

Docket # 15-BSTD-01

2016 Building Standards Update, and hopefully also 2013 improvement

HOW TO PROCEED AFTER BERNIE KOTLIER'S AND STAN WALERCZYK'S TITLE 24 DEBATE

November 3, 2015

Greetings

Introduction

I took the time and effort to write this regarding lighting retrofits, not to focus on Bernie Kotlier's statements, but for the bigger picture, which may include similar statements from others.

One key point is that Kotlier firmly believes that automatic demand reduction (ADR) with advanced controls are pretty much necessary with lighting, and I provide good evidence that addressable HVAC units and electric car charging stations are much better than today's high performance lighting. And with more PV, wind power, natural gas microturbines, energy storage, micro-grids and utilities probably becoming more electric balancers than products, ADR should become less important. There are several energy storage technologies. Solid-state batteries include electrochemical capacitors, lithium ion batteries, nickel-cadmium batteries and sodium-sulfur batteries. Other types include flow batteries, flywheels, compressed air energy storage, thermal storage systems and pumped hydropower. It is my understanding that the IOUs provide rebates for energy storage systems.

Kotlier, the Co-Chair of California Advanced Lighting Training Program (CALCTP) and I debated about the lighting retrofit section of Title 24 at LightShow West in Los Angeles on October 22, 2015. LightShow West should be applauded for hosting this debate.

For those not aware of CALCTP, this is from its website. <https://www.calctp.org/what-calctp>

What is CALCTP?

Why Advanced Lighting Controls?

The California Advanced Lighting Controls Training Program (CALCTP) is a statewide initiative aimed at increasing the use of lighting controls in commercial buildings. CALCTP will educate, train and certify licensed C-10 electrical contractors and state-certified general electricians in the proper programming, testing, installation, commissioning and maintenance of advanced lighting control systems. Such systems typically include dimmers, occupancy sensors, photo-sensors, relay modules and communication-based control devices.

Through proper installation practices, advanced lighting controls have the potential to improve energy efficiency in commercial facilities across California and help achieve significant energy savings.

Who is CALCTP?

The CALCTP is a collaborative effort of the following utilities, government agencies and labor associations:

- California State Labor Management Cooperation Committee for the International Brotherhood of Electrical Workers and the National Electrical Contractors Association (LMCC/IBEW-NECA)
- Southern California Edison (SCE)
- Pacific Gas and Electric (PG&E)
- San Diego Gas and Electric (SDG&E)
- California State University System
- California Community College Chancellor's Office
- California Energy Commission
- California Lighting Technology Center, University of California, Davis
- Sacramento Municipal Utility District (SMUD)
- Los Angeles Department of Water and Power (LADWP)
- National Electrical Manufacturers Association

You can see CEC, LMCC/IBEW-NECA and NEMA are listed. Big Labor does not do most of the lighting retrofits. Lighting retrofitters do. There is a big difference between electrical contractors and lighting retrofit contractors.

Hardly anything that Kotlier stated was realistic to me. You can check out his pdf and compare it mine.

http://www.lightshowwest.com/wp-content/uploads/2015/10/S19_Retrofit_Under_Title_24_Part-2.pdf

[http://www.lightshowwest.com/wp-](http://www.lightshowwest.com/wp-content/uploads/2015/10/S16_Retrofit_Regulations_Under_Title_24_Part-1.pdf)

[content/uploads/2015/10/S16_Retrofit_Regulations_Under_Title_24_Part-1.pdf](http://www.lightshowwest.com/wp-content/uploads/2015/10/S16_Retrofit_Regulations_Under_Title_24_Part-1.pdf)

You can get verbal content from attendees.

Kotlier's presentation reminded me of Doug Avery, who when he was still working for Southern California Edison, with the assistance of Jim Benya, pushed controls in the 2013 Title 24. Although a number of us retrofitters provided good evidence that would not be good for retrofits, they pushed controls anyway. You can see the current results. Avery is currently the other Co-Chair of CALCTP. Why is Benya still a consultant for the CEC?

For the most part I do not want to repeat what Kotlier presented, but expand what I offered during that debate. If anybody thinks any of my statements are inaccurate, please let me know. I will research that and if applicable, make corrections.

