

LED Lighting for Hotels

Also referred to as Solid State Lighting (SSL)

George Tregay
Waste Reduction Partners

Green Hotel Webinar Series
Session 6, May 21, 2014



General Purpose



Flood/Spot



Downlight



**Linear
Fluorescent
(Troffer)**



Outdoor

Key considerations will differ depending on lighting type

STEP 1 - GET THE CORRECT QUANTITY OF LIGHT

All Lighting Upgrades

- The goal is to provide sufficient illumination for people to do their activities comfortably and in an aesthetically pleasing environment.
- How much light is enough?
Illuminating Engineering Society of North America (<http://www.iesna.org/>) sets officially recognized standards measured in foot candles (or lux).

Illumination Level for Space / Task	Foot candles, fc
Lobbies , Reception Areas	10-30
Typical Offices	30-50
Meeting Rooms	30-50
Kitchen	30-50
Retail	50-100
Guest Rooms	10-30
Corridors, Elevators, Stairs	5 minimum
Parking Garage	10

Determine the amount of light produced by current fixtures (measured in lumens). Proportionally increase or decrease target lumens per fixture if necessary to bring illumination to recommended standards.

STEP 2 - GET THE RIGHT QUALITY OF LIGHT

All Lighting Upgrades

Color Temperature

- Influences aesthetics of area
- People can have strong personal preferences
- Be consistent about color temperature of lamps within a room

Color Rendering Index (CRI)

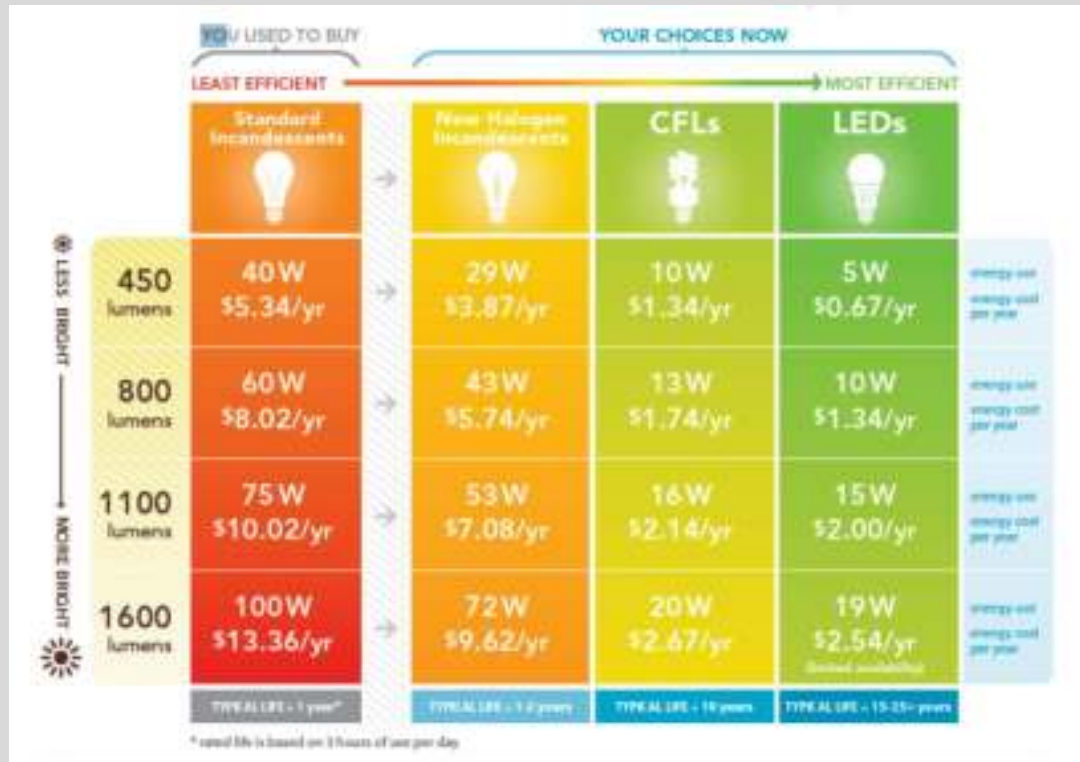
- Measure of color accuracy relative to incandescent source (100)
- Critical for retail and artwork
- Target 80 or above where color is important



Product Label

LEDs are available in a range of color temperatures and with good color rendering

ADVANTAGES OF LEDS



- LEDs are a rapidly improving technology
- Over 3000 Energy Star rated LED products
- Color and color rendering generally better than CFLs
- Prices are falling every year
- Rebates and incentives are widely available

