

Docket No. 15-BSTD-01

April 7, 2015, 6th letter

Greetings

Although Proposed 2016 Code: Version 16.x (interior) and 6.x (exterior) is a significant improvement compared to the existing and original 2016 codes, it is not enough, especially in this age of diminishing returns, to save the most energy in lighting retrofits.

The only part that is really okay in Version 16.x is Luminaire Component Modifications (Section 141.0(b)2J).

Many stakeholders provided input and could survive with the compromise of the previous draft language, which basically included what is in Version 16.x (Section 141.0(b)2J). In all other ways the previous draft language is better.

Permits, even simple ones, controls, CLCATTs and/or other requirements increase costs significantly without necessarily saving extra energy. Allow lighting professionals and end-customers to make decisions for each specific project. We are in a democracy, aren't we?

Does the CEC really want to save the most energy from lighting retrofits or have a nice looking Title 24?

I would bet my house that more energy from lighting retrofits would be saved with no Title 24 than with the Proposed 2016 Code: Version 16.x and 6.x. Does anybody disagree?

The longer the CEC still it thinks it knows best instead of really accepting qualified stakeholders' input, the more likely that lighting companies will not survive, more people will lose their jobs, and more lighting retrofits will not be done or will be done under the radar. Plus the longer the CEC thinks it knows best, the longer people in and out of California will laugh or cry at this Title 24.

In this letter, I am focusing on that lighting with controls and even controls by themselves are often not cost effective in many retrofit projects, and anybody with decent lighting knowledge should have been aware of that while planning the existing Title 24, but some of them may have had other agendas. Lighting with controls or controls by themselves may be cost effective in many retrofit projects, but it is foolish to mandate them across the board.

Time clocks, occupancy sensors and other controls are often not cost effective, and their extra costs can make the paybacks bad enough so end-customers do not approve projects, so no energy will be saved.

Plus automatic controls can often increase hours of operation.

Following is a modified version of my recent magazine article draft. I was surprised that combining lighting and controls in retrofits is worse than I previously considered, and I knew it was bad before.

What should end-customers and lighting professionals focus on for profitable and cost effective energy savings in interior spaces?

- Mainly lighting
- Mainly controls
- Both

It really depends.

In spaces where the lights are on for multiple hours at a time with no traffic, just occupancy sensors may be the most cost effective solution. Examples can be offices that the lights are left on all night frequently, some warehouse rack aisles that you can see dust on the floor with no footprints, library book stack aisles with books, which are not used that much, and company parking garages that there is little activity between shifts.

In most areas just lighting is often the most cost effective solution. In some areas, doing both may cost effective, but be aware of a different diminishing return than was in a previous column.

In the past it was often cost effective to do both lighting and controls, but now that LED and even high performance fluorescent being so efficient and low wattage, there is not that much wattage or KWH for controls to save cost effectively. Now, if energy codes permit, it is usually better doing one or the other, but not both.

You can do your calculations, and I bet that often lighting by itself is often more cost effective than controls by themselves or lighting with controls. If that is the case, consider lighting first, and then see if controls are sufficiently cost effective with that efficient lighting. For X amount of money, it is often more cost effective doing more lighting and less or no controls.

What ever is considered second has diminishing returns, because the reference is no longer the not-that-efficient existing condition.

Although many energy codes are mandating efficient lighting and controls - dimming throughout North America, I hope you can see, especially for retrofits that does not seem to make 'dollars and sense'.

You can also see and take photos of exterior windows to see how many rooms have lights on during the night. But be aware that cleaning crews may be in several rooms.

As you may already be aware, data loggers can often be very useful tools to determine the percentage of time lights are on without anybody there. Several manufacturers offer these, and contractors can purchase these from distributors. Some utilities have these in their tool lending libraries.

