

Docket No. 15-BSTD-01

March 16, 2015, 5th letter

Greetings

California Energy Commission

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A good number of stakeholders, including me, fully support Version 9 of the proposed language for Indoor Lighting Alterations in its entirety. In particular, we feel the following *Exceptions* are critically important and should not be subject to further modification:

EXCEPTION 2 to Section 141.0(b)2I. “For work consisting of only luminaire replacements per ii above, where replacement luminaires have at least 20 percent lower power consumption compared to the original luminaires.”

and

EXCEPTION 2 to Section 141.0(b)2J. “Replacement of luminaire components where the modified luminaires have at least 20 percent lower power consumption compared to the original luminaires.”

In addition, I believe the proposed Wiring Alterations language in Section 141.0(b)2K properly applies daylighting controls to large projects only, while not creating barriers for small and medium projects where the associated costs are unacceptable to the retrofit market. This language should remain as currently proposed in Version 9.

It is also critical to add an Exception for exterior fixture replacements such that Code is not triggered so long as replacement luminaires have at least 40 percent lower power consumption compared to the original luminaires.

We appreciate efforts to revise Title 24 lighting rules, but cannot emphasize strongly enough the importance of implementing these changes right away.

Summer is the best time to do retrofits on K12 schools and colleges and on some other facilities.

And since the existing Title 24 has already caused so much undue damage for lighting retrofit contractors, ESCOs, manufacturers, distributors, consultants and end-users, the CEC needs to do everything it can to right that wrong ASAP.

If not, numerous lighting professionals may not be stay in business that much longer and fewer lighting projects will happen.

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/>

Hopefully for the 2016 Title and also the improved existing version, rooms that will be retrofitted with fewer number of the existing or new fixtures in different locations will not trigger code. An example is an open office area with 2x4 troffers in a typical 8' x 10' grid, where a number of troffers could be removed and remaining ones could be retrofitted and moved directly over office modules or work stations.

It should be clear that existing is what is there now and original is what was installed when the building was built or remodeled. The original fixtures may have been retrofitted at least once over the years. We should deal with the existing.

In the final document(s), please use clear and simple language, such as retrofit and replacement and get rid of as many exceptions, etc. as much as possible. Gene Thomas's Plain English Update Re 3-12-15 Title 24 2016 Draft Language is a good example.

Following is rationale supporting CEC's efforts to make the 2016 and the existing Title 24s much more lighting retrofit friendly. Much of this also applies to new construction and remodels, because many controls, daylight harvesting and automatic demand response may not be cost effective.

Diminishing Returns is an article I recently wrote for the Electrical Distributor Magazine. Following is a modified version of it.

Lighting retrofits are having diminishing returns. Although we can still often reduce wattage by 50%, reduced watts are much less than before.

In the past going from four F34T12 fluorescent lamps and two energy saving magnetic ballasts, which consumed about 144W to two 32W F32T8 fluorescent lamps and a high BF electronic ballast, which consumes about 72W, saved 72W, which was 50% and quite cost effective. We can now reduce wattage another 50% by going with 36W LED or high performance fluorescent systems, but only 36 watts are saved, so the electric bill reduction is only half of the previous retrofit. Based on 3500 annual hours and \$.18/KWH electric rate, reducing wattage by 50% only saves \$22.68 per year.

Hibays have a similar story. 1000W mercury vapor lamps with magnetic ballasts could be replaced one for one with 400W probe start MH lamps and magnetic ballasts very cost effectively. Later those 400W MH systems could be cost effectively replaced with 220W fluorescent T8 or T5HO lamps and electronic ballasts. But now it is a challenge replacing the fluorescent hibays with 110W LED hibays, because though the wattage is cut in half, only about 110 watts are saved. Based on 4000 annual hours and \$.18/KWH electric rate, reducing wattage by 50% only saves \$79.20 per year. Since LED hibays are relatively expensive and labor costs are usually quite substantial at these heights, \$79.20 annual electrical savings is not that great.