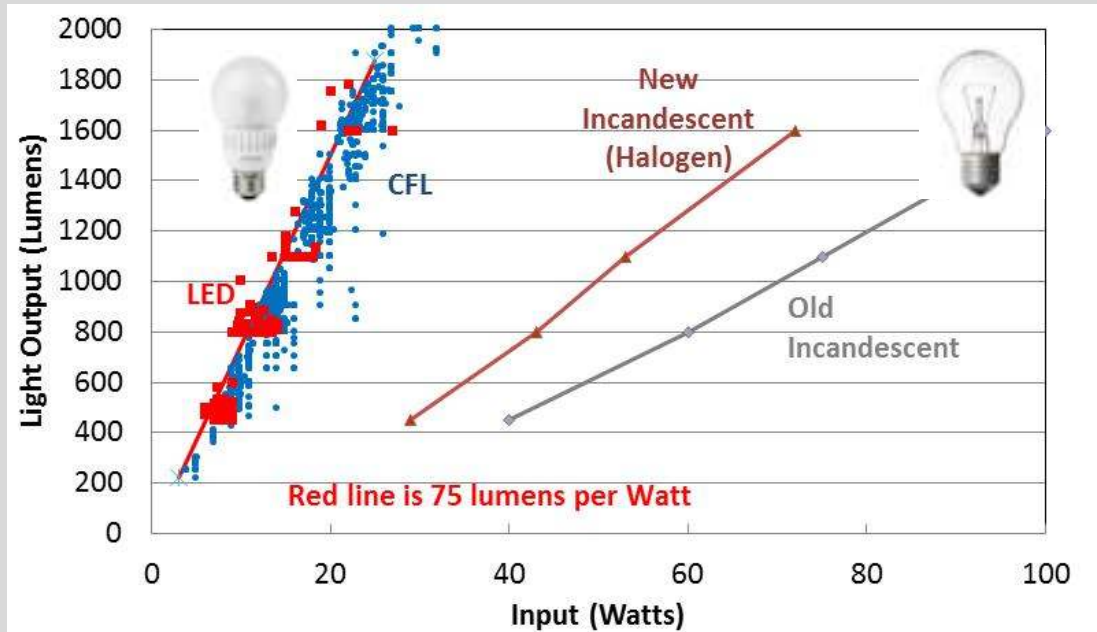
Specify Energy Star to insure quality for more than 20 product parameters

Source: <http://www.nrdc.org/energy/lightbulbs/files/lightbulbguide.pdf>

See ENERGY STAR® Certified Light bulbs – Product finder
<http://www.energystar.gov/productfinder/product/certified-light-bulbs/results>
 Another certified product list is by the DesignLights Consortium
<http://www.designlights.org/>

Replacing incandescent/halogen bulbs should be a top priority.
 Selecting between CFL and LED requires a more detailed assessment .

GENERAL PURPOSE BULBS



Similar considerations apply to decorative (candelabra) bulbs

Target >60 Lumens/W
(Energy Star minimum 40 lumens/W)

Key Considerations

- LEDs have achieved higher efficiency than CFLs
- Target LEDs with >75 lumens/W (Energy Star minimum 50 to 55 lumens/W)
- LED bulbs can differ significantly in angular distribution of light – test in fixture
- Some LEDs can cause FM radio interference - check sample in guest rooms
- LEDs can be cost effective (up to 1000 lumens for <\$10 , up to 1600 lumens for <\$20)

