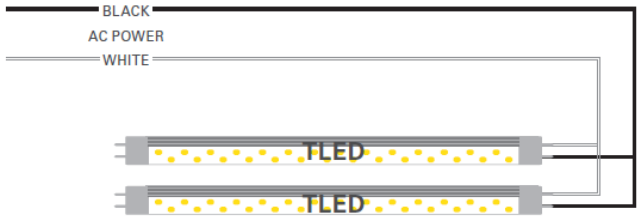
Type A: Internal driver that is designed to operate on a linear fluorescent lamp ballast.

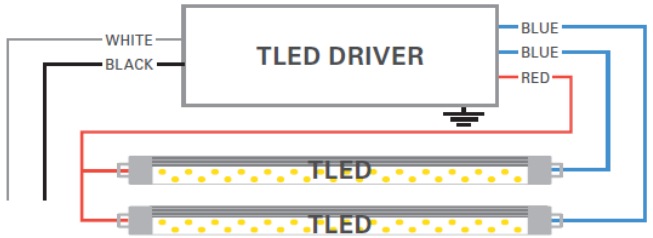
Type B: Internal driver that must be connected directly to line voltage for power.

Type C: External driver that is designed to replace both the linear fluorescent lamp and fluorescent lamp ballast.

Hybrids: Linear LED lamps with two Type A, B or C options in one product. Also referred to as 'dual-mode' by select manufacturers







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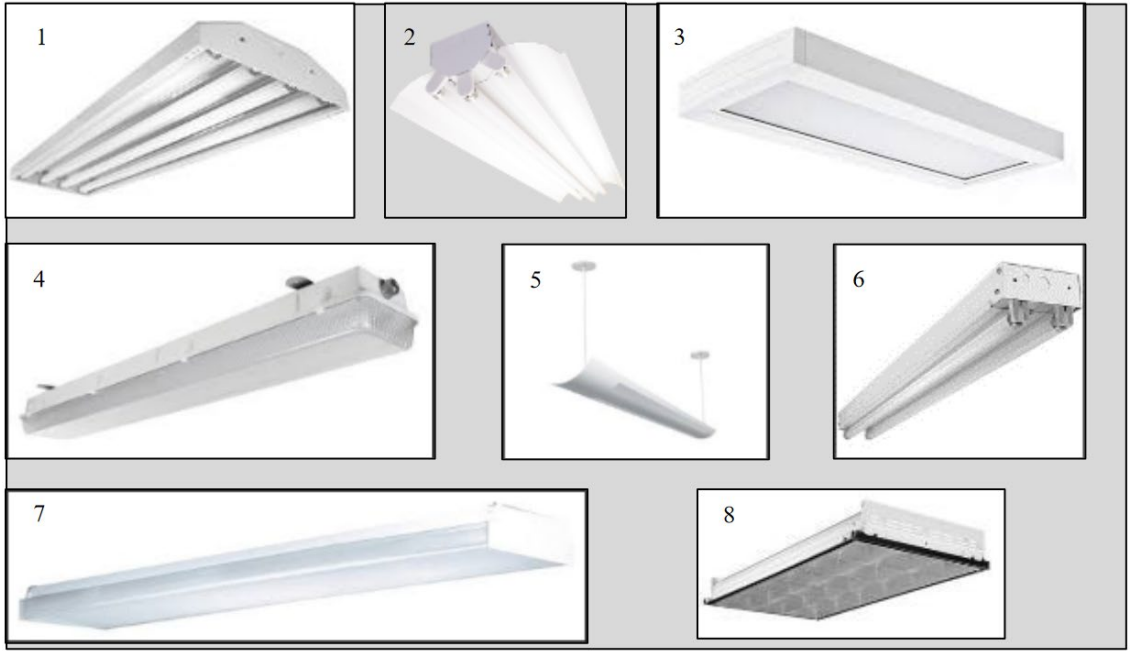
Light output & distribution – why 2,250 lumens and 220-degree beam angle?

Allows for LED technology to mimic incumbent technology characteristics to ensure equivalent delivered lighting service, or better, as compared to linear fluorescents installed in key fixture types

(troffer, strip, pendent, wrap)



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System efficacy – why 120 lumens per Watt?

