



Linear Replacement Lamp (TLED) Dimming Frequently Asked Questions

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INTRODUCTION

The dimming requirements in SSL V5.1 enhance the controllability of qualified lighting products across all DLC eligible categories in order to increase potential energy savings and improve quality of light, comfort, and wellbeing for end users of the occupied spaces. The policies ensure that products listed on the QPL have the capability to be dimmed, and are marketed by manufacturers as such, should the customer wish to take advantage of dimming. QPL products designated as dimmable may require the installation of additional components and/or building infrastructure to enable dimming. The DLC does not set requirements for how products are installed and/or used in the field.

BACKGROUND

How did the DLC decide to require dimming?

The dimming requirement was proposed conceptually in Draft 1 of V5.0 to cover nearly all products because it addresses all three goals of V5.0: energy, quality, and controllability. Applying the requirement consistently to all products was intended to maximize the energy savings potential for utility members and their customers.

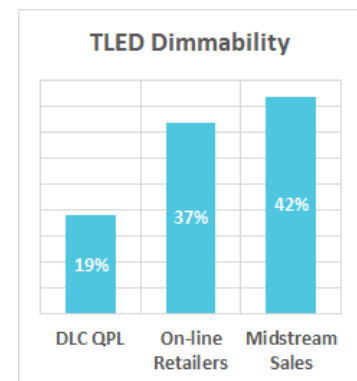
Market research was conducted and revealed that availability and sales of dimmable linear replacement lamps (TLEDs) in the market was greater than expected; and the implementation timelines that included the split between V5.0 and V5.1 enabled more time for manufacturer compliance (nearly two years). The DLC reached the conclusion that non-dimmable products on the QPL in 2022 and beyond would be inconsistent with the goals of the V5 policy and the DLC's guideposts of energy, quality, and controllability.

What research was conducted?

Dimmable linear replacement lamps (TLEDs) are available:

An analysis of three online retailers (bulbs.com, 1000bulbs.com, and grainger.com) in January 2020 found that over one-third (22 out of 60) of DLC-qualified models for sale are dimmable. (Limited to 4' 4000K type A and type B TLEDs).

In addition, an analysis of the Rhode Island midstream program found that 42% of TLEDs sold in 2019 are already dimmable, based on a SKU match against the QPL.



TLED midstream pricing is comparable:

Within the Rhode Island midstream program, the 2019 Q4 sales-weighted average price of DLC qualified dimmable models was \$7.08, compared to \$6.87 for DLC qualified non-dimmable models.

A variety of dimmable models from multiple manufacturers are available at a price comparable to non-dimmable models.

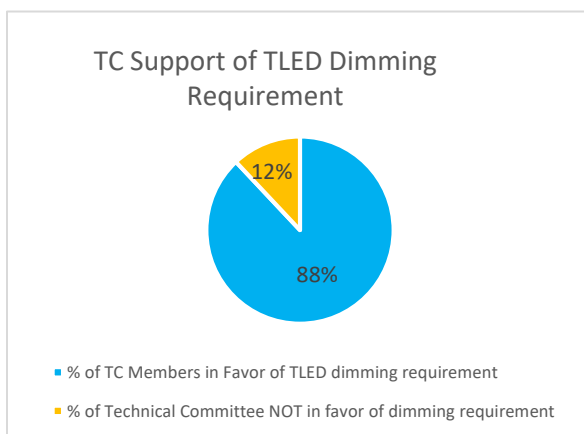
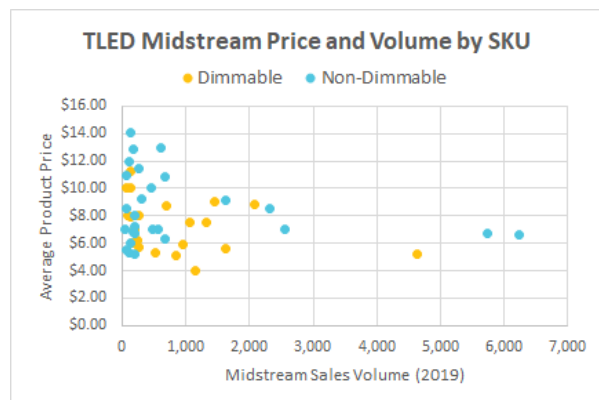
TLED price trend is decreasing:

Over the past two years, the cost of DLC qualified models has been reduced by roughly half, according to research conducted by Energy Solutions. The price of TLED products, particularly non-dimmable models, is expected to continue to fall and may be at or near price parity with baseline fluorescent products by 2022.

With little to no incremental cost for a non-dimmable TLED, there's no justification for a utility sponsored rebate. Accordingly, free-ridership would likely be high and attribution of savings to the program would be minimal. TLED free-ridership is already impacting programs by reducing the claimable savings. For example, Massachusetts and Rhode Island will apply a net-to-gross factor of 0.73 to TLEDs in 2020 and 0.66 in 2021.

