



**Upgrading to LED Light Sources
Rodney Heller LC, CLEP
Lighting Geek**

A Little Bit about Me

- ⦿ Lighting Certified, NCQLP
- ⦿ Certified Lighting Efficiency Professional, AEE
- ⦿ IES –Chair, Upgrading Lighting in Commercial & Institutional Spaces, LEM 3
- ⦿ IES –Member Visual Efficiency Committee TM24
- ⦿ I am a radical compared to traditional designers
- ⦿ I freely give my opinion, but back it up with science!

This Presentation

- ⦿ There is no sugar coating anything
- ⦿ I am 100% neutral
- ⦿ I will give you my experience, the brutal truth!
- ⦿ Open forum – question; ask it, comment or tell me I am nuts I am ok with that too
- ⦿ This is how we learn

Goals of this Presentation

- Get lighting right for the task
- Understand how LEDs light spaces
- Solving lighting problems
- Solving control problems
- Thinking outside the box to make new light sources work in existing fixtures

Where to Start?

- ◎ What is your budget?
 - Most important
 - LED versus fluorescent
- ◎ What are you trying to accomplish?
 - Trying to impress
 - Save energy
 - Both?
- ◎ What is the application?

Lighting Upgrade Minefields

- ⦿ Lighting Manufacturers- very few have real world LED experience, “worked in the lab”
 - Use them for base knowledge only
 - Count on them 100% you will for sure have problems
 - Consistently over light every space!
- ⦿ Control Manufacturers – same thing!
- ⦿ DLC – Do **NOT** base decisions on grants
 - How do they know the task? Existing spacing? Ceiling height? Reflectancies

Most Import Rule

- ◎ Light to Task, Light to Task, Light to Task
- ◎ IES Lighting Handbook 10th edition –My Bible
- ◎ Tasks have changed
- ◎ Technology has changed
- ◎ Our understanding of how we see is evolving, TM-24

Lighting Upgrades

- ◎ Just because there was 80 fc of light in the existing space does not mean you replace 80fc or make it brighter!
- ◎ Most buildings are over lit
 - No penalty for over lighting
 - Same thing with HVAC

Light to Task

	Old	10 th Edition
Classroom	50 fc	20 fc
CAD work	50 fc No Glare	2.5 fc <u>vertical</u>
Hallway	40 fc	5-10 fc
Office	70 fc	20-40 fc

- Paper to Computer
- Chalk board to white board to smart board to iPad
- Lathe to CNC machine
- Hallways –just moving through space
- Full moon is .01 fc, how much light do you need to see?

Old Standards vs.
Lighting Handbook

Light to Task

How You Going to Get There?

- ◎ LED's emit light differently than a tube or lamp
- ◎ LEDs emit light in a 15-20° angle
- ◎ Direct light to the task, little to no need for reflectors
- ◎ How many lumens do you need to adequately illuminate your work plane?
- ◎ Think how hard it is to see your cell phone in sun light

Can Lighting

13 watt CFL, 900 lumens



Can Lighting

8.5 watts, 630 lumens

Retrofit Pin based to Edison base



Can Lighting

14.3 watts, 1000 lumens



Can Lighting

14 watt, 600 lumens



2x2 or 2x4 Luminaires (Fixtures)

- Fluorescent or LED?
- March, 2014 fluorescent is more cost effective
- October, 2014, now it is a toss up – depends on what is there

2x2 Upgrade



Direct/indirect , 2-40 watt biax—very difficult to retrofit

2x2 LED



Installed new 2x2 LED fixtures for the same price of a fluorescent upgrade

Retrofit Kits

⦿ Pros

- Easy to install
- Cost competitive

⦿ Cons

- Not always easy to control lumen output
 - Need to control light emission
- ## ⦿ I like kits, but installing more new troffers

Which is LED?



Key is Controlling Emission



LED T8 Tubes

- ◎ July 2014, I would not touch them
- ◎ October 2014, I am ready to try
- ◎ T8 LED Tube
 - 1750 lumens, 110 lumens/watt
 - Works on instant start ballast only
 - Saves a lot on labor!
 - Still just a little edgy on them (lampholder UL)

LED Challenge

- Fluorescent lamp emits light in 360° pattern
- LED emits light in 15-20° pattern
- Bounce fluorescent off top then down
- LED is all direct
- How many lumens do you need to get same amount of light on task?

Fluorescent Lumen vs LED Lumen

- ⦿ 3000 lumens/lamp
- ⦿ Run through PSL ballast, 2100 lumens
- ⦿ Bounce 60% of lumens off top and sides
- ⦿ Now you are at about 1800 delivered lumens

Fluorescent Lumen vs LED Lumen

- ⦿ LED T8 lamp 1750 lumens, all delivered
- ⦿ Same thing with LED 2x4, par lamp, etc.
- ⦿ Bottom Line – you may only need 40% of rated lumens from LED to illuminate the space previously lit by fluorescent

Exterior Lighting

- LED - No brainer
- Very Low operational and maintenance costs
- Replace whole head, we seldom do retrofits unless it is a simple screw in lamp
- Do NOT over light
- Direct light at ground
 - LED light sources carry a long way and will cause glare in neighboring homes

School Driveway

271 watts



Dock Area

40 watts



School Parking Lot

271 watts



Pathway

Poles 129 w, wall pack 30 w, Canopy 20 w



Canopy 8.5 w, Bollards 8.5 w



And Then There's Dimmers

- ⦿ As of October, 2014, rheostats are out. They do not work
 - 20% dimming, choppy, flickering
- ⦿ Common cure is to add an incandescent or quartz at end it will pull enough energy to make dimmer work
 - Had to do this with elevators too, even though no dimming

Dimming

- ⦿ Line voltage, sometimes it works sometimes it does not
- ⦿ Large control systems be very cautious, crap shoot as to whether it works on not
- ⦿ 277 line voltage does NOT work, regardless of what manufacturer tells you

Dimming

- ⦿ 0-10 low voltage works
 - Got to run the line
- ⦿ Wireless is really coming along
 - Lutron has a very interesting system
- ⦿ Cad 5 is coming on too
 - Bring power to switch then cad 5 from there

My Advice

- ◎ Stay with Tier 1 manufacturers as much as possible
 - If they are not making them, there is probably a reason for it
 - If you must use Tier 2 or 3 have budget for replacements
- ◎ Test all fixtures and lamps you are working with for the first time

My Advice

- ◎ Use new fixtures where you can
 - They were specifically designed for an LED light source
- ◎ Dimming
 - If using existing controls **ALWAYS** test regardless of what manufacturer says

The Future

- ◎ Prices dropping
- ◎ Tunable
- ◎ OLED
- ◎ Utilities attempting to change rate structure to keep income up
 - Increase monthly charge and lower kWh rate



The New Look of Efficiency

Thank You!

Rodney Heller LC, CLEP
rheller@energypowerperformance.net

(608) 661-5555

EnergyPerformanceLighting.com