- Feasible efficacy target based on market assessment results
- Five commercial Type C products available at time of RFP with at least 120 lm/W
- Higher efficacy encourages deeper load reduction/energy savings

TABLE 3. TESTED PRODUCTS WITH MANUFACTURER LISTED PERFORMANCE

Product ID	Operating Mode	Beam Angle (degrees)	CCT (K)	CRI (Ra)	Input Power (W)	Light Output (lm)	System Efficacy (lm/W)
Fluorescent	-	360	3500	>70	59.0	4484	76.0
LED B	A	180	4000	>80	30.0	3200	106.7
LED B	B	180	4000	>80	30.0	3200	106.7
LED C	A	220	4000	>80	34.0	3600	105.9
LED C	B	220	4000	>80	30.0	3600	120.0
LED D	A	Not stated	4000	>80	33.2	3750	113.0
LED D	B	Not stated	4000	>80	30.0	3600	120.0
LED E	B	Not stated	4000	>80	26.0	3120	120.0
LED F	C	Not stated	4000	83	36.0	4400	122.2
LED G	B	310	4000	80	29.0	3400	117.2
LED H	B	Not stated	3500-5000	Not stated	36.0	5040	140.0
LED I	A	120	4100	82	36.0	Not stated	121.0
LED J	A	160	4000	82	34.0	4200	123.5
LED J	C	160	4000	82	33.0	4200	127.3
LED L	A	220	4100	82	36.0	4400	122.2
LED L	C	220	4100	82	36.0	4400	122.2
LED N	C	Not stated	4000	80	44.0	4500	102.3
LED O	C	Not stated	4000	>80	30.0	3600	120.0
LED P	C	Not stated	3700-4300	>80	30.0	3700	123.3

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Dimmability, controllability & flicker – why bother?

- Dimming allows for the tuning (and other control strategies) of the lighting system over time & leads to deeper energy savings
- Allows project to meet Title 24 multi-level lighting control requirements (Section 130.1(b))
- Controllability means the light source can communicate with lighting controls to know when to dim or turn off
- Dimming LEDs is complicated, it is important to define a minimum acceptable flicker level that users will tolerate in their spaces
- As of today (May 25, 2021), MLC-approved products are compatible with 0-10V and/or wireless protocols

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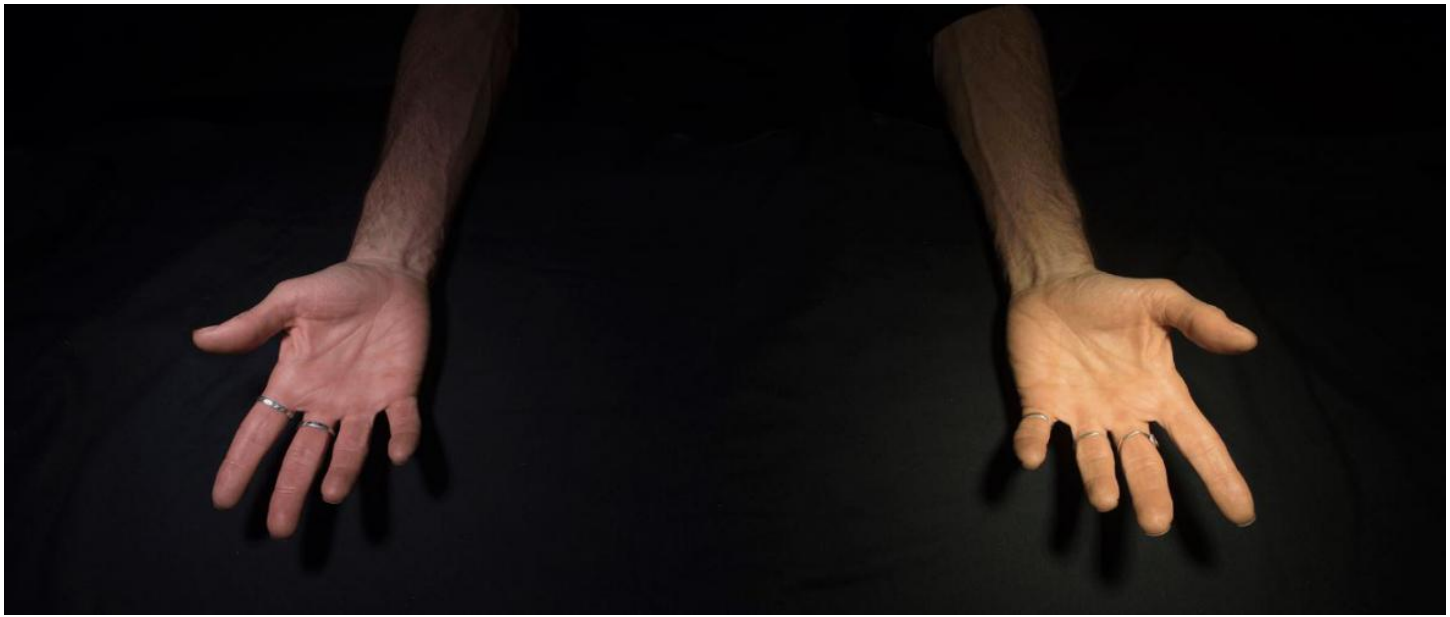
What's the difference between 90 & 80 ratings for color fidelity? Why 90?