DLC Member Technical Committee input supported:

- During the Technical Committee meeting held on February 7, 2020, 88% of program administrators indicated support for a TLED dimming requirement.
- Most programs have no plans to sunset TLEDs in near term and want to continue to offer incentives.
- Few programs are aware of contractors/ customers installing dimmable TLEDs.



How does DLC define “dimmable”?

The V5.0 and V5.1 policies use the following definitions for dimming:



Dimmable: A product that (a) includes a dimmable driver and/or is capable of being dimmed by an external control signal, and (b) is identified as dimmable on the product specification sheet.

Continuous Dimming: Per NEMA LSD-64: *a lighting control strategy that varies the light output of a lighting system over a continuous range from full light output to a minimum light output without flickering in imperceptible steps.* Continuous dimming shall be capable of reducing the light output to at least 20% of full light output.

Stepped Dimming: Per NEMA LSD-64: *a lighting control strategy that varies the light output of a lighting system in one or more predetermined steps of greater than one percent of full output. The changes between levels are generally perceptible.* Stepped dimming shall be capable of reducing the light output to at least 70% of full light output.

Field-Adjustable Light Output (FALO): Products with field-adjustable light output (FALO) are not automatically considered dimmable. To comply with V5.0 and V5.1 dimming requirement, products must meet the definition of dimmable above and be capable of either continuous or stepped dimming depending on the product category.

How are linear replacement lamp (TLED) products dimmed?

There are many ways a TLED can dim, depending on the type. Each type can be dimmed through a wired or wireless option.

Type A TLEDs can be dimmed using a dimmable fluorescent ballast (0-10V, DALI, etc.) or through a wireless signal from wall switch, sensor, NLC, etc.

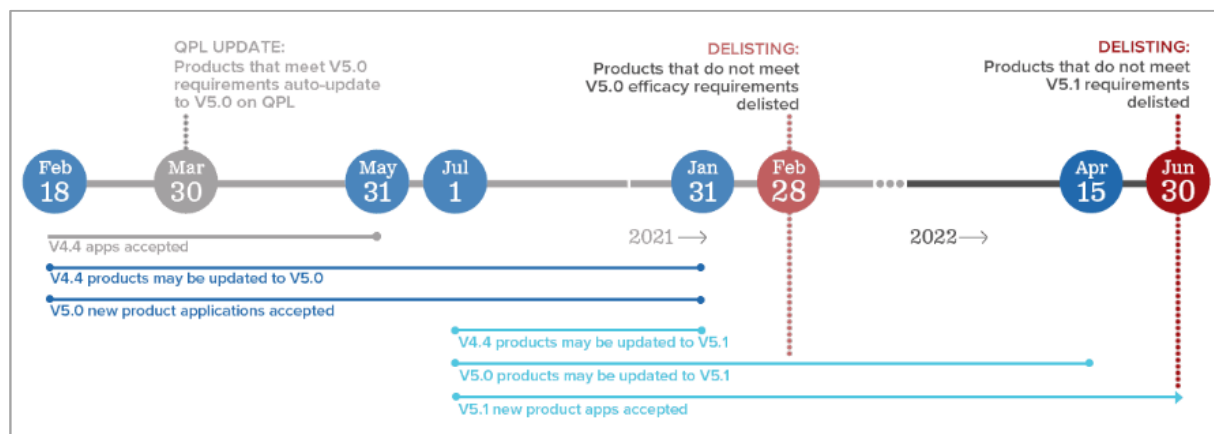
Type B TLEDs may be dimmed using Phase-cut dimming or via a wireless signal from wall switch, sensor, NLC, etc.

Type C TLEDs are paired with an LED driver as part of the system, so if this driver is dimmable (0-10V, DALI, etc.), TLEDs are dimmed through a signal sent to the driver. This may also be sent to the driver by wireless signal from a wall switch, sensor, NLC, or other control system.

DLC IMPLEMENTATION

When will dimmable linear replacement lamp (TLED) requirements be implemented?

TLED dimming is a requirement under V5.1, and products meeting the V5.1 requirements may appear on the SSL QPL by July or August of 2020. Products that do not meet the V5.1 requirements will be delisted on June 30, 2022. By July 1, 2022, all TLEDs on the QPL will be dimmable.



How will dimmable linear replacement lamp (TLED) products be displayed on the QPL?

V5.1 qualified TLEDs reflect the following characteristics:

- V5.0 efficacy requirements
- Continuous dimming capability
- Quality metrics for color and light distribution
- Reporting of integral controls, such as a networked replacement lamp
- Reporting of Control communication protocol

How will the DLC verify that products are dimmable?

DLC application reviewers will rely on manufacturer claims represented directly on the product specification sheet provided to DLC at the time of application. Currently, there are no existing industry standards for testing or evaluation of dimming performance. The DLC requires documentation to explicitly declare the capability, along with any ordering information (i.e. model number or ordering code variants) that are associated with the specific capability or attribute.

