

# Easily Commissioned Lighting Controls

## E3T Emerging Technologies Showcase

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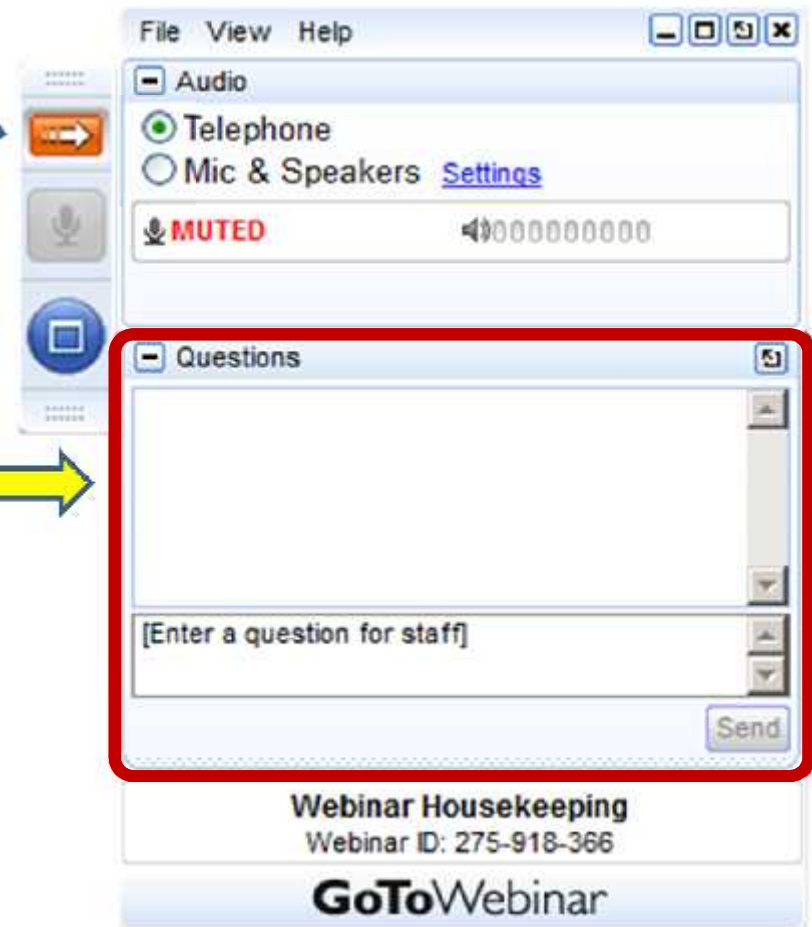
October 22, 2015

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- Minimize or maximize control panel
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NOTE: Today's presentation is being recorded and will be available at

<http://e3tnw.org/Webinars>

# Advanced Lighting Controls

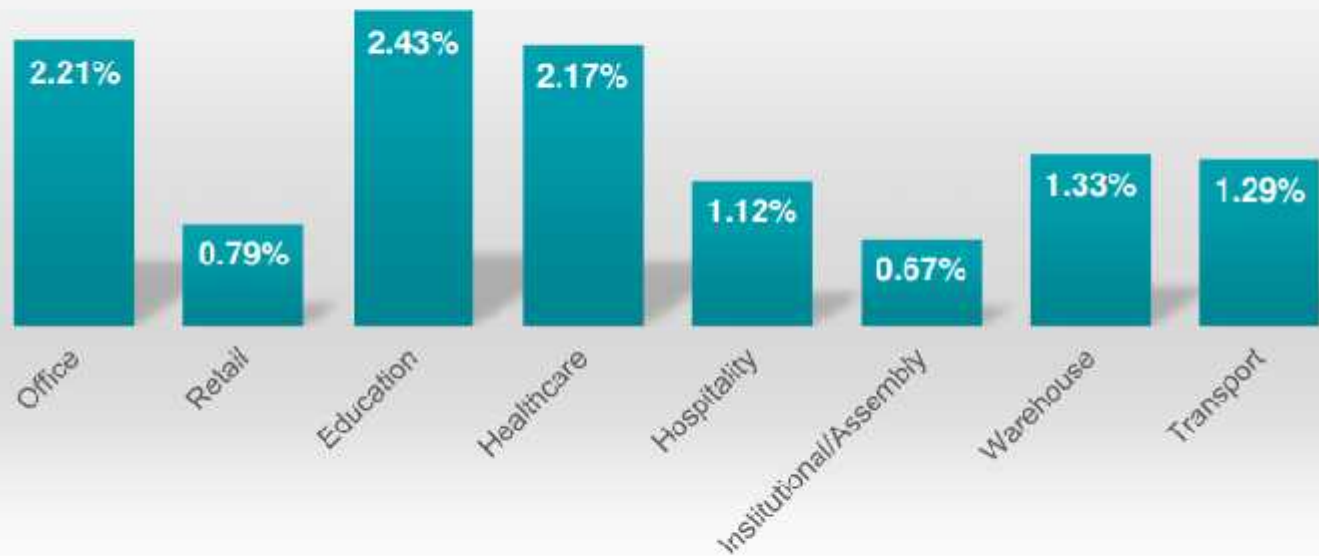
Goal:  
The right amount  
of light,  
when & where  
it's needed.