Main Body

1. Kotlier stated that he was aware of various people, who lost their jobs, retrofit contacting firms and distributors whose sales and profits have gone way down, lighting retrofit companies which have gone out of business and end-customers which cancelled lighting projects because not cost effective with this Title 24, but called it 'anecdotal' and then referred to the PG&E report as 'proof' that this Title 24 is working. I will discuss the PG&E report later, but want to focus on his 'anecdotal' now. I think it is an insult to the people, who have been significantly harmed from this Title 24, calling them 'anecdotal'. Many of them have written letters to the CEC and/or communicated during CEC meetings. That is public record, so it is not 'anecdotal'. Both Gene Thomas at Ecology Action and I know numerous others, who did not contact the CEC. An example is Sun Industries, an established lighting retrofit contract, who I used to work for. They closed their doors this summer, and a big reason was this Title 24. That is not 'anecdotal' either.

2. Although Pacific Gas & Electric may have stated that lighting retrofits have still been good with the current Title 24, let's look into this before making bold statements. The main reason that lighting retrofits are not totally decimated is Prop 39, and it is very important to be aware of that. Most of these and other projects are using TLEDs or reduced wattage fluorescent T8s with existing ballasts, which does not trigger Title 24. Some lighting retrofit contractors are focusing on projects with less than 40 fixtures, because that does not trigger Title 24. Gene Thomas at Ecology Action told me that for their third party rebate program with PG&E, they have been focusing on both of those approaches to reach their quotas, but it is not sustainable, because the number of remaining potential customers is dwindling. That is also the case with many other lighting retrofitters. Also, what about lighting retrofits in other IOUs and MUNIs?

3. A strict Title 24 with low LPDs and mandated controls may look good on a superficial level, but not a practical one, because fewer and smaller lighting retrofits will actually be done. There would be much more energy savings from lighting retrofits with the way the previous Title 24 was generally handled or with no Title 24. If projects are not cost effective, end-customer will not approve them. I would love anybody to try to refute this, especially with so little low hanging fruit left.

4. Title 24 is not the main reason why California has been so efficient over the years. It is mainly high electric rates, the lighting retrofit industry and utility rebates for close to three decades. Now that electric rates are quite high in New England, Massachusetts has been the most efficient state for five years according to ACEEE, and Vermont and Rhode Island are right behind California. Although California may have been considered where some energy efficient products got a good start in the past, now with a worldwide market, California is nothing special. Although not related to Title 24, if California was really a leader, it would not be only state that does not have ground water pumping regulations.

5. Title 24 is not for the common good, and that was proved with the 2013 version, which has been decimating the lighting retrofit industry. Much more energy would have been saved without it. The free market could do much better saving energy cost effectively if the shackles of Title 24 were removed. Now lighting retrofit professionals and many-end customers have more practical expertise than the CEC and its consultants. End-customers can keep their lighting, so what right does the CEC have limiting end-customers' rights to retrofit as they want as long as it is safe?

Another reason that Title 24 is not for the common good is that CEC has not included anything about allowing more light and wattage for the nonvisual or biologic part of the visual system. It is my understanding that even if extra wattage is only used for the first 30 – 45 minutes of the morning at work or school, and those lights are automatically controlled, all of that wattage is included in LPD, just like the other lights, which are on all day long. What is the sense of saving every watt, if student performance or worker productivity goes down?

If you have not already seen this recent European report, please check it out, because it shows in several applications that increasing light levels and wattage can improve productivity, learning, wellbeing significantly, which dwarfs the higher electric bills. Europe is way ahead of the United States regarding this, and one reason is that most areas do not have energy codes, which just get in the way. Even without energy codes, Europe is usually quite efficient. For example, this report shows the benefits of 2000 lux (200 fc) in industrial applications. To achieve that light level, Title 24 probably does not allow that much wattage, which is a shame.

www.lightingeurope.org/uploads/files/Quantified_Benefits_of_Human_Centric_Lighting_April_2015.pdf

If you have a hard time opening it, save it a pdf and then open the pdf.

The Human Centric Lighting Society or certain members on their own may be willing to help. You could compare the depth and breath with anybody else.

<http://humancentriclighting.org/>

For example, a good number of people got concerned after reading this article.

<http://luxreview.com/article/2015/07/the-jury-s-still-out-on-human-centric-lighting-says-global-standards-body>

CIE sources were researched and no problems were found.

Basically the long used photopic lumen should be eliminated or at least its influence should be greatly reduced. A good example is this slide, which Dieter Lang from Osram in Germany presented at the Pacific Energy Center on May 21, 2014. (Europe uses commas as we use periods for decimal points)

Melanopic Photometric Data

DIN

DIN Deutsches Institut für Normung e. V.