I learned a very important tool regarding occupancy sensors close to twenty years ago, and it is still useful. It can be called 'owned and non-owned'. Owned spaces include private offices and elementary school classrooms where the teacher or the 'energy police' students feel ownership and turn off the lights most every time they leave. **Occupancy sensors can cause increased annual hours of operation, because the office workers, teachers and students can allow the 10 – 15 minute delay before the occupancy sensors turn off the lights.** If the private office workers, teachers and students do not currently properly turn off lights, they can often be educated and motivated to do so at low or no cost. Non-owned spaces can include open offices, conference rooms, break rooms, print rooms and restrooms. People usually do not feel ownership, so if the lights are on when they enter, they often leave them on they leave. These rooms are often cost effective for occupancy sensors.

Although there are numerous honest and knowledgeable control and dimming manufacturers, suppliers and contractors, there are others, some who play games, such as artificially specifying excessive high wattage lighting, so the dimming and controls can look attractive. For example, existing 3F32T8 18 cell parabolic troffers can often be retrofitted with fixed 20W LED troffer kits, some of these companies may specify something like dimming 40W LED troffer kits and include controls, which may bring the wattage down to 20W for each, but with the extra parts and labor costs for dimming and controls. Often with dimming and controls, the project has a worse financial return and the customer may not approve it. I have seen some people and companies combine savings from lighting and controls and try to make controls look better, while lighting is actually doing a better job. Relatively low light ambient lighting with good task lighting is better than dimming ambient lighting.

This part compares lighting only, basic controls only, advanced controls only, lighting with basic controls and lighting with advanced controls in a typical private office. No Title 24 costs are included. You can decide what is best for you.

EXISTING TYPICAL PRIVATE OFFICE

- 10' x 12'
- Two 2x4 18 cell parabolic troffers
 - Each with three basic grade fluorescent 32W F32T8s and generic standard ballast factor (BF) ballast, which consumes 90W
- 3500 maximum annual hours of operation, because building facility manager or owner turns on and off switch rated breakers every day
 - 3000 annual hours, because office worker does an average job manually turning off lights in office when leaving
- \$ 0.18 KWH rate
- \$ 97.20 Annual lighting consumption
- There is already good LED task lighting, which will be kept
- Good size south facing window
 - With the sun's intensity and glare the window blinds are closed most of the time

Although these products may qualify for rebates, which would improve financial return, rebates are not included.

LIGHTING ONLY

- \$260.00 Parts and labor for 2 20W 5000K LED troffer kits
- \$ 21.60 Annual electrical consumption
- \$ 75.60 Annual electrical savings
- 3.4 Year payback without rebate

This could also be done by retrofitting each troffer with 1 high lumen 32W F32T8 850 lamp, 71 BF high performance program start ballast and upscale kit for about \$110 parts and labor. Wattage would be 25.

BASIC GRADE CONTROLS ONLY

- \$ 70.00 Install wall mounted occupancy sensor
- 16% Estimated energy savings, based on California Energy Commission Database for Energy Efficient Resources (CEC DEER)
- \$ 15.55 Annual savings
- 4.5 Year payback without rebate (if controls are mandated, there may be no rebate)

ADVANCED CONTROLS ONLY

- \$140.00 Install advanced controls
- 25% Estimated energy savings
- \$ 24.30 Annual savings
- 5.8 Year payback without rebate (if controls are mandated, there may be no rebate)

LIGHTING & BASIC CONTROLS

- \$330.00 Parts and labor
- \$ 79.06 Annual electrical savings, which controls savings are based on 40W lighting
- 4.1 Year payback without rebate (if controls are mandated, there may be no rebate)

Based on getting the lighting down to 40W, the occupancy sensor would only save \$3.46 per year, which is a 20 year payback, which may be infinite because sensor may not last that long.

LIGHTING & ADVANCED CONTROLS

- \$400.00 Parts and labor
- \$ 81.00 Annual electrical savings
- 4.9 Year payback without rebate

Based on getting the lighting down to 40W, the advanced controls would only save \$5.40 per year, which is a 26 year payback, which may be infinite because controls may not last that long.