Lighting Research Center

# Market Penetration < 3%

## Penetration of Advanced Networked Lighting Controls in Commercial Buildings



Source: DLC, Navigant Consulting 2014

4

# Lighting Research Center

<http://www.lrc.rpi.edu/>



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



NVLAP-accredited testing laboratory



30,000 sq. ft. near Rensselaer campus

40-60 concurrent projects in field & lab



Research & education revenue = \$6 M/year

34 full-time faculty & staff, 15 graduate students



**E3T** Energy Efficiency Emerging Technologies

Lighting Research Center

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Report available soon at the bottom of this webpage:

<http://www.bpa.gov/EE/Sectors/Commercial/Pages/Commercial-Industrial-Lighting.aspx>

**E3T** Energy  
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# Purpose

Pilot study to evaluate interior lighting controls with “plug and play” or “automatic configuration” setup options.

1. Ease of installation, commissioning and use
2. Default control characteristics
3. Power demand differences between zone and luminaire-integrated controls
4. Power demand differences when different luminaires were used with the same control system.

**3 control systems paired with 2 LED troffer layouts  
1 integral LED troffer layout**

# Overall Findings

- Advanced control systems tested were easy to install, but ease of initialization and commissioning varied.
- Daylight conditions during Cx matter
- Lighting control systems should allow occupants to override the automated light levels by default
- Manual-on saves energy vs. auto-on
- Control algorithms and driver response determine power demand and light levels



# Conference Space & Open Office



Conference space with  
Lithonia LED luminaires

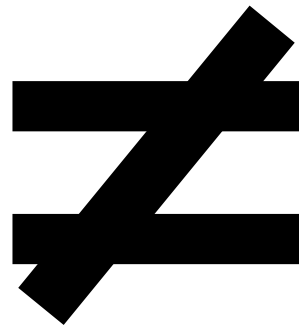


Open office space with  
Cree LED luminaires

# Disclaimer: NOT Apples to Apples

Small qualitative pilot study.

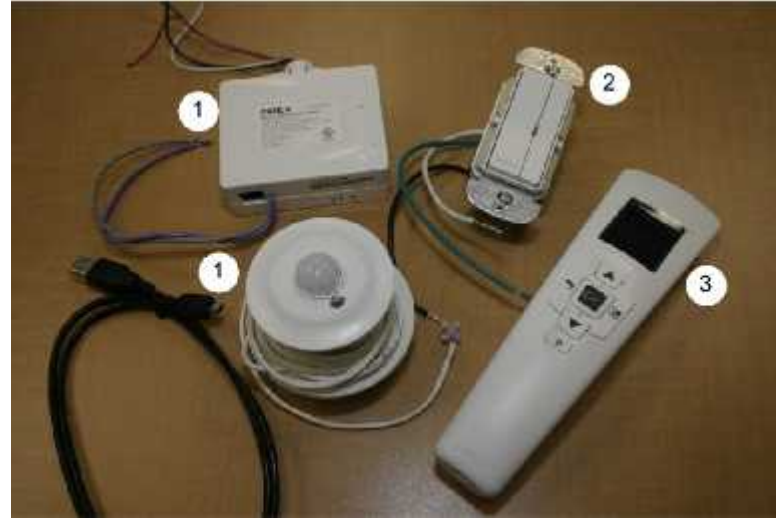
Daylight access & occupancy details changed between products, only 1 week data.