Examples for melanopic illumination levels at a given photopic illumination level of 1000 lx

melanopische photometric quantity:
(e.g. illuminance level, lumen output)

$$X_{mel} = K_{mel} \cdot X_{e, mel}$$

$$X_{mel} = \frac{K_{mel}}{K_m} \cdot a_{mel, v} \cdot X_v = m_{v, mel} \cdot X_v$$

illuminant	illumination level Φ photopic $V(\lambda)$	Melanopic daylight-equivalent illumination level $\Phi_{mel, D65}$	ratio melanopic/photopic illumination levels $m_{v, mel, D65} = \Phi_{mel, D65} / \Phi$	melanopic power(mW) / lumen (phot.)
standard illuminant A (CCT= 2856 K)	1000 lx	496 lx	0,496	0,657
illuminant F10, CIE (FL, CCT= 5000 K)	1000 lx	683 lx	0,683	0,906
illuminant F12, CIE (FL, CCT= 3000 K)	1000 lx	404 lx	0,404	0,535
standard illuminant D65 (daylight, 6500 K)	1000 lx	1000 lx	1,000	1,326
illuminant P (candle light)	1000 lx	267 lx	0,267	0,354
LED, white (CCT= 3035 K)	1000 lx	428 lx	0,428	0,567
LED, white (CCT= 5400 K)	1000 lx	787 lx	0,787	1,044
LED, white (CCT= 6535 K)	1000 lx	800 lx	0,800	1,062
fluorescent tube, white (CCT= 8000 K)	1000 lx	957 lx	0,957	1,269

Dieter Lang | OSRAM

If the CEC is short sighted and only wants to focus on energy saving, it will be a big picture loser.

There will be probably additional significant breakthroughs in lighting before 2020, and Title 24 should not block them.

6. Although the CEC's work to determine what controls may be cost effective may have been correct with fluorescent and HID for the 2013 Title 24, most of that should be thrown out in this LED world, because the wattage can often be so low there is often not enough remaining energy to cost effectively save with controls. Other old studies based on fluorescent should also be tossed.

It is important to understand the difference in control cost effectiveness between new construction and retrofit. In new construction the labor to install a wall switch or a wall sensor is about the same and a basic wall sensor does not cost that more than a wall switch. But in a retrofit the existing wall switch needs to be removed and a new occupancy sensor needs to be purchased and installed.

This is the same table I have shown before, based in a private office with two troffers. If anybody can claim that example is anecdotal, please let me know.

Lighting upgrade	Existing wattage	Proposed wattage	saved KW	Annual operating hours	KWH Saved	KWH rate	Annual electric savings	Installed cost	Payback
	180	40	0.14	3000	420	\$0.18	\$ 75.60	\$ 260.00	3.44
Basic Controls			Controlled KW	16% reduced operating hours	Controlled KWH	KWH rate	Annual electric savings	Installed cost	Payback
			0.04	480	19.2	\$0.18	\$ 3.46	\$ 70.00	20
Advanced Controls			Controlled KW	25% reduced KW (or KWH)	Controlled KWH	KWH rate	Annual electric savings	Installed cost	Payback
			0.04	750	30	\$0.18	\$ 5.40	\$ 140.00	26

Since those controls will probably not last that long, the paybacks are probably infinite. Even with four troffers in a private office, controls are often not cost effective. And in many 'owned' spaces, annual hours of operation can increase with occupancy sensors, because people, who used to do a very good job manually turning off the lights, now allow the 10 – 15 automatic delay.

Addressable HVAC units and electric car charging stations can usually be much more cost effective than lighting for automatic demand reduction (ADR).

Even without any push from Title 24, with good LED task lights, for ambient lighting we can easily get down to .25 WSF in open offices with 20W LED troffers or troffer kits in an 8' x 10' grid. That could be dimmed 10% for automatic demand response, but let's compare that with others.

- Addressable 5 ton HVAC unit at 1 KW/ton sheds the demand equivalent of $5000/.25/.1 = 200,000$ SF of lighting, which at 1 lighting fixture covering 80 SF, is equivalent to 2500 dimming lighting fixtures and controls. Each 5-ton HVAC may cover 2000 SF.
 - An option with HVAC is making ice during nonpeak times, which would really reduce peak load.
- Addressable 3KW electric car charger with connected electric car batteries sheds the demand equivalent of $3000/.25/.1 = 120,000$ SF of lighting, which at 1 lighting fixture covering 80 SF, is equivalent to 1500 dimming lighting fixtures and controls.
 - Electric car batteries could also help feed the grid.

