



Lighting for an Improved Environment of Care

June 10, 2015
1:00 PM - 2:00 PM EDT
1-877-309-2074
Access Code: 469-590-937

Overview and Agenda

- Welcome and Overview
- Making Lighting a Priority
- Technology Guidance and Interior Lighting Campaign
- Question & Answer Session

Presenters

John D'Angelo



NORTHWESTERN
UNIVERSITY

- VP for Facilities
- 27 years of facilities experience
- Formerly with NY Presbyterian and Cleveland Clinic

Michael Myer



Pacific Northwest
NATIONAL LABORATORY

- Lighting expert with Alliance's Lighting & Electrical team
- 12 years of lighting experience
- Formerly an architectural lighting designer



Making Lighting a Priority

John D'Angelo

Lighting is NOT in the Top 10

Things that a HC FM Director Worries About:

1. Patient Outcomes
2. Patient Safety
3. Patient Experience
4. Declining Budgets
5. Aging Staffing
6. Aging Infrastructure
7. Redundancy
8. Reliability
9. Outsourcing Threats
10. Access to Capital

Or, is it?

1. Patient Outcomes

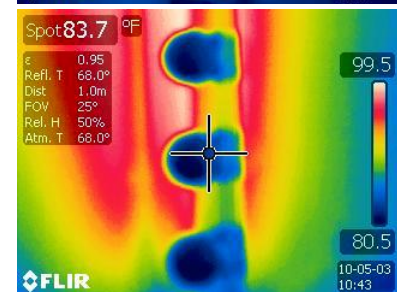
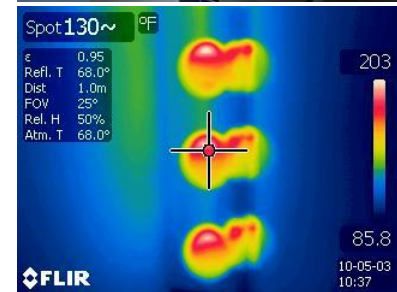
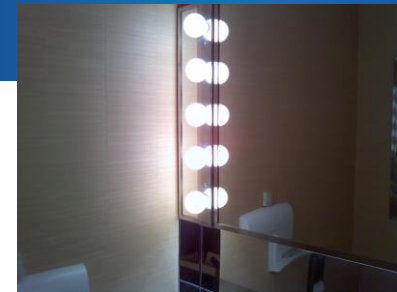
- Circadian Rhythms
- Healthcare Associated Infections
- Consistent visual presentation
- Radiation vs. conduction in the OR
- Asthma from airborne particulates
- Carcinogens and toxic byproducts

2. Patient Safety

- Fire – waste heat and circuit loading
- Reliability – e-power/transformers
- Maintenance focus – FTE efficacy
- Visibility – security and falls

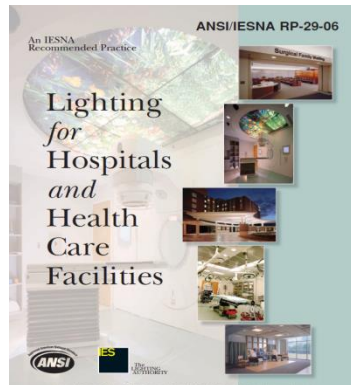


On May 15, 1929, the main building of the Cleveland Clinic caught fire. The fire began when an exposed light bulb was too close to some nitro-cellulose x-ray film, igniting the film. In the end, 123 people lost their lives. Eighty of the dead were either patients or visitors at the clinic, and the rest were employees. One of the Cleveland Clinic's founders, Dr. John Phillips, was among the dead. Most of the victims died from inhaling poisonous gases produced by the burning x-ray film.



3. Patient Experience

- Patient control of lighting
- Natural light & quality artificial light
- Quiet at night



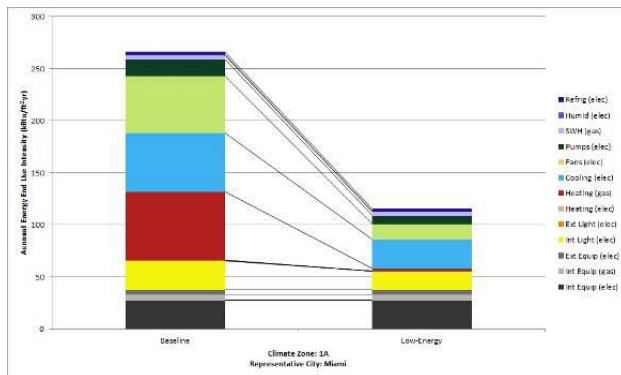
“Although lighting should serve the demands of the medical staff, it should also permit patient/visitor comfort. Patients feel comfortable when they can control the lighting in the space and participate in defining their own level of personal privacy.”