A DLC qualified dimmable product must be capable of dimming in at least one configuration, so it is possible that it may not be dimmable in all configurations. For example, a dimmable type A TLEDs may be compatible with only certain dimmable fluorescent ballasts and not others. Specifiers and users of the QPL should reference the manufacturer literature to confirm dimming compatibility for the specific application.

The DLC will monitor users' experience with QPL dimming information and intends to use surveillance testing procedures to address any concerns about dimming performance claims not matching QPL or market available data.

ENERGY EFFICIENCY PROGRAM SUPPORT

Why require linear replacement lamps (TLEDs) to be dimmable?

Dimmable products reduce energy use through manual or automatic dimming, allow users to fine tune light levels, mitigate issues with glare, and enable compatibility with networked lighting controls.

Dimming can unlock additional savings: A high efficacy TLEDs can save substantial amounts of energy, but much more savings are possible when the lighting is controlled to automatically provide the right amount of light, and only when needed. While non-dimmable TLEDs can work with occupancy sensors, they are not capable of leveraging all potential capabilities offered by networked lighting controls such as high-end trim, daylight dimming, and personal control/manual dimming, all of which can be used to achieve greater energy savings when paired with dimmable TLEDs.

Avoid stranded savings: Non-dimmable products lock out deeper energy savings over the life of the product, which could easily surpass a decade. Even if the controllability of a dimmable TLED is not leveraged immediately, the capability to do so later is maintained.

Provide the easy upgrade while still enabling control integration: Dimmable TLEDs are modestly more expensive than non-dimmable TLEDs, but pairing dimmable lamps with NLC is much less expensive than a luminaire + NLC.

Ability to dim is a desired capability: Building occupants want the ability to control light levels and a dimmable TLED can help occupants mitigate any post-installation issues with glare and over lighting.

Technology readiness: LEDs are inherently dimmable devices, there's no technological limitation. A majority of TLEDs are non-dimmable simply because the legacy technology they replace (fluorescent) was challenging and expensive to dim, but this shouldn't restrict TLEDs from achieving greater energy savings and meeting customer preference.

Comply with new quality metrics for color performance and light distribution:

- **Color** – Under V5.1, products must meet a color maintenance requirement that will help prevent shifts in chromaticity over time. TM-30 color rendition metrics will be reported to aid product specification and selection.
- **Light distribution** – Under V5.1, products must have a beam angle of 140 degrees or greater; this prevents narrow-beam strip TLEDs that could introduce glare and negatively affect light distribution.

How can efficiency programs prepare?

Measure development assumptions

- Programs that rely on a watts-saved methodology for prescriptive or custom measures will not require an update for efficacy.
- Programs that rely on deemed savings for energy, and/or wish to capture controllability savings can update their TLED assumptions using one of the following approaches:

	Claim V5.0 Efficacy Savings Only	Claim V5.0 Efficacy and V5.1 Controllability Savings
One-step Approach	Start Planning April 2020 Programs should update their efficacy measure assumptions between April and December of 2020. All V5.0 TLEDs will meet the efficacy requirements by 2021.	Start Planning July 2020 Programs should plan to update their efficacy and controllability measure assumptions between July 2020 and December 2021. The first V5. TLEDs products may appear in July 2020 and all V5.1 TLEDs will meet the efficacy and controllability requirements by 2022.
Two-step Approach	N/A	Step 1: Start Planning April 2020 Programs should update their efficacy measure assumptions between April and December of 2020. Step 2: Start Planning July 2020 Programs should plan to update their controllability measure assumptions between July 2020 and June 2022.

Program Offerings

Programs need to be aware of two delist actions that will affect TLEDs on the QPL:

1. January 31, 2020: TLEDs that do not meet the V5.0 efficacy requirements will be delisted.
2. June 30, 2022: TLEDs that do not meet the V5.1 quality and controllability (dimming) requirements will be delisted.

How can programs claim more savings from dimmable linear replacement lamps (TLEDs)?

The following example assumes the use of a type A TLEDs, 2095 initial lumens, replacing a 2-lamp F32T8 fixture, 3120 annual hours, 6.2% manual dimming savings, and 47% networked lighting control savings.

	V4.4 TLED (2020)	V5.0 TLED (2021)	V5.1 TLED (2022)	V5.1 TLED (2022)
Dimming Status	Non-dimmable	Non-dimmable	Dimmable	Dimmable
Controls	None	None	Manual Dimming	Networked Replacement Lamp
TLED Efficacy	110	120	120	120
kWh Savings	76.4	85.1	91.0	130.2
Savings % Change		11%	19%	70%
Rebate	\$3.00	\$3.34	\$3.58	\$5.11
Rebate \$/kWh	\$0.039	\$0.039	\$0.039	\$0.039
*Confirm with reference manufacturer literature for compatible dimming protocols, ballasts, etc. for in-field application				