wikipedia

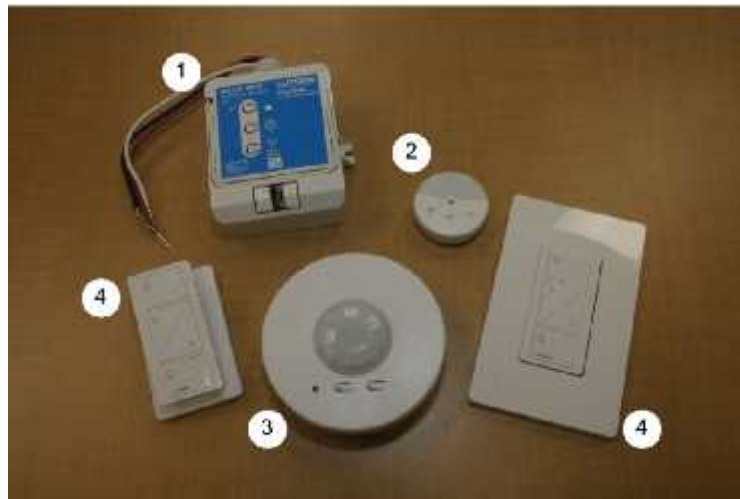
# The Control Systems

## Cree SmartCast



- 1: CIF-10V-CWC-SNSR  
0-10V Interface  
(control module and  
sensor)
- 2: CWD-CWC-WH  
wireless dimmer
- 3: CCT-CWC-1  
wireless configuration tool

## Lutron Energi TriPak



- 1: RMJ-5T-DV-B  
Powerpak dimming  
module
- 2: LRF2-DCRB-WH  
wireless daylight sensor
- 3: LRF2-OCR2B-P-WH  
wireless occupancy  
sensor
- 4: PJ2-2BRL-GWH-L01  
Pico wireless dimming  
control

# The Control Systems

## Philips SpaceWise



## Wattstopper DLM



- 1: LMRC-211 dimming room controller
- 2: LMDC-100 dual-technology occupancy sensor
- 3: LMDM-101-W dimming wall switch
- 4: LMSW-105-W 5 button scene switch
- 5: LMLS-400 single zone daylight sensor
- 6: LMRJ-CS8 coupler/splitter
- 7: LMCI-100 computer interface tool
- 8: LMCT-100 wireless configuration tool
- 9: LMRH-102 2 button handheld remote
- 10: LMRH-105 5 button handheld remote

# LED Luminaire and Control System Combinations Used in Pilot Study

Combo	LED Luminaires	Control System	Default Control Mode
1	Cree CR24 40L-35K-10V	CREE SmartCast	manual-on/automatic-off
2	Cree CR24 40L-35K-10V	Wattstopper DLM	manual-on/automatic-off
3	Cree CR24 40L-35K-10V	Lutron Energi TriPak	automatic-on/automatic-off
4	Lithonia 2ALL4 49L D50 LP835 NX	CREE SmartCast	manual-on/automatic-off
5	Lithonia 2ALL4 49L D50 LP835 NX	Wattstopper DLM	manual-on/automatic-off
6	Lithonia 2ALL4 49L D50 LP835 NX	Lutron Energi TriPak	automatic-on/automatic-off
7	Philips 2DLG49L835-4-D-UNV-DIM-SWZG2	Integrated into luminaire	Selectable during set-up (manual-on/automatic-off or automatic-on/automatic-off)

# How Easy Were These Controls to Set Up?

	Cree SmartCast	Lutron Energi TriPak	Philips SpaceWise	Wattstopper DLM
<b>Install</b>	Easy	Easy	Easy	Easy w/ RJ45 cable selection
<b>Cx instructions</b>	Little then (more now)	Yes	None then (more now)	Yes
<b>Cx process</b>	Easy. Use remote, then create groups	Easy. Pair sensors first, then calibrate daylight sensor	Not intuitive. Remote to set up groups and switch	Easy. Use remote to calibrate daylight sensor
<b>Increase light level with daylight present?</b>	No	Yes	Yes	No (can change in advanced settings)
<b>End User Operation</b>	(control mode: manual-on) Aggressive dimming	(control mode: auto-on) Cree fixtures whistled; Lithonia did not	(can select control mode) Once setup, worked well	(control mode: manual-on) Could not switch on lights with daylight present