Some people do not think that there are or will be enough electric cars and chargers for them to really help. But that is not really the case. ChargePoint stated:

The number of electric vehicle (EV) drivers has increased 10X in the last 4 years and EVs are expected to comprise over 5% of all car sales by 2020.

http://info.chargepoint.com/index.php/email/emailWebview?mkt_tok=3RkMMJWWfF9wsRoiuK3OZKXonjHpfsX56eksULHr08Yy0EZ5VunJEUWy24QASNQ%2FcOedCQkZHbIFnVwPQ62iRaMNo6wN

I have PV on my house roof, Nissan Leaf electric car and have signed up for JUMPStartMaui's phase 2, which is getting a free 220V fast and smart charger installed in the garage. Peak load is 5 – 9 PM here. When the car is plugged into the charger during peak load and if the grid needs the power, the smart charger will drain the car's battery down to 30%, and then after 9 PM, the charger will automatically fully charge the car, so it is totally ready in the morning.

On Maui every parking lot with at least 100 parking spaces needs at least grade 2 chargers, which are 220V and fast. JUMPStartMaui has been installing grade 3 chargers, which are 440V and very fast, across the island. These can typically provide a full charge within 15 – 30 minutes.

Why isn't the CEC taking the lead in something good like this, instead decimating the lighting retrofit industry with Title 24, when the most retrofits and most energy savings would happen with no Title 24 or something similar to how most people dealt with the previous version?

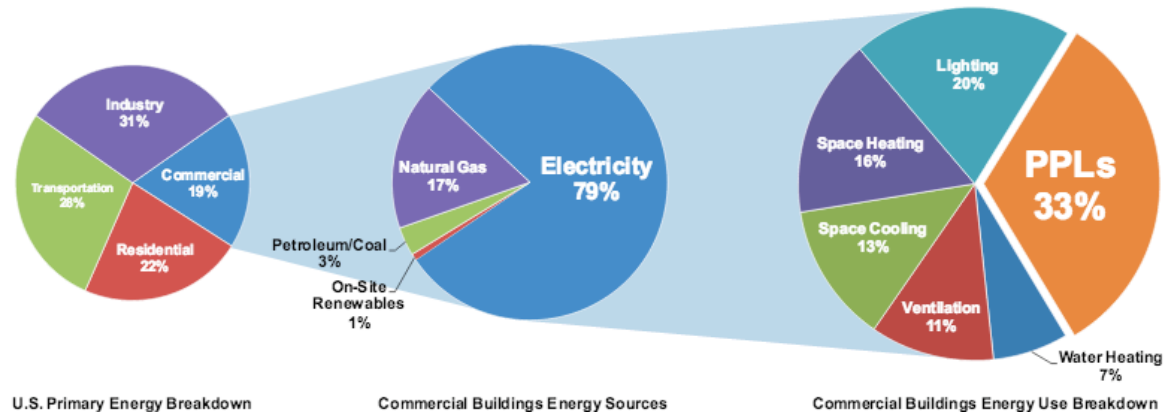
Don't try to fix something if it is not broken, and the previous Title 24 was not broke.

Plus as lighting keeps getting more efficient, plug load has been overtaking lighting in KWH.