ANSI/IESNA RP-29-06, Lighting for Hospitals and Health Care Facilities

Advanced Energy Design Guide (AEDG)

Interior Lighting in Healthcare as a percentage of total energy use:

8-10%



Energy averages 2% hospital budget, or about 25% of the FM budget. What if you cut lighting in half?

≈\$50K savings on \$1M energy spend

AEDG - Daylighting

Form-Driven Daylighting Option	All spaces	Comply with LEED for Healthcare Credits iEQ 8.1 (Daylighting) and iEQ 8.2 (Views)
	Diagnostic and treatment block	Shape the building footprint and form such that the area within 15 ft of the perimeter exceeds 40% of the floorplate
	Inpatient units	Ensure that 75% of the occupied space not including patient rooms lies within 20 ft of the perimeter
	Staff Areas (exam rooms, nurse stations, offices, corridors), Public spaces (waiting, reception), and Other regularly occupied spaces as applicable	Design the building form to maximize access to natural light, through sidelighting and toplighting
Non-Form Driven Daylighting Option	Staff areas (exam rooms, nurse stations, offices, corridors) and Public spaces (waiting, reception)	Add daylight controls to any space within 15 ft of a perimeter window
Interior Finishes	Room interior surface average reflectance	Ceilings \geq 80% Walls \geq 70%

AEDG – Electric Lighting

Interior lighting	Lighting Power Density (LPD)	Whole Building = 0.9 W/ft2
	Light source efficacy (mean lumens per watt)	T8 & T5 > 2ft = 92 T8 & T5 < 2ft = 85 All other >50
	Ballasts - 4ft T8 Lamps	Non-dimming = NEMA Premium Dimming= NEMA Premium Program Start
	Ballasts - Fluorescent and HID	Electronic
	Dimming controls daylight harvesting	Dim all fixtures in daylighted zones
	Lighting controls - general	MANUAL ON, AUTO/TIMED OFF wherever possible to encourage occupant interaction and maximize energy savings
	Surgery Task Lights	Use LED lights exclusively
	Exit Signage	0.1-0.2W Light Emitting Capacitor (LEC) exit signs exclusively
Exterior Lighting	Façade and landscape lighting	LPD = 0.15 W/ft2
	Parking lots and drives	LPD = 0.1 W/ft2
	All other exterior lighting	LPD = Comply with Standard 90.1* Auto reduce to 25% (12am-6am)

Practical Example

Attribute	FHC/ASC #1	FHC/ASC #2
Size	190,000 sf	190,000 sf
90.1-2004 minimum	25% improvement	16% improvement
Envelope		
Walls	R-10 (FHC), R-22 (ASC)	R-13
Roof	R-20, reflective	R-30, reflective
Glazing	U=0.4, SHGC= 0.23	U=0.35, SHGC=0.215
Lighting		
Exterior	HID site, LED wall washers	LED
Interior LPD	0.61 w/sf	1.06 w/sf
Lamps	LED downlights, T5 area lights	T8
EXIT signage	LEC	LED
HVAC		
FHC	Evaporative cooled RTU with economizer with hot water reheat	Evaporative cooled RTU with economizer with hot water reheat
ASC	Custom AHU with DOAS, forced-draft flex-tube heating boiler	AHU with high efficiency modular chiller and condensing boilers
Pumps and Motors	Premium Efficiency	Premium Efficiency



Technology Guidance

Michael Myer

Lighting Technology Guidance

- LEEP Campaign
- Exterior Lighting
- Interior Lighting
- Interior Lighting Campaign

LEEP

As John D'Angelo says, patient experience starts on the exterior as the patient enters the space

Lighting Energy Efficiency in Parking (LEEP) Campaign – supporting and recognizing energy efficient parking facilities

Healthcare facilities were recognized in Phase 1 and new facilities will be recognized in Phase 2 (end of June)



Appleton Medical Center – Thedacare

- Converted from metal halide to low wattage LED
- 86% energy savings
- Power density (watts / square feet) 0.22 → 0.03 W/sf
- ≈ \$16,000 electricity savings



Vacaville Northbay Hospital - CLTC

- Conversion of lighting technologies and introduction of lighting controls
- 58% energy savings
- Power density (watts / square feet) 0.07 → 0.06 W/sf
- ≈ \$1,200 electricity savings

LEEP

Parking facility lighting can and should be replaced with more efficient lighting.

