

Totally Tubular – How can I upgrade my old troffers with LED?



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Various LED Options for Troffers



LED T8 lamps



Dedicated LED troffers



LED retrofit kits

Upgrading Troffer Luminaires to LED

Lighting accounts for roughly 20% of the electricity use in a typical commercial building, and the workhorse in these indoor applications has been the linear fluorescent lamp. In 2010, lighting systems using linear fluorescent lamps accounted for over 75% of the lighting service in commercial buildings. Recessed troffer luminaires, commonly available in 1' x 4', 2' x 4', and 2' x 2' sizes, provide the majority of this lighting. The total installed stock of common linear fluorescent luminaires in the United States is estimated to be over 960 million luminaires.¹

Although the installation of LED troffer-style luminaires jumped from an estimated 40,000 units in 2010 to nearly 700,000 units in 2012, LED luminaires still represent less than 0.1% of the troffer luminaires installed in commercial buildings. It may be possible to achieve over 25% energy savings on a national level if LED technology reaches its projected market penetration in troffer luminaires of over 65% by 2030. The energy savings on an individual project can be much greater than 25%. The related economic and environmental benefits are substantial.²

Introduction

Three primary LED options exist for upgrading lighting systems that use fluorescent troffers: replacing the fluorescent lamps with LED replacement lamps, replacing the fluorescent lamps and other luminaire components with an LED retrofit kit, and replacing the fluorescent luminaires with new luminaires designed for LED light sources. Selecting the best option for an installation depends on the current lamp and ballast types and the condition of the fluorescent troffer luminaires, the desired photometric properties of the upgraded lighting system, the accessibility of the ceiling plenum, and the initial and ongoing economic goals for the upgrade. This fact sheet provides guidance on the various factors to consider when deciding on an LED upgrade for a fluorescent system.

System Factors to Consider

An evaluation of LED upgrade options includes assessing the system costs and the impacts on the lighting system performance. Table 1 summarizes a number of the key factors, and the accompanying text explains those factors. The column heading *Lamps* refers to LED replacement lamps; the heading *Kits* refers to LED retrofit kits; and the heading *Luminaires* refers to new LED luminaires. For each of the three LED upgrade options, the table provides a color-coded identification of whether a factor is favorable for the related LED option (green circle), whether there may be reasons to exercise caution based on this factor (yellow triangle), or whether there may be significant barriers to implementing the related LED option based on this factor (red square). Note that the performance of the products available within each of the LED options varies and each individual product must be evaluated on its own merits.

¹ "Energy Savings Potential of Solid-State Lighting in General Illumination Applications", Navigant, January 2012, http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/energy_savings_report_jan_2012.pdf
² "Adoption of Light-Emitting Diodes in Common Lighting Applications", Navigant, April 2010, http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led-adoption-report_2010.pdf



Initial Costs

Equipment Purchase Costs
LED replacement lamps often provide the lowest cost option in terms of purchasing the LED components. The cost of LED retrofit kits is usually more than replacement lamps, and purchasing new LED luminaires usually is the highest cost.