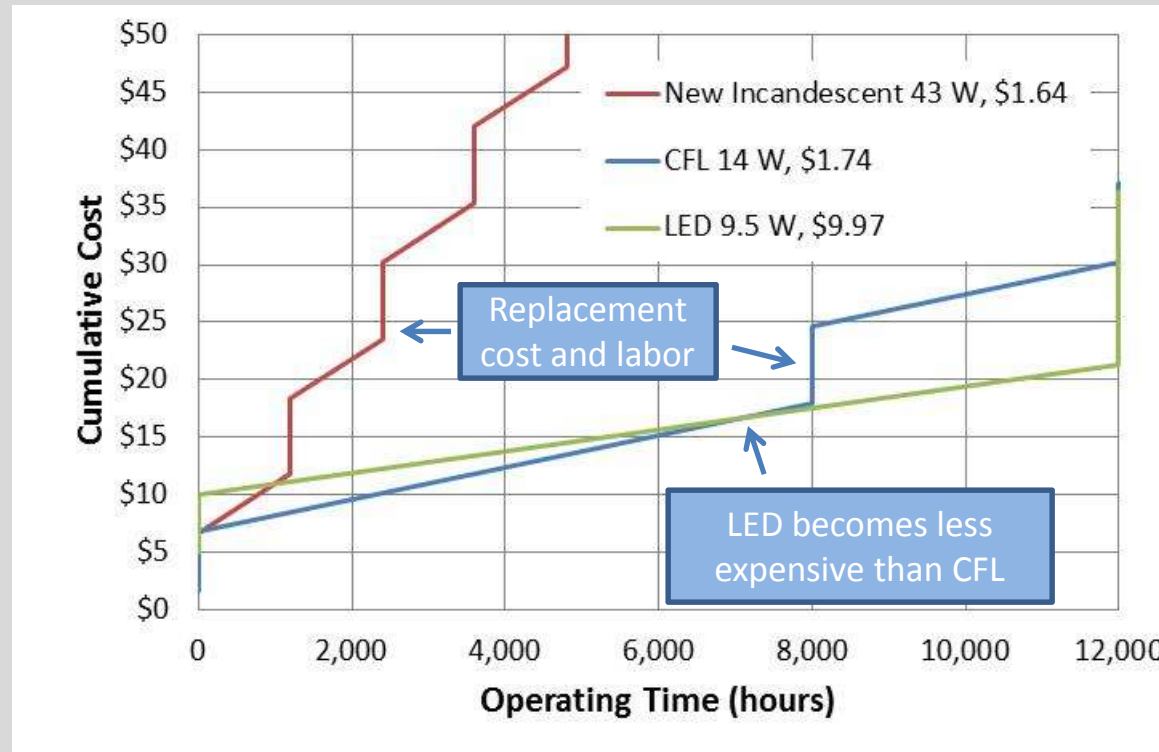
Fact Sheet General Service Lamps

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led_general-service-lamps.pdf

LEDs can be preferred replacement for incandescent and halogen bulbs

COST ANALYSIS

Replacing a 60 Watt Incandescent Bulb



Key Considerations

- Evaluate for operating times in 3 to 5 year range to balance assessment of initial and operating costs
- Include incentives/rebates and labor in analysis

LEDs with high efficiency and at least moderate operating time can be more cost effective than incandescent/halogen bulbs

COST ANALYSIS

Replacing a 60 Watt Incandescent Bulb

Example:

A 4-year period for a bulb operating 3,000 hours per year is 12,000 hours.

The effective electric rate is \$.10 per kWh.

	Halogen	CFL	LED
Wattage	43	14	9.5
Life of Bulb	1,000	8,000	20,000
Number of Replacements (12,000/Life)	12	1	0
Price	\$1.64	\$1.74	\$15.00
Rebate	none	none	-\$5.00
Installation Labor	\$5.00	\$5.00	\$5.00
Operating Cost (Watts x 12,000 hr x rate x.001 kW per W)	\$51.60	\$16.80	\$11.40
Replacement Cost (Price x # of replacements)	\$19.68	\$1.74	\$0.00
Replacement Labor Cost (Install x # of replacements)	\$60.00	\$5.00	\$0.00
Total Cost for 4 years	\$137.92	\$30.28	\$26.40

Cost analysis should include initial cost and rebates, labor and replacement cost and labor.

LED APPLICATION EXAMPLES

LED Type and Output		Lumens per Watt		
Application	Lumen Range	Average	Best	% Best over Avg.
Bulbs and Lamps				
General Purpose	700-1,100	69	94	36%
Directional	600-1,300	57	89	56%
MR16	400-600	55	77	40%
Decorative	400-700	58	77	33%
Luminaries				
Downlights	600-1,500	49	88	80%
Troffers	1,000-8,000	83	119	43%
High-Bay	15,000-35,000	88	110	25%
Parking Garage	1,000-6,000	72	106	47%
Parking Lot	10,000-20,000	78	101	29%
Streetlights	10,000-20,000	79	110	39%

DOE Adoption of Light-Emitting Diodes in Common Lighting Applications
http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led-adoption-report_2013.pdf

Maximize benefits by selecting highest lumens per watt among options meeting other specs

DIRECTIONAL – FLOOD AND SPOT

Flood/Spot Key Considerations



- LED directional lamps have three times the lumens per Watt of typical halogen lamps and are on par with CFL and ceramic metal halide lamps
- Check compatibility with existing dimmers
- Target LEDs with >70 lumens/W (Energy Star minimum 40 lumens/W)
- LEDs can be cost effective at operating times >40 hours per week

Fact Sheet LED Directional Lamps

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led_directional_lamps.pdf

MR16 Key Considerations



- LED lamps typically produce 40 to 60 lumens/W (up to 600 lumens) and surpass halogen MR16 lamps capable of only 10 and 25 lumens/W
- Heat buildup shortens life – check for restricted air access
- Check compatibility with existing dimmers and/or transformers
- Target LEDs with >60 lumens/W (Energy Star minimum 40 to 45 lumens/W)
- Target color rendering (CRI) index >80 for retail