Although 75% savings was typical case replacing incandescents with CFLs, replacing CFLs with LEDs often saves much less. For example, replacing a screw-in 13W CFL with a screw-in 9W LED only saves 31%, which at 3500 hours per year at \$.18/KWH is only \$2.52 per year in electricity.

I challenge anybody at the CEC and Jim Benya to design a retrofit project for a typical 5,000 square foot office building or space meeting the owner's or tenant's maximum three year payback with the current Title 24's requirements and additional costs for permit, CLCATT, etc. This is what lighting retrofit contractors are faced with everyday. Let's say that this office building has 50 2x4 clear prismatic lensed troffers in open and private offices. Each troffer has 2 32W F32T8 741 lamps, generic .89 BF instant start ballast and a white reflector kit. Fixture wattage is 59. Each of the 30 workstations has one task light, which consumes 20 watts. There are 20 recessed cans with one 4-pin 18W 4100K CFL and electric ballast in lobby and halls. Fixture wattage is 20. There is a time clock for the building set at 3500 annual hours in offices and 4000 annual hours in halls and lobby. Private offices do not have occupancy sensors, because workers are very good at turning off lights whenever they leave. There are windows on all sides, but blinds are usually relatively closed, except on the north side, because of glare. Since there is a relatively small number of lighting fixtures, parts pricing will probably not be very good. The average KWH rate is \$.18. DLC currently requires 3000 out of fixture lumens in a 2x4 to be approved for a rebate, which at 100 LPW is 30W per troffer kit. Occupancy sensors would actually increase annual hours of operation in private offices, and if they are required, there is probably no rebate for them.

I would really like to see at least one proposal.

As long as permitting, measuring each room, calculating WSF in each room and maybe also occupancy sensors and CLCATT are required, I only see two ways that this can be accomplished. One is lamp for lamp with either reduced wattage fluorescent T8s or TLEDs keeping the existing ballasts, even if they are close to 10 years old and will probably fail soon, in the troffers and pin based LED lamps in the recessed cans keeping the existing ballasts, even if they are also old. The reason that this may work is because it does not trigger code. The problem is that this is not a very good solution regarding energy savings, quality of light and maintenance costs. The other way is doing the retrofit under the Title 24 radar, which a number of contractors and end-customers have done.

Just dealing with Title 24's permit process, measuring each room, calculating WSF and CLCATT can easily increase a job cost by 20 – 30% without any guaranteed extra savings. For small projects, like with 50 to 100 fixtures, that percentage will be higher. If dimming and controls are required, the job cost can be doubled without any guaranteed extra savings.

As I wrote in 'Do Energy Codes Really Save Energy?', which tED Magazine published on February 3, 2015:

At least for lighting retrofits, I would bet my house that more energy would be saved without this Title 24, which took effect on July 1, 2014, than with it.

Here is the link to the entire article.

<http://www.tedmag.com/News/features/Do-Energy-Codes-Really-Save-Energy.aspx>

Regarding controls, let's look at a modified version of my 'Controls or LEDs: What's the Best Bang for the Buck?' article, which Architectural SSL Magazine published in December of 2014. Although the focus was on retrofitting, it also applies to new construction.

Let's examine a 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
- Building time system set at maximum annual hours of operation at 3500
 - Office worker does an average job manually turning off lights when leaving, so 3000 hours a year with the manual switches
- KWH rate is \$0.15
- Annual lighting consumption is \$81
- 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.

LED

- Each troffer can be retrofitted with fixed 20W 5000K troffer kit
 - 20W
 - \$130 parts, labor and disposal
- Room
 - 40W
 - \$18 annual electrical consumption
 - \$63 annual electrical savings
 - \$260 parts, labor and disposal
 - 4.1 year payback without rebate

Let's look at an inexpensive wall mounted occupancy sensor in addition to the lighting retrofit.

- 16% estimated energy savings, based on CEC DEER numbers
- \$2.88 annual savings
- \$80 installed cost, including CLCATT cost
- 28 year payback (there is no rebate because Title 24 mandates them)
 - Probably infinite payback, because sensor will probably not last 28 years

Even if an advanced control system could double the savings, which would be \$5.76 per year, the cost may be about \$160, so the payback would be the same 28 years, which would probably be infinite, because the system would probably not last that long.