Installation Labor Costs

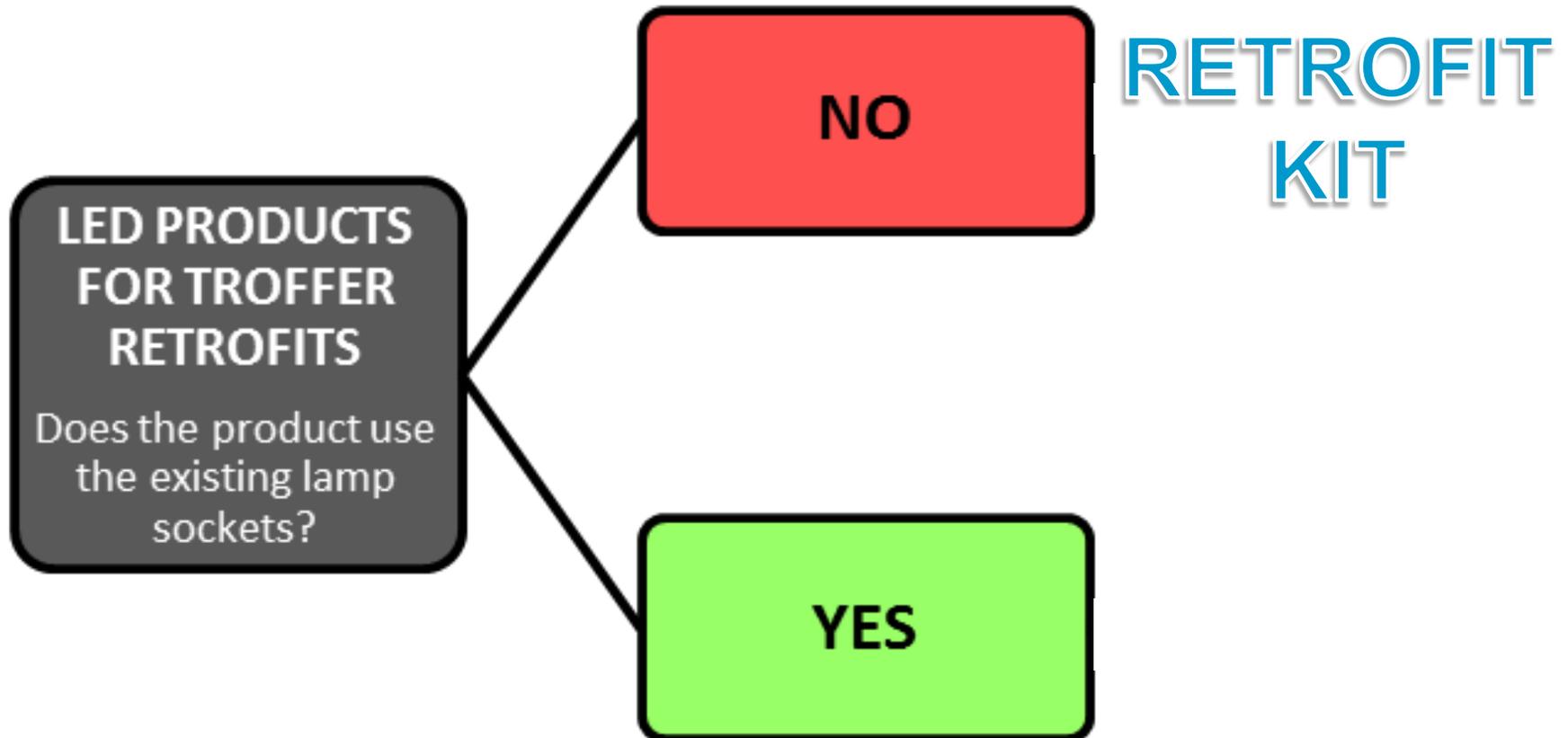
Replacement lamps that simply snap into the existing fluorescent lamp sockets provide the lowest labor costs for installation. However, most products marketed as replacement lamps require further modifications to the luminaire, and will have labor costs similar to products marketed as retrofit kits. Labor costs for installing retrofit kits are generally higher than those for replacement lamps, and depending on the extent of the luminaire modifications required, may approach or even exceed the labor

Table 1. System factors to consider for LED upgrades.