90 Rf

80 Rf

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Why does "all else" need to meet DesignLights Consortium (DLC) Standard's minimum criteria?

- Correlated color temperature (CCT)
- Lumen maintenance (projected life)
- Warranty
- Power quality
- Safety certifications

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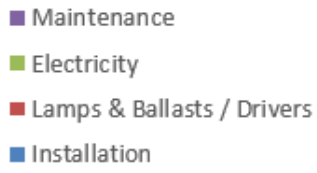
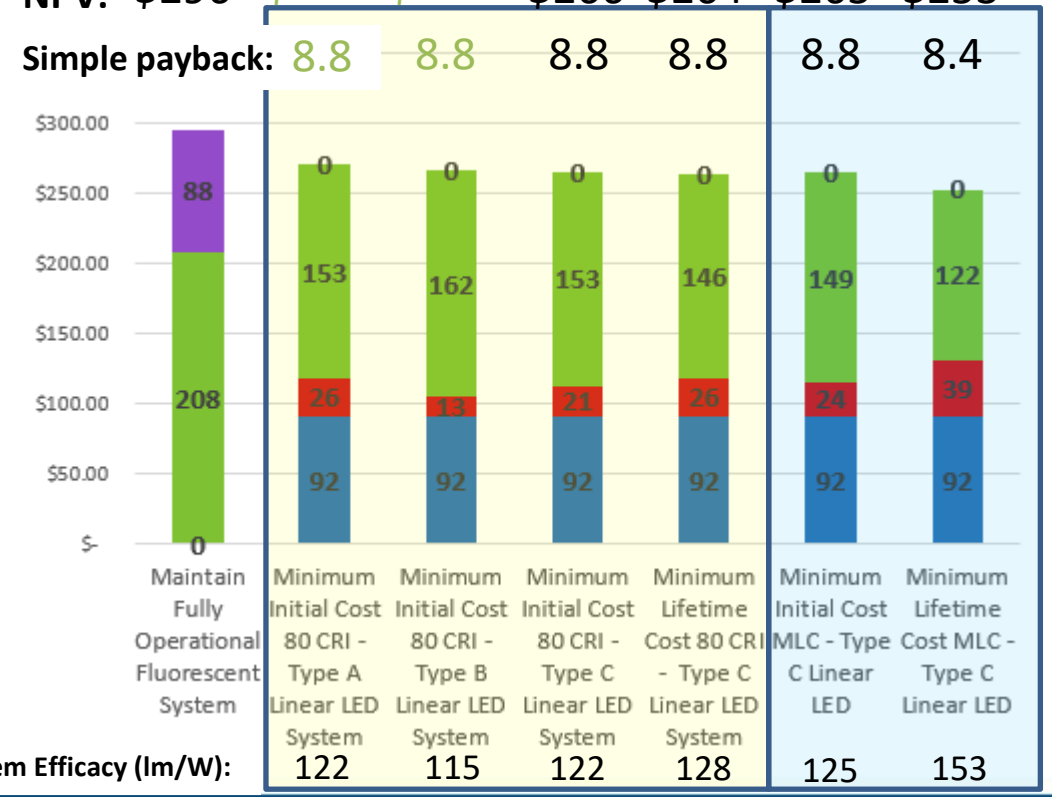
10% 14%

Are these Phase 2 products cost effective?