Even if the LED troffer kits were each 40W and the KWH rate was \$.18, controls would still not be cost effective in the above example in new construction or retrofits.

Let's look at automatic demand response with lighting in new construction or retrofit. I have been using this in some of my cost effective lighting retrofit tools for Title 24 seminars for SDG&E and PG&E. I thank Jonathan Baty at Enerpath for this.

We can compare load shedding from 0.5 WSF lighting and other measures, based on 10% reduction.

- An addressable 3KV EV charger sheds the demand equivalent of $3000/.05/.1 = 60,000$ SF of lighting
 - Vehicle batteries could be used to feed into the grid when necessary.
- An addressable 5 ton HVAC unit at 1KW/ton sheds the demand equivalent of $5000/.05/.01 = 100,000$ SF of lighting
 - 1 ton HVAC handles about 400 square feet.
- Based on one light fixture per 80 SF, there would be 750 lighting fixtures in 60,000 SF and 1250 lighting fixtures in 100,000 SF.
 - It will cost a lot more to connect dimming and demand response controls to 750 or 1250 lighting fixtures than to one electric car charger or one HVAC unit.
- Even if lighting is 1.0 WSF, which would be 375 or 625 fixtures, car chargers and HVAC would still be much more cost effective for automatic demand response.

The best expert on LEDs and controls that I am aware of is Dr. Robert Karlicek, who is the Director of Smart Lighting Engineering Research Center at Rensselaer, who the CEC could contact.

<http://news.rpi.edu/luwakkey/2676>

As mentioned in the beginning of this letter, it is so good that the CEC realizes that it needs make the 2016 and existing Title 24s much more lighting retrofit friendly.

But thanking the CEC is not really appropriate, because what worked quite well for lighting retrofits should not have been taken away 1st of July last year.

Although making the 2016 and existing Title 24s much more lighting retrofit friendly can be considered an informal 'apology', CEC's credibility would really improve if it made a formal apology, because so many stakeholders have lost money and lost their jobs over the last eight plus months when this Title 24 started. Many stakeholders are California taxpayers and utility ratepayers.

Maybe the CEC does not want to apologize, because that may provide a rationale for one or more lawsuits against them. But numerous stakeholders, who I am aware of, would think much higher of the CEC if the CEC apologized and may be less prone to sue the CEC.

During the planning stage for the existing Title 24, several lighting retrofitters and others, including me, really tried to make this Title 24 much better, because we knew how the lighting retrofit industry works, how unnecessarily expensive dealing with permits, CLCATs, etc., are in most applications and with LED and high performance lighting technologies, occupancy sensors, dimming, daylight harvesting and automatic demand response are often not cost effective in retrofits and also in new construction.

But the team including the CEC, Doug Avery and Jim Benya kept stating that they knew best and what they promoted, including permitting, dimming, controls, etc., would work after we got used to it. I perceived many of their responses as self-righteous and self-serving. After a while of keep getting that message, most of us gave up, because we had to do our work in our regular jobs. It is so good that Ecology Action could keep paying Gene Thomas for his continued efforts, because without him, the existing Title 24 would be much worse than it currently is.

Gary Flamm and Owen Howlett left the CEC and Doug Avery retired from SCE, but it is my understanding that Jim Benya is still being paid by the CEC, while several lighting companies have

lost money, numerous people have lost their jobs and many lighting retrofit projects have not been done because of this Title 24.

Although Jim Benya was very helpful to me during my early days in lighting, which I greatly appreciate, we disagree about most lighting issues now, and I can back up all of my positions with good science and other evidence. This is especially the case with lighting retrofits, which I have focused on for more than 20 years, including over 500 retrofit projects and presenting close to 1000 seminars, most of which have been in California. In addition to presenting information, I also learned a lot from lighting retrofitters, ESCOs, distributors, manufacturers and end-customers.

Even though it seems that now Jim Benya is open to fewer controls and dimming and open to more retrofits that do not trigger code regarding Title 24 now, is that sufficient to compensate for his previous actions?