# Daylight Conditions During Cx Matter

- Systems were commissioned under different daylight conditions
- Assumed sensor-task ratio may result in a system that dims too much or switches off too often



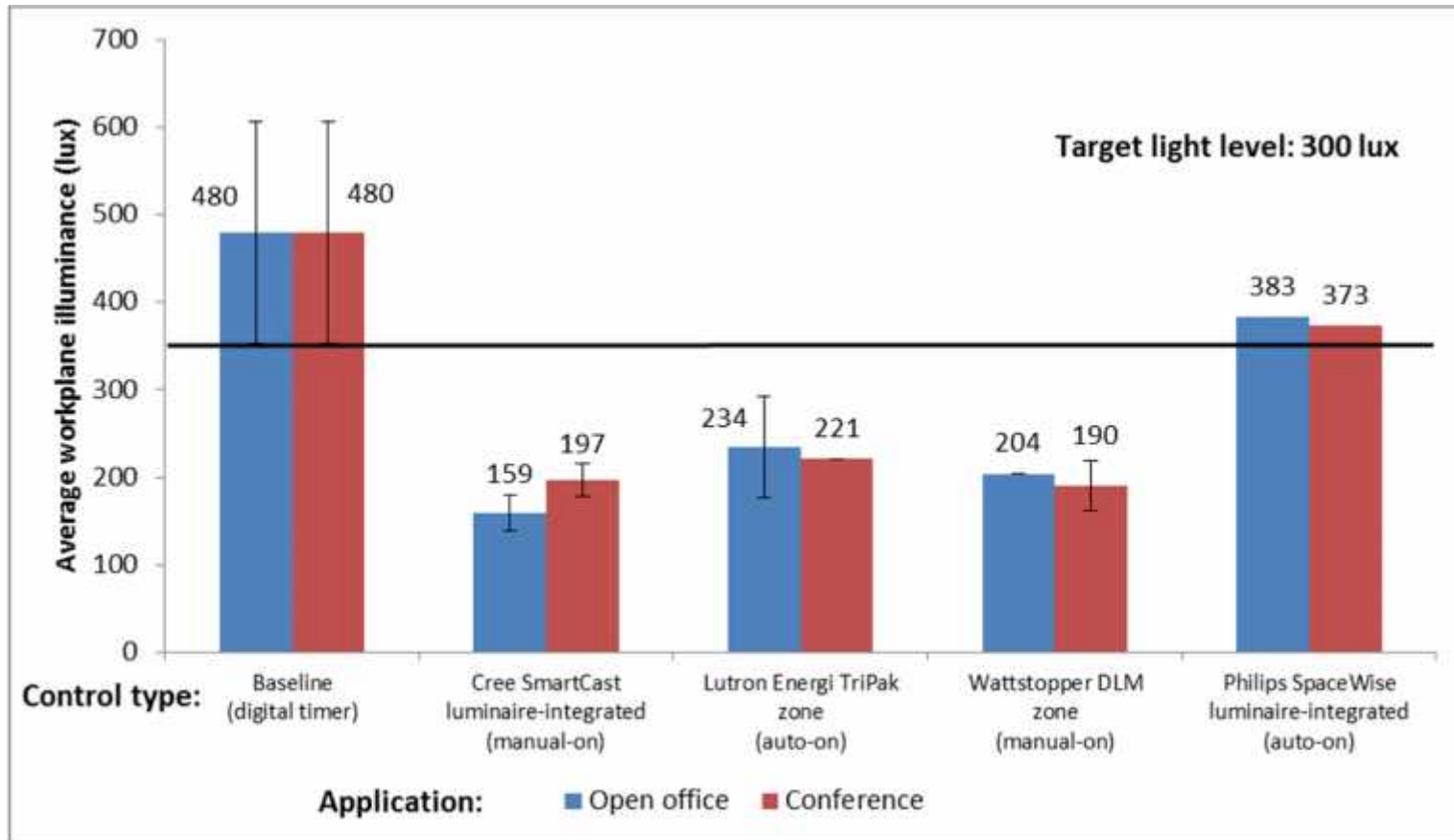
## Wish-list: Semi-automatic Mode (manual-on day, auto-on night)

- Manual-on mode is great during the day, when daylight is present.
- For manual-on at night, you may need a flashlight to find the wall switch if sensors' don't detect motion. Waving your arms doesn't work.