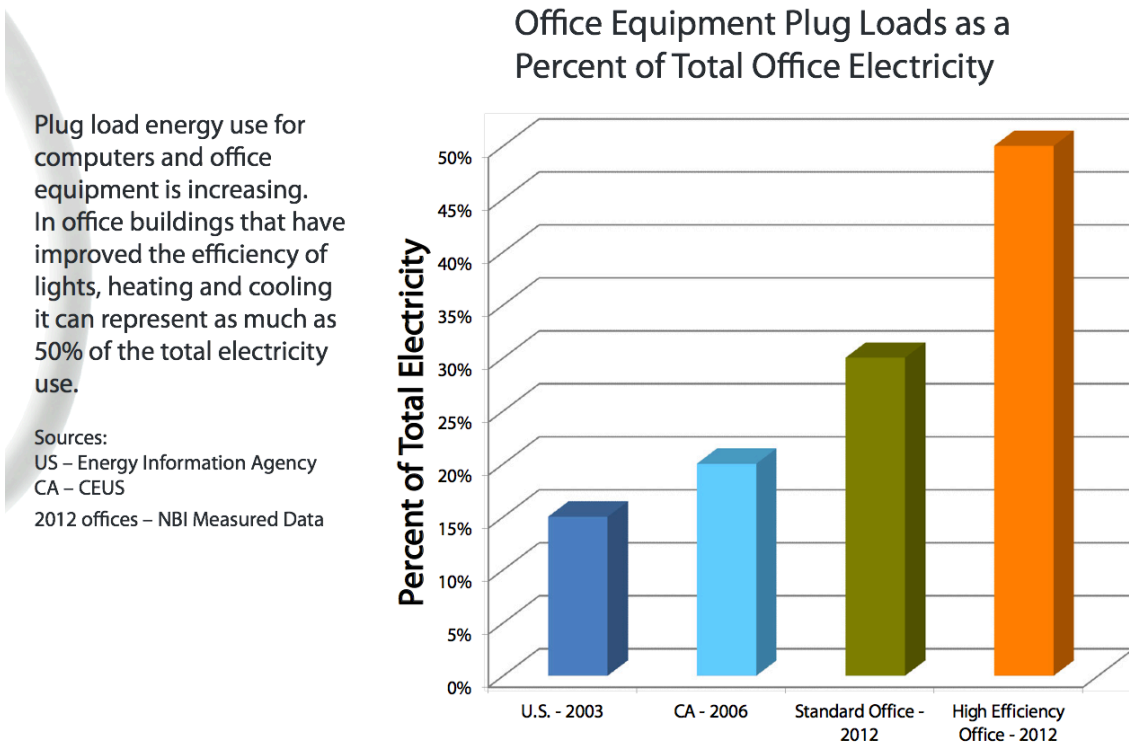
The following is from the National Renewable Energy Laboratory (NREL), which shows that plug and process loads now account for 33% of the power in commercial buildings and that will increase by 49% by 2030. This shows lighting is now 20% and that percentage should decrease in the future.

<http://www.nrel.gov/docs/fy13osti/54175.pdf>

Plug and process loads (PPLs) account for 33% of U.S. commercial building electricity consumption (McKenney et al. 2010). (See Figure 1.) Minimizing these loads is a significant challenge in the design and operation of an energy-efficient building. [Lobato et al. \(2011\)](#) and [Lobato et al. \(2012\)](#) define PPLs as energy loads that are not related to general lighting, heating, ventilation, cooling, and water heating, and that typically do not provide comfort to the occupants. The percentage of total building energy use from PPLs is increasing. According to the U.S. Department of Energy (DOE), by 2030, commercial building energy consumption is expected to increase by 24%; PPL energy consumption is anticipated to increase by 49% in the same time frame ([DOE 2010](#)). These trends illustrate the importance of PPL energy reduction to achieve an overall goal of reducing whole-building energy consumption.



Here is more information from the Sacramento Municipal Utility District. Now lighting is more efficient than what it was in 2012.



The CEC should be commended for its Title 24 plug load controls for new construction.

With more PV, wind power, natural gas microturbines, energy storage and micro-grids, utilities will probably become more electric balancers than producers and ADR may become much less important.

There are several energy storage technologies. Solid-state batteries include electrochemical capacitors, lithium ion batteries, nickel-cadmium batteries and sodium-sulfur batteries. Other types include flow batteries, flywheels, compressed air energy storage, thermal storage systems and pumped hydropower. It is my understanding that at least one of the IOUs provides rebates for energy storage systems.

As storage evolves it may become much better than ADR to reduce peak load charges, etc. Some people say that lights can be dimmed down 10 – 15% without people noticing, but if that is the case why can't the lighting be dimmed another 10 – 15% and then another 10 – 15% without people noticing? With battery storage there does not need to be any dimming of lighting or higher temperatures from AC.

7. Controls, including time of flight (TOF) ones, will become quite cost effective to save energy in the future, probably as the Apples, Ciscos, Googles and Qualcomms of the world get into lighting and controls, which may be within five years. Sensors, which could fit into a dimple of a golf ball, may cost less than a dime.

That generation of controls, internet of things (IoT) and power over ethernet (PoE) will be able to adapt and learn, so lighting design and control installation and commissioning expertise will become much less important. CALCTP and its certifications may become obsolete.