It is my understanding that Jim Benya, mainly as a lighting designer, has been promoting dimming and controls for a long time, even with when it was mainly a fluorescent world. So even if he is open to less controls and dimming for Title 24, I think that he really still prefers dimming and controls.

Do you agree with some of Jim Benya's recent statements? For example, please read his blog from last November.

<http://energywatchnews.com/lighting-quality-suffering-leds-james-r-benya-pe-fies-fiald-httpbenyaburnett-com-2/>

Although several of his points seem valid, you can decide on some others. Let's just look at his number 2. Is the Kruithof Curve is valid? It is my understanding that the IES has stopped mentioning it in its documents. Ian Ashdown's 'The Kruithof Curve' is a very well researched document. <http://aqi32.com/blog/category/color-rendering-index-cri/>

Do you think that most interior LED products should not be higher than 4000K, when higher CCT products can be beneficial for spectrally enhanced lighting and Human Centric Lighting benefits, including improved circadian rhythms, short and long term alertness, sleep, etc.? I am aware that in the future, there will be various cost effective LED products with substantial 460 – 490 nm content for improved visual acuity, melatonin suppression and short and long term alertness that can be 4000K or lower CCT, but I am not aware of them yet. For those who have not read the IES TM-24-13 yet, I highly recommend it regarding spectrally enhanced lighting. Here is a good presentation from Brian Liebel, who was the first lighting coordinator at PG&E's Pacific Energy Center, directed the DOE's research on spectrally enhanced lighting, is the chair of the IES committee, which wrote TM-24-13, and is currently on the IES Board of Directors.

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/liebel_enhanced_longbeach2013.pdf

Although spectrally enhanced lighting should not be used to determine lower lighting power densities, it can be used quite well to meet other-way prescribed ones.

I have seen that Jim Benya stated that the results from the DOE research on spectrally enhanced lighting are due to the Hawthorne Effect. But if you examine the protocol, I think you will see that Brian Liebel, Dr. Sam Berman and the Pacific Northwest National laboratory properly avoided the Hawthorne Effect.

Although some people have stated that blue enriched lighting should be avoided in interior applications, please read Ian Ashdown's 'Blue Light Hazard... or Not?'

<http://aqi32.com/blog/category/human-centric-lighting/>

You could also watch the recording of Ian's and my webcast for LEDs Magazine.

<http://www.ledsmagazine.com/webcasts/2015/01/leds-and-humans.html>

Do the CED others think that the think that the CEC should keep Jim Benya as a lighting consultant? I know several people, who could do a very good job with him or by themselves and are objective with various strategies, technologies, manufacturers and organizations.

I wish more public officials and people, who work for utilities, would be more knowledgeable and open in the future, so if a similar problem arises, it may be fixed sooner. For this Title 24 many of them with their public hat on, supported Title 24, even if they knew it was terrible, which many of them told me privately. Some of them were probably working confidentially with the CEC to improve it, which is good, but if these people would have been more open with stakeholders, there is a good chance that stakeholders could have helped improve Title 24 sooner.

Every time I presented a cost effective lighting retrofit tools seminar for the various utilities, I was instructed to be politically correct, which I was. During those seminars, my tongue got very sore, because I bit it so many times, so I could keep being politically correct. I got sick and tired of hearing some people say that it will be business as usual after the lighting retrofit industry gets used to this Title 24.

A while ago, one utility person publically stated that this Title 24 is awesome, because it includes ADR. If you are not already aware, ADR is automatic demand response. I am glad that a number of other utility people told me that the person that made that statement is so off base. So if officials and utility people are more knowledgeable and open in the future, similar problems may be able to be fixed sooner than it is taking Title 24 to be fixed now.

Lastly, if the CEC significantly improves the 2016 Title 24 and by this summer also substantially improves the existing version, I will write another magazine article about energy codes, but this time discuss how the CEC realized their mistakes and welcomed input from stakeholders. I will also include how many stakeholders took the time and effort to submit verbal and/or written input, even though many of them remembered in the past that their efforts were wasted. The frosting on the cake would be if the CEC makes a formal apology.

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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