- Scenario A – 65% of UC audit
  - 2-lamp 1x4, 2x4, strip and pendants
  - Fluorescent vs. non-MLC LED vs. MLC LED
- Cost Effective Metrics
  - Net present value ($ to operate for 15-year period)
  - Simple payback (years)
  - $0.143/kWh
- Cost types

14% cost savings & 41% energy savings!





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Will my retrofit project trigger Title 24 requirements?

Please consult your construction design group to determine if your project triggers Title 24 requirements!*

- Alterations to indoor lighting systems that **include 10 percent or more** of the luminaires serving an enclosed space must meet one of the following requirements

- If the project includes **less than 10 percent** of the luminaires in the enclosed space, or the enclosed space has just one luminaire, the project is **exempt** for these requirements.

EXEMPT

from lighting alteration requirements

! Healthcare facilities using Option 2 or Option 3 are exempt from the shut-OFF control requirements.

1 Projects disturbing asbestos during construction

2 Any enclosed space with only one luminaire

3 Modifications to portable luminaires or those attached to moveable partitions

4 Any alteration that simply adds lighting controls or replaces lamps, ballasts, or drivers

5 One-for-one luminaire alterations of up to 50 luminaires per complete building floor, or per complete tenant space, per year

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Will my retrofit project trigger Title 24?

- **Option 1:** Comply with the indoor lighting power and lighting control requirements for new construction (middle column, **Table 3**).
- **Option 2:** Alterations using 80 percent or less of the indoor lighting power allowances for new construction must adhere to the lighting control requirements in the right column of **Table 3**. This is a reduction from 85 percent under the 2016 Standards.
- **Option 3:** Projects in small buildings, or tenant spaces (5,000 square feet or less) that include one-for-one luminaire alterations to 50 or more luminaires can retrofit with new luminaires that achieve at least 40 percent power reductions over pre-alteration luminaires. The project must include the lighting controls shown in the right column of **Table 3**.

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Control Requirements for Indoor Lighting System Alterations

Based on Table 141.0-F from the Energy Standards

Control Specifications		Trigger	Projects Complying with Section 141.0(b)2li	Projects Complying with Sections 141.0(b)2lii & 141.0(b)2liii
Manual Area Controls	**130.1(a)1** – Be readily accessible.	Enclosed areas with ceiling-height partitions of any size.	Required	Required
	130.1(a)2 – Be located in the same enclosed area with the lighting fixture it controls.		Required	Required
	130.1(a)3 – Provide separate control of general, display, ornamental and special effects lighting.		Only required for new or completely replaced circuits	Only required for new or completely replaced circuits
Multi-Level Controls	**130.1(b)** – Allow level of lighting to adjust up and down.	Enclosed areas 100 square feet or larger with connected lighting load that exceeds 0.5 watts per square foot.	Required	Not Required
	130.1(c)1 – Be controlled by an occupant sensing control, automatic time-switch control or other control capable of automatically shutting OFF all lighting when the space is typically unoccupied; provide separate controls as specified in 130.1(c)1B-D; and include a manual-ON mode for automatic time-switch controls.		Required; 130.1(c)1D only required for new or completely replaced circuits	Required; 130.1(c)1D only required for new or completely replaced circuits
	130.1(c)2 – Countdown timer switches may be used to comply with shut-OFF control requirements in closets less than 70 square feet and server aisles in server rooms.		Required	Required
	130.1(c)3 – Manual override for automatic time-		Required	Required

Please consult your construction design group to determine if your project triggers code.

Full table available here:

https://cltc.ucdavis.edu/sites/default/files/files/publication/2019-Nonresidential-Lighting-Guide-Final.pdf#page=86

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How do I purchase Phase 2 products?