Now it is too early to push controls, because we do not know who the winners and losers will be in technologies and communication standards. Many end-customers could get systems that the technologies and communication standards could be discontinued or the companies go out of business. I see various DALI and other systems bypassed. Recently I inspected a building with a 10-year old Ledalite Ergolight system. Some of the electronic cards in the fixtures have failed, and Ledalite has stopped production of those cards. So the entire system probably needs to be trashed. Now there may be as many new control companies as new LED companies, which may have sufficient funding to last a few years. If they do not make it big or get bought, they will probably go out of business, and if they have a proprietary system, their customers will probably have to start from scratch.

I was a salesman when electronic ballasts for fluorescent T8s became popular in the late 80s and early 90s. So many manufacturers went out of business with the end-customers stranded. I do not want customers swearing at me again with failed control systems.

So it is a wasted effort trying to push controls now. Let the free market decide what is the most cost effective at any time on specific projects. Now it is usually more cost effective to do more lighting and less controls.

You do not have to believe me. As I have stated several times previously, contact Dr. Robert Karlicek, director of The Smart Lighting Engineering Research Center at Rensselaer Polytechnic Institute. I would bet my house he knows more about advanced lighting controls than Kotlier, Avery and Benya.

8. This Title 24 has reduced jobs in California. For any mandated control devices, do you think that very many of them will be manufactured in California? What is more likely is making them in China, which would make our trade deficit worse.

9. Kotlier does not want the CEC to approve the existing 15-day language, which makes no sense to people, who really do lighting retrofits and potential end-customers. Although the 15-day language will still greatly limit lighting retrofits, it is so much better than doing nothing.

With diminishing returns due to so little remaining low hanging fruit, no rebates for controls which are mandated in Title 24 and the IBEW cancelling light fixture maintenance, so now inside wiremen at \$60 - \$90 per hour are required in union and prevailing wage jobs, any extra cost dealing with Title 24, will make it more difficult for lighting retrofit projects to be approved and installed. Title 24 does not save any additional energy!

Here is one prevailing wage project that I specified the lighting for a retrofit 8 years ago, and now they want to do another retrofit. Work hours are on the low side, and there is a building time clock system. It has a lower than typical electric rate. In this county inside wireman rate is about \$90/hour and after the contractor puts a mark-up on that it is at least \$110/hour to the end-customer. Even without any Title 24 costs and controls, this project is a major challenge. With any significant Title 24 costs and controls, it probably will not happen. This is a real project, not anecdotal.

MOST COMMON FIXTURE TYPE FEASIBILITY STUDY																	
\$0.14		blended KWH rate		1.05	additional air conditioning savings (1.00 is none)												
existing				proposed													
fixture type	watts	annual hours	annual electric cost	option	retrofit option description	appr. watts	annual electric cost	watts per square foot (WSF) based on 1 troffer per 80 SF	watts reduction	% watts reduction	annual unit electric cost savings	appr. installed cost (excluding Title 24 costs)	appr. KWH saved first year rebate multiplier	rebate	payback in years just electricity	based on CEC DEER 16% savings with occupancy sensors, following are additional savings from each troffer retrofit	estimated energy savings with advanced controls
2X4 troffer with upscale kit, 2 3100 lumen F32T8 850 lamps & high performance .77 BF instant start ballast (keep existing task light or get new LED task light)	48	3000	\$20.16	A	Retrofit with 2 approximate 18W 5000K TLEDs, keeping existing ballast	30	\$12.60	0.38	18	38%	\$8	\$45	\$0.03	\$1.62	5.5	\$2.02	none, because would require dimming, which would cost extra
				B	Retrofit with 25W 3000 lumen 5000K LED troffer kit	25	\$10.50	0.31	23	48%	\$10	\$200	\$0.08	\$5.52	19.2	\$1.68	\$3.36
copyright of Stan Walerczyk of Lighting Wizards, www.lightingwizards.com																	

Option A is using TLEDs with existing ballast, which does not trigger code, so there is no additional cost. But the payback is 5.5 years, which is usually not acceptable to most end-customers. Although it looks like TLEDs can extend ballast life, it would be preferred if existing ballasts were replaced. Since there are no rebates for mandated controls, a \$70 installed wall mounted occupancy sensor would have to control at least 10 troffers to be cost effective, but most rooms have less than that.

Even without Title 24 costs, option B has a 19-year payback, and who in their right mind will accept that? But if they were approved, a \$70 installed wall mounted occupancy sensor would have to control at least 10 troffers, when many rooms have much less than that. An advanced control system may cost \$40 per troffer, so they would not be cost effective at all.