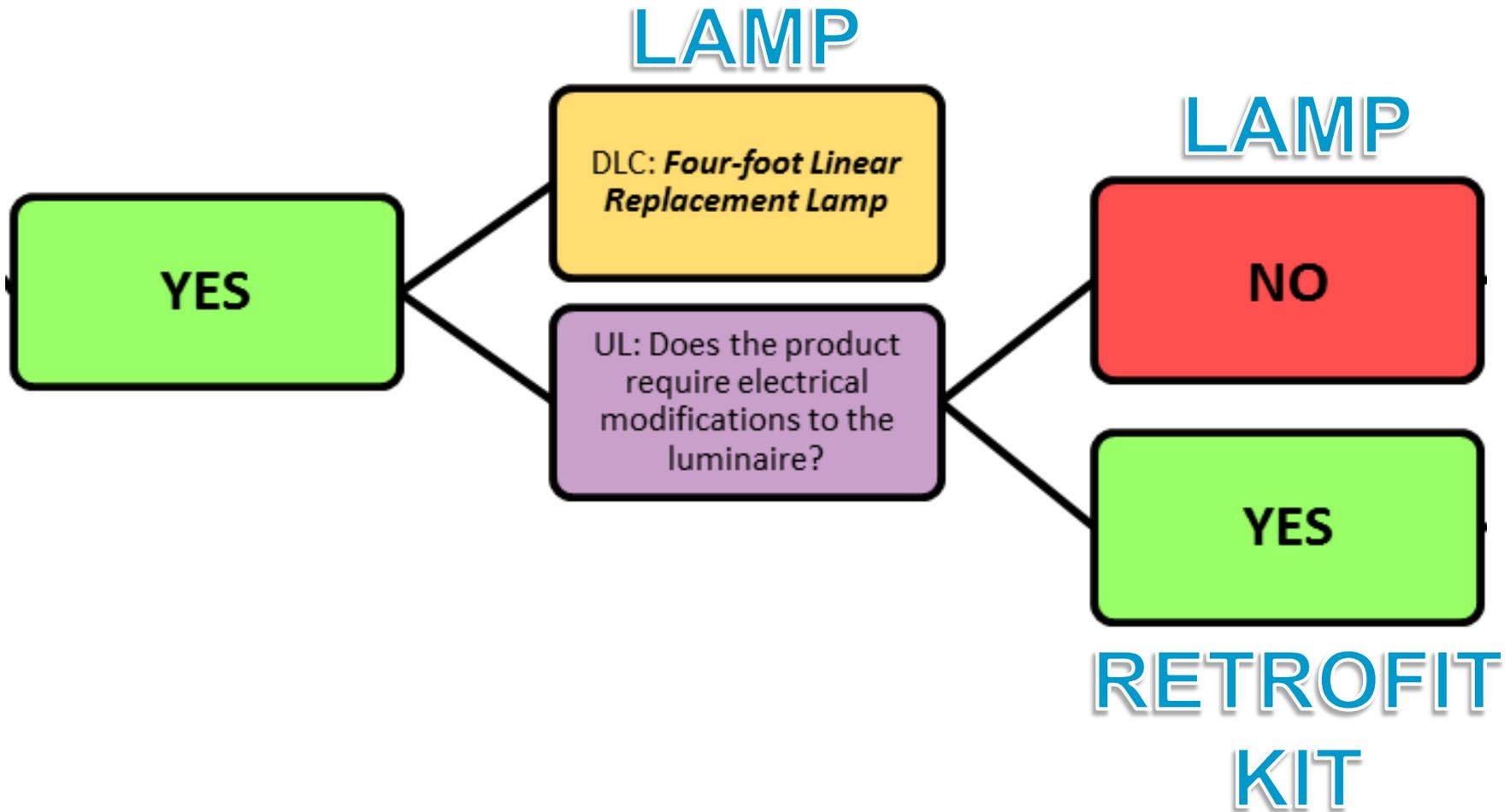
SYSTEM FACTORS TO CONSIDER	DESCRIPTION	LAMPS	KITS	LUMINAIRES
Initial costs	Equipment purchase costs	●	▲	■
	Installation labor costs	●	▲	■
Operating costs	Safety certification costs	▲	▲	●
	Energy costs for equal light output	■	▲	●
Current light levels	Replacement costs over system life	▲	▲	▲
	Acceptable; should not be reduced at all	▲	▲	▲
Dimming required	Reductions of 10% or more are okay	●	●	●
	No dimming is not required	●	●	●
	Yes, dimming is required	■	▲	▲

Fact sheet available!