Vendor	Products Offered	Contact Information
Rexel Energy Solutions	Linear LED Lamps	mlc@rexelenergy.com https://www.rexelenergy.com/mlc.html
ledgreenlight® Bringing Innovation to Light	Linear LED Lamps Retrofit Kits Luminaires	info@ledgreenlightint.com https://www.ledgreenlightint.com/contact
All-Phase Electric Supply Co.®	Linear LED Lamps	MLC@AllPhaseElectricSupply.com https://www.allphasemlc.com/mlc-phase-2

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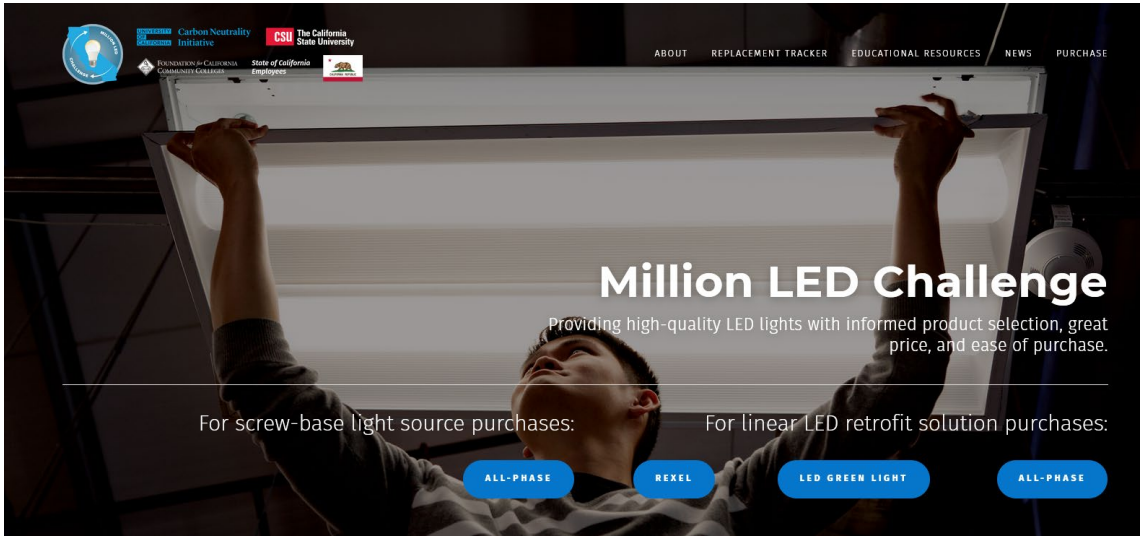
Where can I learn more about the MLC Program and research outcomes that informed the product selection?

https://www.millionLEDchallenge.org/



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Where can I learn more about the MLC Approved products?