If you lived in this area, would you want your tax dollars to pay for close to a 20-year payback, which may really be infinite, especially after Title 24 costs are added? With advanced controls, it would be worse.

Installers, who can make \$90/hour, probably like that, but they have to work to get paid. Many union and prevailing wage retrofit projects will not happen with that high of an hourly cost. If the IBEW would re-instate light fixture maintenance, that would benefit union contractors, non-union contractors, end-customers and the state. For example with the above mentioned project, with \$30 - \$35 hourly wages, the TLED with existing ballast option would cost about \$30 per troffer, which would improve payback to less than 4 years, which provides a much better chance for the end-customer to approve the project.

10. Basic is often better than complex, and an example of that is good task ambient lighting can usually be better than general dimming in typical offices. If you walk through many office buildings, you will see that numerous office workers have had numerous fluorescent lamps twisted out or removed, to reduce glare on their self illuminated computer screens. Younger workers, who do more computer only work, tend to do this more than older workers, who need more light and may do more paper and other tasks.

Having dimming LED troffers or troffer kits controlled by a general dimmer for some or all of an open office, does not work, because some workers will want more or less light.

The LED troffers or troffer kits could have additional sensors, and TV style remote controls could be used to control each fixture individually. Another option is for each fixture to have an individual address, so it can be controlled through the building control system. But both of those are complex and expensive.

What is usually much better and less expensive is a relatively low light level from non-dimming ambient lighting, like 100 – 200 lux, which is usually plenty of light for walking around and doing computer work, and adding good task lighting, such as tunable (dimming and Kelvin changing) LED task lights, which can be used when people are doing non-computer tasks. IES allows task and ambient light to be added to meet their recommendations. It is good that the CEC does not include task lights in LPD calculations as long as they are under .3 WSF, which is very easy to do.

11. Is the 35% savings in the 15-day language enforceable? A better question is who cares? Most lighting retrofits without controls can save over at least that much and often more. The lighting retrofit industry and end-customers have done quite well for decades without dealing with any minimum savings. For decades, utilities have dealt with before and after wattages and KWH with customized rebates.

What I do not like about the 35% number is that it may penalize end-customers, who have already been efficient and want to do another retrofit, but since their wattage is already quite low, they may not be able to drop it by 35%. But other end-customers, who have not done retrofits in the past, would have no problem cutting wattage by 35%.

The best solution would be for Title 24 to be like how the previous version was handled or Title 24 just get out of lighting retrofits.

12. I still do not understand Kotlier's definition of cost effective and his double pane window analogy regarding lighting retrofits, which he brought up several times.

In the real world of lighting retrofits, most customers, especially if they are in a leased space, will only accept a max 3-year payback and often only a 2-year one. If longer they will not do lighting retrofits, so no energy is saved.


Email to CALCTP

On July 3, 2015 I wrote the following email to the CALCTP, which was never answered.

Stan Walerczyk

Sent: Friday, July 3, 2015 10:00 AM

To: info@calctp.org

 Stan Walerczyk's 4-10-15 Docket No. 15-MISC-02.pdf (186.6 KB)

Dear Sir or Madam

Attached is a letter, which I sent to the CEC regarding Title 24.

If you find any flaw in that regarding how controls are often not cost effective saving energy with currently available low wattage LED and other high performance lighting technologies, please let me know.

Most of the time end-users do not want anything over a four-year payback, and for some that is also too long.

I have been involved with several projects that were tested with data loggers and burn time increased after occupancy sensors were installed in private offices and elementary school classrooms.

What I have found much better than dimming ambient lighting in many applications is a relatively low light level from that and include tunable (dimming and Kelvin changing) LED task lights.

On the other hand, there are many projects that controls are quite cost effective, but why should they be mandated in most retrofit projects? When they are cost effective, they will usually be installed.

If you respond or not, I may use that in my upcoming seminars and/or magazine articles.

Stan Walerczyk

(The attached document in that email is at the end of this document)

Wrap Up

Based on my debate with Kotlier, he and the CALCTP have no credibility. If the CEC agrees, why is the CEC still sponsoring the CALCTP?

If other parties and individuals have similar messages, what is their credibility and should the CEC be listening to them?

Although the existing 15-day language is better than the status quo, it is not sufficient to really get the lighting retrofit energy savings where they should be. The existing 15-day language could be modified to be more retrofit friendly, but the best solution to save the most energy in lighting retrofits is to make it like it was dealt with in the previous Title 24 or totally get rid of Title 24 for lighting retrofits.