# Light Level Analyses

Occupants accepted low light levels, provided that they could increase light levels when desired



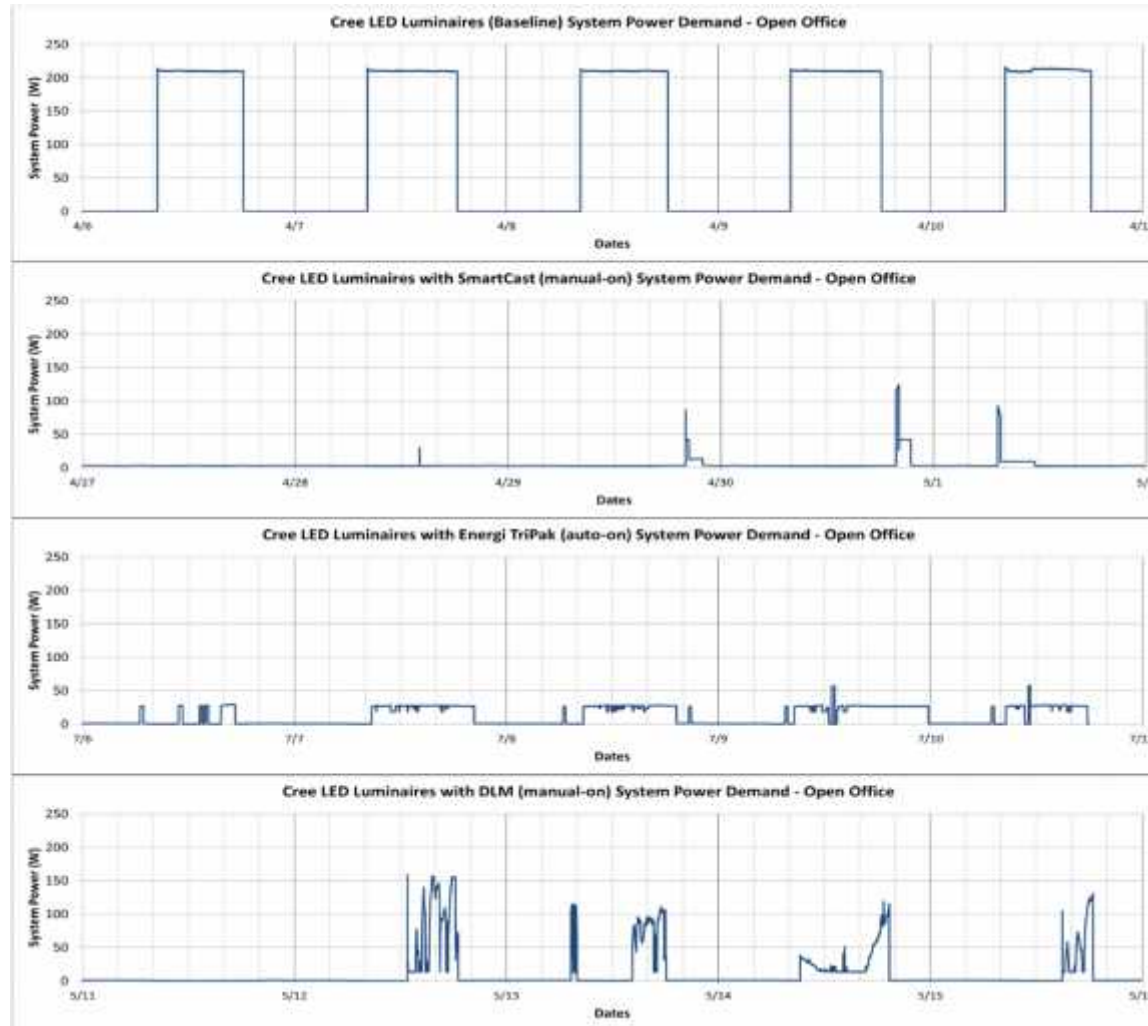
# Measured Power Demand in Office

Baseline using digital timer  
[Avg. Power: 87 W]

SmartCast (manual-on)  
[Avg. Power: 5 W]

Lutron Energi TriPak (auto-on)  
[Avg. Power: 11 W]