PAYBACK IN YEARS COMPARISON

- 3.4 Lighting only
- 4.5 Basic controls only
- 5.8 Advanced controls only
- 4.1 Lighting & basic controls (20 years for occupancy sensor assistance)
- 4.9 Lighting & advanced controls (26 years for advanced controls assistance)

Many real world customers do not want anything over a 3-year payback. This lighting option with rebates would usually be less than 3 years. Those customers would not approve any other option, so there would be no energy savings.

Paybacks and other financial returns would vary depending on other parameters, which you could do for your projects. But even if the percentage savings from basic or advanced controls were doubled, their paybacks would still be terrible when done with lighting.

If you want to learn more about controls, I will present these classes.

- New Age Of Controls, seminar through San Diego Gas & Electric, 4/20/15
 - https://seminars.sdge.com/iebms/coe/coe_p1_all.aspx?cc=coe&oc=05
- Lighting Controls & The Evolution of Smart Lighting, webinar through Association of Energy Engineers, 6/22/15 – 6/23/15
 - <http://www.aeeprograms.com/realtime/SmartLighting/>

I am aware of some high tech firms in Silicone Valley, which the practice is for office workers to purposely leave their lights in their offices, where ever they go during the day, so others know that these office workers have come to work that day and could be found. These companies are willing to pay for the extra KWH.

What right does the CEC or any other organization have to mandate occupancy sensors if these companies want to replace troffers with suspended indirect/direct fixtures in the private offices?

So these companies may not do anything, so there would no energy savings.

Or these multi-million or billion dollar companies could sue the CEC.

What is also very important for the 2016 and existing versions is to allow sufficient wattage for the biologic or non-visual part of the visual system. What is the sense of saving every watt if worker productivity or student test scores go down? I recently completed a school project for SDG&E's Emerging Technologies Program. Each 2x4 fluorescent troffer was replaced with 2 2x2 LED troffers. One type of the 2x2s is maximum 35W tunable 2700 – 6500K that with smart wall controller can be dimmed and CCT changed.

The teacher and one group of students typically prefer 6500K most of the day. The other type is max 35W fixed output 10,000K, controlled by a 30 minute timer, because it should only be on early in the morning to help suppress melatonin production.

If the teacher forgets to hit the 30 minute time in the morning for math class, the students remind her to do it, because they have stated they can learn math better with the 10,000K troffers on in addition to the other troffers set at 6500K. With the current Title 24, the combined wattage for both types of 2x2 troffers is close to exceeding maximum allowed WSF. Hopefully the CEC can allow extra wattage, at least when that extra wattage will not be during peak times. That extra wattage can translate to better student learning and in other applications better worker productivity.

Being the Chair of the Human Centric Lighting Society, I could assist the CEC. Here is the website of the Human Centric Society, which has some of the best neuroscientists and other experts in the world in it.
<http://humancentriclighting.org/>

In case Jonathan Baty does not include this link, which he sent me, here it is. This relates to Title 24.
<http://www.encyclia.org/negawatt-blog/moving-to-from-programs-to-markets>

The dimming and control issue is bigger than just California. ASHRAE, International Building Code and maybe others may also have swallowed too much from dimming and control manufacturers, organizations and proponents, who can make dimming and controls appear good.

Follow the money to see if dimming and controls are really cost effective to save energy with currently available high performance and low wattage lighting.

You can email or call me 10 AM or later Pacific time during daylight savings time, which is 7 AM or later here in Hawaii. Thanks for your consideration.

Stan Walerczyk

Stan Walerczyk, HCLP, CLEP
Principal of Lighting Wizards
Chair of Human Centric Lighting Society and Committee
<http://lightingwizards.com/>
<http://humancentriclighting.org/>
stan@lightingwizards.com
808-344-9685