

LEDs for Low-Income Residences

Presentation to LIFE Conference

May 29, 2014

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Lighting Research Center,
Rensselaer Polytechnic Institute

Agenda

- ◆ Introduction to LRC
- ◆ LEDs
- ◆ Other lighting efficiency options
- ◆ Resources and education

Lighting Research Center

Advancing the effective use of light, thereby creating a positive legacy for society and the environment.



NVLAP-accredited testing laboratory

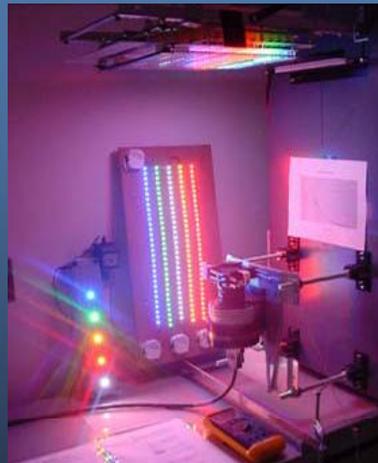
Founded in 1988

30,000 sq. ft. near Rensselaer campus



40-60 concurrent projects in field and lab

Research & education revenue = \$6 M/year



35 full-time faculty and staff
15 graduate students



LED availability

- ◆ ENERGY STAR qualified:
 - › 3,800 LED bulbs
 - › 3,300 LED fixtures
 - › Mostly residential products
- ◆ DesignLights Consortium qualified:
 - › 4,300 LED bulbs (linear fluorescent replacements)
 - › 41,600 LED fixtures
 - › Commercial products



As of May 2014

Retrofit applications



	Halogen	CFL	LED
Retail price	\$1.50	\$2	\$12
Life	1,000 h	12,000 h	25,000 h
Power	43 W	13 W	11 W
Payback Period	N/A	0.1 yr	1.5 yr
Cost of Ownership	\$9/year	\$2/year	\$3/year

Retrofit applications

- ◆ Situations that favor LEDs over CFLs
 - › Downlights & other directional applications
 - › Difficult-to-reach locations
 - › Circuit with dimmer
 - › Light quality
 - › Cold temperatures
 - › Child's room
 - › Frequent switching
- ◆ Situations that favor CFLs over LEDs
 - › High temperatures

New construction: Upgrade to T8 or LED?

T12 Troffer

2x F40T12, parabolic troffer
Fixture flux (mean) 3200 lm
Input power 99 W
Fixture opt. efficiency 74%
Luminaire efficacy 32 lm/W
Lamp life 20,000 hours

Electricity Cost:
\$43.36/yr
Relamping Cost:
\$6.50/yr

T8 Retrofit

2x F28T8, ballast
Fixture flux (mean) 3330 lm
Input power 49 W
Fixture opt. efficiency 74%
Luminaire efficacy 67 lm/W
Lamp life 40,000 hours

OR

LED Retrofit Kit

Fixture flux (mean) 3400 lm
Input power 44 W
Fixture opt. efficiency 100%
Luminaire efficacy 77 lm/W
L₇₀ life > 50,000 hours

Upfront Cost: \$49
Electricity Cost:
\$21.46/yr
Relamping Cost:
\$3.29/yr

Energy Savings: 51%
Cost Savings: \$25.11/yr
Payback Period: 2 yrs

Upfront. Cost: \$255
Electricity Cost:
\$19.27/yr
Relamping Cost: \$0
Energy Savings: 56%
Cost Savings: \$30.59
Payback: 8.3 yrs

LED: Cree CR24 upkit with 4000 lumens
Assume 12h per day, COE: \$0.10/kWh
Equipment prices as of Sept. 2013

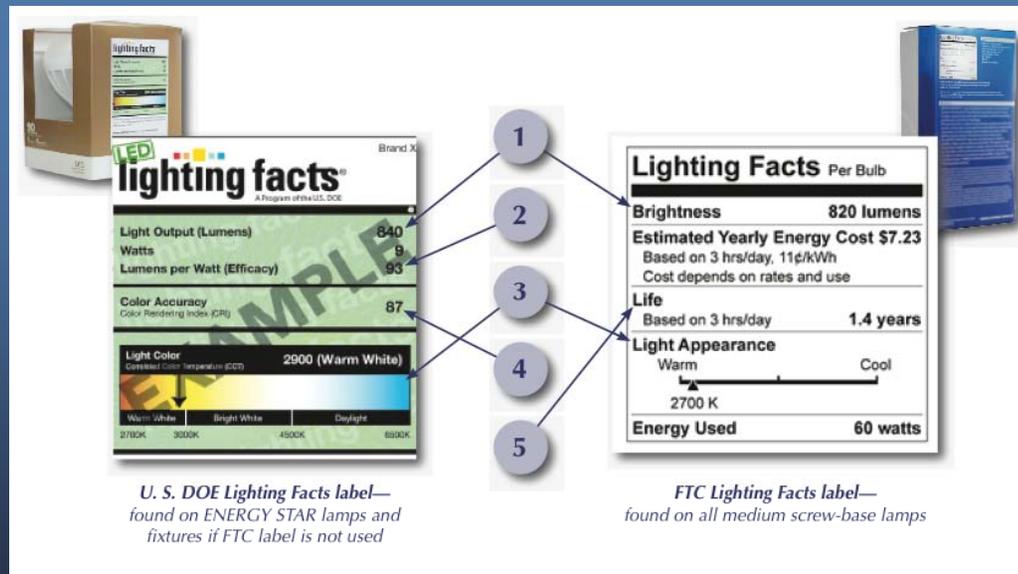
New construction applications

- ◆ Situations that favor LED luminaires
 - › Layered lighting design
 - › Dimming
 - › Cold temperatures
 - › Frequent switching
- ◆ Situations that favor other luminaires
 - › High ambient light levels