New lighting:

- Provides better uniformity making the spaces feel safer
- Provides better color quality that patrons and security staff like
- Saves money and energy

Exterior Lighting

DOE's Better Building Alliance has links for:

- High performance parking structure lighting specification
- High performance parking lot lighting specification
- Exterior controls guidance
- www.leepcampaign.org
- <https://www4.eere.energy.gov/alliance/activities/specifications>

Interior Lighting

Circadian Rhythms

Circadian Rhythm:

- ≈24-hour cycle that affects sleep and certain hormones
- Light is one of the single largest zeitgeber for entrain/synchronizing the cycle
 - When the exposure occurs matters
 - The intensity of the exposure matters
 - The spectrum of the light matters
- Area of significant current research
- Also an area of potential sales marketing
 - Color tuning are light fixtures that change “shades of white”
 - Potential benefits, but claims need to verified
 - Solutions might be person specific

Interior Lighting

Circadian Rhythms

Overview of Recent Research:

- U of Toronto / Northwest University – bright light associated with extreme, visceral (good & bad) emotions
- Nara Medical University School of Medicine – light at nighttime is correlated with depression and metabolic anomalies in the elderly
- Imperial College London and LMU Munich – blue light activates Type 2 drug in human pancreatic cells
- Tulane University – light exposure at night appeared to negate the efficacy of cancer drug Tamoxifen rats with breast cancer
- Northwestern University Feinberg School of Medicine – light exposure in the morning linked to lower BMI in adults

Source: The Case of Circadian Correct Lighting
Illuminating Engineering Society
LD+A January 2015

Interior Lighting

Daylighting

CBRE
Green

CBRE Green ([@cbregreen](https://twitter.com/cbregreen))

5/23/14, 5:02 PM

Healthy Glow: [#daylighting](#) improves healthcare outcomes, shortens recovery for patients ow.ly/wFIS0

Tweet from CBRE

- Major commercial developers highlighting relationship of daylight in healthcare
- Surgeon requested daylight for the operating room
- Healthcare research indicating access to daylight reducing depression and reducing time in hospitals
- Highlights **pairing** any daylighting with lighting controls!

Interior Lighting

Daylighting

Natural Experiment:

- A trend in patient stay was turned into a natural experiment & is being cited for some of the benefits of daylighting
- Female patients stayed 2.3 days in sunny rooms vs. 3.3 days in “dull” rooms
- Women generally do less well than men after myocardial infarction
- No difference in patient stays for male patients

	Summer	Winter
North-facing	200 – 400 lux	200 lux
South-facing	1200 – 1300 lux	2500 lux
East-facing	2000 lux	400 lux

- 10 lux \approx 1 footcandle (fc)

Source: Dying in the dark: sunshine, gender and outcomes in myocardial infarction
Beauchemin & Hays
Journal of the Royal Society of Medicine
Vol. 91 July 1998

Interior Lighting

Abundancy of equipment

Troffers:

- Represent 50% of commercial fluorescent fixtures
- ≈ 1 troffer per person in the U.S.
- Troffers are the most common light fixture in hospitals and healthcare facilities



Interior Lighting Troffer efficacy

- Current average troffer LER = 66 lm/W
- New troffers are 85 to 120 lm/W



- New equipment more efficient & more features

Interior Lighting Campaign (ILC) Overview


Organizers:

- Department of Energy (DOE), Building Owners and Managers Association (BOMA), Illuminating Engineering Society of North America (IES), and the International Facility Management Association (IFMA)

Goal:

- 100,000 troffers either retrofit (tubes, kits, or new fixtures) or new construction by May 2016
- \approx 10,000,000 square feet of lighted area
- \approx 5,000,000 kWh savings annually or roughly the equivalent annual energy usage of 540 homes
- \approx \$500,000 in savings

Interior Lighting Campaign Resources

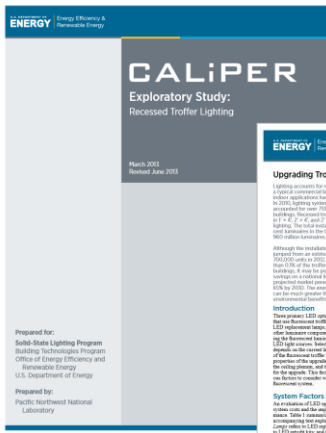


High Efficiency Troffer Performance Specification

Version: 5.0
17 APRIL 2015

U.S. DEPARTMENT OF ENERGY

Specifications



Prepared for:
Solid-State Lighting Program
Building Technologies Office
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