Wattstopper DLM (manual-on)  
[Avg. Power: 12 W]



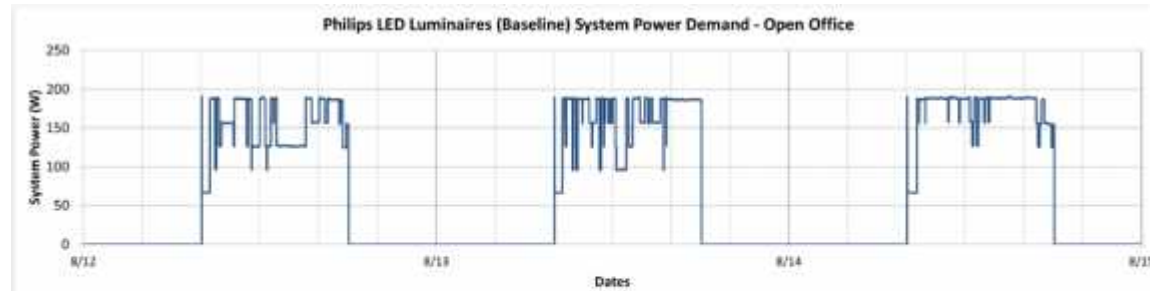
*Controls paired with Cree LED luminaire*

*Not concurrent periods*

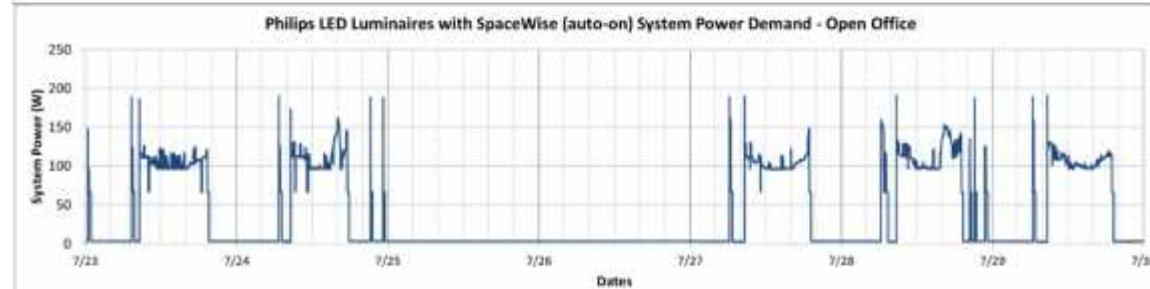
*Different daylight and occupancy during each period*

# Measured Power Demand in Office

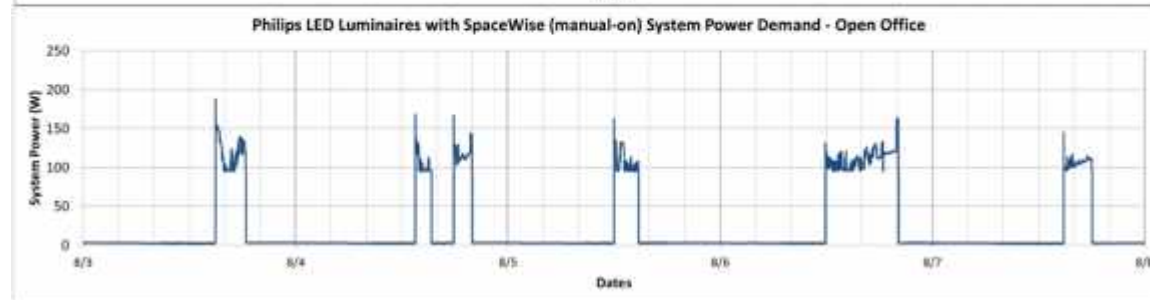
Philips  
SpaceWise  
Baseline  
[Avg. Power: 68 W]



SpaceWise  
(auto-on)  
[Avg. Power: 52 W]