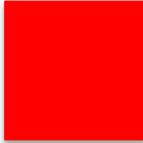
LED Retrofit Options: Is it a LAMP or a RETROFIT KIT?



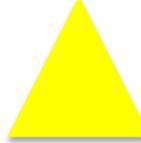
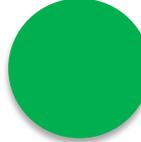
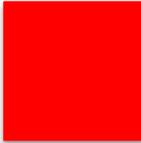
LED Retrofit Options: Does it use existing sockets?



System factors to consider for LED upgrades

SYSTEM FACTORS TO CONSIDER	DESCRIPTION	LAMPS	KITS	LUMINAIRES
Initial costs	Equipment purchase costs			
	Installation labor costs			
	Safety certification costs			
Operating costs	Energy costs for equal light output			
	Replacement costs over system life			

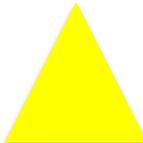
System factors to consider for LED upgrades

SYSTEM FACTORS TO CONSIDER	DESCRIPTION	LAMPS	KITS	LUMINAIRES
Current light levels	Acceptable; should not be reduced at all			
	Reductions of 10% or more are okay			
Dimming required	No, dimming is not required			
	Yes, dimming is required			

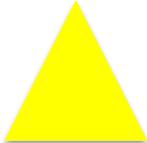
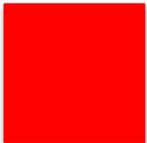
Existing conditions to consider for LED upgrades

SYSTEM FACTORS TO CONSIDER	DESCRIPTION	LAMPS	KITS	LUMINAIRES
Condition of sockets sockets	Looks like new			
	Some wear but no major cracks			
	Looks old, blackened, cracks cracks apparent			

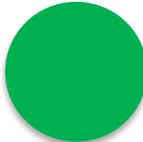
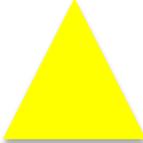
Existing conditions to consider for LED upgrades

SYSTEM FACTORS TO CONSIDER	DESCRIPTION	LAMPS	KITS	LUMINAIRES
Condition of interior interior surfaces surfaces	Nice and white			
	Slightly worn but no major scratches or peeling paint			
	Very worn, scratches scratches in paint, paint, some peeling peeling paint			

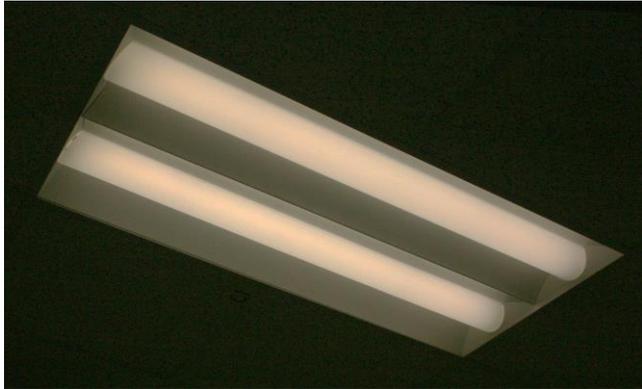
Existing conditions to consider for LED upgrades

SYSTEM FACTORS TO CONSIDER	DESCRIPTION	LAMPS	KITS	LUMINAIRES
Condition of lens or louvers	Looks new; very little wear apparent			
	Some minor color variations or scratches in surface			
	Looks old, obvious cracks or yellowing			

Existing conditions to consider for LED upgrades

SYSTEM FACTORS TO CONSIDER	DESCRIPTION	LAMPS	KITS	LUMINAIRES
Ceiling access	No concerns with working above the ceiling; easy access			
	Some concerns about working above the ceiling; limited access			
	Working above the ceiling should be avoided			