Prepared by:
Pacific Northwest National Laboratory

Reports Fact Sheets




Upgrading Troffer Luminaires to LED

Lighting accounts for roughly 20% of the electricity used in a typical commercial building, and the electricity it uses is often wasted. Upgrading lighting systems can reduce electricity costs significantly. And, by using high-efficiency lighting technology, the general lighting luminaires commonly available for 1, 2, 4, and 8 foot troffers provide the most advanced lighting technology available in the United States. It is estimated that LED troffer luminaires can save up to 70% of the electricity used in a typical office building. This report provides information on the benefits of upgrading troffer luminaires to LED technology.

Introduction
This report provides information on the benefits of upgrading troffer luminaires to LED technology. It includes information on the benefits of LED technology, the benefits of upgrading troffer luminaires to LED technology, and the benefits of upgrading troffer luminaires to LED technology.

System Factors to Consider
The benefits of LED technology include increasing the amount of light produced by the lighting system and reducing the amount of energy used to produce that light. This report provides information on the benefits of LED technology, the benefits of upgrading troffer luminaires to LED technology, and the benefits of upgrading troffer luminaires to LED technology.

System Factor	LED	Fluorescent	Incandescent
Energy Efficiency	High	Medium	Low
Light Output	High	Medium	Low
Life Span	Long	Medium	Short
Heat Output	Low	Medium	High
Cost	High	Medium	Low
Availability	High	Medium	Low
Recycling	High	Medium	Low
Health	High	Medium	Low
Environment	High	Medium	Low



PNL-21983

Prepared for the U.S. Department of Energy
www.eere.energy.gov/buildings

EE Richman

October 2012

Pacific Northwest National Laboratory
Funded by SBIR/STTR since 2003

M&V guidance





A Program of the U.S. DOE

Lighting Project Evaluator

The Lighting Project Evaluator allows you to estimate the energy savings of a new lighting system against a specified energy code. This tool can also compare proposed lighting upgrades to your existing conditions.

This tool is the preferred method of data submission for the Interior Lighting Campaign, which is a great place to go for troffer-specific lighting resources and to receive awards and recognition for implementing an energy saving lighting system using high-efficiency troffers and controls.

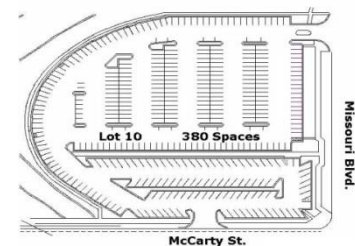
Log In Don't have an account? [Sign up now!](#)

email password

Forgotten your password?

Energy Estimator to compare against code

Technical Assistance (limited)



Indoor Lighting - Troffers (incl retrofit kits), Controls

Utility	State	Technology	Product
PPL Electric	PA	Controls	Occupancy S
PPL Electric	PA	Fluorescent	High Perform
PPL Electric	PA	LED	High Perform

Interior Lighting Campaign

Benefits & Features – Participants

- Limited technical assistance available to participants
 - Identifying appropriate sites for a high efficiency troffer installation or upgrade
 - Properly applying specification guidelines
 - Completing “Join” or “Awards” applications
- Campaign web site offers:
 - High Efficiency Troffer Performance Specification (released April 2015)
 - Case studies
 - Technical reports
 - Fact sheets
 - Lists of available incentives
 - Lighting project evaluator to estimate potential savings by comparing different lighting equipment and controls
- Recognition and possible award(s)

Interior Lighting Campaign

Schedule:

- Campaign started at the end of May
- Webinar – June 24, 2015
- Phase 1 runs through May 2016
- <http://www.interiorlightingcampaign.org/>

Q & A

Additional Questions? Feel Free to Contact Us

eere.energy.gov/betterbuildingsalliance

Today's Presenters	John D'Angelo Northwestern University JohnDAngelo@northwestern.edu	Michael Myer Pacific Northwest National Laboratory Michael.Myer@pnnl.gov
DOE Program Support	Erin Richmond Healthcare Sector Expert Erichmond@jdmgmt.com	John Jameson Healthcare Account Manager John.Jameson@icfi.com

Thank You!