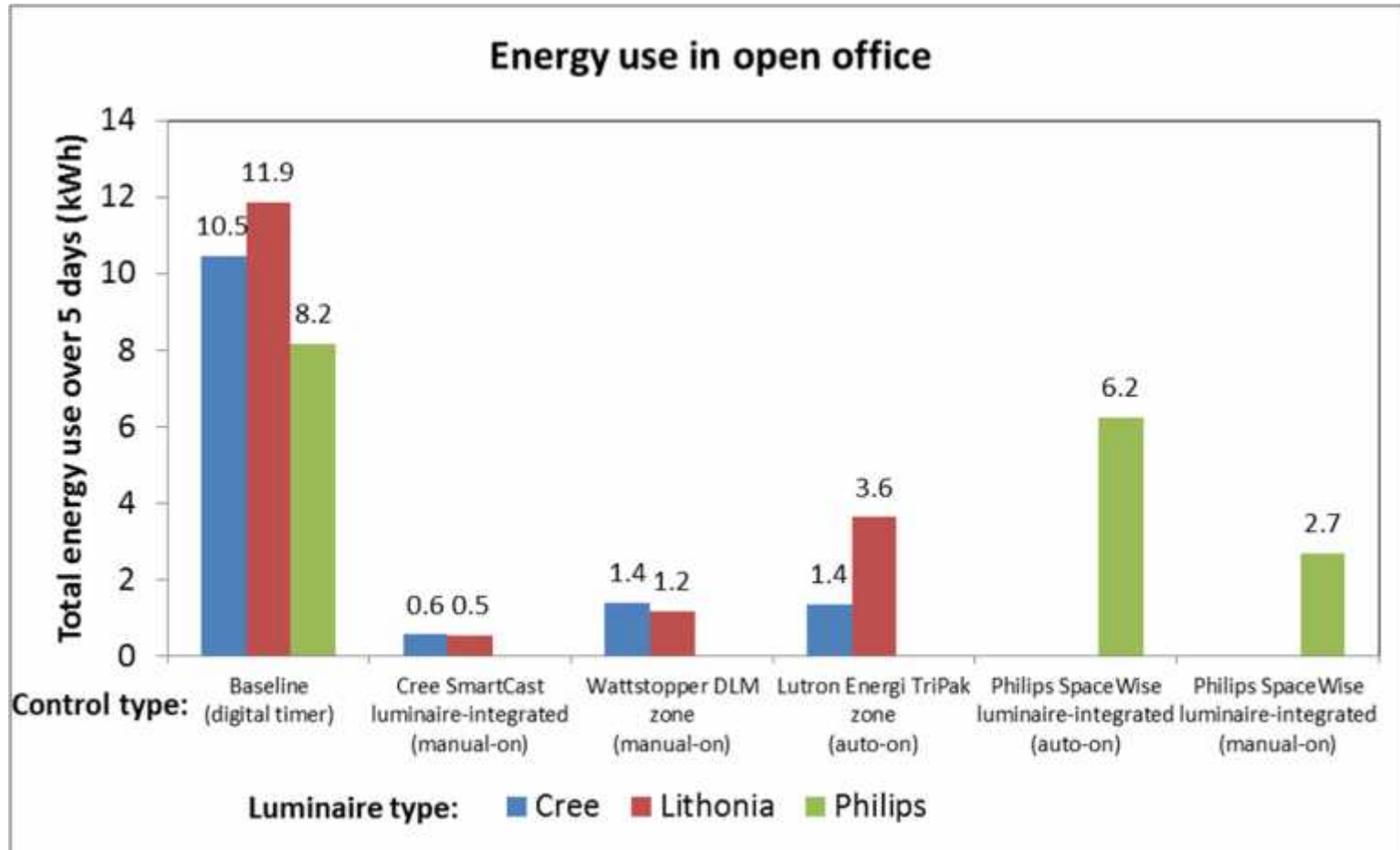
SpaceWise  
(manual-on)  
[Avg. Power: 22 W]