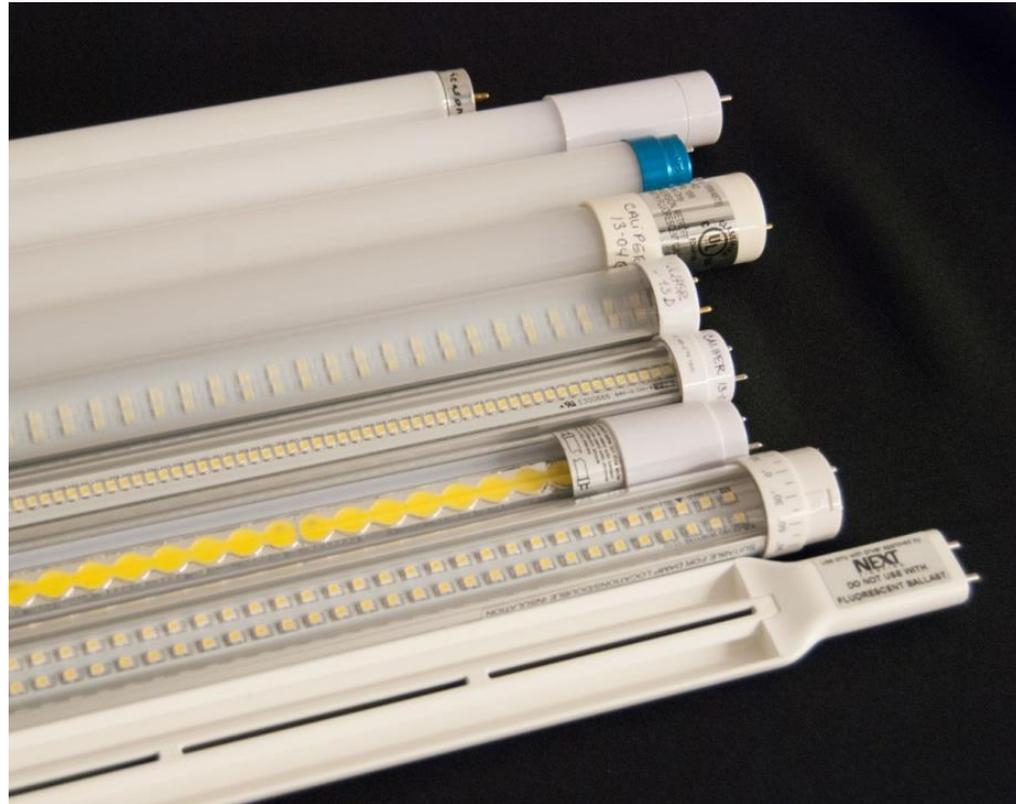
Totally Tubular: How will it look?



Totally Tubular: TLEDs (T8 LED tubes)

28W T8 FL lamps

- >1900 lm
- >100 LPW
- >80 CRI
- Beam angle $>133^\circ$
- Same lamp/wiring type
- Keep 5% spares



Totally Tubular: Retrofit Kits

- Energy savings vs. light levels?
- NRTL approved / UL1598C?
- Limitations on troffers or depth?
- *>70 LPW as installed*



Watch for new DOE report on Princeton's Icahn Lab:

- Converted >800 2x2 U-lamp troffers to LED
- Reduced wattage from 60W to 45W
- Reduced energy by over 110,000 kWh/year with controls

Totally Tubular: New luminaires

Better Buildings Alliance – LED Troffer spec

- Target minimum luminaire efficacy of 85 LPW
- 5 year warranty
- PF>0.90 THD <20%
- Driver efficiency >80% for <50W
- Minimum luminaire lumens:
 - 2 × 2 - 2,000 initial lumens
 - 2 × 4 - 3,000 initial lumens
- CRI >80 with R_g >0
- Lumen maintenance >77.4% @ 36,000 hours

BBA spec available at:

http://apps1.eere.energy.gov/buildings/publications/pdfs/alliances/high_efficiency_troffers_spec.pdf

Questions? Discussion? Totally Tubular – How can I upgrade my old troffers with LED?

Link to [Upgrading Troffer Luminaires Fact Sheet](#)
Links to CALiPER reports on [LED Troffer Lighting](#) and [Linear LED tubes](#)



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