Fact Sheet LED MR16 Lamps

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led_mr16-lamps.pdf

Directional nature of LEDs is well suited to these types of lamps

DOWNLIGHTS



Key Considerations

- Light output of the downlight is what counts - Integrated LED/luminaire likely to perform better than bulb replacement
- LED downlights typically produce 40 to 60 lumens/W surpassing incandescent and halogen-based downlights
- Check compatibility with existing dimmers
- Target LED downlights with >50 lumens/W (Energy Star minimum 42 lumens/W)
- Target color rendering (CRI) index >80 for retail

Fact Sheet Recessed LED Downlights

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/recessed_downlight.pdf

LED downlights are replacing alternate technologies

LINEAR FLUORESCENTS AND TROFFERS

LED Lamp Replacement and LED retrofit kits



- Linear fluorescent tubes already have high lumens per Watt and LED lamps will be similar.
- Method of retrofitting LED components into existing luminaires should be checked to insure safety certification (Underwriters Laboratory, etc.) is maintained (details in fact sheet below).

Troffer Replacement



- LED troffer replacements are available for all of the most common troffer sizes (2-ft by 2-ft, 1-ft by 4-ft, and 2-ft by 4-ft)
- Target LED troffer performance > 74 Lumens/W.

Fact Sheet Upgrading Troffer Luminaires to LED

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led_troffer-upgrades_fs.pdf

Fact Sheet CBEA High-Efficiency Troffer Lighting Specification

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

Troffer replacement can offer performance and aesthetic benefits

OUTDOOR LUMINARIES

Source Type:

LED

Dimensions:

6.1" deep
17.5" square

Input Watts:

133

Lumen Output:

10,575



Source Type:

Metal Halide

Dimensions:

11.5" deep
15" round

Input Watts:

175

Lumen Output:

10,400



General Considerations

- LEDs have exceptional ability to direct the light to where needed thereby reducing lumens per fixture
- More even lighting across sidewalks or parking areas without stray light disturbing guest rooms
- Instant start and dimming can be employed with controls to achieve better than 50% reduction in energy usage

EERE Using LEDs to their Best Advantage

SSL DEMONSTRATION: Parking Garage Lighting, Washington, DC

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/deptoflabor_brief.pdf

LED outdoor lighting upgrades can reduce operating cost and improve guest satisfaction

CREDITS, INCENTIVES AND REBATES

DSIRE is a comprehensive database of information on state, federal, local, and utility incentives and policies that support renewable energy and energy efficiency.

<http://www.dsireusa.org/>

Utility Incentives and Rebates are very common. Examples:

- Mass Save (NSTAR, national grid, others): Incentives of \$30 per LED track fixture, \$75 per LED replacement of 1x4' or 2x4' Fluorescent
<http://www.masssave.com/>
- Mid American Energy (Iowa) has rebates of \$10-\$15 for LED screw in bulbs and \$100 for 400 W HID equivalent
http://www.midamericanenergy.com/ee/include/pdf/ia_bus_lighting_table.pdf
- NSTAR: Direct install for small business – Free energy audit and pays up to 70% of total project cost for retrofitting qualifying lighting
http://www.nstar.com/business/energy_efficiency/electric_programs/direct_install_program.asp
- Duke Energy Progress: Similar to above
<https://www.progress-energy.com/carolinas/business/save-energy-money/sbes/index.page?>

Incentives and rebates offset the higher initial cost for LED upgrades

SUMMARY

For all lighting upgrades:

- Determine illumination level needed and required lumens per fixture
- Specify color temperature and minimum color rendering index

For replacing bulbs:

- Specify Energy Star and above average performance in terms of lumens per Watt
- Evaluate samples for acceptable spatial distribution and color
- Check compatibility of bulbs with dimmers, transformers, etc.

For recessed fixtures (downlights and troffers):

- Integrated lamps and fixtures are likely to provide greatest energy saving

For outside lighting:

- Use directionality of LEDs to provide more uniform illumination with less lumens

LED upgrades can be cost competitive now.
Incentives and rebates expand types of viable projects.
LED performance is improving annually and prices will continue to fall.

QUESTIONS

Contact information

George Tregay
WRP Volunteer Energy Assessor
tregaygeo@aol.com
828-693-0553

Waste Reduction Partners
339 New Leicester Hwy. Suite 140
Asheville NC 28806
wastereductionpartners.org
828-251-6622



WASTE REDUCTION PARTNERS

dedicated professionals sharing expertise