https://www.millionLEDchallenge.org/purchase

Approved Products List

Product	Product Type/Combination	Vendor	Manufacturer	SKU	Rated System Wattage	CCT (K)	Lumens
Linear LED Lamps	2 ft.	LED Green Light	LED Green Light	GL-T8-2F-C-8W-4000K-95CRI-0	8.26	4000	1313
Linear LED Lamps	2 ft.	LED Green Light	LED Green Light	GL-T8-2F-C-8W-5000K-95CRI-0	8.26	5000	1313
Linear LED Lamps	2 ft.	LED Green Light	LED Green Light	GL-T8-2F-C-8W-4000K-95CRI-B	8.26	4000	1313
Linear LED Lamps	2 ft.	LED Green Light	LED Green Light	GL-T8-2F-C-8W-5000K-95CRI-B	8.26	5000	1313
Linear LED Lamps	2 ft.	All-Phase	Sylvania	LED8T8L24FGDIM930DC290	10	3000	1200
Linear LED Lamps	2 ft.	All-Phase	Sylvania	LED8T8L24FGDIM935DC290	10	3500	1200
Linear LED Lamps	2 ft.	All-Phase	Sylvania	LED8T8L24FGDIM940DC290	10	4000	1200
Linear LED Lamps	2 ft.	All-Phase	Sylvania	LED8T8L24FGDIM950DC290	10	5000	1200
Linear LED Lamps	2 ft.	Rexel	Keystone	KT-LED9T8-24G-935-E	8.5	3500	1125
Linear LED Lamps	2 ft.	Rexel	Keystone	KT-LED9T8-24G-950-E	8.5	3500	1125
Linear LED Lamps	3 ft.	All-Phase	Sylvania	LED12T8L36FGDIM930DC290	14	3000	1650
Linear LED Lamps	3 ft.	All-Phase	Sylvania	LED12T8L36FGDIM935DC290	14	3500	1650
Linear LED Lamps	3 ft.	All-Phase	Sylvania	LED12T8L36FGDIM940DC290	14	4000	1650
Linear LED Lamps	3 ft.	All-Phase	Sylvania	LED12T8L36FGDIM950DC290	14	5000	1650
Linear LED Lamps	4 ft.	LED Green Light	LED Green Light	GL-T8-4F-C-14.75W-4000K-95CRI-0	14.75	4000	2313
Linear LED Lamps	4 ft.	LED Green Light	LED Green Light	GL-T8-4F-C-14.75W-5000K-95CRI-0	14.75	5000	2313
Linear LED Lamps	4 ft.	LED Green Light	LED Green Light	GL-T8-4F-C-14.75W-4000K-95CRI-B	14.75	4000	2313
Linear LED Lamps	4 ft.	LED Green Light	LED Green Light	GL-T8-4F-C-14.75W-5000K-95CRI-B	14.75	5000	2313

The Approved Product List does not include pending items from vendors. DOWNLOAD .XLS FILE: Download

How is the Approved Products List maintained?

- MLC Program will review new products annually
- Product manufacturers work with MLC contracted suppliers to propose new products to MLC Program
- MLC Suppliers/Manufacturers must provide accredited testing documentation for review
- Proposed products must be compliant with MLC Program Requirements in original RFP to be added
  - MLC Performance Specification
  - Cost of products must comply with not-to-exceed pricing negotiated in original RFP
  - Sustainability requirements
  - Etc.

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Learn More from MLC vendors in their deep-dive webinars!

Vendor	Webinar Date	Meeting Link
Rexel Energy Solutions	June 17, 2021 1-2 PM PST	https://UCOP.zoom.us/j/98737614603
ledgreenlight® Bringing Innovation to Light	June 22, 2021 1-2 PM PST	https://UCOP.zoom.us/j/97314401713
All-Phase Electric Supply Co.®	June 30, 2021 1-2 PM PST	https://UCOP.zoom.us/j/91292050360

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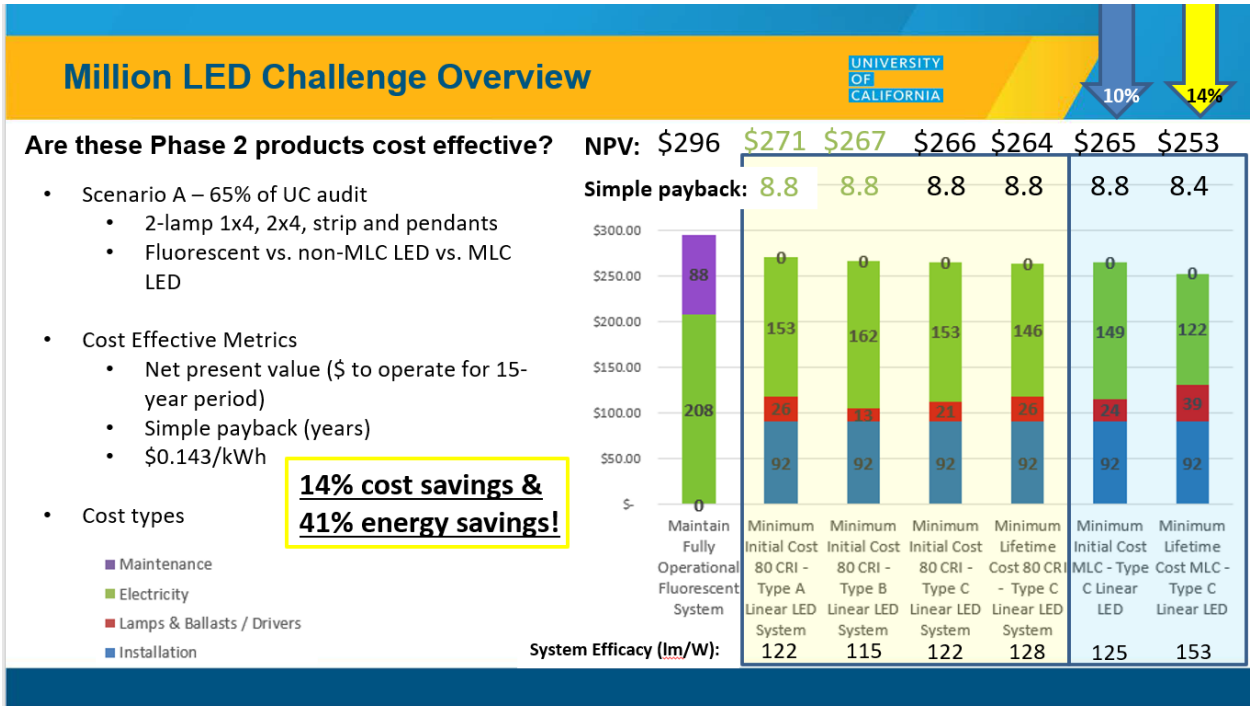
Questions?