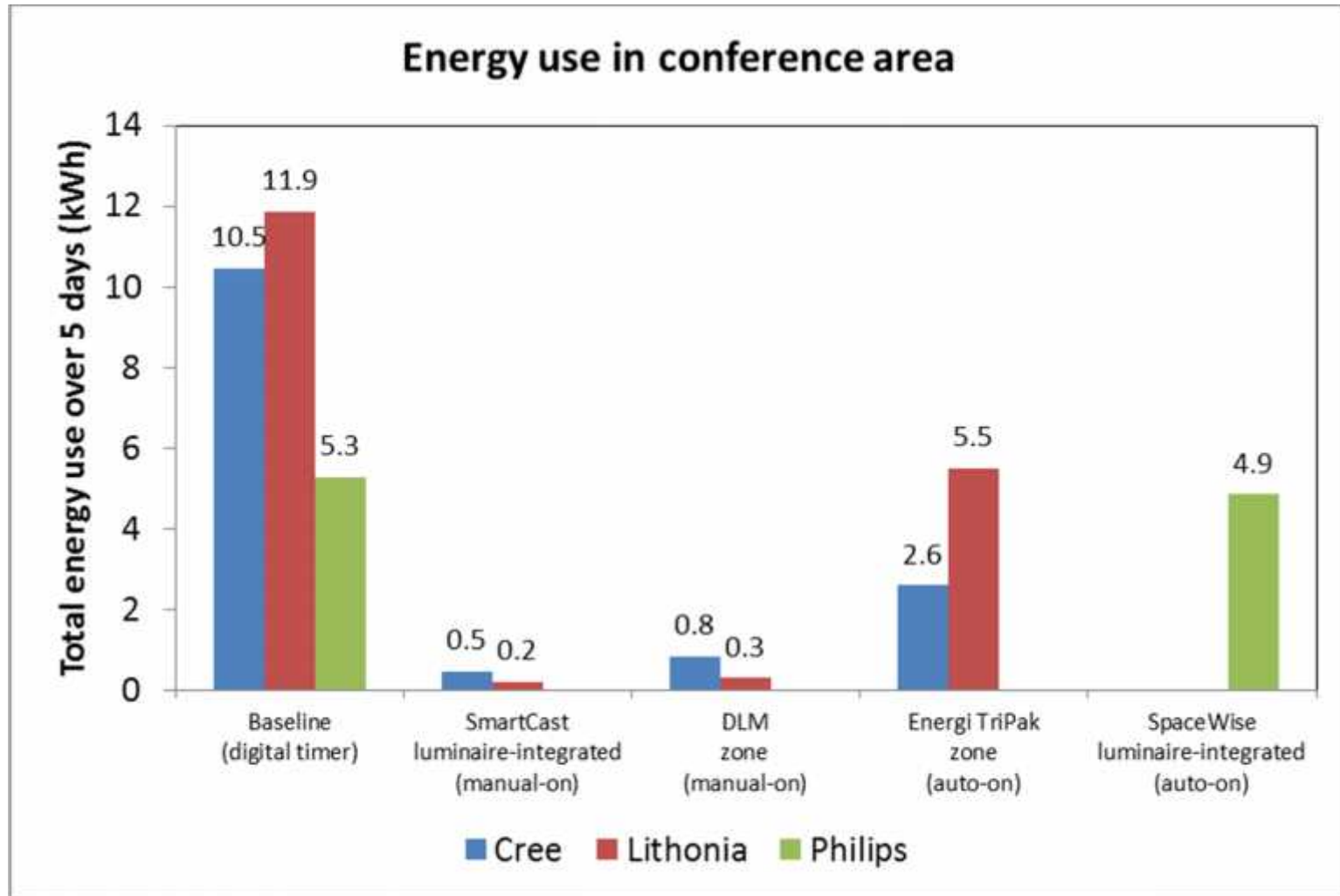
*Not  
concurrent  
periods*

*Different  
daylight and  
occupancy  
during each  
period*

# Lighting Energy Use in Open Office



# Lighting Energy Use in Conference Area



# Summary

- Easy to install
- Ease of initialization and commissioning varied
- Daylight conditions during Cx matter
- Occupants satisfied working under lower light levels if they could increase light levels when they wanted
- Lighting control systems should allow occupants to override the automated light levels by default
- Manual-on saves energy vs. auto-on
- Control algorithms and driver response determine power demand and light levels
  - Energy savings depend as much on the control algorithm as on integrated vs. zone
  - Different luminaires with the same control system may give different light levels and power demand

# Easily Commissioned Lighting Controls Reports

<http://www.bpa.gov/EE/Sectors/Commercial/Pages/Commercial-Industrial-Lighting.aspx>

Scroll down to

- Energy Efficiency Lighting Research
  - Advanced Lighting Controls
    - Easy Controls Product Review is the Phase 1 report
    - **Coming soon – Easily Commissioned Lighting Controls (Phase 2 Report)**

# Questions?

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**December 2, 2015 – Low-e Storm Windows**

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