Even if the CEC approves the existing 15-day language, there will still be substantial lighting retrofits done under the radar. Something better than this 15-day language is necessary.

The main message is that now with educated and evolved lighting professionals and many end-customers, Title 24 will get in the way much more often than be beneficial. Let the free market decide what is best for each project now and in the future.

Lighting professionals and end-customers will work together and will install the lighting, basic controls and advanced controls, which are cost effective for each specific project. But no controls should be mandated in lighting retrofits.

Lastly with lighting and controls evolving near the speed of light, the planning time and 3-year cycles for Title 24 does not work. The Association of Energy Engineers wanted me to write a book for a long time. I finally gave in and agreed in 2013. Although I tried for it not to get of date soon, about one fourth of it of it was by the time it was published in 2014. By now, about half. The title is 'Lighting & Controls: Transitioning to the Future'.

Stan Walerczyk

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Note: This is written as an individual. It is not a Human Centric Lighting document.

The next page starts the attachment I emailed to the CALCTP.

Docket # 15-BSTD-01

April 10, 2015

Greetings

Since the CEC did not really seem to get my previous information about controls not being cost effective with currently available low wattage LED and even high performance fluorescent systems in lighting retrofit projects, I am reformatting it now for the same typical private office.

Lighting upgrade	Existing wattage	Proposed wattage	saved KW	Annual operating hours	KWH Saved	KWH rate	Annual electric savings	Installed cost	Payback
	180	40	0.14	3000	420	\$0.18	\$ 75.60	\$ 260.00	3.44
Basic Controls			Controlled KW	16% reduced operating hours	Controlled KWH	KWH rate	Annual electric savings	Installed cost	Payback
			0.04	480	19.2	\$0.18	\$ 3.46	\$ 70.00	20
Advanced Controls			Controlled KW	25% reduced KW (or KWH)	Controlled KWH	KWH rate	Annual electric savings	Installed cost	Payback
			0.04	750	30	\$0.18	\$ 5.40	\$ 140.00	26

It is my understanding that the CEC's payback hurdle is 15 years or less for controls, and if that is the case, neither of these controls would qualify.

In general a 15-year payback does not make any practical sense, because

- Controls may not last that long.
 - It is my understanding that DEER estimates 8 years end of useful life for controls.
 - So a wall mounted occupancy sensor would need a maximum \$27.68 installed cost.
 - So advanced controls would need a maximum \$43.20 installed cost.
- With the upcoming IoT and tunable products a majority of everything installed now will probably be replaced within 5 years, 10 years max.
- Most important, show me one real world end-customer, who will accept a 15 year payback on a retrofit project.
 - Many only want 3 years or less. (With rebate this lighting is probably be below 3 years)
 - A significant number of end-customers will only accept maximum 2 years.

Yes, people can get new fixtures and kits with a wireless module for about an extra \$10. But when you include the control devices, transceivers, computer, software, software licensing fee, labor, commissioning and optional service contract, it can cost \$50 - \$100 per fixture. I used \$70 per fixture.

Plus, controls, including wall mounted occupancy sensors, can often increase annual hours of operation.

Yes, dimming and control manufacturers, organizations and proponents can try to make dimming and controls system look like the best thing since sliced bread. But please 'follow the money' and do your own calculations.

Following are my calculations, which you can check.

This 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. If they are, costs could be increased by 20 – 50%.

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, include modules in fixtures and percentage of transceiver, computer, software, licensing fee and optional service contract
- 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. But even if the percentage savings from basic or advanced controls were doubled, their paybacks would still be terrible when done with lighting.

In open offices each 2x4 troffer could cover 80 SF, compared to 60 SF in this private office, so the WSF and LPD would be lower with the same LED troffer kits in an open office.

In a previous letter I mentioned that several pro-dimming and pro-controls companies specify much higher wattage lighting systems than necessary and show how much energy can be saved with their controls. It is much better to just get low wattage lighting.

In a previous letter, I showed that electric car charging stations and addressable HVAC units are much more cost effective for automatic demand response than lighting.

For X amount of money, allow lighting professionals and end-customers to do more lighting and less controls, when lighting is much more cost effective.

Lighting retrofitters and end-customers will use controls, when they are cost effective, but it is not a good idea to mandate controls.

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/>

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.

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