Q: Will MLC make Type C products cost competitive with Type A and B?

A: Yes, see updates on Slide 20. Type A and Type B cost comparison, assumed energy rate, and system efficacy for each scenario added.



Q: Has there been any consideration of quick-connect/snap-in wiring harnesses for connecting retrofit and new luminaires? This was allow fixture replacement without requiring an electrician.

A: Each vendor offering is slightly different in this regard; I recommend attending the vendor webinars to learn about the details of each product being offered.

Q: What issues will MLC products have with OSHPD PIN 13 when retrofitting healthcare lighting systems?

A: OSHPD's PIN 13 outlines specific steps to take when retrofitting lighting systems in healthcare facilities. MLC products meet the requirements of OSHPD's PIN 13. Specifically, all MLC safety certification requirements must align with industry standards contained in the DesignLights Consortium's (DLC) standard requirements.

> *"All products are required to submit a compliance certificate from an approved safety certification organization relevant in the United States or Canada. This compliance document shall bear the manufacturers name and will be proof that the products listed have been investigated by the safety organization and found to be in compliance with the standards listed on the certificate. The name of this document*

varies by safety organization, however, is commonly referred to as a Certificate of Compliance or Authorization to Mark." – DLC Testing & Reporting Requirements

Q: Are the MLC Type C lamps compatible with forward and reverse phase existing dimmers?

A: No, depending on the specific MLC product they require controls with either 0-10V or wireless communication protocols.

Q: What is the impact from modifying an existing UL listed fixture with LED lamps other than those used as part of the original UL listed specifications?

A: To meet the industry standard for safety requirements, MLC's Type C LED lamps are required to meet UL-1598C requirements. Please see UL's stance on luminaire retrofits and how to fulfill safety requirements for luminaire retrofits:

https://code-authorities.ul.com/about/blog/led-retrofit-kits-ul-certified-luminaire-retrofit-kit-faqs/

Q: My project triggers Title 24, Part 6 requirements. The design process and additional controls add considerable costs to my lighting retrofit projects pushing me over budget. Advice?

A: When working with your construction design group for projects that are not exempt[1], please explore Title 24's lighting alteration Option 2 and Option 3 (Section 141.0(b)I). These options reward projects with reduced lighting power density (typical of LED products like those in the MLC Program) with reduced mandatory lighting control requirements. If your project qualifies, you can reduce your mandatory lighting controls to manual area controls and shut-off controls (can be addressed by an existing lighting control panel with schedule features, or occupancy sensors) only. If your project is in a healthcare facility and you are using Option 2 or Option 3, it is only required to install manual area controls to comply.

[1]Examples of exempt projects include 1) those with asbestos disruption and no abatement budget, and 2) one-for-one retrofits in projects 5,000 SF or less that address fewer than 50 luminaires. There are more exemptions, please consult your construction design group for details.

More information on Title 24, Part 6 lighting requirements are available here.