Selecting LEDs

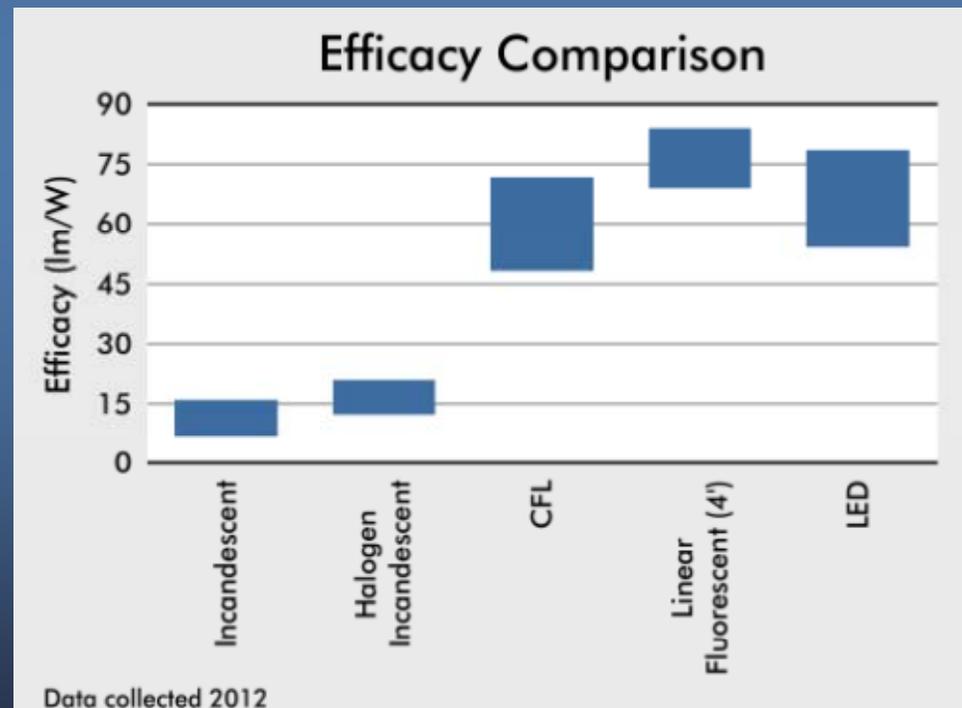
◆ Match:

- › Type of bulb or fixture
- › Match light output (in lumens or lm) of current lighting
 - Illuminance on application area (in footcandles or lux) is better
- › Correlated color temperature (CCT) in Kelvin (K)
- › Size
- › UL rating



Selecting LEDs

- ◆ Consider:
 - › Efficacy
 - › Compatibility with dimmers
 - › Warranty
 - › CRI
 - › ENERGY STAR label
 - › Thermal conditions
 - › Replace bulb with fixture



Potential lighting issues to avoid

◆ General

- › Low light levels
- › Glare
- › Mismatched or inappropriate CCT
- › Poor color rendering
- › Improper control commissioning

◆ LED-specific

- › Thermal management
- › Heavier product may sag
- › Difficult to predict life of product "system"
- › Potential for color shift

Lighting controls

- ◆ Occupancy sensors
 - › Auto on and off
 - › Best for common areas with little sense of ownership
 - › Use with bi-level switching in stairwells
- ◆ Vacancy sensors
 - › Manual on, auto off
 - › Best for private areas
- ◆ Manual switches
 - › Inexpensive energy savings for new construction
 - › Consider wireless solutions for retrofits & plug-in fixtures

Light distribution

- ◆ Task/ ambient lighting
 - › Put more light where it's needed for tasks
 - › Reduce light in other areas
 - For navigation
 - Avoid gloomy look
 - Avoid big contrast



Resources and education

- ◆ ASSIST's The Lighting Field Guide: Upgrading to LEDs for Multi-family Housing
- ◆ <http://www.lrc.rpi.edu/programs/solidstate/assist/pdf/multifamilyLEDGuide.pdf>



Resources and education

- ◆ Lighting Patterns for Homes website
- ◆ <http://www.lrc.rpi.edu/patternbook>
- ◆ Includes multi-family
- ◆ Calculators
- ◆ Lighting and equipment guidance



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Lighting
Research Center

Resources and education

- ◆ LED lighting for contractors interactive video
- ◆ <http://www.lrc.rpi.edu/resources/JSFlash/LEDforContractors/LEDForContractorsv20.html>
- ◆ Requires broadband and Flash player



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Resources and education

- ◆ Upgrading incandescent bulbs interactive video
- ◆ <http://www.lrc.rpi.edu/resources/JSFlash/lampupgradewebisode.html>
- ◆ Requires broadband and Flash player



Resources and education

- ◆ Residential lighting seminar
- ◆ <http://www.lrc.rpi.edu/education/outreachEducation/ResidentialLightingSeminar.asp#.U3pfUV66K0I>
- ◆ One-day, hands-on training
- ◆ Discounts for NY residents



Thank you